SMART FACILITIES - THE INTEGRATION OF ARTIFICIAL INTELLIGENCE, ANALYTICS, INTELLIGENT SENSORS AND ROBOTICS TO IMPROVE INSIGHTS, REDUCE COSTS, INCREASE PRODUCTION AND IMPROVE SAFETY

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Abstract

Advances in artificial intelligence (A.I.), analytics, sensors and robotics are already adding tremendous value to the liquefied natural gas (LNG) sector.

Woodside has already deployed:

- Multiple A.I. systems throughout the value chain in areas as diverse as major capital projects, health and safety and drilling;
- Advanced analytic networks assisting in production optimisation and predictive planning;
- Low-cost, long-life wireless sensors that can be easily deployed and integrated with existing data systems to provide further insight to staff; and
- Robotics to assist operations, maintenance and engineering staff in the running of remote facilities, including performing basic tasks.

While each of these technologies have proven valuable in their own right, Woodside – together with our collaboration partners inside and outside the oil and gas industry - is now combining technologies to create a bridge between the digital and physical realms of our facilities.

In this presentation, Woodside will share lessons learned from our proof-of-concept site trials of these digital and robotic systems.
Background

Our global exploration portfolio is balanced across established, emerging and frontier provinces covering Australia and the Asia-Pacific region, the Atlantic margins and sub-Saharan Africa. Currently, we are focused on drilling to grow our resource volumes.

We have significant equity interests in high-quality development opportunities in Australia (Wheatstone, Scarborough and Browse), Senegal, Myanmar and North America (Kitimat), and are pursuing new concepts and technology to enable cost-effective commercialisation of these resources.

Our producing assets include the landmark North-West Shelf Project, Pluto LNG and non-operated Wheatstone LNG. Our operated assets are renowned for their safety, reliability and efficiency. As Australia’s leading LNG operator, we produce 6% of global LNG supply, and operate a fleet of floating production storage and offloading (FPSO) facilities.

We continue to expand our capabilities in marketing, trading and shipping and have enduring relationships that span more than 25 years with foundation customers throughout the Asia-Pacific region.

Woodside continues to promote the use of LNG as a low-emissions and economically viable alternative fuel. Today we are also pioneering remote support and the application of artificial intelligence, embedding advanced analytics across our operations and making improvements in additive manufacturing.

Woodside demonstrates strong safety and environmental performance in all its operations. We are committed to upholding our values of integrity, respect, working sustainably, discipline, excellence and working together. Our success is driven by our people, and we aim to attract, develop and retain a diverse, high-performing workforce.

Core Aims and Overall Philosophy of Advanced Technology Integration

The energy sector remains at the forefront of operating complex equipment and facilities remotely.

The technology, process and procedures have evolved due to increasing remoteness and depths of new resource discoveries.

A new wave technologies are emerging that offer the potential to vastly increase the scope of oil and gas assets that can be operated remotely. These technologies include: data science, remote operator awareness, automation, autonomy, Industrial Internet of Things (IIOT) and robotics.

Companies that can successfully integrate these (often disparate) technologies can achieve a step-change in:

- Health and safety, through reducing staff exposure to tasks carry a degree of risk;
- Workplace efficiency, by elimination of dull and repetitive tasks;
- Operational margins, through automating of low value work, and increasing production by using data science to augment operator skill;
- Capex, through reducing the infrastructure, equipment and consumables needed to support people working remotely; and
- Workforce engagement and development, by automating dull and repetitive tasks, and creating new career paths for both trade and tertiary backgrounds.

Woodside continues to innovate in this area by developing new and novel solutions, testing them in operational LNG facilities and deploying them. Our remote operations work continues to support Woodside’s immediate growth priorities, as well as our long-term future.

Approach
The data science and technology teams at Woodside operate within a different framework that is traditional within the energy sector and has more in common with software development. The solutions are a mix between advanced data science technologies and new hardware development – both of which occur concurrently within the teams.

We accomplish this by building and developing teams that are both highly skilled and motivated, but also diverse in skill-sets and backgrounds. As an example, our teams contain instrumentation, electrical and controls (ICE) engineers, operations staff who have previously been Offshore Installation Managers (OIM’s), software developers, autonomous systems specialists, and those with deep software and systems integration experience.

However, the teams are not restricted to Woodside staff only. Woodside also collaborates heavily with organisations outside of the oil and gas sectors, including the space sector (e.g. NASA), defence (e.g. ASC Pty Ltd), and mining, as well as several academic institutions. It is common to see staff from these organisations embedded with teams at Woodside.

Woodside’s approach to innovation is to “Think Big”, that is, to work on solutions that provide a “step-change” in capability, are not commercially available or are yet un-proven. We then “Prototype Small”, or to prove the concept or system on operational facilities. This is done on a typical two-week sprint cycle, with 2-3 days of that time being on site to install and test new systems. Finally, we “Scale Fast” by developing supply chains and working with organisation to provide ongoing and wide-ranging development and support.

Achievements to Date

Woodside’s achievements in data science over the past four years is well documented and includes award winning cognitive computing applications, overarching A.I. systems (Willow) as well as Advanced Analytics platforms.

In 2018, Woodside merged our Intelligent Systems (IIOT team) and Cognitive Robotics team to form a dedicated group to develop Intelligent and Autonomous System technologies. The aim is to greatly increase the complexity of facilities that can be operated remotely by using intelligent and autonomous systems to:

- Quickly gather new data, fusing it with existing data, analysing the updated data and packaging results and recommendations to staff;
- Provide staff with better awareness of the state of their equipment than would be possible if they were physically next to it;
- Automate operational rounds and routines to free up staff to act on insights above; and finally;
- Investigate anomalies and in the longer-term, directly respond, whether supervised by human operator, or autonomously.

Woodside has now shifted from a series of largely independent proof of concepts (IIOT, Visualisation, Robotics) to a pilot program on our Pluto LNG facilities to prove the robustness and value of these technologies, as well as provide significant insight on the system integration required to scale these technologies and incorporate them into the base design of new facilities.

Examples of our growing maturity include:

- Designing, developing and installing a variety of new, low-cost, EX-Rated wireless temperature and vibration sensors that supplement existing sensors, including the IIOT platforms required for device management and data analysis;
- Developing small wireless cameras that can be used to detect fluid levels as well as general operational awareness;
- Conducting robotic site trials, including operating a surveillance robot on the North Rankin Complex on the North-West Shelf of Australia from Woodside’s head office in Perth, Western Australia (an Australian-first use of robotics on an offshore oil and gas platform);
- Assisting a mining company to eliminate a hazardous situation at an underground mine using robotics;
- Advanced visualisation (digital twin) of the equipment on the Pluto LNG facility, fusing together data and insights from multiple sources.
Key Learnings

Innovation is defined as new and novel ideas, executed well, that deliver demonstrable value. In the past, innovation largely took the form of invention (one new product, software, hardware). Now, innovation increasingly comes from eloquent systems integration – getting disparate technologies to work together to deliver value through a multiplier effect.

This transition requires a change in mindset from the old and slow-moving inventor model, including secretive research and development (R&D), and patents to protect intellectual property (IP), to a much faster and more iterative model of delivery and implementation. The pace of the component parts of a technology stack are upgraded and changed yearly, if not quarterly.

Given the increased pace of innovation, a change is required in terms of how we develop software or hardware solution to either solve our industries challenges, or to take advantage of the opportunities that our sector is presented with.

Historically, our sector looks to our suppliers and service providers to provide quotes on solutions, services, or equipment. However, to take advantage of rapidly-changing technology, a more modular and open architecture is required, where energy companies can weave in required functionality from a range of suppliers – and change it out as needed. This requires different capabilities to those we’ve traditionally sought.

Additionally, in this new era of innovation, open collaboration produces meaningful results and pace demanded by industry. Woodside teams compose not only of Woodside staff, but our collaboration partners’ staff, represent different industries. This collaborative not only accelerates the development of solutions across participating organisations, but increases the mutual trust to the extent we now rely on each other to assist with operational challenges.

Within the energy sector, collaboration is also important as exploration and production companies have different strengths. Woodside enjoys the benefits of collaborating with our joint venture partners, as well as other technology leaders within our industry.

Additionally, we have found it critical to “blur the lines” between our operational staff, engineers, data science and the traditional information technology functions. It is now common to see software engineers hold hot work permits and install equipment on our operating facilities, working in full compliance with all the processes, procedures and systems that governs traditional oil and gas work.

Woodside looks forward to showcasing real examples of the technologies described in this paper at LNG 2019 in Shanghai, China.

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