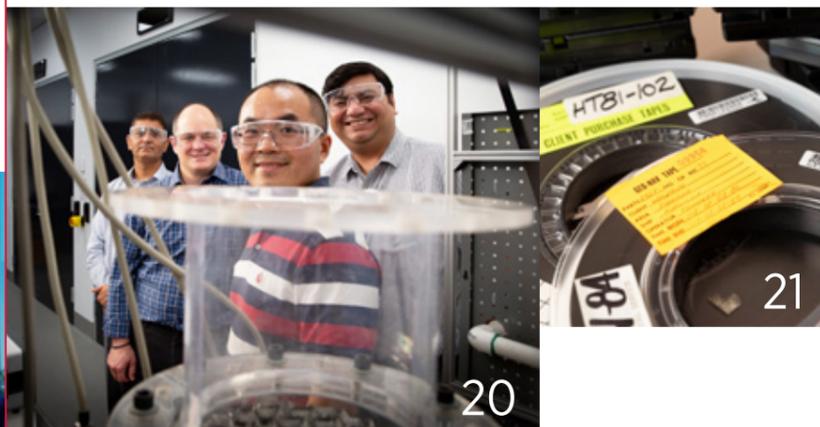


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On the cover

People power: Our annual in-conference – the Woodside Sprint – brings staff together to build knowledge and share ideas.

When entries rolled in for the 2019 Woodside Awards, the depth and breadth of high-quality effort taking place throughout our business was clear.

In fact, for the first time ever, there were joint winners of the Chairman's Award for Excellence – the Greater Enfield Project and Unlocking Scarborough's True Potential.

In one case, the team delivered a complex project scope safely, on time and under budget.

In the other, inquiring minds searched for previously unseen

value in our Scarborough prospect and, leveraging the latest technology, found it.

These examples show that Woodside's gritty pioneering spirit and determination to achieve strong results remain strong.

The following pages provide even more evidence, so read on.

Woodside's everywhere are working hard to set up a long and successful future for our company.

Notes on Petroleum Resource Estimates: All petroleum resource estimates in this publication are to be read in conjunction with the Reserves Statement in Woodside's most recent annual report, as updated by subsequent ASX announcements available at <http://www.woodside.com.au/Investors-Media/Announcements>. This publication may contain forward-looking statements that are subject to risk factors associated with oil and gas businesses.

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Myanmar **moves** ahead

Woodside's proposed deep-water gas development in Myanmar took an important step forward in December with the signing of important fiscal agreements.

The agreements move the Block A-6 Joint Venture (JV) development from its exploration and appraisal phase into its pre-front-end engineering design (pre-FEED) phase.

Block A-6 is located offshore Myanmar in the Rakhine Basin and covers approximately 10,000 km² in water depths of up to 2300m.

It will be the first ultra-deep-water development in the country's history.

Woodside holds interests in nine offshore blocks in Myanmar and these activities support Horizons II and III of our growth strategy

Executive vice president Development Meg O'Neill represented Woodside at the signing, in Nay Pyi Taw, the capital of Myanmar.

"This gives Woodside the certainty we need to move forward with the A-6 Joint Venture (JV) towards achieving our target of FEED entry next year," Meg explained.

"This milestone has been reached through hard work, cooperation and support from the Government of Myanmar and our joint venture partners MPRL and Total."

Woodside holds a 40% interest in the JV and is the technical joint operator for exploration and appraisal operations.

French energy company Total holds a 40% interest and MPRL E&P Pte Ltd holds 20% and is also a joint operator.

Total will assume operatorship in the development phase and Woodside will become a non-operating venture (NOV) partner after FEED entry – targeted for the second half of 2020.

Five wells have been drilled at Block A-6 since 40m of net gas pay was first discovered in 2018 at Shwe Yee Htun-2.

Gas has been found in all subsequent wells. The estimated resource (Woodside share, subject to finalisation of agreements) is 67 MMboe.

The development concept includes the drilling of around 10 ultra-deep-water wells (six wells in Phase 1 and up to four additional wells in Phase 2), drilled in water depths of between 2000m and 2300m, linked to a subsea gathering system to a shallow water processing platform.

The gas will be exported via a 240 km export pipeline to a riser platform located near the existing Yadana platform complex and then to Myanmar and Thailand via existing pipeline infrastructure.

Meg said that Woodside, as a responsible investor in Myanmar, could play a positive

role in the country's development.

She noted the A-6 Development would generate a significant long-term revenue stream for the country and pay taxes and royalties to the Government of Myanmar.

"We know that natural gas has a vital role to play in delivering the extra energy that countries need as part of a lower-carbon future," she added.

"We are also proud that this development has been structured to benefit the people of Myanmar through training, development and capability build for Myanmar nationals."

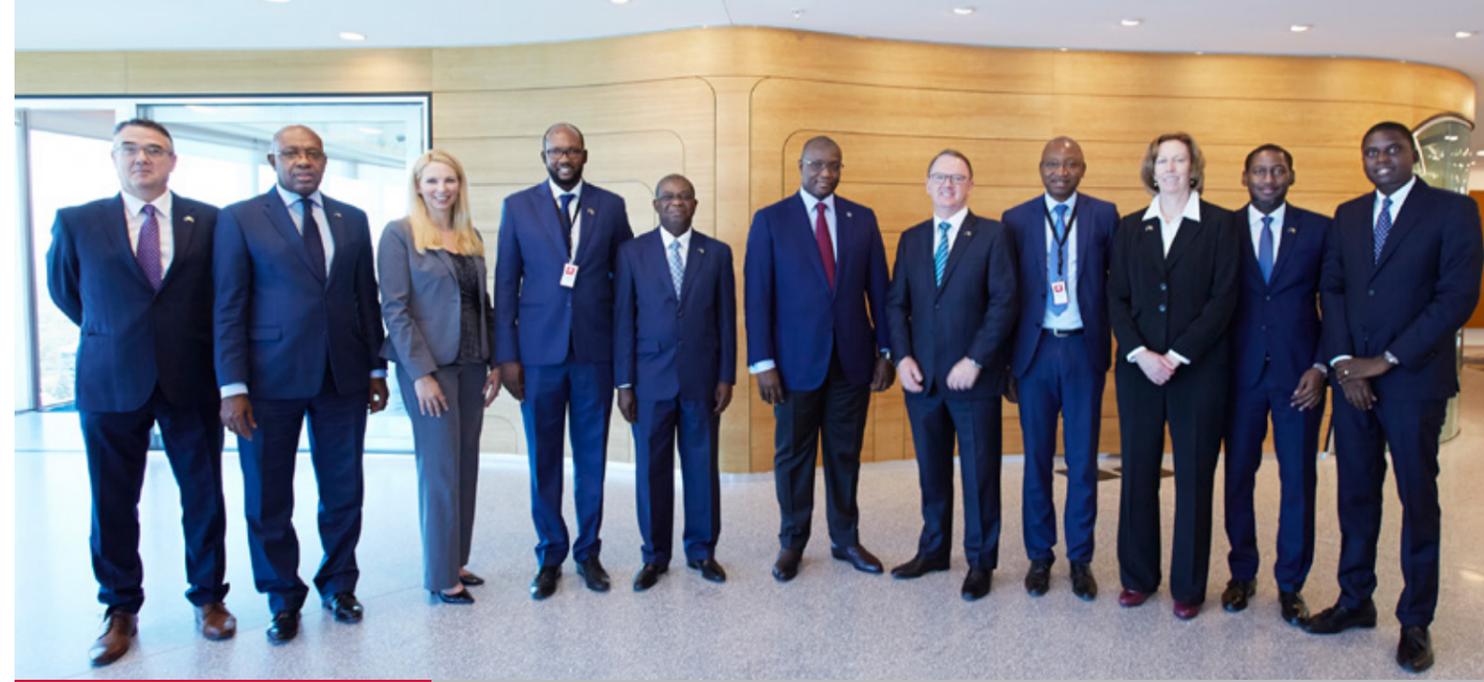
Woodside maintained a strong focus on ensuring local people and businesses could participate along all stages of the supply chain, she said.

"Pleasingly, during our last drilling campaign 35% of the contractor workforce were Myanmar nationals – employed through our drilling services supply chain," Meg said.

Another pleasing statistic was the safety record Woodside, as the exploration operator, had achieved across three separate drilling campaigns.

"I am proud to report that there were zero lost time injuries," she said.

The date of first gas from Block A-6 is subject to finalisation of agreements.



Delegation visit: Mouhamadou Cisse, Senegal's Minister of Petroleum and Energy, on CEO Peter Coleman's right in the above picture, led a delegation to Mia Yellagonga in December and met senior leaders of Woodside. Below, one of the facilities inspected by the visitors was the incident coordination centre.

Senegal delegation welcomed

Woodside played host to Senegal's Minister of Petroleum and Energy Mouhamadou Cisse when he led a delegation to Western Australia in early December.

The Minister was accompanied by senior officials from the Ministry of Petroleum and Energy, the National Institute of Petroleum and Gas, the Government agency GES-Petrogaz and senior officers from Petrosen – Senegal's State-owned oil company which is a participant with Woodside in the Sangomar (formerly the SNE) Field Development Joint Venture.

Meetings in Perth included two days of briefings and a tour of the facilities at Mia Yellagonga, where visitors inspected the incident coordination centre as well as the robotics laboratory and remote operations centre, showcasing Woodside's experience and capabilities as a world-class oil and gas operator.

The delegation also flew to the Pilbara where they saw our offshore assets and inspected the Karratha Gas Plant, the Pluto LNG Park and the King Bay Supply Facility, including a visit to the Siem Thiema – Woodside's LNG powered platform support vessel.

The Sangomar Field Development (Phase 1) targets about 230 MMbbl of oil resources and is a key component of the company's Horizons II growth strategy.

The development concept includes a stand-alone floating production storage and offloading (FPSO) facility and a network of subsea infrastructure to support future development opportunities including supplying gas to shore in Senegal.

Woodside is operator and holds a 35% participating interest in the Senegal Rufisque Offshore, Sangomar Offshore and Sangomar Deep Offshore (RSSD) production sharing contract and RSSD

joint operating agreement covering the RSSD exploration blocks.

At a dinner for the delegation, our chief executive officer Peter Coleman said that as a true partner of choice for Senegal, Woodside was committed to progressing discussions with the Senegal Government for timely execution of the development with first oil in early 2023.

The CEO added Woodside looked forward to progressing exploration opportunities and further seismic and drilling activities over the next two years, as well as a domestic gas opportunity in partnership with Senegal.



Block development: Woodsiders including Meg O'Neill joined Myanmar officials for the signing of fiscal agreements in Nay Pyi Taw, the country's capital, in December. The agreements help move the Block A-6 offshore development into its pre-front-end-engineering phase.



Winning smiles: Clockwise from overpage, the 2019 Woodside Awards broke new ground when two entries shared top prize, the Chairman' Award. The teams behind the Greater Enfield Project and Revealing Scarborough's True Potential receive the award from Board Chairman Richard Goyder; the Base Business Excellence prize went to the team that brought Situational Awareness to the Frontline; work on staffing the Pluto platform resulted in Breaking Down Diversity Barriers Offshore collecting the Culture and Inclusion award; and Goodwyn BESS - A World First was awarded the Sustainable Outcomes award.

Honours **shared**

Two entries shared top prize in the 2019 Woodside Awards after our Chairman Richard Goyder declared he was unable to separate them.

It's the first time in the awards' history there were joint winners of the Chairman's Award - the Greater Enfield Project and Revealing Scarborough's True Potential.

"Each, in their own way, has reinforced the fact that Woodsiders can and will deliver on the promise of our growth horizons," the Chairman told the audience at the awards ceremony, held at Boolah daa Moort in early December.

"In fact, these successes show we may well exceed expectations."

The Chairman continued that in one initiative (the Greater Enfield Project), the team had demonstrated exceptional project capability in completing its complex program of work safety, on schedule and under budget.

"Along the way, we set new world benchmarks," he added.

In the Scarborough initiative, Woodside had been bold enough to challenge the assumptions of others and been handsomely rewarded.

"Leveraging the latest technology, we have revealed greater clarity - and greater resource volumes - for our Burrup Hub," he said, alluding to the 52% increase in the potential resources of the Scarborough gas field.

"These are amazing feats."

The annual Woodside Awards recognise and reward outstanding achievements in the business during the year.

The Chairman described the winners and finalists as "just the tip of the iceberg".

He continued: "There is a lot of incredible work going on throughout the company, onshore and offshore, in Australia and overseas.

"Our judges were spoilt for choice."

Entries came from throughout the business, including overseas offices, offshore assets and Karratha.

The category winners were:

Innovation: Revealing Scarborough's True Potential.

Through integrated subsurface studies, Woodside has revealed a 52% increase in the estimated resource volume of our Scarborough field (see page 8).

This incredible outcome was the result of astute technical work, incorporating full waveform inversion 3D seismic

reprocessing and updated petrophysical interpretation.

The Scarborough subsurface and geoscience technology teams took a legacy dataset spanning decades and, through integrated assessment, made a game-changing discovery.

Value: The Greater Enfield Project.

The Greater Enfield Project involved the drilling and long subsea tie-back of three complex oil fields to a refurbished Ngujima-Yin floating production storage and offloading (FPSO) facility 60 km offshore of Exmouth.

This ambitious project exceeded many of the expectations set at FID, coming in under budget.

The FPSO shipyard scope was completed without a single recordable incident.

The project has set several new benchmarks, including the longest horizontal subsea water injection well in the world and the world's first buoyant pipeline crossing of a seabed canyon.

Sustainable Outcomes: Goodwyn BESS: A World First.

The Goodwyn Battery Energy Storage System (BESS), a world-first offshore installation, allows the platform to operate with three gas turbine generators online instead of four, while improving the reliability of the power supply system.

BESS reduces both fuel gas consumption and CO² emissions and is expected to save the company substantially on maintenance costs

over the next five to seven years.

Since start-up, BESS has been performing better than originally expected (see page 15).

Base Business Excellence: Bringing Situational Awareness to the Frontline.

Traditionally operators have had to extract, sort, analyse, prioritise and communicate key asset information manually, including via spreadsheets.

A group from Operations, Digital and Engineering got together to develop a better way and Situational Awareness was born.

Automated insights enable operators to make higher quality and more timely decisions.

Culture and Inclusion: Breaking Down Diversity Barriers Offshore.

Pluto is not normally a manned platform, so bed space is tight. There are only four rooms with four beds in each, and each room is required to be filled by people of the same gender.

To ensure people on board (POB) limitations did not impede diversity and inclusion aims, the operations readiness team, with strong collaboration from within the company and our contractors, took a fresh approach.

A diverse multidiscipline execution team was assembled, opening a pathway for development and setting an example of future projects and existing assets, highlighting what can be achieved within POB and facility limitations.





Being flexible: Lewis Kemp, Tony Owens and Sjef Ijzermans discuss flexible risers for the Scarborough project.

Rising to the occasion

Woodside has become the first operator in Australia's oil and gas industry to embrace a breakthrough in flexible riser technology.

New "carcass" technology has been successfully tested and Woodside's collaboration with and support for the flexible riser supplier has allowed the vendor to commercialise its innovation.

The aim was to best exploit the Scarborough reservoir, which comprises very dry gas at a water depth of more than 950 m.

Bringing this resource to the floating production unit (FPU) on the surface, where the gas will be processed, comes with its challenges.

The plan is to extract the gas via flexible risers, which will boast a big internal diameter of 14 inches.

"This will ensure that a large volume of gas can be produced through a relatively simple subsea field layout," says Scarborough project manager Morgan Harland.

The 14 inch diameter pipe will require sufficient collapse resistance to

withstand the pressure at 955 m water depth to export the dry gas to the FPU.

Records suggest this will be the first use of such a large diameter riser in such deep waters.

But when flexible risers are used, the dry gas brings risks of something called flow-induced pulsation or FLIP.

FLIP can be described as a high-frequency sound and vibration phenomenon that might generate unacceptable noise and structural vibrations in adjacent piping or equipment, explains senior flexibles and umbilicals engineer Sjef Ijzermans.

Fortunately, NOV Flexibles, a sub-contractor of the Subsea Integration Alliance (SIA) which is delivering the subsea engineering, procurement, construction and installation (EPCI) scope for Scarborough, is working on a solution to mitigate this issue.

NOV believes the answer lies in improving the unevenness of the inside of the pipe's "carcass" – an interlocked metallic construction that is used as the innermost layer and which prevents the pipe from

collapsing due to external pressure.

A qualification program, developed in close cooperation with NOV and SIA, ran until late October.

The program included fabrication trials and a range of tests such as large-scale dynamic testing and various collapse tests, during which pipe samples were exposed to an external pressure of 160 bar.

And it included a large-scale dynamic test of the carcass in which the carcass was bent 1.4 million times.

Lewis Kemp, general manager for subsea and pipelines, has been pleased with the results of the tests as it proves the selected concept works for the project.

"It is another great example demonstrating that we can secure value if our functions and projects work collaboratively with our informed buyers," Lewis says.

This innovative approach to managing risk and optimising opportunities will continue to be used in all aspects of our business, he adds.

Unlocking Scarborough's potential

The exciting announcement in Q4 of a massive upgrade in the Scarborough field's potential resources is the result of years of dedicated research and teamwork.

Another pivotal factor for the success was the company's determination to push the envelope rather than accept the traditional way of working.

In 2016, Woodside entered a new frontier in digital technology and geoscience innovation.

We became the first company to apply the power of Google Cloud computing to Full Wave Form Inversion (FWI) advanced seismic processing techniques. The completion of the 3D Thalín high resolution FWI project in Myanmar was run entirely on cloud computers.

This initiative set the scene for the application last year of FWI to the Scarborough 3D dataset of 2004.

"This resulted in significantly improved imaging of the reservoir and led to the game-changing assessment for the resource," says Ungsing Wong, principal geophysicist.

Chief geophysicist Fabio Mancini says Woodside's Technology and Geoscience

teams provided the "horsepower" to drive the breakthroughs, but many others were involved.

The result was a 52% increase in the gross contingent resource from 7.3 Tcf to 11.1 Tcf.

Woodside's commitment to high-performance computing began with the acquisition of a suite of super computers named Moorduij in 2013.

The next year, working with Imperial College, London, Woodside applied FWI to 2D lines from the Exmouth basin in Western Australia.

"Results showed that FWI can produce excellent high-resolution seismic velocity models," says seismic processing and imaging manager David Dickinson.

"We were one of the first to recognise the potential of performing FWI at high frequency and resolution."

According to Fabio: "This early investment positioned Woodside as an industry leader when it completed the first in-house high-resolution 3D FWI on Google Cloud in 2016."

Previous FWI pilots were limited to 2D seismic due to the magnitude of

computing power required to crunch the numbers.

"For a field the size of Scarborough, Woodside would need more than 30 times all our internal computational capability to perform high resolution FWI," says Fabio.

"Cloud computing represents an ideal solution for this challenge, offering almost unlimited computer power in a pay-as-you-go system."

By moving to cloud computing, the full power of FWI processing was unlocked for future applications.

The Scarborough FWI results were combined with Geoscience Technology (GT) expertise to deliver an updated characterisation of the reservoir, and the Scarborough subsurface team together with GT took a legacy dataset spanning several decades and performed an integrated assessment that was a game changer for the resource.

"The collaboration between technological innovation and regional geoscience knowledge highlights Woodside's expertise and the value delivered from early adoption of technology," says Yousof Hourani, Scarborough subsurface development manager.



Game changers: Subsurface development manager Yousof Hourani, seated centre, and members of his team were just some of the many people who helped uncover the real extent of Scarborough's gas reserves.

Pyxis powers ahead

The final investment decision (FID) has been taken on the Pyxis Hub Project and Woodside is proceeding quickly to the next stage – the drilling of development wells in 2020.

The project comprises the subsea tieback of the Pyxis, Pluto North and Xena 2 infill wells to existing Pluto infrastructure to support the future operation of the Pluto LNG Plant, Domgas, the Pluto-NWS Interconnector and the Burrup Hub concept.

“It increases our flexibility in how we operate Pluto wells and provides a gas supply option for the Interconnector,” explains Pyxis project manager Warren Wyld.

All up, the Pyxis Hub resources total just over half a TCF of gas. Woodside is 90% partner in the project with Tokyo Gas and Kansai Electric Power Australia holding 5% each.

The Pyxis Hub is being managed as part of the Integrated Projects Portfolio (IPP), which is also responsible for Julimar Phase 2 and the Greater Western Flank 3/Lambert Deep subsea tie-back projects.

FID was taken on Pyxis in August and two months later Woodside announced

a contract had been signed with TechnipFMC for the design, supply and installation of subsea equipment including a subsea production system, flexible flowlines and umbilicals.

Warren says the Xena field was added to the Pyxis Hub project during the front end engineering design (FEED) phase in Q2.

“Rather than running Pyxis and Xena as two separate projects, we pitched the idea of taking a combined FID as one project, maximising synergies and allowing us to take advantage of opportunities in the market,” he says.

Mike Price, vice president Pluto, floating production storage and offloading (FPSO) facilities and Wheatstone, says the team’s idea proved a great success.

“It simplified business approvals and has enabled the team to capture synergies to improve value which would have been difficult if Pyxis and Xena were two separate projects,” Mike notes.

Pyxis subsea and pipelines delivery manager Jamie VanDeVelde adds: “We optimised the subsea layout to incorporate the Xena well to deliver it as part of the Pyxis project without affecting budget or the schedule.”

Warren notes the Pyxis project is the first to use a new integrated engineering procurement construction and installation (EPIC) frame agreement for the subsea supply.

“It’s one integrated project with one contractor, TechnipFMC, and it delivers a one-stop shop that minimises the interfaces necessary while leveraging the contractor’s strengths,” he says.

Jamie says Woodside was able to select from a “catalogue” of TechnipFMC’s latest technology subsea equipment offerings.

This leveraged on the standardisation developed by TechnipFMC.

It will also be the first project globally using new smooth carcass flexible flowlines, which will increase gas recovery.

Manufacture will take place in Scotland, Norway, France, Houston, Brazil, Singapore, Malaysia and Australia.

“It’s been very fast paced,” says Warren.

“We accelerated the project to take advantage of a drilling rig that was in the country and the drilling campaign is now scheduled for Q1 2020.”



Fluid answer: Left, project engineer Derek Munro and Process Dynamics’ Henry Bardolf-Smith admire the Subsea Energy Australia Industry and Innovation and Technology Award; right, Derek with the two subsea accumulator modules manufactured for the Greater Enfield Project.

Staying pumped

The 12-month refit of the Ngujima-Yin floating production storage and offloading (FPSO) facility, in preparation for the Greater Enfield Project (GEP), created many challenges.

One was to find an engineering solution to preserve the integrity of the Vincent oil field’s multiphase pumps (MPPs).

Located subsea, the MPPs provide enhanced oil recovery to the Ngujima-Yin, where oil is processed and stored before being off-loaded.

The challenge is what to do with these pumps when there is no topside facility; and how best to protect them from the ravages of process fluid.

Project engineer Derek Munro explains the pumps use barrier fluid to insulate their internal windings and lubricate the pumps’ seals.

“It is essential to maintain the barrier fluid pressure at a positive pressure or the process fluid will work its way through the seal and contaminate the fluid,” Derek says.

During normal operation, over-pressure is maintained from a dedicated hydraulic power unit located on the Ngujima-Yin.

If over-pressure is not maintained, the barrier fluid pressure will degrade due to leakage across the pump seals.

Because process fluid is conductive, contamination of the barrier fluid around the high-voltage pump windings would

result in a short circuit and render the pump useless during start up.

“Not only would replacing the MPPs create a multi-million-dollar headache, it would cause a loss of production for Vincent, and a delayed start-up of up to three months for the GEP,” Derek notes.

The subsea engineering support team assessed how best to manage the MPPs for the 12-month downtime.

Previously, barrier fluid recharging was conducted from a support vessel via a downline every six weeks. This was extremely expensive.

Four main options were examined and the one selected centred on a subsea accumulator module (SAM) whereby barrier fluid would protect the MPPs’ internal motors.

“This option has less risk, less impact to schedule and expert opinion suggested an 800 litre SAM would last about three months before it needed refilling,” says Derek.

Collaboration with Woodside and contractor Pressure Dynamics extended that more than fourfold because their work indicated lower pressures would mean a lower leak rate.

“Keeping regulated pressure just above ambient extended the life of the accumulation to more than a year,” Derek reports.

“In fact, when they were retrieved after a year, only 400 of the 800 litres of barrier fluid had been used.”

There were other innovations, too.

Geotechnical helped develop a “one-lift” concept instead of the traditional multi-lifts by a crane.

Another innovation was remote data logging to monitor subsea accumulation pressures remotely using an acoustic system to confirm how the SAM was performing.

“This reduced the size of the vessel required to acquire accumulator pressure data trends and eliminated the need for a remote-operated vessel to perform the monitoring,” Derek says.

Lewis Kemp, general manager Subsea and Pipelines, says he is extremely proud of the team’s simple but innovative solution, which resulted from challenging the industry norm and genuine collaboration.

“It’s an excellent example of how enablement of people can deliver a safe, reliable and efficient operations,” Lewis notes.

He urges other areas of the business to engage with the team to understand better the reasons for its success.

Pressure Dynamics’ solution also produced the Subsea Energy Australia Award for Industry Innovation and Technology.



Fast paced: The Pyxis Hub Project has taken the final investment decision (FID) with drilling scheduled for early in 2020.

Chopper delivers dividend

The Brownfields offshore delivery team has delivered a first for Woodside – changing an offshore flare tip by helicopter.

Thanks to exceptional teamwork within the company and with contractors, the innovative replacement of the high-pressure flare tip on the North Rankin A (NRA) platform paid dividends.

“The conventional approach would have been to employ trolley cranes or mechanical flare tip handling packages,”

says project engineer Soon Khoo, focal point for the flare tip replacement.

The project team reviewed various options to achieve an ALARP (as low as reasonably practicable) risk position.

These included employing a lifting barge via a heavy lifting vessel; a gantry on the work platform; and a trolley crane (as used for a previous flare tip replacement).

But the team was convinced that using a

helicopter would not only be faster but safer.

The last time a flare tip was changed, by trolley crane, it took around 7500 hours, Soon reports.

“By using a helicopter, we calculated it would take about 2500 hours for all the pre- and post-work to set up the helicopter activity – about three and a half times faster,” he says.

“And less time means a lower health, safety and environment (HSE) risk.”

In fact, the tip was replaced in even less time than had been scheduled and there were zero HSE incidents.

“The task has set a new benchmark and driven an exceptional outcome for base business,” says Soon.

The NRA flare tip was replaced during the September turnaround using a Sikorsky 92 helicopter from CHC in less than three hours – the quickest a flare tip has ever been changed on one of our operating facilities.

“This was a critical activity within the NRC full platform shutdown,” says Eric Kumar, brownfields offshore shutdown delivery manager.

“The team did a great job in planning for execution which included a thorough understanding of all risks and ensuring the controls were effective during the preparation and execution phases.”

Soon says the great result was because of the collaboration with the EPCM (engineering, procurement, construction management) contractor Wood, flare tip specialist Vertech Offshore and implementation contractor Vertech Australia and CHC, together with support from our aviation and travel teams and the NRA turnaround team.

Final word to brownfields general manager Ty Chapman.

“Using new approaches and technology in Brownfield projects can add enormous business value,” Ty notes.

“The installation of the flare tip on NRA with a helicopter is a great example where new approaches in Woodside can be implemented safely and successfully.

“It was a great effort by the team.”



New delivery: Changing the offshore flare tip on North Rankin A, top, was delivered in a novel way thanks to the cooperation of our contractors. Below, Jarrod Mason (Wood PLC), Shivas Lindsay, Soon Khoo, Lance Tantom (all Woodside) with Bruce McKenzie (Vertech Australia), Steve Nota and Luke Vanson (CHC Australia) admire a model of the helicopter that delivered the goods.



Clean machines: Maintenance team leader Tim Woodward, senior process engineer Craig McWilliam, and maintenance team leader Shane Dow inspect KGP fin fans from above.

Keeping their COOL

Clean fin fans mean green fin fans.

And it also equates to more LNG production for the same fuel gas consumption.

Those are two key findings of the air-cooled fin fan heat exchanger cleaning campaigns conducted at LNG trains 4 and 5 at Karratha Gas Plant (KGP) in 2019.

In total, two cleaning campaigns resulted in a combined production gain of 204k/T of gas a year.

“That’s equivalent to more than three cargoes of gas,” calculates senior process engineer Craig McWilliam.

There are 240 fin fans on LNG trains 4 and 5 refrigerant circuits at KGP used for cooling or condensing.

The process gas/fluid travels through the fin fan tubes, while ambient air flows over and between the externally finned tube surfaces.

The process heat is transferred to the air, cooling the process gas/fluid while expelling the heated air into the atmosphere.

Improving the airflow and heat transfer reduces compressor power requirements, which in turn helps maximise LNG production.

The fin fan banks, located in the roof, span the length of each LNG train and collect airborne dirt.

Over time this reduces airflow and heat transfer.

Craig says the KGP team was aware that the fans had not been cleaned in the past six years, but fin fan performance had remained relatively unchanged.

“Rather than just continue to monitor and study long-term performance, it was decided to conduct a cleaning trial to baseline fin fan performance,” he reports.

The cleaning was done by a contractor using fresh water to hose the tube bundles clean from underneath.

It was a messy task, but on certain fin fans the duty gains were upwards of 14%.

Based on these results a larger cleaning campaign was arranged for the entire 240 fans across both trains.

“Cleaning fin fans using water is not rocket science but it’s a good example of doing the basics right, understanding unit operations and deciding to attempt a trial since on the balance of cost there is probably more to be gained than lost,” Craig says.

“In the past we have steered towards conducting desktop studies to determine cleaning regimes when we should have jumped straight to cleaning trials to get a new baseline and confirm cleaning costs.”

Engineering, Maintenance, Operations and the contractor personnel worked together to clean the tube bundles safely and effectively.

“It’s a good example of how adopting an optimisation mindset and seeking ways to improve production has been ingrained into our base business, making KGP more efficient,” Craig points out.

LNG trains 1, 2 and 3 cleaning campaigns began at KGP in October.

Evidence-based maintenance plans are being created and further trials planned for 2020 to baseline airflow and cleaning techniques.

Making **light** work of **power** bills

Here's a bright idea: switch off unwanted lights, save some money and help reduce environmental costs, too.

If it sounds too simple, the brightest ideas often are. (Parents the world over have been telling their children to switch off the house lights since Edison was a boy.)

Woodside has answered the call at Karratha Gas Plant (KGP).

Over the past 12 months, the KGP Electrical Maintenance team, led by Matt Bendall, has been focused on the lighting at Karratha Gas Plant (KGP) and photo cells.

"Lighting makes up approximately 30,000 of the 100,000 electrical

equipment in hazardous area (EEHA) functional locations at KGP," Matt notes.

"We thought there'd be potential for savings, lower emissions and to improve safety."

Matt's predictions were borne out.

"I am pleased to report that we have fixed almost all the cells that had failed – usually due to age – in trains 1, 2 and 3 and we have also fixed timers on Train 5," reports senior system engineer Nathan Mort.

Nathan says the drive to save on emissions was the main trigger for this scope.

But turning the lights off generates a lot more benefits.

Nathan lists them.

"There's the technical integrity," he says.

"Switching off lights significantly reduces the number of 240VAC ignition sources at the train".

Improved technical integrity is also served by the reduction in the heat generated by the operation of the light which, combined with the heat of the day, degrades the light housing. This leads to EEHA defects.

"By turning lights off in the heat of the day we will preserve the EEHA rating of this equipment longer," Nathan explains.

The emissions savings (the original motive) work out at about 601MWh in energy savings over a year.

Then there's the maintenance savings from the reduction in running hours of lights.

"We'll be able to save significant efforts on re-lamping and light replacement," Matt advises.

And that leads to having lights that work when we need them. Turning the lights off during the day improves the availability of lighting when we need it, Nathan argues.

Finally, there's the reputational benefit.

"By not having lights on during the day, Woodside is demonstrating it is acting consistent with its environmental messaging," he reasons.

While this may seem like a small win environmentally, Nathan has calculated that Woodside spends in the order of \$2M a year on lighting/EEHA repairs.

"This is potentially a large saving in lighting maintenance and shows that what is good for the environment is often also good for business," he explains.

And he's not finished yet.

The Priority Electrical Project will next tackle utilities and domestic gas (DomGas).



Team effort: Delivering a successful battery energy system for Goodwyn A platform was due to a team effort that spanned numerous functions.

BESS leads charge

Good for the environment, good for the balance sheet.

Woodside's ground-breaking battery energy storage system (BESS) is up and running on Goodwyn A platform (GWA), producing benefits of lower carbon emissions and less fuel gas burn.

"It's a win-win for Woodside and the wider community," says Amy Nielsen, asset manager offshore gas platforms.

"The bonus is that BESS has performed even better than expectations."

The value of Goodwyn BESS was recognised at this year's Woodside Awards when it collected the Sustainable Outcomes award.

Woodside's gave the go-ahead in 2017 (see Trunkline's Q3 2017 edition) for the world's first installation offshore of a battery energy storage system.

Ryan Beccarelli, the then operations manager North West Shelf (NWS) gas, identified the potential for an offshore battery storage system when he visited a copper and gold mine in remote Western Australia in August 2016.

That was the start of a lengthy and complex journey.

The process of modifying the GWA platform, some 135 km off Karratha in WA's Pilbara, to accommodate BESS' heavy lithium-ion battery and its control module, plus other associated works, took until July 2019 when BESS came on line.

At Woodside, Technology, Operations, Engineering and Development were all involved; externally, the support of ABB and the NWS Joint Venture participants was critical to the successful delivery and installation of, and investment in, the battery system.

Maintenance engineering team lead Paul Epstein explains how BESS works in tandem with GWA platform's four 3.2MW gas turbines.

"To ensure high reliability, our 3.2MW generators operate at a low load to provide what is called 'spinning reserve'," Paul says.

"Goodwyn BESS is an integration of a 1MWh (megawatt hour) storage system

into GWA's power generation and distribution network.

"It allows the platform to operate with only three gas turbines running, while also improving the overall reliability of the power supply system."

In August this year, one of the platform's four gas turbines was shut down successfully, thanks to the availability of BESS, Paul reports.

Amy notes that the use of battery technology is proof that Woodside is actively embracing new technologies to both improve energy efficiency and reduce carbon emissions.

BESS is expected to save fuel gas consumption at GWA platform of about 3000 tonnes per year and reduce CO₂ emissions by around 7500 tonnes.

And that's likely to be just the start.

"This is the first application of battery storage technology on an offshore facility, but it's unlikely to be the last," Amy notes, adding such a solution could generate significant long-term value across a number of Woodside projects.



Lights out: Senior systems engineer Nathan Mort has discovered keeping a close eye on lighting generates many benefits.



Safe foundations

“The Perfect HSE Day isn’t about ticking a box.”

Those are the words of Sandy Sibenaler, vice president Treasury.

If they sound familiar it’s because Sandy expressed them in the video which launched the We Stand Together for

a Perfect HSE Day 2019 program in September.

Run over eight weeks, this year’s campaign showcased activities and events built around the theme “Our Foundations: We Support Each Other”.

This theme really resonated for our

Finance and Commercial division, which has been working to strengthen its safety culture this year.

Marc Lewis, vice president Tax and executive sponsor of the Finance and Commercial division’s Health and Safety Committee, says: “In 2018, a survey drew to our attention the need to mature Finance folk’s safety culture to better support our people and our teams on the front-line.

“We Stand Together for a Perfect HSE Day’ is an important part of our ‘One Team’ health and safety journey, not only in Perth but with our Finance and Commercial people deployed into the business.

“To back this up, Sherry Duhe, our executive vice president and chief financial officer spent time with our Woodside and Bechtel Pluto Train 2 team in Houston. Sherry shared her personal story with the team while also reaching out to contracting and procurement workmates in country.”

Meanwhile, across the Burrup Peninsula, teams were using a range of innovative, engaging and fun activities to mark We Stand Together 2019.

The campaign was supported by former Fremantle Dockers captain Matthew Pavlich spending time with supervisors across our onshore sites on the Burrup.



Safety first: This year’s safety campaign again was marked across the company’s activities, around the globe. Clockwise, from overpage, TV presenter Todd Sampson makes a point during his presentation at Mia Yellagonga; in Houston, US, Daniel Kalms frames the Bechtel Pluto Train 2 team and Woodsiders, including Sherry Duhe and Mark Palermo; in Myanmar, Yangon office staff follow suit; Dave Harwood MCs a panel discussion on inherently safer design, held at Cara Auditorium; and Matthew Pavlich and Penny Bayliss catch up on the Burrup Peninsula where the former Fremantle Dockers captain lent a hand to the We Stand Together for a Perfect HSE Day campaign.

Penny Bayliss, senior adviser health and safety at King Bay Supply Base, reflects that Matthew’s presentation was “fantastic”.

“He delivered a down-to-earth discussion with really helpful tips for leaders,” Penny enthuses.

“I would give it 10/10 because it was exactly what we were after.”

Of course, a Perfect HSE Day has no boundaries and complementing team activities across the globe were 14 organisation-wide events hosted by internal and external experts on a diverse range of topics.

The huge variety of events included offerings for families, which were a real hit.

But it is probably fair to say that a session featuring documentary-maker, TV presenter and businessman Todd Sampson was the most popular event this year.

Todd is behind award-winning programs Redesign My Brain and Body Hack.



In discussing his intriguing and inspiring journey to test the power of the human brain, Todd showed video clips of some of his amazing challenges.

While most of us will not rock climb blind-folded, or walk a tightrope between high-rise buildings with no harness, everyone who attended his presentation at Mia Yellagonga took away some gems of wisdom for adults and children.

The Wellbeing Wheel was introduced by clinical psychologist Tom Nehmy as he shared his secrets to maintaining a healthy mind. Tom highlighted the importance of building trusting relationships at work and at home to improve wellbeing and build our resilience.

“The Wellbeing Wheel helps us to bring balance to our personal wellbeing and start important conversations about mental health and wellbeing with our workmates,” says Debbie Morrow, vice president Health Safety Environment and Quality (HSEQ).

“The enthusiasm of our people ensured that this year’s We Stand Together for a Perfect HSE Day campaign was such a great success.”

Debbie adds: “The HSEQ team wishes everyone a safe summer and we hope that you find the contents of the ‘Taking Safety’ home gift bags which we handed out to Woodsiders in December useful.”



A day in the life of a ... robotics laboratory manager

Delene (Dee) Jones, robotics laboratory manager, has discovered that an inquiring mind coupled with a willingness to tackle new challenges can take you far.

In October it took her to Texas where she spent a month at NASA's Johnson Space Centre in Houston learning about robots, and a follow-up trip is on the cards.

"Woodside and NASA have developed a close relationship under an umbrella agreement and we're finding we can both help each other in areas like remote operations and intelligent assets," Dee explains.

Working on robots at NASA might seem a far cry from her first job after leaving school in Perth – a receptionist at a photographic studio.

But it was there that her "can do" attitude emerged.

"I went on to become responsible for quality control on the photo reproduction side before I decided to travel and moved to London for a year," Dee says.

Through a temping agency she secured various positions as a personal assistant at investment banks and picked up new computing skills before she came home to Australia.

A stint as a tender coordinator in an electrical business was followed by a move to a railway company where she joined as an administration assistant. The skills she picked up then allowed her to move to a small start-up company where she was the business manager. "I like being challenged and administration is a diverse job," she relates.

"I did accounts, payroll, HR, admin, purchasing, writing contracts, managed FIFO contracts . . . plus running my own team and managing the office."

In 2015, Dee joined Woodside as a management assistant in Contracting and Procurement, and then took another role in the same function before transferring to the Australian Business Unit.

She then joined the Intelligent and Autonomous Systems team (as the robotics and wireless sensor and data fusion discipline is officially called) at the start of 2019.

"It's fast paced and diverse, which I enjoy very much; I like to be challenged and this role definitely does that," she reports.

Dee works in our Karda building in a team of 30-plus.

"We're very close knit – it's one of the features of my work that I really appreciate," she says.

Below is a typical day:

6am: I prepare for work and take the train into the city. I normally arrive at Karda around 7.30am and my priority is to get a coffee to start my day. I then check my emails to see if anything's arrived that I need to deal with urgently. Then I have a quick catch up with my lab assistant Kieron Pearce who joined us in October, where we discuss and plan the day's activities.

9am: I run the monthly safety meetings at the lab. All the team comes together for 15-30mins and we run through any safety issues people need to be aware of and address. I also update everybody on any works that are happening in the lab, or Facilities Management items. If any

Dee's day: Clockwise, from opposite page, Dee Jones in the robotics laboratory in Karda on the Mia Yellagonga campus; discussing Robonaut with robotics manager Shawn Fernando; explaining Woodside's work at a resources technology conference; and enjoying some R&R with her dogs Shelby and Milly.

of the staff have any requests or want to raise safety issues, this is a good time to discuss them with everybody here. It's important to keep our team aware of what's happening in the lab and the wider campus to ensure their safety at all times, especially as we deal with robots and have a workshop in the lab.

10am: I deal with correspondence to NASA about my recent visit to Houston. I went there in October to learn more about Robonaut and how we can do repairs and fix hardware issues at Karda. As part of our five-year umbrella agreement with NASA, we have Robonaut on loan – one of only eight Robonauts in the world. Sometimes I get asked if robots will take people's jobs, but that's not why we're using them. We want them to do the high-risk jobs our people do to make it safer for our employees – switching off pumps and closing valves and freeing the operators to do more planning and strategic thinking. NASA wants them to do the menial tasks astronauts do; and together we are working on coding for robots.

11am: A meeting with Corporate Affairs advisers Ruth Collins and Sally Knight. There's a resources technology conference in Perth coming up and we need alignment on what is required of our team and what robots are expected at the event.

Midday: I take myself down to the gym for a workout, a class or whatever might be happening. This is my mental health



time. It clears my head and sets me up with a fresh mindset for the afternoon. Then I'll eat lunch afterwards as I check my emails.

1pm: A school group arrives. Tours of Karda are in high demand and I run them with a couple of others. We show them Robonaut, discuss why we're working with NASA, show them examples of sensors and the wireless cameras we're using. NASA is doing remote operations like us – it's just that their remote ops is a lot further away.

We have to manage the logistics of these tours carefully. After all, it's a working environment at Karda and we work on confidential projects so we have to be very organised as to who is coming and when.

2pm: A fortnightly team lead meeting canvasses priorities and big demonstrations we might have coming up, and that's followed by our monthly team meeting for the whole intelligent and autonomous systems team. Russell Potapinski, the intelligent assets program manager, updates us on what's happening.

5pm: Time for a last check of emails before I go home. I don't work tomorrow – that's the day when I volunteer for my religion. I've worked out a schedule whereby I work four days a week and I appreciate the flexibility of working conditions because my religion is important to me. I get home about 6pm, greet my husband and then we'll walk our two dogs Shelby and Milly before dinner.



Innovation rewarded: Curtin University's Vishnu Pareek receives the Curtinnovation Award from Andreas Hartmann of Griffith Hack, major sponsor of the event. Woodside's Geoff Byfield is fifth from left.

Magnetic tapes lose attraction

The era of seismic survey data being stored on magnetic tapes has ended at Woodside with the last of more than 100,000 magnetic tapes digitised and safely dispatched to the cloud.

The tapes have been removed from a warehouse, inspected and indexed, before being transcribed and their information moved to cloud storage. Where tapes were not readable, a full dataset has been re-created from backup copies.

New data acquired by the company is going straight to the cloud.

"We had more than 50 years of geophysical and support data – of variable quality – piling up in a warehouse," executive vice president Sustainability Shaun Gregory points out.

"One of the issues that creates is that some physical data such as magnetic tapes has a finite lifespan, no matter how well you look after it.

"Another is that it's not possible to get a single view of data inventory."

In 2015, Shaun presented Woodside's Cloud First strategy to accelerate work flows and store the company's exponentially growing data sets.

To deliver his vision for the primary subsurface data type, subsurface data and information management (SDIM) kicked off the Seismic NextGEN project.

On 25 November 2016, the very first tape was delivered to Katalyst Data Management (KDM) for storing and indexing in the cloud.

And on 25 November 2019, our very last tape was handed to KDM.

In between, more than 100,000 others had been processed.

"They contained a lot of information, comprising not only seismic survey data but also associated support data such as reports, navigation data and operations files," points out Jess Kozman, SDIM's data and solutions manager.

How much information?

"More than 15 petabytes," he replies.

That's more than 15 million million bytes of data.

That's an equivalent amount of data as is contained in non-stop streaming video of hi-definition movies for about 200 years.

"We see the opportunity to use this data much more freely, efficiently, quickly and cheaply in the cloud," says Jess.

For example, as operator Woodside manages the data on behalf of the various joint venture participants of the North West Shelf joint venture, and cloud storage makes it much easier to share.

"Sharing physical data could also take a long time whereas cloud storage means we can make high-speed copies more cheaply and it can take only days, not weeks," he adds.

"Even more importantly, we eliminate the risk of losing information on magnetic tapes."

And storing in the cloud is safe?

Absolutely.

"Woodside undertook a full evaluation in 2015 of public enterprise cloud, and that evaluation concluded it was a safe, reliable and secure location to store confidential data," Jess affirms.

Shaun says he is pleased the transition to the cloud has been successfully concluded.

"Woodside's unique 50-year legacy of exploration on the North West Shelf means that we now have in cloud storage a digital version of the largest contiguous 3D open file seismic coverage on the planet," he says.

Steve Darnell, president and chief executive officer of KDM, says: "Attempting something that has never been done before on this scale takes vision and courage and the Woodside team displayed both."



Cloud cover: Katalyst Data Management's Steve Darnell, left, with strategic technology manager Neil Hookaway and some of the 100,000-plus Woodside tapes that have been stored in the cloud.

Packing a punch

Woodside's search for profitable applications of 3D printing has led to an innovation award for a team of chemical engineers at Curtin University.

The engineers' innovation, called SpiroPak, was the overall winner in this year's Curtinnovation Awards.

Process engineering team lead Geoff Byfield initiated the successful work when he set the following challenge before the university: how could new technology help us solve traditional process problems?

"More specifically," Geoff continues, "how could 3D printing, together with a lot of computing power, devise better designs of structured packing for columns?"

"And would these designs provide appreciably better results than traditional packing?"

Geoff explains that during the processing of gas into LNG, CO₂ needs to be removed from natural gas.

This is done using a liquid solvent in an absorption column within the gas plants.

These tall columns are usually filled with structured packing – thin sheets of corrugated stainless steel stacked together in alternating directions.

These sheets provide a large surface area upon which the liquid solvent can spread out.

"The bigger the surface area of metal within that column, the more CO₂ is transferred from gas to liquid," he adds.

Gas flows upwards through conventional structured packing in a "zig-zag" pattern.

The Curtin team came up with "SpiroPak" to optimise the contact between gas and liquid while smoothing out the gas flow through the packing.

"It's an improvement in the flow of the gas by around 40% and the same performance with about 60% of the typical amount of packing," explains Geoff.

He believes the best opportunity for such an innovation is in the "debottlenecking" of existing columns.

"If the Burrup Hub facilities need to process natural gas with higher levels of

CO₂ in the future, then this might allow us to simply swap the packing rather than installing a whole new column," he says.

The SpiroPak team is now engaging with a major industrial supplier of structured packing to take the next step towards commercialisation of the technology. They are also collaborating with a major 3D printing provider to look at scale-up of metal 3D printing to the larger sizes required.

Further FutureLab research work at Curtin University is continuing to look for applications of 3D printing technology in the process industries, including heat exchangers and separators as well as structured packing.

Vishnu Pareek is head of school at the WA School of Mines: Minerals, Energy and Chemical Engineering.

"In addition to outstanding research outcomes, Woodside's strong support for this project has placed Curtin at the forefront of 3D-printing-driven process engineering," Professor Vishnu says.

"It is a great example of how industry and academia can support each other to drive innovation."



Buyer benefits: Inspection, maintenance and repair manager Wayne Harlon, Contracting and Procurement (C&P) managers Lee-Ann Pereria and Craig Stannard and C&P adviser Richard Pilcicki are discovering the many benefits of the new CaPP, rolled out in June.

If the CaPP fits

Getting the right goods and services delivered at the right time can be a complex process if quality, reliability and competitive costs are to be ensured. Maximum value is safeguarded by best practice contracting and procurement activities.

At the same time, “acceleration” is one of Woodside’s strategy tenets which is critical if the company is to realise its ambitious growth strategy.

To balance these apparent conflicting pressures, a new contracting and procurement procedure (CaPP) has been developed to enable effective and efficient processes without compromising governance.

“It was designed to change the way we deliver contracting and procurement across the business,” explains Contracting and Procurement (C&P) manager Lee-Ann Pereira who oversaw the process review.

Work began in November 2018 and the new CaPP was rolled out in June.

Lee-Ann says the changes apply to everyone who procures goods or services, including requisitioners, approvers, supervisors, company representatives, contract sponsors and support functions such as Health, Safety, Environment and Quality (HSEQ), Legal, and Tax.

“The changes were designed to

maximise value from Woodside’s supply chain by establishing and maintaining collaborative working relationships between the business, C&P and support functions,” she continues.

Major changes include:

- New automated cloud-based approval forms, including a checklist for contract execution; and
- Greater clarity around roles and responsibilities.

On the last point, Lee-Ann explains that when she first moved into a C&P process and systems role most queries involved people seeking clarity on their role and responsibilities under the CaPP.

The changes are expected to deliver efficiencies and time savings.

“The aim has been to help both C&P advisers and their customers – the business users – to become more agile and able to react faster to achieve outstanding results,” she continues.

Digital operations manager Kendra Mulatz has been impressed with the improvements achieved, not least in the new checklist for contract execution.

“It’s much easier now to satisfy the approvals needed,” Kendra notes.

Wayne Harlon, inspection, maintenance and repair (IMR) manager in Subsea and Pipelines, has used the new CaPP for

recent activities, including contracting the Julimar Development Phase 2 subsea tree installation services.

“It allows for streamlined approvals to accelerate execution activities and reduce our operational risk,” Wayne opines.

“C&P is then freed up from generating countless documents and more able to help us manage our contracts more effectively.”

Corporate C&P manager Robert Goulding believes bringing online approvals for contracts up to the increased dollar and risk thresholds has significantly benefited the C&P team without compromising governance.

“It has allowed both C&P and the business to accelerate the procurement process, thereby creating opportunities for increased business collaboration around planning and value creation,” he notes.

Paul Sullivan, senior vice president and chief procurement officer, notes it is imperative to continually improve what we do at Woodside.

“We all need to play a part in finding ways to achieve better outcomes and to this end, simplifying the contracting and procurement procedure will support our ambition for Horizons I, II and III,” Paul states.

NASA stalwart finds space in Perth

From space agency to oil and gas company, from Washington, DC, to Perth, from NASA to Woodside; they all seem like giant leaps, but Jason Crusan has taken them in his stride.

“It might seem like a big jump to go from NASA to Woodside, but at the technology level there are more similarities than differences,” reasons Jason, who became our vice president Technology in March.

Till then, his entire working career had been spent with America’s space agency.

He signed up aged 19 without waiting to finish his degree (“I was a science major on a music scholarship with plans to transition to engineering”) after being selected for a US Government apprenticeship and being sent to work at NASA.

He finished his physics and electrical engineering degrees while working full time, and has since collected a master’s in computer information systems and is currently completing a PhD in systems engineering.

Jason enjoyed a variety of roles in 22 years at NASA; his last was in charge of the technology portfolio for human space flight, and the development of the return of humans to the Moon.

It was an invitation in 2017 to Woodside Week that started his current journey, even though he’d never heard of Woodside and never been to Perth.

“I was walking around the stalls and speaking to people and they were so proud of what they were doing,” he recalls.

“I thought, this is a really forward-looking organisation.”

When he decided it was time to leave NASA, Jason approached Woodside to say he was interested to understand any opportunities at the company.

“A couple of months later, and I was on my way to Perth,” he says with a laugh.

First impressions are very positive with the “can do” culture, technical

engineering organisation and the all-round value-driven organisation, he says.

Jason’s wife Leslie and their children Samantha (14) and Derek (10) moved with him, and all are loving life in Perth.

“I’ve travelled widely around the world and Perth is by far the best city I’ve ever been in,” he states.

Jason has joined Woodside at an exciting time.

Technology has just undergone a review of its strategy in which four main goals emerged for the function.

Jason summarises them as follows:

- Increasing efficiency in production and exploration, including the option for new business and licence opportunities. “Advanced Manufacturing (3D printing), for instance, creates the opportunity to manufacture parts for our facilities for which spare parts might no longer exist,” Jason explains.

- Leveraging “intelligent” assets such as sensors, Artificial Intelligence, and robots that both collect data and in future can carry out manipulative tasks.
- New energy: how to diversify into other energies delivery options such as large-scale hydrogen for export where customers want a decarbonised fuel source. “It’s a big technical challenge that isn’t going to happen overnight,” Jason notes, “but it will happen over the next decade.”
- Employing technology to reduce emissions and turn carbon dioxide streams into value-added products. “Instead of seeing our emissions as having a negative impact on the environment we can look to produce things like fuels and gases, plastics, building materials, or even products such as pharmaceuticals, because the technology pathways are now available to us to produce value-added products and not just emissions,” he says.

Jason is now focused on putting those goals into action.



Mission controller: Technology vice president Jason Crusan is focused on four main goals to help position Woodside for future success.

Kai is our IT girl

A Curtin University computing student on Woodside's Student Vacation program has been awarded Woodside's inaugural Women in IT scholarship.

The recipient is 19-year-old Sarah (Kai)

Ciccarelli – a former student of Santa Maria College in Perth.

The aim of the scholarship is to encourage women to pursue their interest in IT.

"We've looked at establishing this scholarship for some time and re-invigorated the process at the end of last year," says Rachel Brennan, manager cyber capabilities and threat intelligence.

Woodside's goal is to achieve gender diversity in its workforce, she notes, adding: "This is one way we're hoping that we in the digital space can help us reach that goal."

The scholarship comprises a \$6000 grant over two years, plus mentoring from Woodsiders.

Rachel, graduate digital analyst Gautam Gunjan and an officer from Curtin University conducted interviews with scholarship candidates.

"It wasn't just Kai's excellent marks but also her creative approach with a strong technical process to solving problems

that won us over," says Rachel.

"We need to be creative because we're coming up against problems we haven't come across before."

Kai's interest in IT began largely through video gaming.

"The more investigating I did the more I realised that it was the back-end systems I found interesting, and then I became more interested in how they work than the gaming itself," she reports.

Kai is particularly interested in innovative technologies like Artificial Intelligence, and is spending her 12-week vacation program in Digital.

Rachel says next year similar scholarships are planned for Edith Cowan University (ECU) and the University of Western Australia (UWA).



Scholarly work: Woodside's inaugural Women in IT scholarship holder Kai Ciccarelli, left, discusses her student vacation program with Rachel Brennan and Gautam Gunjan.



Friendly takeover: Myanmar country manager Michelle Grady, left, handed the reins to the Yangon office for one day in October to zoology student Hnin Phyu to celebrate International Day of the Girl.

Opening doors

Woodside's Yangon office was recently taken over – with the full support of our country manager Michelle Grady.

Masters of zoology student Hnin Phyu was selected to step into Michelle's role for the day.

It was to celebrate the International Day of the Girl, held in October with the purpose of commemorating the power of young women while also highlighting the barriers they face around the globe.

"It was a fantastic opportunity to open our doors and to be able to share our commitment to diversity," says Michelle.

"The takeover day allows girls from underprivileged areas across the world to spend time with host organisations and mentors to understand more about the way organisations work, as well as the opportunities that are available to them."

The initiative, organised by not-for-profit Plan International, hopes to build aspiration among young women.

"I wanted her to think about what she's passionate about and to think about the types of organisations she aspires to work with."

People and Global Capability's Jo

Middleton and Myanmar A-6 asset manager Rebecca Lewis were there on the day.

"I was fortunate to meet one-on-one with the Hnin Phyu and go through what diversity means at Woodside, diversity in recruitment for our development and overall statistics," says Jo.

"I also helped to facilitate a round table discussion on gender equality in the workplace, where the Yangon office staff were able to share their experiences on gender equality in the workplace."

Michelle wants to reinforce Woodside's inclusive culture in our Myanmar operations and she's proud that four out of the six Myanmar nationals employed at the local office are female.

"The takeover day showcases this," she says.

Jo believes the day was of particular importance to Woodside because it highlighted how injustice affects the lives of people living in some areas where the company operates.

"For me, it was also around the ability to touch the hearts and minds of our employees and doing that through true demonstration of our commitment to our diversity strategy," she says.

Boosting student skills

Woodside engineers loaned their expertise in Q4 to judge a competition aimed at boosting the engineering skills of young women in high school.

Jan Flynn, chief metocean engineer, and Fiona Stachowiak, integrated activity

planning manager Pluto, were judges at the Emerging Engineers Competition – a collaboration between the University of Western Australia's (UWA) Girls in Engineering and OceanWorks, a joint initiative of Woodside and the UWA.

"It was extraordinary to see the

creativity of all the girls, of different ages, to approaching a real engineering challenge for the offshore industry," says Jan.

The team-based problem-solving challenge this year was bio-fouling – the uncontrolled growth of marine organisms such as barnacles and algae on subsea infrastructure.

"Bio-fouling is a common problem in the marine environment, impacting subsea infrastructure such as Woodside's, but most commercially available antifouling has negative impacts on the environment," explains Jan.

The girls were asked to develop innovative solutions to a real-world problem, and surprisingly, some of the best solutions they devised used the simplest of materials, such as items from the kitchen pantry.

The teams were judged on how they applied the engineering process: how they defined the problem, worked



Emerging engineers: Woodsiders were judges of a competition designed to promote the engineering skills of high school girls.

Strengthening connections

Woodside signed new agreements in Q4 with two leading Indigenous organisations based in the Pilbara.

One is with the Ngarluma Yindjibarndi Foundation Limited (NYFL), which represents the Ngarluma and Yindjibarndi people; the other is with the Murujuga Aboriginal Corporation (MAC), which represents the Wong-Goo-Tt-Oo, Ngarluma, Yindjibarndi, Yaburara and Mardudhunera language groups.

Niall Myles, senior vice president North West Shelf (NWS) and Burrup, said the agreements built on existing long-term partnerships Woodside enjoyed with the two organisations and the communities they represent.

“We are pleased to extend and expand our community, cultural, heritage and economic participation arrangements with NYFL and MAC in line with our plans to continue the NWS and Pluto operations for decades to come,” Niall said.

“Woodside has operated on the Burrup for 35 years, and these agreements demonstrate our ongoing commitment

to the successful co-existence of heritage and industry and support for long-term, positive outcomes for Aboriginal communities.”

The NWS Joint Venture and NYFL first signed an agreement in 1998.

The updated commitment includes increased funding for a number of programs and benefits that are being delivered under the existing agreement.

Additional support has also been made available for capacity-building and social investment programs.

A key success has been the outcomes achieved via the Gumula Mirnuwani (GM) education program which has supported Roebourne High School students to graduate at Year 12 level.

“These students have gone on to complete tertiary and trade qualifications,” Niall noted.

He said Woodside and NYFL will work together on the implementation of these programs to promote sustainable outcomes in areas such as economic participation, capacity building, safer

and healthier communities and cultural heritage.

NYFL chair Michael Woodley described the agreement as a new milestone in the long-standing relationship between NYFL and the North West Shelf Project.

“The benefits provided for today will benefit the community through the next generation and beyond,” he said.

The agreement with MAC strengthens the current support Woodside provides for the protection, preservation and management of the nationally heritage-listed Burrup Peninsula.

This agreement is in addition to Woodside’s commitment to the management, protection and research of the National Heritage values under the Burrup Conservation Agreement, signed by Woodside and the Commonwealth Government in 2007.

Woodside supports World Heritage Listing of the Burrup Peninsula on the basis that heritage and industry can and will continue to co-exist, as has been demonstrated for the past 30 years.

Among other activities, the new agreement with MAC provides for:

- the ongoing funding of the Murujuga Rangers
- support for education and training initiatives
- support for MAC to enhance its commercial capabilities, and
- funding and support for rock art management and World Heritage Listing activities.

MAC chief executive officer Peter Jeffries described the new agreement as an important next step in MAC’s relationship with Woodside.

“This new agreement represents significant progress in delivering recognition and support for the Traditional Custodians of Murujuga,” Peter said.

“What has been agreed will help deliver MAC’s mission to preserve and protect its landholdings for future generations and to enrich and support the welfare of its members now and into the future.”



Showtime: Left, the West Australian Ballet’s Jessica Machin and artistic director Aurélien Scannella with Corporate Affairs vice president Sandra McInnes, seated; right, the Barking Gecko Theatre will be heading to the Pilbara next year.

Art for our heart

Investment in communities in which we operate has taken on an exciting dimension with the renewal of key partnerships with arts companies directed at the heart of Woodside’s operations.

Woodside has announced an enhanced partnership with increased funding for Barking Gecko – Western Australia’s premier professional theatre company for children and families – which will enable productions to be staged in the Pilbara from 2020.

Barking Gecko is a not-for-profit company based in the State Theatre Centre of WA, where its performances premiere – and then it takes these shows on the road performing from Perth to the Pilbara before heading off to venues such as the Sydney Opera House.

Barking Gecko celebrated its 30th birthday this year and looks forward to delivering an expanded program through the Pilbara.

Woodside’s commitment until 2023 will enable Barking Gecko to visit the Pilbara, allowing schools to book productions with a degree of certainty they haven’t previously enjoyed. Barking Gecko will also work with teachers across all the primary schools to bring the curriculum alive through drama.

Sandra McInnes, vice president Corporate Affairs, says the company

was delighted to extend its partnership and offer families in Karratha and the wider Pilbara experiences families in other cities enjoyed.

The announcement came in Q4 – the same quarter Woodside revealed it had extended and enhanced its partnership with the West Australian Ballet for three years.

It came with a similar focus on the Pilbara – the heart of Woodside’s operations.

Woodside became the West Australian Ballet’s Principal Partner in 2009.

Sandra noted the company had enjoyed a remarkable decade since, and had developed from a mid-tier organisation to a slick, leading company with 38 dancers of world-class quality based in Maylands.

“Equally remarkable are the opportunities that the company has provided for developing young artists and engaging communities through its access and education programs,” she said.

“With Woodside’s continued support, the WA Ballet will expand their educational and community outreach initiatives in 2020 across the Pilbara.”

A youth ensemble in Karratha will further develop local skills in dance,

choreography, stage management and design.

“Critically, the access program and the youth ensemble will allow people to determine what is needed locally, and leverages what is already in place, building a sense of pride in community and culture,” Sandra added.

“The Pilbara is, of course, the heart of Woodside’s operations and the centre of our growth plans.

“We are committed to the community of Karratha and are pleased its residents, including many Woodside employees, will have the chance to enjoy the WA Ballet and their engagement program in their home town.”

WA Ballet’s artistic director Aurélien Scannella said: “The critical support we receive from Woodside allows us to reach new heights both on and off stage.

“Not only are we grateful for the support they provide, but so are the communities that are given access to the arts.”

The announcement was made at an evening event at Cara Auditorium at Mia Yellagonga, where the ballet company rehearsed a scene from their latest production, Alice in Wonderland.

A family night at Karlak allowed guests close-up interaction with members of the ballet company.



Enduring dialogue: Sharon Reynolds, Corporate Affairs manager Indigenous affairs, Peter Jeffries, MAC chief executive officer, and Niall Myles, senior vice president North West Shelf and Burrup, established a dialogue to extend and update long-standing agreements.



Photo competition hooks Karratha snappers

Woodsiders need no prompting to take a photo or three and there was no shortage of entries in the Woodside Sprint photographic competition, held in Q4.

More than 100 entries were uploaded on to our This Is My Karratha Yammer page, and the Burrup Hub team had a tough job whittling them down to the top 10 finalists.

Every entry captured an element of living and working in the Pilbara - which made it even more difficult for the executive team and professional photographer to decide the winners.

The winner was surveillance engineer Narelle Dale's "Millstream Park"; runner-up was project engineer Lawson Wylie's "Four Wheel Driving at Sunset". That photo also won Lawson the People's Choice award.

Both photos wonderfully capture the unique beauty of Karratha and its spectacular surrounds.

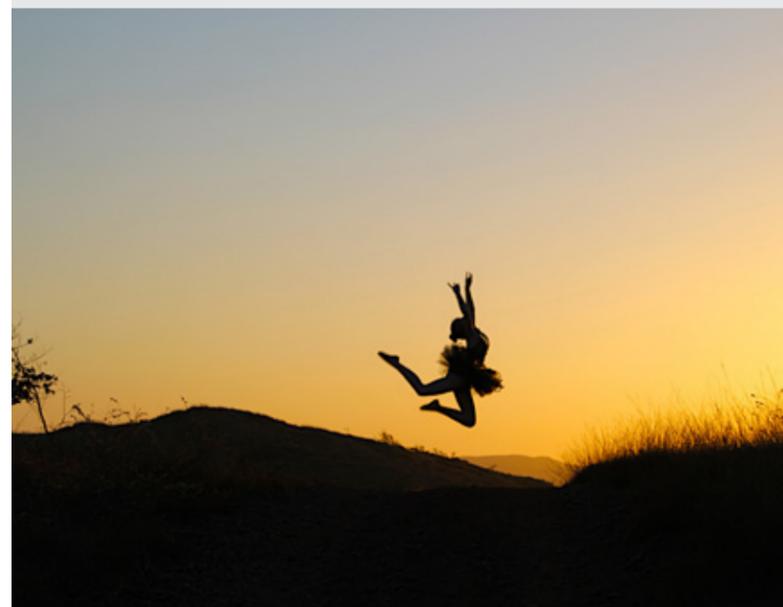
Trunkline photographer James Campbell describes Narelle's photograph as very well timed, with strong colour and good tonal range.

Lawson's photo, he says, demonstrates a perfect execution of exposure blending to create pleasing tonal range with well-balanced colour between the green spinifex and the Karratha sunset.

The #SprintPhotoComp exhibition, held in the foyer of Karlak at Mia Yellagonga, was an alluring addition to the wonderful aesthetics of our Perth headquarters over the busy Sprint period.

All finalists now have some stunning images to hang in their homes, too.

Picture perfect: These stunning shots vividly portray some of the amazing elements which make up the Pilbara, but they also presented judges of the Woodside Sprint photographic competition with some hard choices. First prize went to Narelle Dale's Millstream Park, opposite page, while Lawson Wylie took out runner-up and the People Choice award with his Four Wheel Driving at Sunset, this page, top. Below is The Pyramid, Millstream; Dance Like No One Is Watching and Old Boots, below and right.



Growing in good country

While Woodside marked 30 years since its first cargo of LNG left the Karratha Gas Plant (KGP) jetty, the City of Karratha celebrated its own milestone – 50 years since it was gazetted a town.

Karratha, a local Indigenous word meaning “good country”, has grown from a town of a few hundred to today’s City of Karratha with a population of more than 20,000.

The Pilbara is more than the heartbeat of Woodside’s operations, it is where our story gained its greatest traction.

Now, proposed Burrup Hub activities are set to spur further growth.

The Burrup Hub projects are expected to deliver significant long-term benefits to WA’s economy, employment and

energy supply, contributing to the growth and sustainability of the Karratha community for decades to come.

Woodside and Karratha’s successes have been entwined since their histories collided in 1972 with the discovery of the Goodwyn gas and condensate field and Lambert oil fields on the North West Shelf (NWS).

The early 1980s was a busy time with the construction of the Woodside-operated NWS Project and the first two processing trains for the KGP.

By 1999 the NWS Project had marked its 1000th LNG cargo delivery to Japan and the beginning of the 2000s led to renewed LNG investment, including an extension of the NWS Project and construction of the Pluto LNG Plant.

Woodside surveillance engineer Narelle Dale has seen a lot of changes since she moved here in 2005.

“Karratha has undergone a radical transformation from a country mining town to a vibrant city where we can enjoy breakfast on the café strip, play our favourite sports at the Leisureplex and catch a movie or a play at the new Red Earth Arts Centre,” Narelle says.

Woodside and its joint venture partners have played a key role in this development of Karratha from small mining town to thriving regional centre, investing more than \$300 million in critical infrastructure projects.

In the past 10 years, Woodside and its joint venture partners have contributed more than \$18 million to nine key infrastructure projects, aimed at enhancing health care, education opportunities and liveability.

The initiative was known as the Karratha Infrastructure Strategy and complemented the State Government’s Royalties for Regions program, which has delivered a new Karratha Health Campus, a new Karratha Senior High School and the recently refurbished North Regional TAFE.

Most recently, the NWS Project contributed to help build the Red Earth Arts Centre, Karratha’s arts and cultural precinct, which was opened to the public in 2018 and has become an integral part of bringing quality entertainment to the region.

There is also an abundance of sports and recreation on offer in the town including the Karratha Leisureplex and more than 150 active sporting clubs.

“We love having the amazing Dampier Archipelago for ocean activities and the beautiful Millstream and Karijini national parks on our door step to explore,” says Narelle.

Locals also enjoy monthly markets, the Roebourne Races, the Cossack Art Awards and the Red Earth Arts Festival as part of a vibrant list of year-round activities.

For those who live in Karratha, there is a sense of optimism and confidence about their city’s future.



Gas man: Left, operations readiness team lead Ron Wright closes the valve he opened in 1988 to let first gas into Karratha Gas Plant; right, Ron, third from the right, in Thailand where he was commissioning components for Pluto LNG Plant.

Wright man at right time

Ron Wright has spent 33 varied years at Woodside, mainly in Karratha but including placements in London and Thailand.

His place in the folklore of Woodside, however, is cemented by two simple acts he carried out at Karratha Gas Plant (KGP) that each lasted little more than an hour: opening and closing a pipeline valve.

Ron opened it in late 1988 and earned himself a footnote in the history of LNG in Australia.

For opening valve 10GAV 1090, as it is officially called, let the first gas from North Rankin platform into KGP’s LNG Train 2.

As such, it was the first gas received at KGP (Train 2 became operational before Train 1) and it launched what was to become the multi-billion-dollar LNG industry in Australia.

“It’s a big valve with a smallish handle and it’s high off the ground and the construction scaffold had already been removed,” Ron relates.

It took a while to open and its height off the ground necessitated a large cherry picker be brought in.

Ron and fellow operator Peter Holmes took turns at winding the wheel to let into KGP the first gas from North Rankin.

They took turns to turn the handle which, via a shaft and gear box, wound the valve stem upwards.

“It took thousands of turns,” recalls Ron.

“That’s why you need at least a couple of people otherwise you’d be up there all day trying to do it yourself. It probably took us an hour and a half.

“You’d go flat out and when you’re puffed, your mate steps in.

“These days they use what is called a nut runner – a device which slots on to the handle and uses compressed air to wind the valve open or closed.”

When it was decided the valve was no longer needed and as part of the Domgas Recycle Project it had become redundant, Ron was sought out to finish what he’d started 31 years ago and close the valve.

September 7 was earmarked as the day, and Ron did the honours around 11am.

And even with a nut runner, it took around an hour to close.

Ron believes the valve might never have been closed since he and Peter opened it because the preferred feed gas isolation points are at the entry of each train, although he concedes it may have been used during the feed gas header tie-in for LNG 3 in 1993.

Originally from New South Wales, Ron was a mechanical fitter when he joined Woodside in July 1986 to become a trainee operator (though he’d worked on the KGP site preparation with an earth-moving contractor in the early 1980s).

He’s since worked in all areas and panels at KGP and had many jobs in a variety of places, including stints in London working on the design of Train 5, and Thailand, commissioning components for Pluto LNG plant and more recently the start-up of Wheatstone.

He’s been an area operator, senior operator, shift controller, commissioning superintendent and currently a Team Lead in Operations Readiness.

“Woodside has been brilliant for me,” he says.

“When I look back on it, I couldn’t think of doing anything better and I still enjoy it.”



He’s behind you: Surveillance engineer Narelle Dale takes the ultimate selfie with a Humpback Whale off the Pilbara coast.

This is where Woodsiders discover a little bit more about their colleagues – and what they’ve been getting up to outside work hours. Think of it as Trunkline’s version of the water cooler.

Because whether it’s satisfying a passion for a sport, an unusual hobby or doing good deeds in the community, Woodside’s employees and contractors tend to live life to the full. As a result, they often have interesting stories or experiences to recount.

If that sounds like you or a colleague and you think it should be shared with the Woodside community, give us a call or drop us a line.

Riders set record

Woodside bike riders raised a record \$344,000 for this year’s MACA Cancer200 event (formerly known as the Ride to Conquer Cancer), taking Woodside’s total fundraising since the event’s beginning in 2012 to \$1.8 million.

“We had a team of 85 riders who worked together and supported one another to achieve this amazing result,” reports team captain and senior development engineer Craig Duarte.

The event comprises a cycle ride from Perth to Mandurah and back over a weekend.

It raises funds for the Harry Perkins Institute of Medical Research (informally known as “The Perkins”) which is the largest medical research institute in WA working on diseases affecting adults.

The figure raised for the 2019 ride was close to \$4.9 million.

This year’s event comprised a flatter course than in previous years, making it an enjoyable ride for most.

“Heat and wind did take a toll, but in the

end everyone had a great night partying and camping out in Mandurah,” Craig says.

Those considering participating in the 2020 ride are urged to get on board early to be part of the social activities and training. Contact Craig for details.



Quizzing for kids

The colour of candy was a hot topic for 100 Woodsiders in October, and kids in need were the beneficiaries to the flavour of more than \$4000.

The Woodside graduate committee Communities and Social and Networking

teams organised the Telethon quiz night where one of the surprisingly controversial questions was if the red skittle was cherry or strawberry flavoured.

Naida Fonda, Emma Congear, Sam



Hayes, Freya Heeks, Jessica Liddle and Dilupa Konara (pictured) were the names behind the quiz night.

This annual event not only aims to raise money for Telethon, but also to provide an opportunity for graduates and middle management to network.

“We aimed to involve as many organisations possible to donate prizes, silent auction items and giveaways,” says Dilupa, graduate subsea engineer.

“The generosity that exists among us Woodsiders is incredible.”

Telethon is an annual fundraiser supporting Perth Children’s Hospital and many other beneficiaries.

This year, more than \$42 million was raised for Telethon, with our chief executive officer Peter Coleman also contributing \$300,000 on behalf of Woodside.

Right note

A group of Woodsiders has discovered that choral singing delivers many more benefits than simply exercising vocal cords.

They’re members of the With One Voice Perth Choir – an initiative created by the not-for-profit organisation Creativity Australia – aiming to connect advantaged and disadvantaged community groups through the neuro-scientific benefits of singing.

“There’s growing evidence to support the theory that singing is good for the brain and highly beneficial for mental and emotional health,” explains Suad Vlahos.

“Singing in a choir encourages people to come together, form friendships, feel included and belong. It’s about nurturing a happier community and I am thrilled to be a part of such an initiative.”

Suad, a senior Contracting and Procurement adviser, is a member of the choir as well as an active participant of both the choir’s steering committee and implementation team.

The choir was initially endorsed for establishment in late 2018 by the leadership task force comprising

members of the Woodside leadership community and Woodside Young Professionals.

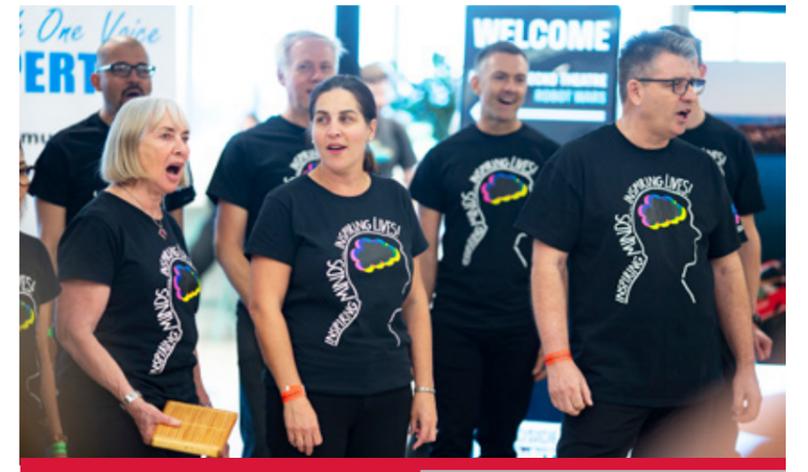
Choir members rehearse weekly and are taught by the choir’s talented conductor, Athena Litis.

The diverse musical repertoire appeals to choir members and community alike and public feedback to performances at the Woodside Sprint, Perth Royal Show and ConnectGroup Expo has been

overwhelmingly positive.

In addition, the choir will utilise a busking permit granted by the City of Perth to fundraise for the choir and spread the message of inclusivity. “It doesn’t matter where you come from, whatever your age or ability, everybody is welcome,” Suad says

“The choir is about connection and belonging through music. Who wouldn’t want to be a part of that?”



Top drop

Simon Bourman has quickly developed a knack to the sometime-frustrating craft of making fine beer.

Within three years of taking up the hobby, Simon walked away with the Champion Beer award at the Australian Amateur

Brewing Championships in October.

Held in Bankstown, NSW, Simon’s Baltic Porter took out the top prize.

Baltic Porter? “It’s a dark, strong beer, along the stout lines, but it’s brewed

with a lager yeast, not an ale yeast,” Simon explains.

The recipe is his own and the result, he acknowledges, is not to everyone’s taste.

“It’s a roasty, chocolate taste and can have hints of liquorice and dried fruits,” he reveals.



The judges were impressed, though, and Simon was “a bit chuffed” when it wowed the judging panel, topped the Baltic Porter category, and was crowned the Best Beer of the championships.

Another of Simon’s entries - a Russian imperial stout which took out back-to-back wins at the Queensland competition in 2018 and 2019 - took out third in the national comp.

Simon is a maintenance technical inlec (instrument electrician) on North Rankin, and lives on Queensland’s Sunshine Coast where he stores his beer-making equipment in his garage and makes the beer on his patio.

From Sweden to Rotto

Woodside's adrenaline junkies have found a new way to satisfy their cravings with an event devised in Sweden in 2006.

It's called Swimrun and, as the name suggests, it combines swimming and running.

But the Swimrun race calls for more than the usual "accelerate"; to "collaborate" is necessary, too, because participants enter as a pair.

"Triathlons and Ironmans are solo affairs, but with a team of two you need to talk to each other and motivate each other," reports project engineer Andrew Graham.

"This element makes it very different from other events."

No changing of clothes is allowed during transitions between disciplines so entrants must swim in their running shoes and run in their Speedos – and carry all the supplies they need for the race.

The third Rottne Swimrun was held in November at Rottne Island off Perth, with 10 swim legs totalling about 4.5 km and 10 running legs on beach, road and trail totalling about 28.5 km.

By all accounts, high temperature made for a tough 33 km day.

At least half a dozen staff took part including Tom Ridsdill-Smith, Robyn Tissiman, Emma Kiekebosch-Fitt, Cameron Robertson, Michael Lawrence and Andrew (pictured).

Tom reports: "It was gruelling in the heat but I think it is possibly the most

beautiful I've ever seen some of the bays - so blue it hurt to look at them."

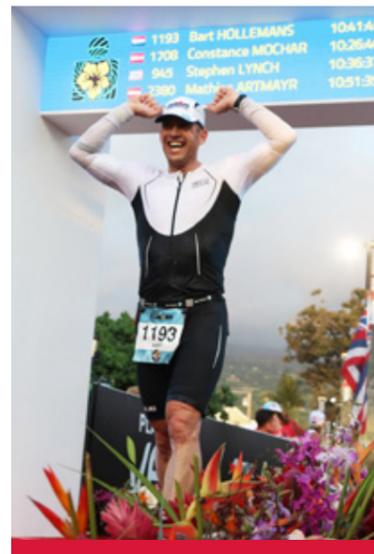
Says Robyn: "Highlights included doing it with a good crew of friends, the spectacular Rotto scenery and crossing the finish line."

Emma reports: "The most amount of smiles and laughter I've ever seen on a course. The vibe was incredible."



Bart blooms in Hawaii

Several Woodsiders have been lucky enough to compete in the IronMan World Championships in Hawaii, but few have been "late bloomers" like Bart Hollemans.



Ten years ago, Bart, by his own admission, was on the typical mid-life slide: sitting down too much, too little exercise and steadily gaining weight.

In 2009, aged 37, he was "volunteered" into a team at the BRW Corporate Triathlon at Langley Park and it was his wake-up call.

"I couldn't swim freestyle to the first buoy in a 400 m swim without panicking and lower back issues meant running was a painful experience," he recalls grimly.

Rather than being discouraged, Bart – part of the Scarborough team which looks after the 430 km trunkline – did something about it.

He slowly built his fitness, lost weight and worked on his back issues with Pilates.

"It's easy to make excuses to not exercise, but the 'I don't have time' one rarely stacks up. Committing 30 minutes

a day by prioritising your health is possible for everyone," he notes.

"I'm a great supporter of accountability through joining organised events: Park Run on Saturdays or a class at our fantastic gym facilities during the day."

Last year he qualified for the Hawaii event at the Busselton IronMan, tackling the 3.8 km ocean swim, 180 km bike ride and 42.2 km run.

In the lead up, Bart raised funds for On My Feet, an organisation involved in providing a structured community for homeless people to run and exercise together to build physical and mental strength.

"The heat and humidity made the run in Hawaii the toughest part," he reports, "but the hurt is only temporary. Finishing was a proud moment."

"I would never have expected to complete something like this. It has been - and still is - a great journey," Bart concludes.

Christmas Lights can be found in all London's major shopping streets these days and the tradition dates to 1954 when it was decided to brighten post-war London. Regent Street (200 years old this year) was the first street chosen, and it's captured here by geologist Kaitlyn Richards of our

London office. It remains a favourite with locals and visitors alike and in November huge crowds attend the opening of the lights by celebrities. The 44 Spirit of Christmas angels draped along the street, however, invariably steal the show.





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