OceanWorks

ANNUAL REPORT 2020

THE UNIVERSITY OF WESTERN AUSTRALIA | OCEANS INSTITUTE

Woodside FUTURELAB

"Through our 2020 OceanWorks prototype project, we had the opportunity to connect with key industry partners to develop research, share ideas and discuss how to expand current knowledge frontiers.

These exchanges and new perspectives were valuable, produced important preliminary data, and brought a new appreciation of the role of industry in supporting innovation in ocean solutions to increase natural carbon sinks."

Karen Filbee-Dexter
Research Fellow, School of Biological Sciences

OceanWorks

OceanWorks is a collaboration between UWA and Woodside Energy that is designed to address challenges and boost innovation in ocean engineering. We bring together high-calibre engineers, researchers and students to identify new ideas and nurture promising solutions that will shape the future of ocean industries. OceanWorks achieves this by providing a unique portfolio of programs to enable applied research, a physical space for problem-sharing and collaboration and a rich program of outreach and teaching activities to upskill our community.

In 2020, OceanWorks initiated research activity across 16 new areas (5 prototypes, 8 RiverLab projects and 3 ocean challenges). Despite the impact of COVID-19 on our ability to host events in the OceanWorks space from April-July, and with ongoing restrictions to our capacity for the remainder of the year, we hosted 1,800 visitors across 152 events. 40% of all events included industry collaborators.

"Working with OceanWorks allows us to collaborate with high calibre researchers to think big, prototype small, scale fast and to innovate and to apply those learnings to Woodside's projects".

Jan Flynn
Chief Geotechnical & Metocean Engineer, Woodside

UWA, Woodside, Contractors, Consultant

Collaborate and Grow Ideas by Bringing People Together
- Research meetings
- Project sharing
- Challenge sessions
- Away days / hackathons

Community and Outreach
- School students
- Girls in Engineering
- Community engagement
- Women in IOMRC Network

Innovate and Incubate New Ideas Quickly
- Prototype fund
- RiverLab
- Internships
- Large scale research projects
- Commercialisation

Outcome & Impact (over 5 year program)

Developed an ecosystem for open innovation
- 90 applied research projects – generating 10 larger-scale spin-off projects
- Collaboration amongst >50 UWA and Woodside staff

Inspired social change to encourage young girls to pursue a STEAM career through Outreach programs
- Engagement of >600 students (Primary school to PhD)

Woodside Return on Investment[1]
- Prototype >30:1
- RiverLab 10:1
- Example project – development of Vessel Operability Planning Software – is realising an estimated $8m in savings to Woodside

[1]2019 Woodside Valuation of OceanWorks projects

Prototypes

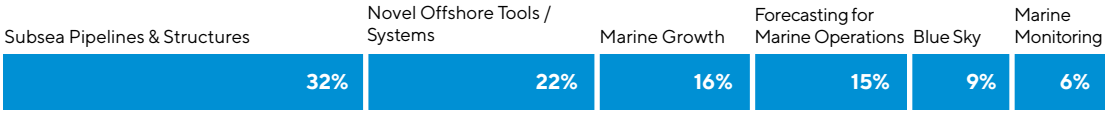
Accessing a wide network of researchers to innovate rapidly with industry.

The OceanWorks Prototype Program nurtures ocean industry innovation by offering early-stage support to promising new ideas. Small Grants are available to researchers and students to allow projects to progress rapidly towards the prototyping and scaling of new ideas.

2020 Prototypes:

1. Uncovering carbon sink potential of Australian kelp forests
2. Using acoustic telemetry to detect tagged marine megafauna
3. Machine learning driven regional wave transformation
4. Data driven real-time prediction of ocean responses
5. Characterising marine growth that disables subsea equipment

25 Prototypes



40 UWA Academics

15 Woodside Staff

16 Projects Complete

4 TiDE

5 Spin-off Projects

Highlight Project

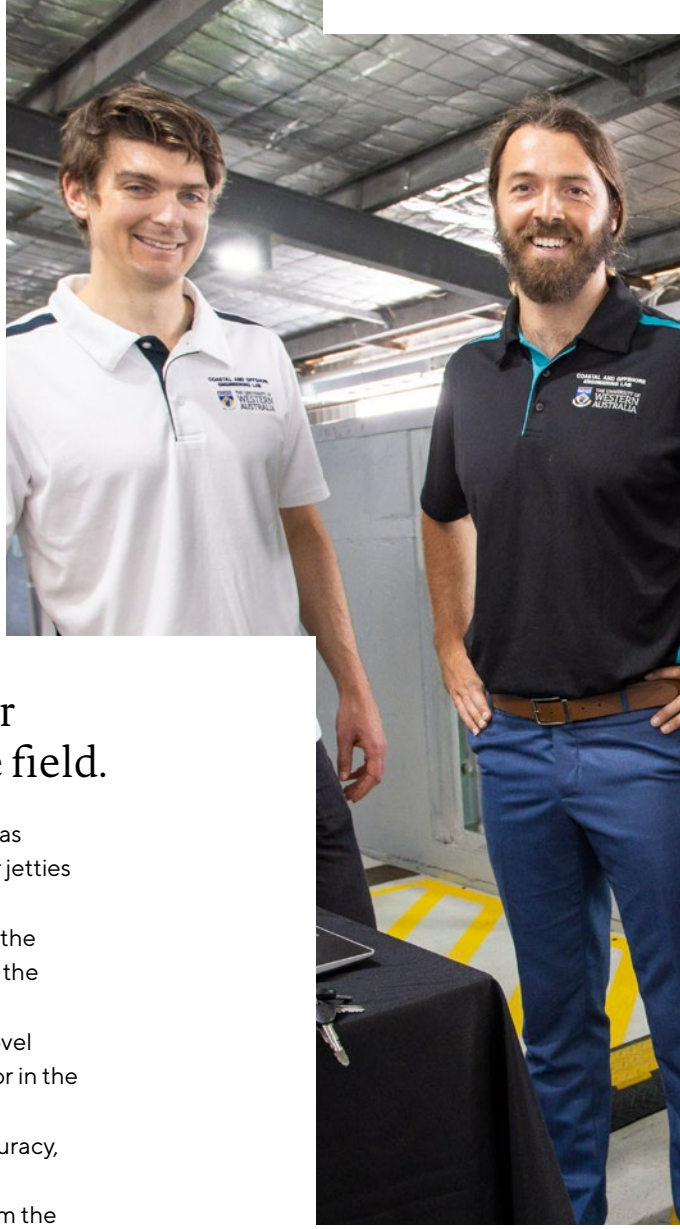
SLAM – Swell Local Adjustment via Monitoring

The need to improve operational wave forecasts to inform the best time for complex offshore operations has lead Dr Jeff Hansen to explore the possibility of using machine learning to improve operational wave forecasts. Machine learning algorithms were trained using historical wave forecasts along with observations from wave buoys, to identify and correct consistent errors in the forecasts. Results from this prototype indicate that the machine learning methodology can reduce forecast errors by as much as 20%.

"Thanks to the 2020 OceanWorks prototype grant, we took our sensor trial all the way through to publishing a brief research report in a well-ranked journal. OceanWorks also connected us to industry partners who were enthusiastic about our study and are interested in future collaborations. The link that OceanWorks provides between UWA researchers and industry is invaluable."

Paul Thomson
Senior Research Engineer,
Oceans Graduate School

RiverLab



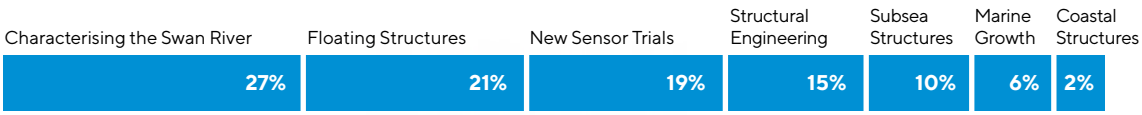
Bringing students and Industry together to trial new engineering solutions in the field.

The RiverLab Program links talented Masters students with leading researchers and industry mentors to work on real problems from offshore and other ocean industries. Using the Swan River as a proving ground, RiverLab allows students and researchers to conduct hands-on research, to gain immediate insights.

2020 Projects:

1. Studying floating wave buoys for sensing and renewable energy
2. Geopolymer concrete made of river water and river sand
3. Using tubular FRP sections as structural members for river jetties and walkways
4. Biofouling maintenance for the Kwilena Monitoring Buoy in the Swan River
5. Field investigation of the novel dynamic installed fish anchor in the Swan River
6. Development of a high-accuracy, low cost water level sensor
7. Open water swimming – from the river to the Olympics
8. Application of floaters on mitigating snap load in umbilical for deep-water ROV operation

48 Projects



30 UWA Academics

9 Woodside Staff

86 Students

43 Projects Complete

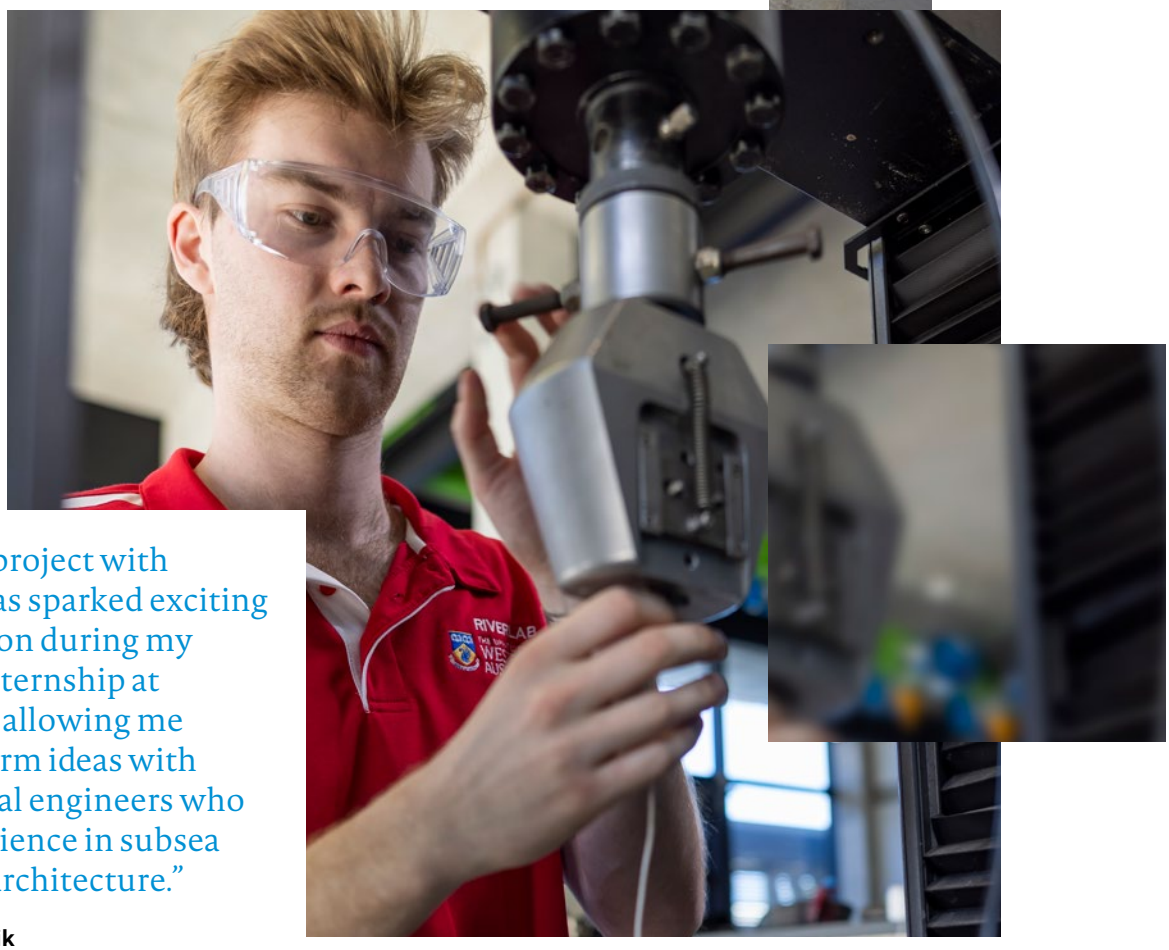
1 Spin-off Projects

Highlight Project

Studying Floating Wave Buoys for Sensing and Renewable Energy

Dr Jana Orszaghova has been using the RiverLab program to study wave energy systems since 2018. Building on the knowledge of past projects, 2020 saw her student investigate how to design a small wave energy converter to operate in swell waves. This work also has some application to swell measurement and prediction, a key area of interest to offshore operators on the NWS.

The project studied in detail the effects of lowering the natural frequency of a heaving device via a negative spring mechanism to improve power capture. Simulated results (due to COVID-19) confirmed the new design was predicted to capture at least twice as much power on average, compared to a device without a negative spring, and provided greater understanding of the non-linear effect of the spring system.



"My thesis project with Riverlab has sparked exciting conversation during my summer internship at Woodside, allowing me to brainstorm ideas with professional engineers who have experience in subsea and naval architecture."

Steffen Remvik
2020/21 RiverLab Student

Internships

Providing applied research training opportunities.

The OceanWorks Internship program brings high achieving students to UWA to work on a 10-week OceanWorks research project. In addition, we provide a program of activities for all intern students across the Oceans Graduate School who are funded from a variety of industry partners.

2020 Projects

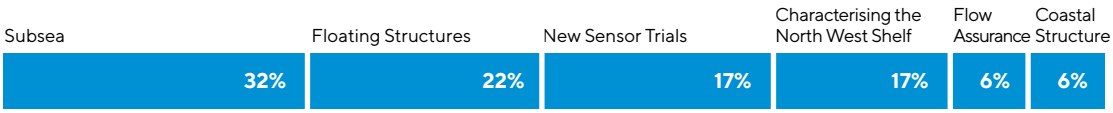
1. Design, Build & Test Floating Wind in the Swan River
2. Design, Build & Test Floating Solar in the Swan River
3. Exploring the effects of gap motion on FLNG offloading
4. Quantifying wave attenuation over novel artificial reef modules
5. Aging of driven piles in clay
6. Statistical modelling of water column density on the NWS
7. Quantifying soil springs to assess the natural frequency of subsea pipeline spans

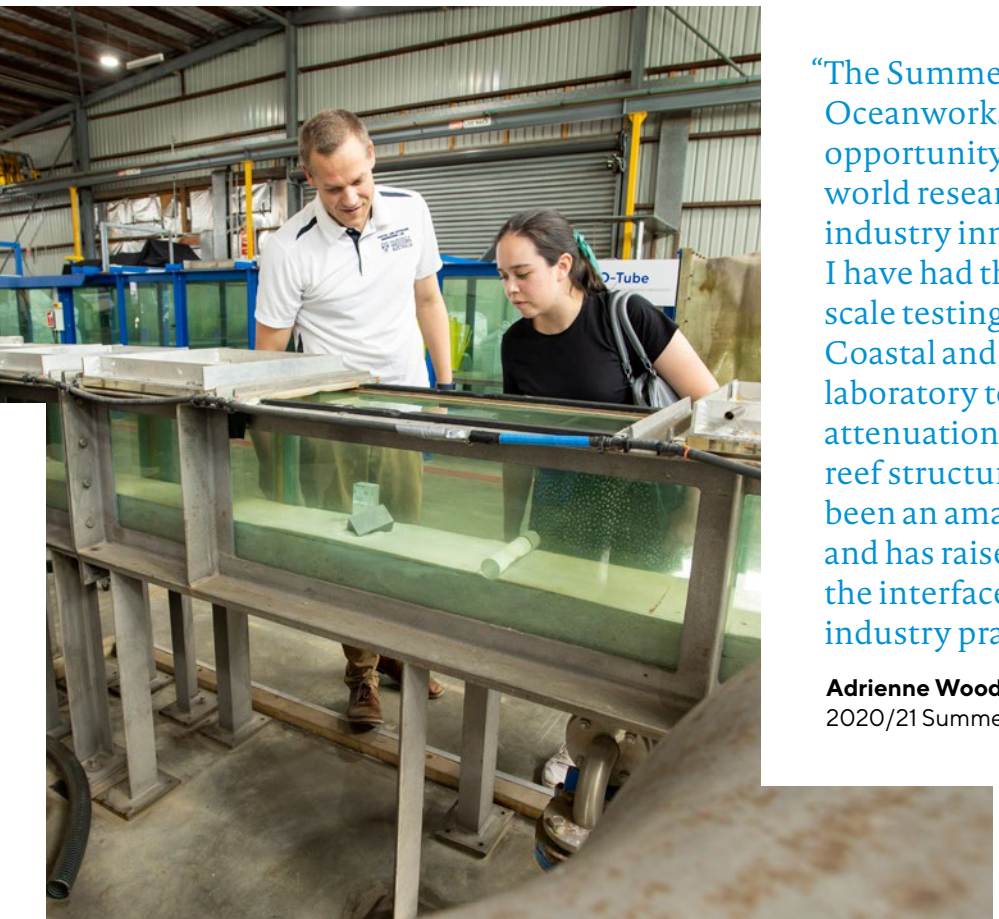
Highlight Project

Design, Build & Test Floating Solar in the Swan River

A future source of renewable energy is floating PV – photovoltaic panels that float on the surface of a waterbody. Floating PV raises engineering concerns not just with cost, but also regarding efficiency effects both positive (water acts as a natural coolant) and negative (overwash and rocking effects). This project analysed the effects of rocking. The first part of the project developed a numerical code to predict the effect of panel tilt and orientation on efficiency. In the second part of the project physical model testing of the panels was undertaken to validate the code. This involved a series of experiments to systematically measure power generation in different scenarios.

18 Internships





"The Summer Intern program at Oceanworks has been a fantastic opportunity to be involved in real world research at the forefront of industry innovations and development. I have had the opportunity to conduct scale testing at the university's Coastal and Offshore Engineering laboratory to quantify the wave attenuation properties of an artificial reef structure from Subcon, which has been an amazing learning experience and has raised my understanding of the interface between research and industry practice."

Adrienne Wood
2020/21 Summer Intern Student

Outreach

Investing in diversity and communication.

OceanWorks recognises that diversity and communication are vital ingredients for innovative engineering. A number of targeted programs have been created to address the need for greater gender diversity in engineering. These activities target students in primary and secondary school, as well as university students and professional engineers.

2020 Programs

1. Future Engineers Program (with WISE – Women's Professional Network part of SEA- Subsea Engineers Australia)
2. Emerging Engineers Competition (with UWA Girls in Engineering)
3. Life Below Water STEAM Competition
4. Post Graduate Student Association Research Week
5. Women of IOMRC Network
6. Space versus Oceans National Science Week Livestream

"This course has enabled me to talk to women and understand their experience as engineers in a male dominated industry, and it has made me confident about studying engineering in the future."

Student

Future Engineers students pictured with Jan Flynn (Woodside Chief Metocean Engineer), right.

25
Programs

500
Students

Emerging Engineers

The Emerging Engineers Competition is an outreach program supported by OceanWorks and UWA Girls in Engineering aiming to engage young women in the future challenges facing ocean engineers. With an emphasis on problem-solving, project-based work, and communication skills, the Emerging Engineers Competition offers primary and secondary students a chance to work on a real problem from ocean industries. Despite a COVID-19 interrupted year, 8 teams of bright students ranging from Year 2 to Year 10 made it to the finish line, and presented their anti-marine growth solutions live at the final event on 15 September. Jitendra Joshi rewarded the top 2 teams with a personal tour of the Woodside Robotics Lab.

Jitendra Joshi (Woodside Principal Scientist, New Energy) with winning students from Perth College and Iona Presbyterian College

O-Tube, UWA Coastal & Offshore Engineering Lab, Shenton Park

UWA National Geotechnical Centrifuge Facility, Crawley

Facilities

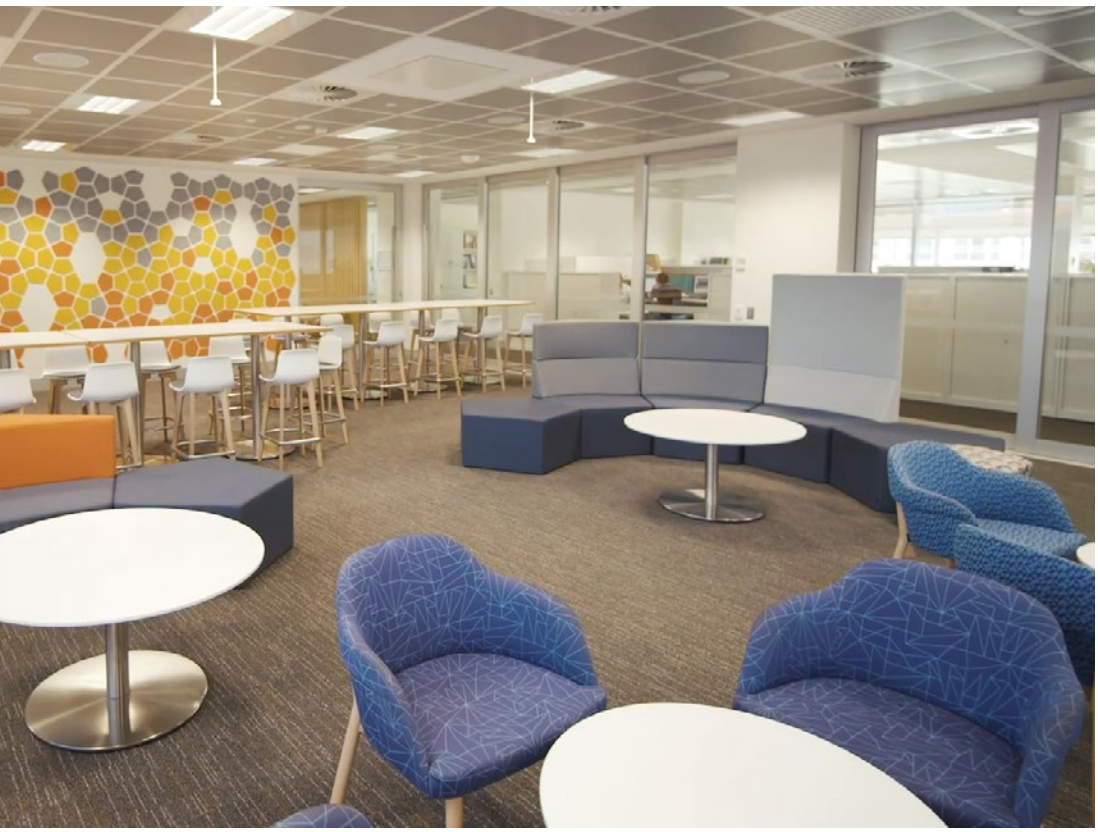
Using world-class facilities to drive applied research.

Our projects have access to:

- OceanWorks Lounge
- Perth's Swan River
- Coastal & Offshore Engineering Lab (COEL)
- National Geotechnical Centrifuge Facility (NGCF)
- Facilities across the wider Oceans Institute and eZone network

Since 2016, 28% of all OceanWorks projects have used our laboratory facilities.

Wave Flume, UWA Coastal & Offshore Engineering Lab, Shenton Park



OceanWorks Lounge, Crawley

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