

## INSPECTION, MAINTENANCE & REPAIR



**INCOMING:** A drone returns from an offshore mission.

# Eyes in the sky

Photo: Sky-Futures

The oil and gas industry is increasingly relying on robots like unmanned aerial vehicles for inspection. These drones can get into hard-to-reach or hazardous spots. They do not get bored. They can measure with precision. And they can save significant amounts of time, as **Jennifer Pallanich** writes.

Low oil price environments tend to prompt operators to seek more efficient ways of carrying out procedures such as inspections. Unmanned aerial vehicle (UAV) specialists such as Sky-Futures and Cyberhawk believe they have the answer.

As Sky-Futures co-founder and chief operating officer Chris Blackford puts it, unmanned aerial vehicles, or drones, make it possible for asset owners to detect anomalies and defects so owners can make repairs before they become serious and costly.

"There are fewer people, and

they're doing more with less. And you can do more with drones," Blackford says.

Inspecting equipment at height, such as flares and cooling towers, or under the deck typically requires personnel to use ropes for access. Setting that up takes time, and the work itself can be hazardous. Enter the drone, which requires little set-up time.

"It takes minutes to set up, compared to a rope access team," Blackford says. "We reduce risk because we're using a robot instead of putting a human at risk."

Sky-Futures carried out a

14-day UAV inspection on a large production platform in the UK North Sea in 2014 that saved the platform from having to shut down, in addition to eliminating an estimated 700 man-days of rope access, Blackford says. The workscope included inspecting the flare structure, communications tower, crane, legs, exhaust, helideck and under-deck.

In September 2015, the company conducted what it says was the first recognized drone inspection in the Gulf of Mexico for the oil and gas industry. The workscope, conducted over two days, included inspecting the derrick, helideck

and four cranes on a drillship. Blackford says current methods of inspection would have taken more than a week.

"On a like-for-like basis, we're 85% cheaper and 75% faster than traditional inspection techniques," Blackford says.

Cyberhawk also reports significant improvements in inspection times. The company carried out an under-deck inspection for Total's Elgin field in the North Sea in May 2014. When the same workscope was carried out using rope access five years before, it took 119 days with six personnel. "We did it in



**DEPLOYMENT:** A two-person team prepares to deploy a UAV for offshore inspection.

Photo: Cyberhawk

three days with two guys," Chris Fleming, Cyberhawk operations director and general manager for the Americas, says.

Earlier this year, Cyberhawk conducted the first commercial oil and gas inspection with a UAV in Qatar, albeit on the downstream side. Work included inspecting flare towers at a refinery.

### Growing acceptance

The road to commercial UAV inspections has been a long one. Over the years, drone companies have worked on system reliability along with regulatory rules and public perception.

As Fleming puts it, the connotation of the word "drone" can be negative, as people may associate them with warfare.

In addition, commercial drones must comply with federal aviation regulations. As such, drones are



**BIRD'S EYE VIEW:** A drone captured this image of the Jintan platform off Malaysia.

technology at ABS. "Monitoring is being done at a distance."

"Smart" assets and new technologies are making inspections and condition monitoring more efficient.

"Right now it's primarily visual, via a general visual inspection," Bond says. Drones can identify anomalies, he says, but "the real question is whether a drone can be used for close-up inspection."

Safety and efficiency both play into the acceptance of drones.

"We see drones as a way to extend our people's eyes. We're looking to safely augment the reach of our people and their experience," Bond says.

ABS is working some pilot projects related to UAVs and is in the final stages of internal reviews for the certifications that would permit a third-party independent specialist to handle

not allowed to exceed a 400-foot ceiling imposed in the US by the Federal Aviation Administration. Agencies in other countries have also set similar rules.

There was also an initial issue of whether classification societies would accept inspection data generated by

UAVs, although drone companies are working closely with the societies to help certify inspection techniques and the data they collect.

"The way the offshore industry works is changing," says James Bond, vice president for marine technology and corporate

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Photo: Sky-Futures

**“We want things to become less reliant on humans, more automated. UAVs will be one of those tools that you use so you don’t send people into harm’s way.”**

**Chris Fleming,  
Cyberhawk**



Photo: Cyberhawk

» drone inspections of ABS-classed assets while ABS witnesses the inspection, Bond says.

The company is working with Sky-Futures and other specialists to determine what processes and reporting will be sufficient, and then work to enhance them.

Blackford says considerations focus on whether the inspection process is safe and whether the data is accurate enough to satisfy survey requirements.

“Inspections are linked to the class societies in terms of what is a standard,” he says. “A class society can say, ‘we approve this as a new technology for replacing the current technique for confined space inspections’, for example.”

#### Close quarters

Fleming, who served as an offshore inspection engineer for Lloyd’s Register for more than two decades before joining Cyberhawk in 2010, says the oil and gas industry would like to see drones capable of carrying out confined space inspections.

“Internal tanks are horrible locations. They’re damp, dark. They’re places you don’t want to die — cavernous, with baffles and walkways and rooms.”

The company used a UAV to

Photo: Cyberhawk



**KEY INFORMATION:** Drones can spot and document anomalies such as the crack shown in this photo taken by an unmanned aerial vehicle.

inspect an internal tank for Maersk Oil in October 2015 and Maersk submitted the report to DNV. “They said they’d accept that in lieu of a person inspecting it,” he says.

Cyberhawk uses a variety of platforms for internal inspections, including a UAV shrouded in a sphere. “It can bounce and won’t lose propulsion or get stuck. If you can get close to it, you can get valuable images,” Fleming says. “We’re proving the technology. There are some things that need to be improved with it.”

The protective cage around the drone can interfere somewhat

with the imagery in much the same way bars intrude on photographs zoo visitors are trying to take of animals. Also, Fleming says, the zoom function could stand to be improved.

Earlier this year, Sky-Futures launched its own confined space UAV inspection capability in partnership with Flyability. It is working with ABS to certify the specialised drone as a qualified inspection technique for confined spaces.

The 40-centimetre Flyability drone sits on a gimbal inside a protective ball-shaped cage.

“It can bump along the walls

so we can get very close to the anomalies without damaging the structures,” Blackford says. “We can see corruptions, we can see cracks, we can see seams.”

It can identify and pinpoint corner welds and locate points of interest on large walls to within two metres.

“That will get better over time, but for now that satisfies class societies for confined space inspections.”

Sky-Futures recently carried out its first client inspection on a floating production, storage and offloading vessel tank in the North Sea. The trial marked the first time a drone was used for a confined space inspection without requiring human entry, the company says.

“The whole idea of using a drone for this type of work is that no one needs to enter the tank to inspect it. This is the real value drone technology can bring,” Blackford says.

#### Improvement

Drone reliability has improved in stages. For instance, early units could disappear or be on their backs after only a few flights. Initial mechanical and operational issues have been



**SAFER ACCESS:** A two-person team carries out an under-deck platform inspection, which would normally require rope access.

Photo: Cyberhawk

worked out for years, Fleming says.

“When we first started, it was pretty tricky to operate, but like everything, the more it gets used, the better the improvements.”

Some of that comes down to proper training, and some to sophisticated sensing systems.

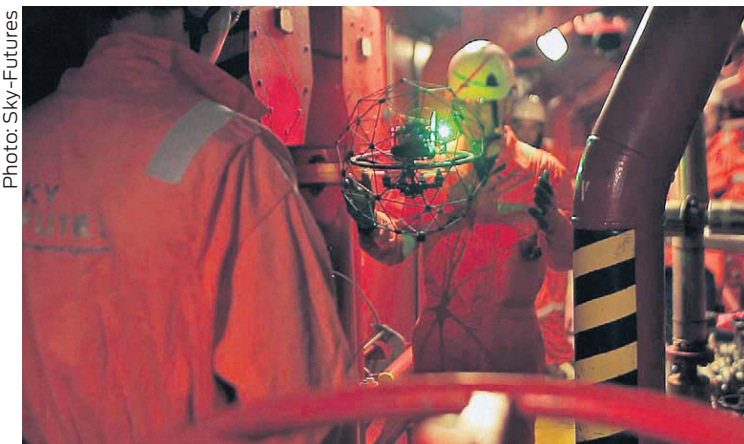
It is necessary for now to fly drones manually while on the deck of platforms, he says, but that could change soon. Some toy drones already have basic “sense and avoid systems” and similar systems are in development for commercial applications.

To carry out certain tasks such as under-deck inspections, which can subject the drone to windy conditions, drone operators need to be very skilled to avoid losing the unit to the water, Fleming says. Cyberhawk’s training features four levels above the basic standard federal aviation certification.

“If I wanted them to pass that basic (UK Civil Aviation Authority) test, you can teach them to pass that in a day. It’s that easy. But it wouldn’t give you the skills to carry out work for Cyberhawk.”

Following basic qualification,

Photo: Sky-Futures



**CLOSE ENCOUNTER:** Swiss company Flyability manufactures this confined space drone.

Cyberhawk’s first training tier is to carry out low-risk operations like aerial photography and survey in an open environment over fields or construction sites. This environment is typically not tense for the pilot. The second tier requires flying close to structures, such as wind turbine blades or electrical towers. Such activity helps the pilot become adept at flying, nose first, to within a metre of a structure, rather than observing from farther away.

The third tier is more intense, allowing the pilot to operate in a refinery or other industrial setting where there may be hazards

such as cranes, flare flames and fumes, along with noise and other potential distractions. The top level at Cyberhawk, usually reached after about 18 months of training, is the offshore environment. The initial offshore experience of simply getting on board can be overwhelming, Fleming says, so for the first few trips offshore, the pilot goes as a second to a more experienced pilot.

“We try to stage the training in such a way that skills are developed incrementally,” Fleming says.

Blackford gained familiarity

with drones during a seven-year stint in the British Army.

“We were using drones to go into areas that were dangerous to go to, to get data,” he says. “It made operations more efficient and safer.”

UK-based Sky-Futures was founded in 2009 with an ambitious agenda for the oil and gas market.

“We are trying to entirely disrupt the inspection sector of the market,” says Blackford, who foresees a future in which inspections have evolved from once a year to daily.

“We’re talking to clients about putting a drone on every single platform,” he says. “I see a future of underwater robots, crawling robots, flying robots gathering data. Humans would only go out for severe interventions.”

Inspections can build up “very solid layers of data that we can use to start forecasting trends”, he says, adding the information — which may be high-definition video or stills, thermal imagery and 360-degree visuals — can be shared on Sky-Futures Cloud. “We get information that can’t typically be achieved unless the platform is shut down. We



**CLEARED FOR TAKE OFF:** A two-person team prepares to launch a drone during an offshore inspection.

» see areas that are not typically accessed on a regular basis.”

Additionally, Sky-Futures is trying to move away from a system in which they carry out all the inspections. The company has set up a joint system with Bristow Group to train UAV pilots, allowing Sky-Futures to focus on delivering technology solutions to inspection problems.

“Why not train the remotely-operated vehicle (ROV) guy to fly as well, and he can do an inspection every day,” he says. “It’s the same thing, just topside.”

### Growth potential

Blackford puts the drone inspection market potential at \$10 billion-plus globally. And possibilities for drones continue to expand — eventually, he believes, drones will be able to deliver some cargo to offshore platforms.

Sky-Futures has carried out thousands of drone flights in 16 countries and opened an office in Houston in August 2015.

“The US is one of the biggest markets for us,” Blackford says.

Scotland-based Cyberhawk boasts more than 13,000 commercial flights carried out

in more than 20 countries. The company, founded in 2008, carries out inspections in multiple industries, and also has a new Houston office.

Each inspection can result in thousands of images. Not only can the data and images be used to create 3D models, Fleming says, but also to generate inspection reports that provide clients with ways to act on the data. All of this can be made available through the company’s iHawk asset management software.


Blackford believes the future for drone inspection reporting is in the ability to present 3D visualisations of the structures at engineering grade tolerances. “It won’t be just a pretty 3D model, it will be a model that can be used

from an engineering point of view.” Blackford also believes laser measurement, fingerprinting and data filtering, corrosion measurement and drone-based ultrasonic non-destructive testing are on the horizon. “Intrinsically safe” drones are also a potential goal.

“Would the oil and gas companies love intrinsically safe drones? Of course they would. But you can’t retrofit that. You have to build it from the ground up.” Such drones would be encased to prevent giving off heat and sparks, which would make them heavy.

As for pilots with “skilled thumbs,” there may soon be a day when humans are no longer needed to fly the drones, Fleming says. A UAV at a normally

unmanned facility could be able to carry out its inspections, analyse the data and sift through it for a change in condition, and transmit to a remote location, without human intervention, just as is done in the military for seeking out improvised explosive devices.

“We want things to become less reliant on humans, more automated. UAVs will be one of those tools that you use so you don’t send people into harm’s way,” Fleming says. “At the moment, they’re expensive, and they rely on good operators, skilled individuals, to fly them. As the technology improves and the sense-and-avoid systems come in, then you’ll see the use of them increase exponentially.” 

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*Chris Blackford,  
Sky-Futures*

Photo: Sky-Futures

