To evaluate the effectiveness of drone-based LIDAR technology, Juniper Unmanned conducted a unique empirical study.

Faults, fractures, and subsurface features buried beneath the earth's surface are important to the petroleum geologist.

Geometric accuracy, particularly vertical, continues to be a relevant topic because of continually changing technology.
DOF, Sonardyne, 2G Robotics and Seatronics Showcase New Underwater Mobile Mapping Technology

DOF Subsea, together with subsea technology companies Sonardyne, 2G Robotics, and Seatronics (an Acteon company), successfully demonstrated a new underwater surveying technique in December 2016 that could significantly shorten the time needed to map underwater structures and offshore sites.

Representatives from across the North Sea energy sector, including senior figures from oil majors, contracting companies and service providers, attended the demonstrations which were held over three days at The Underwater Centre in Fort William.

The event was organised by DOF Subsea to showcase the capabilities of dynamic mobile mapping. The new technique uses a 3D laser scanner fitted to an ROV to create highly detailed, point cloud images of subsea assets and environments. By combining the 3D laser data with precise underwater acoustic and inertial navigation information, it is now possible to generate centimetre resolution engineering models from which accurate measurements can be instantaneously and repeatably captured.

Within the offshore sector, one of the primary applications for the new technology is underwater metrology, a process that requires accurate, precise and robust measurements. These are critical for successful fabrication and installation of spools and jumpers. Not only does the new method save time and money, it also reduces the risk of spool pieces being fabricated incorrectly.

The new laser-acoustic-inertial metrology solution brings together three independent systems, each of which is proven within its respective field.

The 2G Robotics ULS 500 Pro Laser, provided by exclusive distributor Seatronics, is a laser triangulation measurement system that is ideal for capturing high-detail measurements from dynamic platforms such as an ROV or AUV. Sonardyne’s SPRINT inertial navigation sensor makes optimal use of aiding data from transponders deployed on the seabed and from other acoustic sensors to provide dynamic, centimetric-level navigation for the ULS 500 laser, which is post-processed using Sonardyne’s Janus software. DOF Subsea’s Metro software is configured to use the Sonardyne SPRINT-positioned ULS 500 to undertake standardised metrology calculations offshore, reducing risk in metrology calculations and ensuring approved algorithms are used to generate client deliverables.

The new metrology solution is ROV-mounted and mapping operations are conducted in Dynamic Mode (i.e. with the ROV flying the spool route) in order to simultaneously survey...
multiple horizontal or vertical flanges. Key operational benefits of the technique include:

- **Non-Intrusive**—no prior subsea intervention is required in advance of metrology, and no subsea bracketry, control spheres or metrology aids are required
- **Flexible Deployment**—modular system which can be easily fitted to an ROV (for Dynamic data acquisition), or mounted onto a tripod (for static data acquisition)
- **Time to Survey**—significant reduction in the time (and therefore vessel cost) needed to gather the survey data in comparison to traditional techniques such as pure acoustic LBL; typically less than three hours for a laser metrology.
- **Time to Data**—quick delivery of results offshore; typically within six hours of data acquisition
- **Inferred Metrology**—with prior dimensional control information, hub position and orientation can be inferred using laser scan data
- **More than Metrology**, the 3D model used for metrology serves as an As-Built model of the subsea installation and the surrounding area to provide a baseline for future intervention work

When asked about the demonstration, Pieter Jansen, Geomatics Global, said “The combined system components brought together and showcased in Fort William were proof of further advancements within the survey industry, combining technological advancements with operational efficiencies. A much welcome and needed approach in an economically hard hit Oil and Gas Industry.”

Speaking about the success of the demonstrations, Colin Cameron, DOF Subsea said, “At DOF Subsea, we pride ourselves on working in partnership with industry leaders to develop new technological solutions to subsea challenges. The development of this solution is hugely important for the energy sector, and we were delighted with the data that we were able to gather in Fort William. We have proven that the technologies work together in this application and that the method can generate the quality and complexity of data required. We believe that using this combination of technology to provide a full metrology solution is an industry first - we can save days on traditional metrology work, and provide much higher quality data. This in turn brings savings to the operations teams running the projects.”

Seatronics Ltd, an Acteon company, specialises in subsea marine electronic equipment rental for a range of applications; navigation and positioning; environmental and geophysical surveying; inspection and construction work; ROV survey sensors; diver-led non-destructive testing and video inspection. Its skilled engineers provide a comprehensive service that encompasses equipment installation, set-up and calibration, cable moulding and data acquisition. For more information, please visit www.seatronics-group.com
3D, Drones, and Multispectral Images: an Exploratory Project

It doesn’t matter what narrative you hear on climate change, we can agree that keeping the earth’s forests healthy is essential to the future. Large air purifiers, like the giant sequoia trees in California, are key for the environment and studied to measure how much CO2 they capture. As part of a joint project, Pix4D and Parrot used drones and multispectral technology to create a 3D NDVI point cloud of Whitaker’s Forest in Kings Canyon National Park, giving researchers access to information previously hidden.

Multispectral images capture what human eyes cannot: information from spectral bands beyond our sight range. While mapping and modeling from images is increasingly commonplace, multispectral imagery has been limited to 2D map creation.

This is a tremendous limitation for all those using multispectral imagery, as without 3D, critical pieces of information may be missing. Recognizing this, Pix4D developed a methodology to leverage multispectral images for 3D point cloud generation, we found the need to bridge the power of 3D with the value of multispectral images.

These special 3D point clouds are produced by merging radiometric information acquired from different spectral bands into a single 3D point cloud geometry. After doing radiometric corrections to obtain reflectance, the observations of a particular point in each band are weighted separately, taking visibility constraints into account to avoid obstructed points, and obtaining a representative reflectance value for that band.

As a result, each point in the point cloud contains accurate reflectance values for each observed band. Then we simply combine the reflectance values depending on the Vegetation Index formula that wants to be applied.

Now, vegetation is not only analyzable from the top-down, but also in 3D, allowing foresters, agronomists and wide range of other environmental workers to recognize problems in whole structure of the plant. For example, forest conservation organizations can document the trees with both geometric and radiometric information much faster, rather than spending days to survey and CAD-draw individual trees.

The end result is a 3D NDVI point cloud, where plants can be observed and scouted in their entirety, adding a new dimension to an industry previously constrained to information from plant canopies. There are several direct implications of this breakthrough, and we are excited to see what researchers, companies, and industries will do with this data.

This was an exploratory project to prove that generating very high resolution 3D NDVI point clouds was possible. In addition, Parrot & Pix4D announce a ‘Climate Innovation Grant’ to help foster further innovation surrounding the impact of climate change.

For more information, [https://pix4d.com](https://pix4d.com) and see our PROJECT WEBPAGE. (https://pix4d.com/3d-ndvi)
Photogrammetry with Large-frame Sensors

**Pix4Dmapper Pro is more than just a drone-mapping software**

For professional photogrammetrists, the objective of mapping is not just to generate simple 2D orthomosaics and 3D visually-pleasant models, but to create cartography that provides accurate location and precise measurements.

In Pix4Dmapper Pro, users can process large-frame images with an additional add-on. This add-on is for processing images larger than 55 megapixels. Metric camera users, UltraCam, for example, can enter pre-calibrated camera interior and exterior parameters in Pix4Dmapper Pro.

By choosing either to fix or to recompute parameters, it is more flexible and efficient to generate accurate cartography in a short time. Here are some useful features for professional photogrammetrists:

**To Fix Selective Pre-calibrated Camera Interiors**

Pix4Dmapper Pro supports the input of pre-calibrated camera interiors, such as focal length, principal point of autocollimation (PPA), and lens distortion coefficients, etc. The feature of choosing whether to fix or to recompute them is especially important for metric cameras whose interior parameters are pre-calibrated in labs. Those values should have more weight and not to be recomputed every time based on the image content.

**To Fix Selective Camera Exteriors**

One recent method for traditional photogrammetrists to avoid surveying ground control points for every project is direct georeferencing, giving the six accurate exterior orientations (x,y,z,omega,phi,kappa) to produce the surface model and orthomosaic.

*Direct georeferencing* requires a one-time pre-project flight over the calibration field which will give us the shift in x, y, z direction from the GPS receiver and the rotation angles around x, y, z axes from the inertial measurement unit (IMU). These values will not change unless the camera is re-installed and so is the relative position and orientation. The entire flight path can be computed by interpolating the mobile station locations received from the GPS receiver using higher-frequency IMU, and adjusted based on known base stations. Finally, locating the image triggering time along the entire path, based on GPS time, gives the location and orientation of each image.

For more information, please visit pix4d.com
Laser Scanning Helps Ehresmann Engineering Expand Its Business and Offer More to Clients

The Organization
Ehresmann Engineering is an engineering consulting and steel fabricating firm founded in 1983 to meet the highly-specialized needs of the communication industry. The company, headquartered in southeastern South Dakota, offers structural analysis services, cell phone tower fabrication and erection, and cell phone tower quality inspections, as well as structural tower mapping, antenna and feedline mapping.

The Challenge: Point Cloud and Data Accuracy
One way that Ehresmann Engineering conducted cell phone tower quality inspections was by using unmanned aerial vehicles (UAVs) and photogrammetry. They found this combination to be useful, but not as accurate, dense, or as detailed as they needed. As a result, Ehresmann Engineering still sent “climbers” up towers to visually inspect certain areas eliminating the cost and time savings of the UAV and increasing the safety risk.

The Solution: High Definition Laser Scanning
To address this situation, the Ehresmann Engineering team investigated high definition laser scanning. They reached out to IMAGINiT Technologies, who had assisted the company before with CAD software and was known for its expertise in laser scanning.

After discussing the specific needs of Ehresmann’s team, IMAGINiT suggested a proof of concept that included a side-by-side comparison of photogrammetry and laser scanning. The team found that the information generated through laser scanning is significantly more accurate and detailed. In addition, it is possible to calculate the exact angles of cell phone antennas on a tower and many other detailed measurements and calculations from the laser scanning data.

Based on the initial proof of concept, Ehresmann Engineering incorporated laser scanning into the business as a key asset. The company invested in a Leica laser scanner, software, training, and phone support. After the first training session to get the group up to speed on the product and processes, IMAGINiT returned for a second session focused on advanced topics. During that visit, the IMAGINiT team also met with some of Ehresmann Engineering’s customers to educate them about the benefits of laser scanning.

The Result: Higher Quality Deliverables for Existing Customers and New Markets
When Ehresmann Engineering uses traditional methods for its tower inspections, the deliverable is a printed report. Now with laser scanning, the firm can provide clients with a 3D virtual environment via the Internet using Leica TruView Global. “We’ve gotten a good response from that,” said Rich Quinn, Project Manager. “Customers are also impressed with the increased accuracy that’s possible with laser scanning.

The Ehresmann Engineering team also decided to explore how to use their laser scanning capabilities to expand into new markets. The company started a new business unit called EEI Imaging which offers high definition laser scanning services, aerial inspections, and aerial mapping to clients outside the communication industry.

EEI Imaging provides laser scanning services to a variety of clients, and is reaching out to architects and engineers. “Expanding into new markets has been good and we are learning about new disciplines,” said Brian Jensen, Project Manager.

The company enjoys a competitive advantage by using the best laser scanning equipment, providing higher levels of accuracy in their deliverables than other firms. Better accuracy, detail, and support are all attributes that are important to customers interested in reality capture. “We wouldn’t be where we are today without IMAGINiT. The training we received was instrumental and the team has helped us think outside the box about other industries where we could use laser scanning,” said Jensen.

Looking ahead, Ehresmann Engineering plans to continue its business expansion. Technology has always been a cornerstone for the company and the team expects that it will achieve its vision for the future by collaborating with partners like IMAGINiT Technologies.

About IMAGINiT Technologies:
IMAGINiT Technologies, a Rand Worldwide Company, is a leading provider of enterprise solutions to the engineering community, including the building, manufacturing, civil and mapping industries. With over 25 years of experience, and over 40 offices throughout North America, we provide the expertise, training and support to help companies realize the full power of design technology, maximize ROI and gain competitive advantage.

Daniel Chapek is manager of reality capture solutions for IMAGINiT Technologies (www.imaginit.com/realitycapture), with more than a decade working with infrastructure technology. Dan can be contacted at dchapek@rand.com.