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Event Report, Transforming offshore operations – with better use of data 20 June, 2017, Aberdeen

Special report

Transforming offshore operations – with better use of data

June 20 2017, Aberdeen

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Transforming offshore operations – with better use of data

Digital Energy Journal held a forum in Aberdeen on June 20 "Transforming Offshore Operations" through better use of data – which covered improving maintenance schedules, making it easier to complete and change maintenance data, optimising logistics and requirements for vessels, laser scan by drone and using analytics to spot problems earlier

There is a big opportunity to save large amounts of money by optimising maintenance and maintenance strategies, by applying existing technologies, we learned at the conference.

Gerry Ward, vice president of Operational Excellence (OPEX) Group and a former offshore installation manager, noted that the average production efficiency on the UKCS is just 71 per cent (a measure of actual uptime divided by maximum possible uptime). This equates to 243m boe a year not produced, or $10bn a year. 44 per cent of the downtime is due to unplanned shutdowns (mainly equipment failure). Of these, 20 per cent are due to a single cause, gas compression systems. And 90 per cent of all failures are preceded by some kind of warning sign, he said.

Also, he said, 62 per cent of failures are associated with a period just after maintenance – so the maintenance work itself introduces failure modes. So doing unnecessary maintenance has more costs than just the labour and spare parts.

Also, the computerised maintenance management systems often don't help. These, we heard at the forum, typically are very rigid, and helping plan your maintenance tasks on a fixed schedule for each item (such as change the chain every 6 months). They are used for planning the work itself, and for people to record what they have done. There are often complex procedures to changing the maintenance plans on the software, and they typically provide no insight into how important the maintenance task actually is.

Maybe these problems are more due to how the software is used, rather than the software itself.

But companies are tackling the problem. RTAMO, a service from Lloyd's Register, is a part software part consultancy service

Gerry Ward

to work with whatever data companies have to try to come up with a better maintenance plan. Operational Excellence (OPEX) Group takes a daily download of sensor data from all offshore systems, and uses their predictive analytics system to compare the data with what happens during normal operation to provide an early warning of emergent system failures. It doesn't just look at individual sensor readings, since an emerging problem does not necessarily show up there, but it looks at the relationships that exist between the readings to highlight any threats or vulnerabilities.

Other companies tackling the problem are ShareCat, helping companies to keep their asset databases more complete; HubHead Corp, making it easier to change asset master data, maintenance strategies, plans and work orders; and Texo Drone Survey, recording a range of information by drone which can be useful in improving maintenance plans, including laser scanning, thermal imagery and ultrasonics.

As speakers pointed out, the aviation industry has clearly found solutions to the problem of unplanned shutdowns - otherwise no-one would get on a plane - and they do it with better maintenance management systems. So perhaps the question to ask is – how can oil and gas maintenance systems be as good as those used in aviation?

This is a report from the Digital Energy Journal conference "Transforming offshore operations – with better use of data" held in Aberdeen, on 20 June 2017

Event website

www.d-e-j.com/event/aa64e.aspx

Presentations and videos from the conference are available for free download from the event website

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Lloyd's Register – optimising maintenance intervals

Many companies are finding that their offshore maintenance schedules are just impossible to meet – when companies are under intense cost pressure, pressure to avoid interrupting production, and there is less personnel available, limited offshore accommodation, and sometimes difficulty obtaining spare parts. But also companies might be doing maintenance tasks which are unnecessary.

Companies do not question the intervals between maintenance tasks which are recommended by the manufacturer and continue doing it for the lifetime of the equipment, said Nikkii Ng, principal consultant with Lloyd's Register.

It is far easier for staff to stick to the maintenance sequence generated by the CMMS, even if it means doing excessive maintenance.

To try to improve the situation, the company is offering a service called RTAMO (Real Time Adaptive Maintenance Operations Solution) to use a combination of data and technical expertise to help companies improve the intervals between scheduled maintenance.

The software does not replace companies' existing computerised maintenance management systems (CMMS). The idea is that they download data from the CMMS into RTAMO, do work (within RTAMO) to improve the maintenance intervals, and upload a revised plan into their CMMS.

The company claims that by using the software, oil companies might be able to reduce maintenance costs by as much as 30 per cent.

Gathering data

The hardest and most critical part of optimising data is gathering the data and working out what you can get from it. The biggest source of data is usually the CMMS.

There are various software packages in use in the offshore environment, including SAP, IBM's Maximo, SpecTec's AMOS and Star Information Systems. "Each platform has a different way of defining your tags, the location, the information you put in," she said. Even two companies using the same software might have it set up differently.

Useful data can include the maintenance plan, the corrective actions which are done, how the company puts together its work plan over the next 90 days, and how much the maintenance costs, or how long it takes.

Some operators only record how much time they expect a task to take, not how long it actually took.

Not all maintenance databases have data which can help you improve – for example they might only store data about equipment failure, but not why the equipment failed or what was done.

So most maintenance software acts like a kind of library, it does not do this sort of analysis, she said.

Nikkii Ng

Sometimes the systems capture data in a "maintenance report", but it is hard to look through it and see if it means that your maintenance performance is good or bad.

"So having collected all the information it is not easy to utilise the information in a good way," she said.

Also, sometimes the content in the maintenance management system is subjective, with operators giving their opinion on how well it went.

Sometimes the data can be enormous – for example, one offshore operator was collecting data for 10,000 pressure safety valves (PSVs). Just working out how to approach this data is hard, she said.

For the person doing maintenance, if you want to try to understand whether a maintenance task has historically been necessary, you have to do a lot of information digging.

Data quality is a big issue. A challenge is that data quality is a subjective matter. "The concept is easy to understand, we want clean data. In practise it is quite a mountain to climb for that."

Data volume is another challenge. There could be up to 50,000 individual tags (pieces of equipment separately identified) in an offshore asset.

Improving the data system

Data systems are not easy to improve. A maintenance system can be seen as like the foundation of a house. You can make changes to the house over its lifetime, but you will always be restricted to the main frame of the house, she said.

Sometimes companies decide they need more information to be added, and try to redesign the CMMS to collect it. "I have seen operators attempt to make a template, which says 'please fill in this blanks' to put in the CMMS. But the actual implementation again is challenging," she said.

They might train one group of staff to do it, but then the personnel changes. Or it could be implemented well for the first 5 years but not sustained.

"We want to know that the maintenance data is able to fit back into the business driving decision making," she said.

Ideally you would have real time information put into the maintenance system. It would capture all data about failures, and compare it to how many failures were occurring under a previous maintenance regime, and if it was a similar failure to the last one.

There are other commercial aspects, such as some equipment might take a long time to obtain replacements.

RTAMO

The RTAMO "Real Time Adaptive Maintenance Operations Solution") business was founded by Dr Neil Arthur and acquired by LR in November 2016. Clients include Repsol, Maersk, Teekay, OMV, Enquest, Nexen, Wood Group PSN, Centrica Storage, Shell and BG Group.

It includes both cloud based software (which can work through a company's maintenance

data and suggest improvements) and associated consultancy.

The software also includes past experience where available – such as past data from the same company's operations, and academic research. It can also include data about failure modes.

The data analysis can be done by an in-house expert, such as an asset integrity specialist, or rotating equipment expert, or by a LR consultant.

"We're trying to put in the human element to it, rather than just look at mathematical logic," she said.

Business objectives

Different companies have different objectives when it comes to maintenance – and LR is careful not to try to influence their objectives, but make a better plan to achieve their objectives.

For example, the operator can decide whether its business objectives are to make sure there is no interruption to operation of safety critical elements (equipment to prevent accidents), or to increase the reliability of production. Or their priority might be to reduce maintenance hours, or to change the maintenance plan in response to changes in production during the plant lifecycle.

Sometimes companies want to come up with a better balance between CAPEX and OPEX – perhaps finding sensible ways to spend more money upfront (CAPEX) which will lead to less spending during the lifecycle (OPEX).

One issue in optimisation maintenance is the balance between operational expenditure (OPEX) and capital expenditure (CAPEX).

At the beginning of the operational life, CAPEX gets the most consideration. But during production, OPEX is constantly changing and depends on how the facility is operating.

Over the lifecycle various factors can increase the OPEX, so it might end up as big as CAPEX overall.

Bad data

One audience member asked, "The quality of the decision that the software makes will depend on quality of the data. My experience of every database is that data is pretty awful. How do you compensate for that?

Ms Ng replied at the end of the day, the decision making is risk based, so based on whatever you have available and what you feel comfortable with. Although it is possible to run algorithms which assess data completeness.

"You never have all the data," she replied. Even getting all the data held by one operator can be hard, especially if the asset is old.

For brownfield projects, you can do an iterative approach, making small changes on the basis of whatever data you have and seeing how it works. This is why the system is called "real time". Any time there is new information, or operating needs change, you can refine the model.

If it is a greenfield project, then it is usually easier to obtain all of the available data, she said.

About Lloyd's Register

Lloyd's Register (LR) is a global engineering, technical and business services organisation. "A lot of what Lloyd's register do as a business and service to the industry is related to using data, to be able to justify, provide a context to why the solution is provided, and understand better if there are any weaknesses or benefits of what we are trying to do," she said.
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Lloyd's Register's history goes back 250 years, when it was established in a London coffee shop, as a service to let people know if a certain vessel could be trusted as an investment or to carry their cargo. So from the beginning, the company was using data to make decisions.

The core business was as a "class society", indirectly giving an assurance for the vessel that it is safe. The company's services evolved from there, and has been extended to upstream oil and gas, with services linked to integrity management and assurance, safety and risk.

A particular issue for the North Sea is life extension, working out if something which was originally built for say 25 years can safely be used for longer. Also finding ways to optimise asset operations without violating safe working limits and keeping in regulatory compliance.

ShareCat Solutions – reducing time to find maintenance

ShareCat Solutions of Norway makes it easier for oil companies to complete 'tag' data, by keeping an online library of tag data from different pieces of equipment, which can then be shared between operators, so systems can be automatically completed. This leads to less time being wasted searching for information.

Sharecat Solutions, based in Bergen (Norway), puts together shared catalogues of maintenance 'tag' data. Its customers can use the database to automatically complete their maintenance systems, if the data has already been completed by another oil company.

It leads to big time and cost savings. If you have good quality information in your systems, it can take on average 8 minutes to find something. If you don't, it can take 100 minutes. And some of the people doing the searching are working offshore, and cost a lot more than £20 an hour to the company. It is very frustrating when you have highly trained people spending time searching for information, said Sturle Drageset, VP sales with Sharecat Solutions.

As a typical example, when you send a a request to your supply chain department asking them to buy something, you might find they call you to tell you the part number of invalid. The only way to get the right number is to send someone to physically go to the location and read the part number on the item. "It takes a lot of time and a lot of money," he said.

Or you need something urgently, and you have some in store, but because the stores haven't been entered in the system with the right part number, you can't find it. There was an example of a drilling company in Norway that needed double sided sticky tape, couldn't find it in their SAP system, and had to arrange for a helicopter to bring a roll of tape from another rig. The day after the helicopter came, they found they already had some tape in their stores but not recorded in their system, he said.

The "material masters", the list of materials information provided by suppliers, can be used to populate the tags. But often material masters miss a lot of information, he said. Perhaps it can be because one supplier acquired another and did not keep the old suppliers' IT systems running.

Sturle Drageset

When the industry climate improves, companies might start hiring people under 30 years old, who are accustomed to having all information at their fingertips, he said.

Maintenance tags

A tag, in engineering data terms, is a collection of data on a location on an asset, which must include a unique set of data and documents.

So a pump on an offshore platform will have a tag itself, and all of its main components, such as the motor, valve and transmitters, will also have a unique tag.

The tag can also include physical properties of the equipment, part number, such as size, maximum - minimum pressure, which is data from the manufacturer.

It will also have data describing the function of the item - how it is used - which will be specific to the particular installation.

If the same piece of equipment is installed somewhere else it might be used for a different purpose. For example the same ABB motor might be used in a number of different places on the same asset for different tasks.

If there is regular maintenance work done on the asset, then the maintenance information will also be included, such as the replacement spare parts that are needed.

If the information is not there, then staff will need to search for it when they do the work.
Some items need more data than others. For example a cable does not need much data except for the specifications of the cable, but a pump might need a lot of data about how the pump should be used.

SHARECat, the "shared catalogue"

Sharecat Solutions' main business is to develop a "shared catalogue" – basically using standard vendor information to complete the operator's system. This information is made available for all companies using the SHAREcat Catalogue by simple integration via web services.

The catalogue can be used to complete gaps in your catalogue. Typically for a typical North Sea operator, 50 per cent of the maintainable tags won't include the part number, and many of the rest will have errors in the part number, Mr Drageset said.

If the tag doesn't include the vendor and a correct part number, then it is much harder to order the right replacement part if you need to.

The SHAREcat Catalogue is based on NORSOK and the ISO 15926 standard for "data integration, sharing, exchange, and hand-over between computer systems." It includes both data and documents.

Customers can send data from SHAREcat to each other by e-mailing the URL of the data sheet.

SHAREcat also gathers spare part data from manufacturers, which can then be made available to the operators and contractors.

The data can be available to anyone who has paid for a license.

The data can be used as a basis for inventory optimisation – making sure you have spare parts in stock which you might need, and knowing if it is safe to throw a certain item away or sell it.

It can integrate with companies' ERP systems which they use to manage maintenance and purchasing. So you can open a tag data directly from e.g. SAP and have all the information you need.

Driven by digitalisation

The drive in the industry to "digitalise" is leading to more interest in tools like SHAREcat, Mr Drageset said. Oil companies are seeing the benefits of 3D models of their assets, and realising that their data is not good enough to build it.
A 3D model can be very helpful if you want to plan maintenance. You can look at the place where you are going to do the work on the 3D model, before you actually do it. But if you don't know if you will find a Siemens motor or an ABB motor there (for example), you don't know what documentation you need, and you can't plan the maintenance.

One oil company customer set about building a 3D model of a FPSO, and found it only knew what was actually installed on less than half of the functional locations, he said.

Data cleansing project

Sharecat Solutions has executed projects for more operators to cleanse tag information, including requesting data from manufacturers that are missing. A typical project to cleanse an offshore asset cost around £3-400,000.

The company will look for gaps and see which ones it can fill. It has tools which can automatically search tags and spot errors. Some data is scraped from documents, usually from the EPCs.

Caring about data

A constant challenge for companies like Sharecat Solutions is that companies do not give data the care that it requires, Mr Drageset said. Data is like the foundation of a business. So good data is like solid rock foundation, bad data is like a sand foundation.

Some EPCs and operators seem to make the same mistake over and over, building a rig and having bad data.

In sales conversations, Sharecat Solutions will often ask its customers, "do you have experiences where you look up in SAP and information is missing," and nearly everyone answers, "That's the challenge," Mr Drageset said.

About Sharecat Solutions

Sharecat Solutions works with over 100 operating assets altogether. The company does cataloguing for operators in Norway, UK and Australia.

The company has also done technical studies for four major operators, calculating the cost of missing information and other factors. "We are pretty good to analyse poor data," he said.
It manages EQHub, a shared equipment catalogue which is owned by Norwegian operators.
Sharecat Solutions was formed from Norsk Hydro in 1993, a company which merged with Statoil in 2007, scanning and digitising certificates, manuals and other documents. Then it went on to build databases of equipment data attributes.

It has about 50 staff in Norway, and smaller offices in Aberdeen and Houston, and a joint venture with a company in Malaysia, which can arrange for data entry work to be done at lower cost. Its software has been in the cloud since 1993.

The company is currently entirely oil and gas industry, although also looking at extending the service to gas power stations, which have the same challenges, he said.

It has had some success in Australia. "In Australia they are much more leaning forward to do this," he said.

The UK, by comparison, has proven much tougher market than Australia. "It is frustrating having to go almost from the North Pole [Norway] to the South Pole [Australia] to do business. UK is just an hour flight from [Bergen]," he said.

PlanSea Solutions – getting by with 50 per cent less vessels

PlanSea Solutions, an Aberdeen start-up company has worked out that oil companies could cut the number of vessels they need by as much as 50 per cent – by using expertise, continual schedule updating, sharing vessels between companies, and some algorithmic power

PlanSea Solutions, an Aberdeen start-up company spun out of Robert Gordon University (RGU), has worked out that Aberdeen operators might be able to safely cut the number of offshore supply vessels by 40-50 per cent, with a mixture of constantly updating schedules, human expertise, sharing space between companies and algorithmic optimisation.

PlanSea has already done work with oil company Nexen, and calculated that Nexen could have done all of its 2016 deliveries using two vessels rather than four, saving £6.5m a year on fleet hire.

The company's founder and technical director is John McCall, Director of the Smart Data Technologies Centre at Robert Gordon University (RGU) and also a professor of computing at RGU. The CEO is Jim Cargill, an oil and gas logistics professional with 30 years experience, who is also on the board of Montrose Port Authority. Company chairman is Paul de Leeuw, formerly Strategy and Commercial Director for Centrica Energy's upstream business, and now Director of the Oil and Gas Institute at Robert Gordon University.

John McCall

The company was one of three finalists for the "Emerging Technology Award", part of the 2017 Scottish "Offshore Achievement Awards," organised by the Society of Petroleum Engineers Aberdeen section.

Offshore supply management is very complex, but "there's clearly a lot of waste in the system, significant over resourcing," Mr McCall said. "That pain has been acceptable in the past but with a low oil price it is not really acceptable."

And, "as the oil price goes up, vessel prices will go up. They will become very expensive."

"I argue this is a transformative technology, it can potentially save hundreds of millions in the North Sea alone.

How it usually works

Vessel schedules are usually put together manually, with a team of staff deciding what goes on which vessel and when it should sail. Typically, operators will hire vessels for their unique use (although there have been some vessel sharing schemes developed).

Deliveries might be expedited if a certain item is very high priority, and there can be restrictions on the times a vessel can attend a certain platform (perhaps due to weather or fitting around other activities).

Vessels all have different capacities, and are delivering many different things, such as tanks of drilling mud in bulk. So there's a large number of constraints in the problem.

The usual way to resolve problems is to put in more vessels. But it can all lead to low utilisations, particularly when there is urgency, people are saying "get the equipment to the vessel it doesn't matter when it costs". Ultimately, typical utilisation of vessel deck space is as little as 30 per cent, Professor McCall said.

PlanSea's approach

PlanSea's approach starts by gathering an understanding of the problem – certain items have to be delivered to certain offshore platforms by a certain date, and with a certain number of vessels available.

There may be other constraints, for example bad weather or when items are available to be collected. There may be a need to change plans rapidly when circumstances change.

The business objectives may vary, for example sometimes achieving a high deck utilisation is less important than getting a certain item to the platform as fast as possible.

Once you have an understanding of the problem, you can use computing power to work out the best way to solve it, often searching through thousands of different possible options, he said.

The algorithm takes out the hard work of producing an optimised schedule, leaving humans free to focus on fine refinements to address issues as they arise.

The software has separate modules for data collection; modelling / simulation / scheduling / optimisation; higher level strategic analysis; and decision making.

With PlanSea's software, the fleet schedules are optimised on a day to day basis, minimising travel time and vessel non-productive time, working out the most efficient sailing routes.

Having dynamic (non-rigid) vessel scheduling turns out to be a big factor in improving the overall system, because if you have an efficient but rigid schedule, the system can lose support when people discover they cannot get their suddenly urgent delivery made, or a storm messes up the schedule for a week.

It can then be used for fleet planning over longer time periods, working out which vessels you need to have on charter.

Nexen simulation

The company did an experimental project with oil company Nexen in 2016, looking over its North Sea operations, and taking a year's worth of data, including the various trips made to each platform each week from Aberdeen and Peterhead.

The software built a simulation of the operations and tried to work out how it could have been done with fewer vessels – including looking at using different sized vessels.

It worked out that Nexen could have done all of its deliveries using two vessels rather than four, saving £6.5m a year on fleet hire, he said.

"Personally I was quite surprised we were able to make that much saving," he said. "I think it shows the difficulty and complexity of the problem and the gain you can get from data driven optimisation."

More of the efficiencies were gained from improving the schedule of platform visits, rather than avoiding non-productive time.

Further optimisations

PlanSea has funding from UK government agency InnovateUK to try to work out what might be possible if operators were to combine fleets, so a number of vessels serve a number of operators in a pool.

Using the software, it can try out different groups of operators and find out what the savings might be on vessels, if they were to share resources. The results can be shared with the operators, so they can clearly see how much money they could save.

There is scope for extending the system to do further optimisations. Offshore staff can be better prepared for vessel arrivals, so vessels minimise the time they spend at an offshore platform. And there may be better ways to unload the vessels.

The company is doing research into "linked problems" in the supply chain – when you have different players with different interest, and that can work against the main goal.

NRX – making it easier to update maintenance orders

NRX AssetHub, a software package made by Toronto company HubHead Corp, aims to make it easier for companies to work with their asset master data – including making it easier to update maintenance work orders

The software aims to resolve a problem that many asset management systems have rigid work processes and make it very hard to update asset and maintenance master data, and end up serving more as a 'system of record' rather than providing useful insights, said Brendan Kelly, managing director EMEA with HubHead Corp.

There are complex 'management of change' procedures to follow in most companies when updating asset master data, including only certain people having authority to change data, these procedures can be difficult to follow and require many steps which means that a lot of the time data updates and changes are not made when they should be. "There are technical and business roadblocks in the way of some of your most skilled people that limit their ability to introduce improvements and efficiencies into maintenance and operations," he said.

This means that the individuals working with the software, such as discipline leads and technical authorities, often feel that the CMMS / EAM systems aren't providing them with the information they need and make planning and executing work more difficult. "They don't like logging onto a system every day that doesn't do anything useful and just causes more work," he said.

If the maintenance data isn't very good, it means that people do not have the right maintenance activities defined, correct equipment identified, limited spare parts for the work that they need to do, and planning / scheduling gets much harder.

Company staff end up relying on their own experience, local records or just asking each other what they need, not looking it up in software systems like SAP which should be the location of the correct master data, he said.

Normally, if a work order is raised and is not fit for purpose the Discipline Lead will make the necessary changes for the work in question and then release it for execution. Theyshould then raise a master data change request (which requires them to put in all the information again)to make sure that when a work order is raised again in the future that it will be fit for purpose, and once the change request is approved they have to enter the changes manually once more into SAP – so they are entering the same data three times.

As an example, there was one asset lifetime extension project, where staff identified up to 50 changes to master data they would like to make during each week of a 26 week project.

But the processes of initiating and completing each change would take 2-4 weeks. Often, by the time the change gets back to approval, the person who raised it has moved on to a different set of activities or even a different project.

"They have to be reminded of the changes that they asked for a month ago - and have the inclination to fix it," he said.

"These people are highly skilled individuals, in high demand. They are not going to go back and pick up these administrative tasks. It is just difficult and time consuming."

"To update and release one work order could require up to 40 different types of data to be modified for it to be successfully executed," he said. To keep records of all of these changes and follow them up after to make sure that master data is updated requires considerable effort and coordination.

Over the lifecycle of an offshore asset, there can be many changes in its operational requirements – for example a platform might spend decades handling a lower volume of fluids than it was designed for. Much of the original maintenance, integrity and reliability tasks identified to keep assets running effectively need to be reviewed on a regular basis and modified to fit the future operating parameters required, this can be where work processes break down and the improvements to the work management systems are never made.

Making it easier

NRX makes tools which can enable planners to capture the changes they make to work orders as they perform their normal duties. The software lets users get on with the tasks they need to perform and will automate integration into the existing change management approval processes. . We just leave the subject matter experts to make one click at the end releasing or closing a work order to say if they want to add those changes to a change request all at once.

The NRX software then captures all the changes automatically from the work order, and then automatically creates a master change request which can be pushed through the 'management of change' system.

The technical authority can move onto the next task, and the master change request gets processed as normal.

Planners and schedulers can start to see a work order breakdown which reflects the actual tasks which need to be performed, the right spares have been requested, and making sure that the right resources and spares are in the right place at the right time.

Then senior engineers can focus on what is actually required to extend the life of the asset, and make regular improvements which they feel will get reflected back into the systems. It can all be done without any additional work in anybody's day jobs. "Straight away we are getting a much higher level of compliance and trust," he said. "Probably the most important thing is that other disciplines - start to trust the information in their CMMS and can perform their dutues easier."

"As soon as you show there's a way to do this, people see, you can make other improvements."

There is perhaps too much emphasis on 'big data' today, because it can be the 'small data' which is far more important in understanding what is going on, Mr Kelly said. "Those small pieces can be critical. And it doesn't have to be fundamentally changing how you approach your business."

Data in the North Sea "isn't too bad" in general, because there are very high safety standards, which forced good data and business practices. But "when you work in some parts of the world you find that some things are just missing," he said. Capturing change is a normal part of everyday work in the Oil & Gas industry, making this easier and more productive can provide big opportunities, benefits and savings.

NRX Software

The NRX software is designed to help companies do more with asset management data, visualise it, and govern it. It covers maintenance, reliability, operations and engineering.

It does not aim to replace asset management systems and computerised maintenance management systems, but help companies to get them working more efficiently, by improving the data in them, and manage the data over the life of the asset.

It works together with software providers like SAP, Maximo and JD Edwards. Of these, it works most often with SAP.

The software is used both on capital (new build) projects, designing better systems for data, and on helping companies better manage their brownfield assets.

Many oil and gas operators are using the software, and the company works in many other industries. The largest other "asset industry" it serves is power generation, transmission, mining and rail. These companies have similar challenges, Mr Kelly said.

The software also aims to make data more accessible, rather than locking it away inside an "engineering data warehouse" which only engineering staff have access to.

For new projects, NRX provides tools which can be used to ensure that the contractor has provided all of the necessary data, and the data is in an appropriate system, for the asset to go to the operational stage.

This avoids people having to go back to contractors after the start-up has occurred, and asking, you know all that data you never gave us, can we have it now," he said.

Fighting apathy

There is enormous frustration in the oil and gas industry about improving data systems, but often with good reason – many people have tried to improve master data in their systems and failed, Mr Kelly said.

"It is just one of those situations where, from the outside looking in, you would struggle to understand why this is such a challenge to managing asset data better. Many of the systems and processes implemented over the years are extremely inefficient. In some ways, and there is a lot of reluctance from vendors and operators to try to make some of the systems work better," he said. "After years of trying people have in many cases given up."

This apathy might go away if it was easier to actually improve the situation. "One individual - who had a reasonable understanding of what our product can do came with an idea, and said - would you be able to do this? It was a case of getting a few people in a room with ideas they have had for years."

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Texo Drone Survey and Inspection – gathering LIDAR data by drone

Texo Drone Survey is developing technology to scan offshore platforms by drone, gathering laser scan (LIDAR) data, and using thermal cameras, hyperspectral cameras and ultrasonic sensors. It should prove a useful way to gather data

Texo Drone Survey and Inspection Ltd, based in the UK, has multimillion private investment to develop technology and methods to harvest data and scan buildings, assets and offshore installations by drone, gathering precision data which can be incorporated into asset models for engineering and asset lifecycle applications.

It is putting laser (LIDAR) scanners, thermal cameras, hyperspectral cameras and ultrasonic sensors on drones.

The company sees taking photographs and video of offshore assets as relatively simple, and suggests that if companies only want video, they could just buy a drone themselves (although the company offers training in how to use it).

The drones themselves are "just taxis", said James Arnott, principal systems officer with Texo Drone. The hard part is gathering and working with the data.

Laser scanning creates a 3D 'point cloud' of data about the asset, which you can import into an asset model (or 'building information model') and used to monitor corrosion and other problems as well as plan maintenance schedules.

Typically, the data points are at 1-3mm distance – the widest distance is 5mm – representing the most accurate UAV-deployed LiDAR solution in the world.

hyperspectral camera systems work by recording colours from the full electromagnetic spectrum (including non-visible light, ultra violet and infra-red).

From analysing the colours in an image, you can (for example) spot asbestos, or spot rust appearing (before it can be seen as the familiar orange colour). It has already been used to identify Japanese knotweed on a railway embankment.

The company often demonstrates to clients how what looks like a "white tablecloth" can have 120 different spectral 'signatures' on it picked up by the camera.

The points in the 3D point cloud are accurate to less than 10mm in terms of positioning accuracy.

Texo Drone Survey and Inspection Ltd was founded in 2016, although many staff have operational experience of over 20 years. It anticipates a large market, including on-and-offshore installations.

The company claims to own the "world's most comprehensive fleet" of advanced UAV systems . There are other companies doing part of what Texo does, but no-one doing all of it, Mr Arnott said.

The company spends 25 per cent of its overall budget on research and development.

It is the first company in the world to successfully deploy a LIDAR scanner of these accuracies on a drone, he claimed. UAV Laser scan surveys "have never been done before to this accuracy," he said.

Offshore LiDAR Survey - The work process

When surveying an asset, the path of the drone is planned in advance, to ensure the necessary data is gathered. It flies around the asset at a distance of 30m, acquiring a million measured points per second.

The drone is piloted by a professional drone pilot with minimum 300 hours drone flying experience. Experience is very helpful flying drones – for example you will learn that the power consumption is much higher flying against the wind than with it, Mr Arnott said.

The data gathered by drone of the assets' exterior can be complimented by data gathered of the interior of an asset, with a LIDAR scanner fixed to a backpack carried by an offshore worker, walking around.

By putting the internal and external data together, you can see a full asset or building information model of the structure – providing unsurpassed data to inform engineering decisions.

Texo Drone Survey and Inspection Ltd also offers services to help you integrate the drone data into your bespoke asset models.

Benefits

The main benefit of putting laser scanners on drones rather than having handheld cameras is efficiency – it is much faster to do a scan by flying a drone around it, than by having people who need to access all areas. There may be a need to build scaffolds so people can access difficult areas, and associated safety hazards.

As an example of the typical time saving, a scan of a refinery, which would normally take 12 weeks if done by handheld cameras, was done in a week and a half by drone.

Other benefits are that you might be able to gather additional useful data. One refinery used the systems to put together a 'building information model', and discovered that it had 8,000 square feet of un-used space behind cavity walls. The company did not have any structural drawings of its facilities.

Technology developments

Texo Drone Survey and Inspection Ltd is testing out using an ultrasonic steel thickness testing device on a drone, with field trials in oil refineries. This could be used to test for corrosion, because the steel would be thinner if it has corroded.

The drones have also been used for deliveries – they can drop 5kg from an onboard winch, or deliver a 40kg cargo if there is a helideck available.

It has done inspections with a laser scan together with a thermal camera and 360 degree visual camera, so getting 3 types of data in 1 run

James Arnott

The company is also developing new ways to do scanning inside structures, perhaps with a base controller unit which the drone can communicate with.

The internal scanners can be carried in different ways, including on a trolley, or even pulled across the facility on a zip wire.

Spatial integration

One challenge with the system is integrating all of the data together afterwards, particularly if you are scanning a moving asset (such as a ship rolling on the sea).

However computer systems can do a lot of the heavy work of piecing together multiple datapoints to make a single image. The technical term is "point cloud flexing".

The technology can also compensate if the GPS is not available, for example if you are recording the legs of an offshore platform and the topsides are blocking sight to the satellite.

OPEX – Predicting failure to reduce unplanned shutdowns of offshore equipment

Aberdeen-based, predictive analytics company OPEX is focussed on reducing unplanned shutdowns of critical offshore oil and gas plant – by taking daily downloads of offshore system sensor data, and comparing the relationships to what might be expected, to expose warning signs and pinpoint threats/ vulnerabilities.

Aberdeen-based, predictive analytics company OPEX (Operational Excellence Group), founded in 2010, aims to help companies reduce unplanned shutdowns of critical oil and gas equipment – by taking a daily or twice-daily download of offshore system sensor data, and comparing the relationships between data points to what would be expected to happen, and thereby providing early warning if there might be a problem emerging.

Spotting a problem from the data from any particular sensor is very hard – and problems can evolve without any one sensor showing any anomaly, said Gerry Ward, vice president of OPEX.

But problems can be detected using OPEX's Predictive Analysis Service, known as X-PAS, by looking at how the relationships between data points change.

To give a real-life example – there was a problem with a diesel filter after maintenance work, which meant that dirty diesel was passing into the combustion chamber and burning unevenly, so different parts of the engine were at different temperatures. If unfixed, this would ultimately lead to thermal shock and damage to the engine parts.

Any individual sensor would just have shown that the engine was at a temperature within its usual envelope – but the X-PAS service highlighted the problem as the readings from all the sensors on the engine were starting to diverge, rather than all showing a similar temperature.

This way, OPEX is able to look at the entire operating system offshore, not just specific pieces of equipment. So it can look at both rotating and static elements, valves, turbines and compressors, and all process system instrumentation.

Tolerating unplanned shutdowns

An unplanned shutdown basically means an unexpected equipment breakdown.

We know that the aviation industry never has unplanned shutdowns during operation, because if it did, we simply would not get on an aircraft, Mr Ward said. So it must be technically possible to avoid unplanned shutdowns.

Consider the financial implications. The average production efficiency on the UKCS is just 71 per cent (a measure of actual uptime divided by maximum possible uptime), he said. This equates to 243m boe a year not produced, or $10bn a year. 44 per cent of the downtime is due to unplanned shutdowns (mainly equipment failure). Of these, 20 per cent are due to a single cause, gas compression systems. And 90 per cent of all failures are preceded by some kind of warning sign.

Also, he said, 62 per cent of failures are associated with a period just after maintenance – so the maintenance work itself introduces failure modes. So doing unnecessary maintenance has more costs than just the labour and spare parts.

Also – approximately 85 per cent of the shutdowns are associated with what is called "off package events" – which includes ancillary equipment and instrumentation. Problems with ancillary equipment could be harder for human experts to spot, because they would need an understanding of usual operations of the system to spot a problem. But a predictive analytics system can be a great help.

If there is a system shutdown, oil companies must then incur further risk, because the start-up might not go smoothly. It can take a while to restart, and you may discover that the maintenance or remediation work has not been perfect – for example you have a leaky seal – and you have to do it again.

Altogether, unplanned maintenance can cost seven times as much as planned maintenance, because you don't get the benefit of doing everything in a controlled and optimised way.

X-PAS

OPEX's core technology, X-PAS, compares current sensor data from the offshore equipment, with sensor data from a time when the equipment was known to be running normally, to see if it can spot any anomaly.

Gerry Ward

Each data download from offshore equipment might include several million data points, including temperatures, pressures, flows, bearing temperatures, axial displacement.

All of the data is generated by sensors which the oil company has already installed, so no capital investment is needed.

OPEX employs people from different disciplines who work with the data, including data scientists, rotating equipment engineers and process control engineers.

The data scientists analyse the relationships that exist and pinpoint any anomalies, whilst the engineers place these insights into context of the offshore operating environment

"We class ourselves as a bridge between data science and operational outputs," he said.

"The crucial bit is the interpretation, not flooding the client with 'I've found this,'" he said. "That's where we differentiate ourselves from other companies operating within the data science world."

The technology can also be applied to a new facility, comparing the actual data with a simulation showing what the data should be in perfect conditions. Then you can gradually change artificial data for real data, he said.

Gas compressors

The technology creates most value in critical oil and gas systems, such as around power generation, gas compression and water injection,

where the failure rate is the highest and cost of failures is the greatest.

OPEX used its predictive technology with a North Sea operator with one of the "biggest producing assets in the UK North Sea," for the 2016 calendar year, to try to reduce the rate of gas compressor failures.

It managed to reduce the number of "system trips" (when the gas compressors shut down) by 65 per cent, extending the average time between trips from 17 to 54 days. Altogether, the company reckons that its predictive analysis avoided the platform being completely shut down 4 times, and avoided 8 partial shutdowns, Mr Ward said.

The shutdowns incur costs in both lost production and maintenance work to fix the problem.

And as well as these 'headline' items, the company has helped the operator achieve large amounts of incremental change in operational efficiency, with the system operating with much more stability

The work has also identified ways to reduce maintenance from the planned (usually manufacturer set) intervals. If your daily data analysis shows that all operations are within an acceptable envelope, there is the basis for altering the maintenance strategy and potentially removing costly scheduled maintenance with more emphasis on system condition, Mr Ward said.

Finding root causes

Finding root causes of problems can be hard. A typical root cause of a problem could be a faulty seal as a result of an earlier maintenance task. But the faulty seal does not directly cause the breakdown, it may be just the symptom with the actual root cause not being readily apparent.

Conventional monitoring techniques are time consuming and often inaccurate in the identification of emerging system problems. Whilst individual sensor readings may well be plausible, and in isolation, not an immediate concern, the relationship between various sensors may offer a different picture.

Applying X-PAS techniques in retrospective analysis to understand root cause of failure is exceptionally accurate and quite rapid in application, with analysis of statistical data to identify abnormal behaviour, Mr Ward said.

Once this statistical view is acquired, domain experts can then take a deep dive to validate and verify the underlying issues.

The use of X-PAS in root cause analysis has proved to be exceptionally valuable with one customer setting OPEX the challenge of establishing root cause of failure of a gas turbine looking at system data only. With 6 months of operating data acquired, OPEX created the various operating models and within two weeks had established a timeline of events that accurately revealed the root cause of failure (from data alone). Had the X-PAS service been in operation on the system, OPEX would have identified the problem some 5 months prior to failure, allowing for timely intervention.

digital energy journal

Transforming offshore operations - mature asset management and logistics, Aberdeen, June 20 2017 Attendees

Euan Macalister, Business Development Manager, Amec Foster Wheeler

John Lawson, AVEVA Solutions

Boyd Ross, Cetix

Karl Jeffery, Editor, Digital Energy Journal

Graeme Lamont, Manager, DNV GL

Richard Mackay, Consultant, Eira Ltd

Austin McKenzie, eLearning Team Lead, Electra Learning

John Dalton, Snr Managing Consultant, Halliburton

Brendan Kelly, Managing Director EMEA / AP, HubHead Corp (formerly NRX Global Inc)

Graham Davidson, Intrasoft Ltd

Graham Manning, Sales, IVB Limited

Alexander Petrie, Director, Left Field Associates Scotland Ltd

Nikkii Ng, Principal Consultant, Lloyd's Register

Chris May, Systems Director, Oceaneering

Gerry Ward, Vice President, Operational Excellence (OPEX) Group

Jolene Martin, Opxcel

Dan Mosca, Consultant, PA Consulting

Professor John McCall, Director, PlanSea Solutions

Neil Brady, Managing Director, Scopus Engineering

Robert Hamilton, Business Development Manager, Scopus Engineering

Sturle Drageset, VP sales, ShareCat

James Arnott, Principal Systems Officer, Texo Drone Services

Graham Hayward, CEO, Wavelength Scotland

Dan Rigby, Information Management and Document Control Manager, Wood Group ODL

What did you enjoy most about the event?

Informative presentations covering a broad spectrum of the subject matter

Good range of topics with practical application. *John Lawson (AVEVA Solutions)*

Interesting presentations. *(IVB Limited)*

Quality of presentations and dialogue with participants as well as the subject matter. *Alexander (Sandy) Petrie (Left Field Associates/Teradata)*

Some very relevant material - interesting food for thought and some potential new business connections.

The variety of subjects covered.