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"Why the inertia on the adoption of AUVs in the Oil & Gas industry?"

Biography

Len Ricketts has been involved with AUVs since its inception in the 1990's. He gained offshore experience from 10 years of working the diamond fields off South Africa and Namibia. In 1998, when De Beers Marine decided to investigate the feasibility of using AUVs in order to gain higher understanding of the seabed, Len Ricketts was appointed to lead this project.

Len spent 6 months with the Danish Technical University AUV team in order to commercialize their academic AUV project. The AUV was delivered in 2000/2001 and after a 6 month period of trials, started working above expectations. 3 years later another Maridan AUV was delivered to De Beers Marine.

After pioneering dual AUV capability for De Beers Marine (both AUVs working subsea at the same time from a single vessel), he decided to leave and seek further challenges in the Oil and Gas market. In 2008, Len Ricketts joined the DOF Subsea AUV team. He remains committed to driving the highest quality data from the AUV and his offshore teams.

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Abstract

The current downturn in the oil and gas industry should have brought AUV services to the fore. AUVs are ready to take up the technical and commercial challenge, but why the inertia from the industry?

Presently companies that own the larger survey class AUV submarines are heavily invested in ROV assets creating strategic confusion for business development. This is typical of a market that is in transition from one technology to another.

AUVs first entered the commercial market due to a requirement to solve the challenges posed by deep water survey. Demand for AUV surveys are now being fueled by quality demands. Data quality and resolution are seen as the major contributing factors in de-risking projects starting from FEED stage.

AUVs have developed to such a degree that reliability figures match or even exceed that of ROVs.

Pricing has become a major determining factor for the inspection market. AUVs can be easily mobilized onto 3rd party vessels even utilizing the client's own long term charter vessel. AUVs can survey at up to 4 knots and do not need the host vessel to be in DP mode – lowering fuel costs. AUVs ARE cheaper!

Quality of data is a huge advantage when surveying with an AUV. Survey class AUVs carry a full suite of payload sensors tagged to a single time source. Surveys are easily tailored to client specification by adjusting altitude, speed and line spacing. The single time source allows for highly accurate data visualization and data fusion. AUV data ARE better!

Acoustic pipeline surveys are slowly but surely being executed by AUVs rather than ROVs due to the speed and quality that AUVs provide. The same precise survey can be repeated because the pipeline is the navigation guide when doing automatic pipeline tracking. This will eventually lead to technologies such as difference mapping and auto eventing.

Nowadays, AUVs have become so reliable that the bottleneck has moved to issues such as file sizes related to higher resolution data. Data management and data storage become significant considerations going forward. So the AUV industry is saddled with (dare I say it) dated ROV post processing technology AND the personnel that go with it.

Inertia stymies technology development, it also creates short term technologies like fast survey ROVs that will never be able to cope, commercially at least, with multiple AUV or ASV/AUV surveys.

But are AUV service suppliers entirely innocent? AUV surveys are cheap enough, why do we drive down the decision based on cost per kilometer? Do we do enough to educate the client? Does the project based business model disallow technical discussion to deliver the best value project rather than the cheapest one?

Conference Paper

Introduction

The current downturn in the oil and gas industry should have brought AUV services to the fore as companies grapple with cost efficiency. AUVs are ready to take up the technical and commercial challenge, but why the inertia from the industry?

A little history

The first AUV was developed by the University of Washington in 1957and then further developed by M.I.T. in the 1970's. In the Oil and Gas industry it was initially pioneered to mainly solve the technical requirements of going deeper without tether management system complications. AUVs have only really become attractive due to their cost component. Throughout the preceding 20 years of AUV development and maturation, AUV survey suppliers have, in the main, driven down cost to such a degree that cost per kilometer has been the deciding reason why a supplier is chosen.

There is no doubt that this commercially focused strategy has put commercial AUVs on the map. The problem is that this is part of the very reason that it is now stunting the AUV industry.

Early commercial operations were compromised by persistent research and development programs – typical of a technology that has not yet fully matured. Equipment suppliers now had to redevelop their systems like their 19" rack motherboards in order to get them to fit inside an AUV. They also had to consider power consumption for the first time.

Challenges in the beginning included bottom tracking algorithms that failed due to playful dolphins, navigation processing that was complex and full of software bugs. In the beginning battery endurance was pitiful compared to modern dive times.

Offline processes were not geared for the amount of data that came off an AUV after each dive and there was no standard way to deliver data to the client.

The 1990's and 2000's saw the technology come into its own.

Where are we now?

AUVs have developed to such a degree that reliability figures of +320 dives yielding +25000km of survey with less than 4% downtime on 8 different vessels for 6 different clients has been achieved. This is testament to the major strides the AUV industry has made since the 1990's.

From a payload perspective, you are now able to get side scan sonar, chirp seismics, multibeam sonar, backscatter, leak detection, high resolution color photography and laser scanning – on a single AUV all tagged to the same positioning time base. This means that the data are seamlessly accepted into the emerging and maturing technology of data fusion. This in turn leads to powerful 3D visualization datasets like pipeline photo mosaics draped over high resolution laser micro - bathymetry.

Lethargy or legacy?

The legacy of cost per kilometer tendering means that the industry still has not taken full advantage of what the AUV has to offer. In Greenfield surveys, clients still choose the least amount of line kilometers - opening up line spacing to the point where a digital terrain model (DTM) is just achieved. This means that the AUV has to fly at a higher altitude, compromising resolution. This also means that some sensors like side scan sonar are used to acquire data in a non-optimal mode.

For acoustic pipeline inspection surveys, there is a huge amount of client technology invested in ROV, boom camera type surveys that still support video acquisition and eventing.

Companies that own the larger survey class AUV submarines are also heavily invested in ROV assets creating confusion for their own business development teams as they grapple with forward strategy. There are some survey majors without survey class AUVs. There are as yet, no bona fide AUV companies. These are all typical of a market that is in transition from one technology to another.

Short and medium term technologies are being introduced into the market due to this very lethargy. The introduction of fast/hybrid survey ROVs is testament to the fact that there is a slow uptake on AUV technology. Not only are these ROVs limited by depth but also by the vessel they require. They require to survey in DP due to the tether and there can only be one per vessel.

Business development teams and tendering departments are also still not fully technically proficient in dealing with AUV bids. It also suggested that survey companies have not done enough to educate clients with respect to the various options of when undertaking an AUV survey.

Not long ago AUV technology itself was the bottleneck which slowed the uptake of the AUV into the industry. Nowadays, AUVs have become so reliable that the bottleneck has moved to issues such as file sizes related to higher resolution data. Data management and data storage become significant considerations going forward. This includes data management offshore and onshore for the supplier and the client. The GIS standard such as SSDM allow the survey provider to deliver data seamlessly into the client's databases.

Possibly the biggest challenge is delivering on a platform that will allow the client to easily interact with the higher resolution data without having to invest in expensive hardware. This technology is available and it is on everybody's smartphone or tablet – GoogleMaps, GoogleEarth and the iOS equivalent all allow you to zoom in to as far as you can go and then to switch on or off, interpreted layers – like traffic, roads, satellite view, etc. This is where we need to go in order to overcome this bottleneck. Imagine having your entire site or pipeline on your smart device and zooming right in to a debris/freespan event without losing any resolution…

What is in the future?
Future AUV developments include coupling the AUV with an autonomous surface vessel (ASV). Multiple deployments of ASV assisted AUVs can be deployed off a single vessel. Data management will be even more challenging than it is today. Surveys will become extremely efficient. Improvements in satellite bandwidth and cost will mean onshore processing. Battery technology is improving all the time.

Acoustic pipeline surveys are slowly but surely being executed by AUVs rather than ROVs due to the speed, quality and repeatability that AUVs provide. The same precise survey can be repeated because the pipeline is the navigation guide when doing automatic pipeline tracking i.e. the human factor is no longer present. This means that given the same pipeline and the same tracking algorithm, the exact same survey can be reproduced. This will eventually lead to technologies such as time lapse analysis, difference mapping and auto eventing. This technology is already in use with military AUVs.

Automatic pipeline tracking also solves the problem of ultra-deep surveys – the pipe is always at the center of the survey swath no matter the quality of subsea positioning. Positioning is logged rather than used for aiding the AUV.

Questions like how we replace video with high speed photography images will be answered – the jury is out on whether we deliver a mosaic or insert the original higher resolution images into a GIS. There are calls for both.

The essence of the AUV going forward is that it has to be flexible, it has to be able to deliver the highest resolution at every survey event – in other words, it has to cater to what the client requires. We have experienced an astounding difference in deliverable requirements from our clients.

Conclusion
We need to learn how to acquire, manage, deliver and accept large datasets. We need to review our cost based approach to surveys especially at FEED stage – (review the cost difference from closing the line spacing from 125m to 100m and then review the value of the change in resolution).
There is no doubt that pipeline surveys will be undertaken by AUVs – we need to define deliverables that utilize the unique advantages of an AUV survey and NOT try to replace data from an ROV survey. We should be looking at company cloud servers to distribute data to invested parties. We need to design information systems so that they are fully interactive – over multiple surveys.
Most of all we need to realise that if we choose to do a cheap (disregarding resolution) survey, we will lose the benefits the next time we do the survey.