Not Just a Pretty Picture

UAS Data in High Demand on Australian LNG Construction Site

Western Australia’s Land Surveys, provides surveying services on the construction site of the Ichthys Project’s Onshore LNG facilities at Bladin Point, near Darwin. They regularly deploy an unmanned aircraft system (UAS) to capture aerial photography and accurate spatial data of the entire 5-km² (3.1-mi²) site. Complementing surveying systems already in place, the data is used for situational awareness, construction progress, volume calculations, site planning, drainage modeling, and environmental disturbance areas.

The Ichthys LNG Project
Located about 220 kilometers offshore Western Australia, Ichthys represents the largest discovery of hydrocarbon liquids in Australia in 40 years. The Ichthys LNG Project is currently in construction and is ranked among the most significant oil and gas projects in the world. The Ichthys LNG Project is effectively three mega-projects rolled into one, involving some of the largest offshore facilities in the industry, a state-of-the-art onshore processing facility and an 890 km pipeline uniting them for an operational life of at least 40 years.

Chris Bellamy setting up for a flight amongst cranes mid-2014. Land Surveys conducts UAS flights every Sunday, rain or shine. Its eagerly anticipated results are delivered each Tuesday. In this image, a Trimble UX5 is readied for launch.

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The Ichthys LNG Project announced Darwin as the preferred location for its onshore processing facilities in 2008. Four years later, the Australian Prime Minister officially launched construction at the 361 hectare Bladin Point site at a groundbreaking ceremony on 18 May 2012. When completed, the Project’s LNG plant at Bladin Point near Darwin will cool gas from the Ichthys Field and transform it into liquid for transport. The gas will come to Darwin via the Project’s 890 kilometer gas export pipeline.

Land Surveys is an Australian company with offices in Darwin. The company employs over 200 staff to deliver comprehensive surveying services throughout Australia and abroad. Land Surveys was subcontracted by a civil contractor to provide surveying services for the Civil Works package of the onshore construction project, beginning work in May 2013. Having completed that contract they are now providing surveying services on the project’s power plant; they are also working on a structural, mechanical and piping contract. At times Land Surveys has employed up to 57 surveyors on site.

At Bladin Point, Land Surveys uses GNSS and conventional total station technology, including Trimble R10 and R8 GNSS systems and Trimble S8 total stations, which are all supported by Trimble Access field software. They also manage extensive machine guidance operations—approximately 40 excavators and 8 graders. Guidance systems include the Trimble GCS900 Grade Control System for excavators and Trimble Universal Total Stations. All data is processed and integrated in Trimble Business Center—HCE software.

Well before the Ichthys project Land Surveys was already an early adopter of UAS technology, using it to quickly capture data from large areas. While Ichthys initially had no formal requirement for orthophotography, Land Surveys recognized that the site presented an exciting opportunity to showcase the capabilities and benefits of UAS technology.

To complement the construction process, about two years ago Land Surveys began providing regular aerial surveys of the construction site using a Trimble UX5 UAS.
At first the UAS was purely adding value, giving our clients something they’d never previously had,” said Matthew Power, a surveyor and the UAS coordinator for Land Surveys. “But then they started to realize new benefits and applications for the data. What started out simply as an add-on quickly became a contracted service.”

Developing UAS Data Potential
Initially, Land Surveys performed UAS surveys only once a month. However, their flight frequency increased as the value of the data quickly became apparent and sought after. “Pretty soon the UAS data went from being viewed as just a pretty picture of the site to being recognized as meaningful, accurate and invaluable data. The next thing we knew we had guys outside the office door every Tuesday waiting for the week’s deliverable,” said Power. The Trimble UX5 now makes 3-5 flights—covering 3-5 km (2-3 mi)—every Sunday, taking georeferenced aerial images of the entire site. In the air, the UAS can avoid all of the site traffic, machines, and personnel. “That’s probably the number-one benefit of the system,” said Power.

Power says that the kind of orthophotographs taken by the Trimble UX5 give unparalleled ability to remotely monitor progress on a project. The resulting 3D data can even be used to create a virtual fly-through. “The imagery is so detailed that you can actually see bolts and cables and other small components. It’s pretty unbelievable, to be honest, that you can inspect these details from the comfort of your office, wherever that is,” said Power.

All users need to do is open the high-res photo of the site. The imagery is georeferenced, so after importing the data into GIS or computer-drafting software, they can seamlessly integrate it with their own data and zoom into a specific area on site. They can then, for example, see if a certain concrete pad has been poured, or check on the progress of a road. “The Trimble UX5 captures absolutely everything. It records a complete moment in time,” said Power.

The information is used for plotting transport routes, calculating precise measurements, environmental planning, traffic management, planning for crane lifts and for providing weekly updates on infrastructure tasks such as excavation and landfill. It is also used for interface management between contractors.

UAS Data for Environment Planning
UAS data is “an excellent resource for environment planning,” says Power. Environmental engineers onsite use the weekly data to update ESCP’s (erosion and sediment control plans), locate handover areas, facilitate communication with other teams regarding upcoming works and planning, direct waste bin servicing, and identify the number and location of excavations. The data also shows catchment surfaces conditions and spatial extents.

Consistent Workflows Deliver Consistent Results
Power is one of seven UAS surveyors at Land Surveys. He was actively involved in the early stages of UAS flying at Bladin Point, primarily in setting up safe workflows and procedures. Once the system was operational, other UAS surveyors were brought in to perform the weekly flyovers.
“Once there was an increased workload we knew we had to increase our number of UAS operators to meet demands,” said Power. The firm brought on a former commercial helicopter pilot, a surveyor with a remote pilot’s license and “upskilled” an experienced engineering surveyor already with the company. “As demand for the data increased, the team streamlined the delivery process by writing software scripts to automatically export imagery and 3D data,” he said. “This reduced our surveyors’ office times while improving the data delivery turnaround time. The UAS team has a variety of skills and experience which complement every aspect of the operations perfectly and enable us to consistently deliver an awesome product.”

A major consideration when setting up procedures was safety, because Bladin Point lies within controlled air space. In order to fly a UAS in the area, Land Surveys had to receive area approval from Australia’s Department of Defense (DoD). The workflow he and his colleagues subsequently established included speaking with air traffic control each week to communicate schedules, and issuing a Notice to Airmen (NOTAM) to publicize planned UAS flights, so the UAS’s presence didn’t infringe on the safety of other aircraft.

Once Land Surveys knew they would be flying weekly, they established ground control points using RTK GPS. Then, every Sunday—after confirming the ground points with the Trimble R8 system and communicating with Darwin airport air traffic control—they launched at 9am, “when light is optimal for photo quality,” said Power. Each Trimble UX5 flight was managed by two Land Surveys personnel: one to operate the UAS and another to monitor the work area.

Power’s colleagues fly over the entire site in just 3-5 flights, with each flight taking 30-45 minutes. They then download the data and check that every area is captured and of satisfactory quality. Photos are stitched together, image checked, and then georeferenced before exporting into the required formats. “The data also produces 3D data like point clouds and DSMs,” says Power. “But these aren’t used weekly; only when volume calculations for stockpiles or 3D surface models are asked for.”

Processing takes place overnight on Sunday with analysis and editing done on Monday. “It’s possible to deliver the data 12 hours after capture, but our own internal quality assurance stops us from delivering on Monday,” says Power.

And according to Power it’s important to mention that out of 63 missions (almost 250 flights) the Trimble UX5 delivered on 61. The two missions that didn’t deliver were obstructed by severe weather and an ADF (Australian Defense Force) airspace closure. “With UAS’s, that level of reliability is just unbelievable,” said Power. “One of the Trimble UX5 aircraft’s wings has flown over 100 takeoffs and landings,” he added.

During Darwin’s wet season—from November to April—weather conditions, particularly the wind, put the Trimble UX5 through its paces. “There are some pretty hairy environmental conditions to battle with,” says Power. “One minute conditions are still and clear, then ten minutes later you can’t see in front of you. And it sure feels like humidity is 99 percent all day.” Fortunately, the Trimble UX5 can land quickly when weather turns, and he says its performance in windy conditions make it the right tool for the job.

Land Surveys’ work at Bladin Point is just one of many UAS projects the company is undertaking right now, as demand for the technology shows a rapid climb. Systems like the Trimble UX5 clearly complement existing surveying on large-scale construction projects. With its ‘eye in the sky’ Land Surveys is able to provide its clients with frequent, high-quality data delivered fast for better planning decisions across any project.

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