OMAE CONFERENCE
AMC TECHNICAL TOUR

16 JUNE 2023

UNIVERSITY of TASMANIA

AMC

Australian Maritime College

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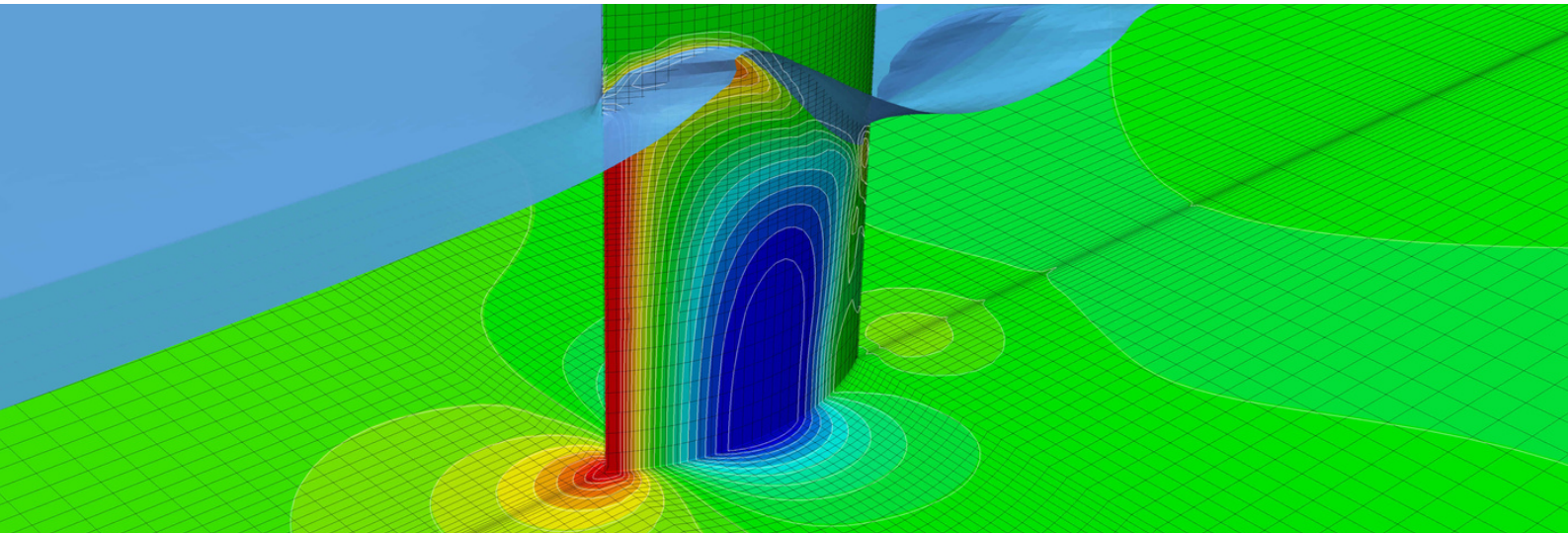


Introduction

WORLD LEADING IN MARITIME EDUCATION AND RESEARCH

The Australian Maritime College (AMC) was established in Launceston, Tasmania in 1978 as Australia's national academic institution for education and training of Seafarers. It has since grown and evolved, gaining recognition for education, training, research, and consultancy in the fields of maritime engineering and hydrodynamics, nautical science, marine and marine-electro engineering, and maritime business and international logistics.

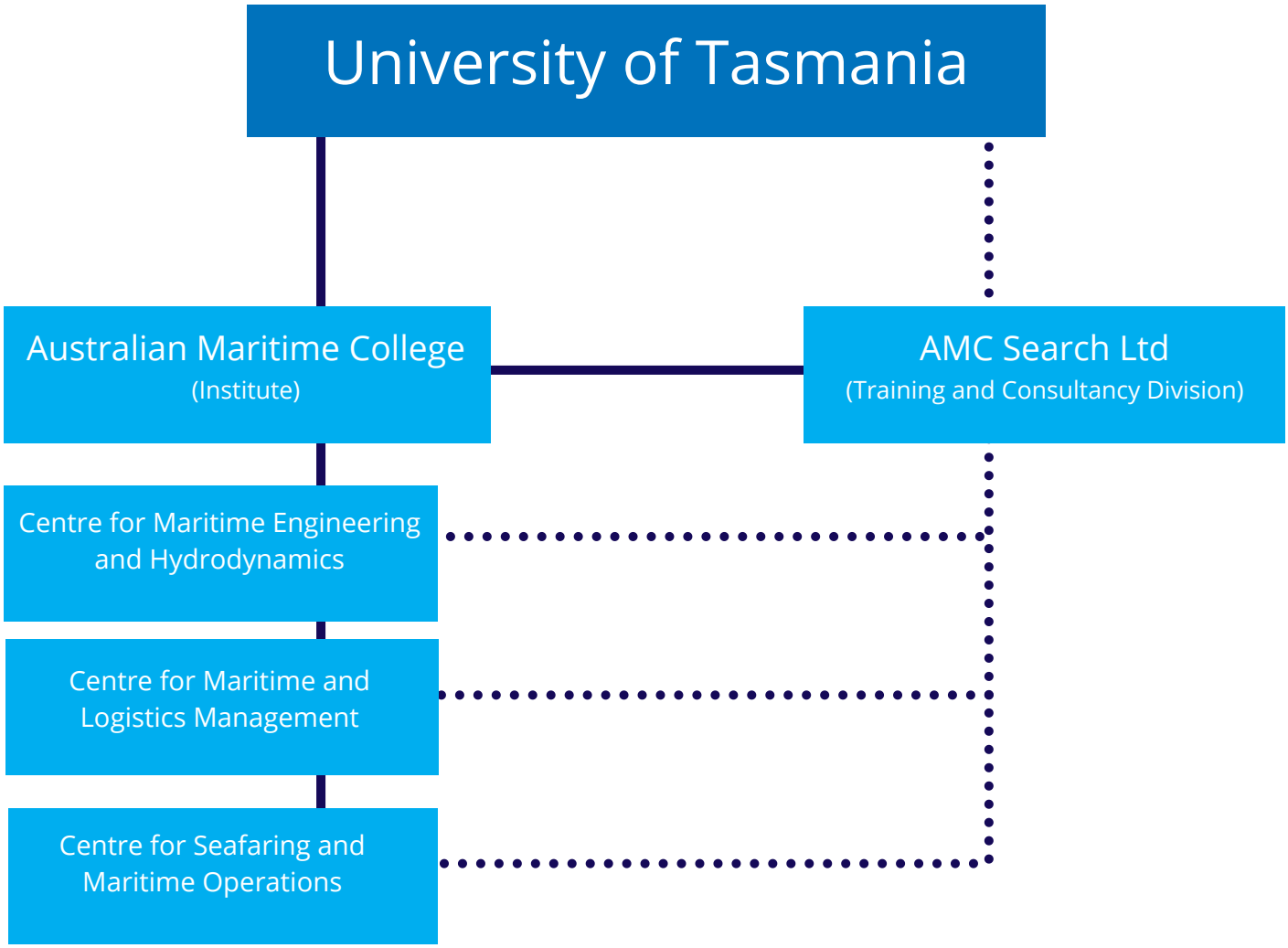
AMC was integrated with the University of Tasmania (UTAS) as a specialist institute in 2008 and is governed by an Advisory Board through the University Council.

Commercial services delivered by AMC are provided through its Training and Consultancy Division, AMC Search, leveraging the academic expertise and research infrastructure of AMC. AMC Search Ltd. is a Public Company limited by guarantee (ABN 29 009 548 618).

AMC Search's corporate culture is underpinned by its not-for-profit status where all monies raised above operating costs are reinvested back into the AMC for the sole purpose of enhancing and developing the specialist R&D facilities and educational services for the benefit of maritime related industries.

The AMC is Australia's national maritime engineering and training institution and has been consistently ranked at or near number one in the world by the International Association of Maritime Universities.

Therefore, AMC clients receive the highest available standard of services delivered by world-class maritime industry specialists.



AMC Corporate OVERVIEW

OUR PEOPLE AND EXPERTISE

AMC knows that its main asset are the people that deliver the services required by the maritime industry.

That is why AMC is considered by industry as a leader in the field and an employer of choice within the sector.

This is evident from our continued ability to attract and retain quality people to Tasmania to work at the college.

By providing in-house and external training and development opportunities, our employees are continually up skilled in their respective fields of expertise.

Further, AMC is the only organisation in Australia that can provide commercial access on an as-needs-basis to highly specialised experts from multi-disciplinary academic institutions, including

- Master Mariners
- Maritime Engineers
- Autonomous Systems Engineers
- Port and Logistics Experts
- Veteran Defence Personnel
- Naval Architects
- Big Data and Sensor Innovators
- Curriculum and Training Development Experts
- Digital Training Development Specialists

DEFENCE AND MARITIME INNOVATION AND DESIGN PRECINCT

AMC is a longstanding provider of research services to DSTG, including testing and evaluation, through the Defence Science Partnership (DSP) program.

To meet key Defence maritime capability domain related strategic goals and priorities for sovereign industrial capabilities (Test and Evaluation, Naval Shipbuilding, and Collins Class Submarine Upgrade), the entire suite of AMC engineering facilities are being enhanced and further co-developed with DSTG to create the *Defence and Maritime Innovation and Design Precinct* (DMIDP).

DMIDP Stage 1

Stage 1 infrastructure upgrades and new equipment acquisitions commenced in 2021 and will be complete by end of 2022.

Stage 1 has included the acquisition of new Autonomous Maritime Systems (AMS) technologies, upgrades to the Beauty Point Campus (Waterfront Operations) acquisition of materials characterisation test equipment, and establishment of a Real Time Power Simulator. A Common User Facility incorporating Defence Protected Network (DPN) and Defence Secret Network (DSN) connectivity and upgraded High Performance Computer Facility is also being developed to create a collaboration and partners support environment.

DMIDP Stage 2

Plans for Stage 2 include building a second, much larger Towing Tank & Shallow Water Wave Basin to enable combined T&E of sub-surface & surface vessel manoeuvrability & stability assessments including:

- Behavioural prediction of dynamic motions and characteristics
- Variable states of sea, wind, & stability
- Evaluation of operational impacts & key design factors
- Manoeuvring, habitability, helicopter ops, sensor performance
- principal dimensions, general compartment arrangements, weight distribution

Plans in stage 2 are also in place to expand the Cavitation Research Laboratory to include a Propulsor Test Circuit for advanced T&E capabilities to investigate:

- Characterisation of cavitation & turbulence phenomena
- Evaluation of threat susceptibility
- Vibration - Broadband Noise - Wake & Bioluminescence
- Protruding Devices Design and Configuration Evaluation
- Evaluation of impacts on vessel operation

CAPABILITIES

Maritime Training	• Seafaring • Shipping • STCW Refresher • Online Digital Training Solutions • Defence • Autonomous Maritime Systems (AUVs and USVs) • Oil and Gas • Port and Terminal Operations • Vessel Traffic Services • Polar Code
Maritime Simulations	• Vessel and area model creation • Port Operations • Port Development Studies • Port Infrastructure Design Studies • Ship and port emergency procedure development • Bridge and engine team familiarisation and refresher training • Marine Pilot Training • Computational Fluid Dynamics (CFD) • Digital/virtual twins • 3D Animation and Video Production
Engineering	• Naval Architecture • Cavitation and Turbulent Flows • Port and terminal master planning and optimisation • Port and terminal sustainability assessments • Channel design and utilisation optimisation • Marine renewable energy systems • Mooring arrangement design and analysis • Terminal simulations • Freight and vessel forecasting • Computational Fluid Dynamics • Physical scale model maritime vessels and structures testing & evaluation
Autonomous Maritime Systems	• AUV & USV Operator & Technical Training • AUV & USV Operator Support Services • Autonomous Maritime Systems Fundamentals Training • Sensor and Software Engineering • Hydrographic survey • Vessel Charter • Underwater inspection

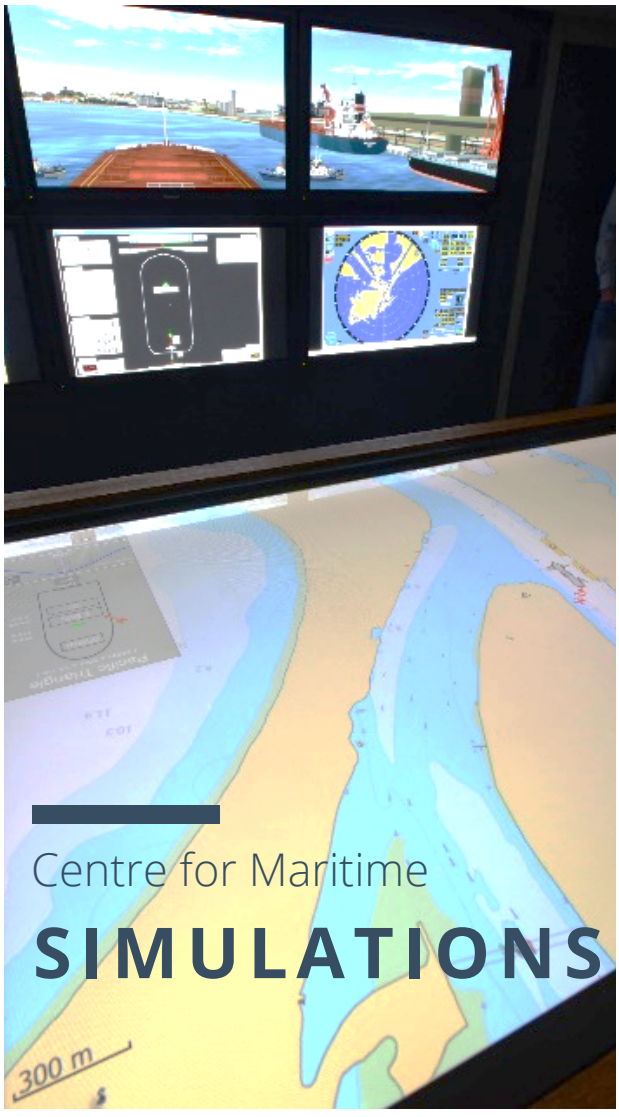
Logistics and Supply Chains	• Port and terminal operation and management • Ship operation management • Logistics management (transport logistics, procurement, and warehousing) • Supply chain management • Maritime economics • Freight management • Multi-nodal transport logistics modelling • Resilience management
Big Data and Internet of Things	• Design, build, test and deploy systems sensors for commercial applications • Design, select and deploy telemetry solutions to transfer sensing data to applications • Software engineering to create prototype systems ready for production deployment • Data analysis and visualisation experience to transform data into knowledge • Full end-to-end data value chain including business development and project management and delivery
Blue Economy	• Asset Management • Renewable Energy
Defence	• Design and Support • Maritime platforms systems test and Evaluation • Bespoke Training Solutions
Marine and Offshore Engineering	Numerical and physical scale modelling for: • Port development • Channel design • Berth design • Installation analysis
Environmental and Social Systems	• Environmental and Social Impact Assessment • Fisheries Management • Pollution and Emission Control

CAPABILITIES CONT...

AMC FACILITIES

Powered by Kongsberg Maritime software, the Centre for Maritime Simulations (CMS) includes a DNV Class A Full Mission Bridge simulator featuring a full-scale mock-up of a ship's bridge and an ultra-high resolution 4K Panasonic Projection System.

The simulations present a full-scale display of the ship and surrounding area as seen through the windows of the wheelhouse. Controller hardware such as telegraph, thrusters, independent helm, and Azi Pods are integrated into the simulator as well as all the instruments required for navigation and manoeuvring.



Used in practical exercises during training courses, the CMS includes a Ship Operation Simulator suite which is comprised of six smaller bridges, and an 18-seat desk-top electronic chart display lab, all powered by the same trusted Kongsberg software.

An extensive ship model library contains over 130 vessels which provides a broad representation of the range of vessel types and sizes visiting ports around the world.

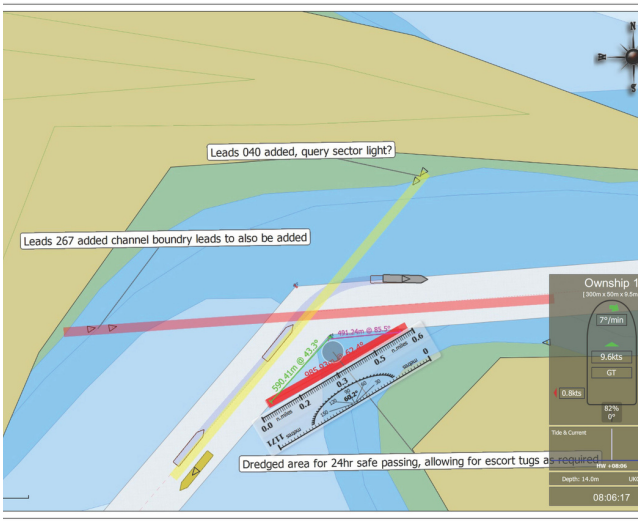
AMC also has an in-house team of hydrodynamic simulation model makers. This team of experts have the capability to create hydrodynamically accurate vessel models, and to make accurate port or sea area models. The port area models can include proposed new berths and new dredged areas, allowing for the testing of new ships in regular ports with new berths. In this manner proof of concept can be achieved before work on new berths is started. This new ship model, and the area model with the new berths can then be used for crew familiarisation training before the new berths are completed, allowing for a seamless transition to the new berths and ships.

This capability provides AMC clients with a cost-effective solution to the development of simulation models as there is no requirement for outsourcing to third parties outside of Tasmania or overseas.

Complementing the Full Mission Bridge simulator for port operational training and development projects are two-purpose built multi-type Tug Simulators comprising 360° visuals.

Finally, a fully interactive touchscreen chart table supports debriefing for port development/feasibility projects is also installed so information and findings from simulations can be delivered to clients in real time.

Our Simulator can also benefit greatly from the provision of data acquired from physical scale model experiments performed within the maritime hydrodynamic test basins (refer below on Model Test Basin and Towing Tank). For example, we can directly measure the manoeuvring coefficients for a ship operating in the site-specific bathymetry of a selected area.



MARITIME ENGINEERING FACILITIES

TOWING TANK

The Towing Tank is used to measure the resistance of objects in moving water, such as ship hulls.

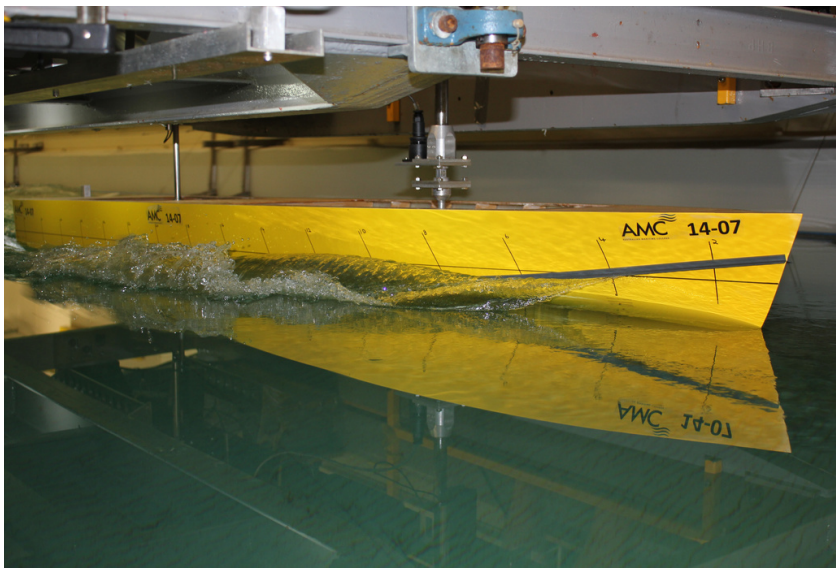
Tests are made by towing models along the 100-meter-long tank at speeds up to 5m per seconds in different environmental conditions, such as heavy waves. The results enable recommendations to be made about how to reduce fuel costs, to limit environmental damage or how to design vessels for optimum efficiency.

The tank has a very flat concrete floor depth that can be varied providing the ability to conduct experiments in very shallow water depths by lowering the water depth. The powered carriage runs on rails that are very accurately aligned to the still water surface. The carriage can accommodate up to six passengers for viewing purposes.

A software-controlled wave-maker generates a wide variety of wave forms. Once a test is completed, wave dampening devices rapidly return the body of water to a calm state, removing the need for long wait times between experiments.

An in-house model making team compliment the facility. This team are specialists in the production of scale models that are used during experiments conducted in the Towing Tank.

AMC is also a member of the International Towing Tank Conference (ITTC) Association, the peak body representing organisations responsible for predicting the hydrodynamic performance of ships and marine installations based on the results of physical and numerical modelling.



MODEL TEST BASIN

The Model Test Basin, which at 35-metres long and 12-metres wide, is used to conduct a wide variety of experiments and experimental modelling, with a particular focus on maritime operations in shallow water environments such as ports, harbours and coastal regions.

The Model Test Basin has a wave-maker with 16 computer-controlled paddles that can produce a wide variety of different types of wave at almost any finite water depth. A wind generator with twenty individually controllable fans can be strategically positioned to obtain the desired wind direction and velocity.

It also has a digital motion capture system consisting of eight digital infrared cameras, providing the ability to track the model's motion of multiple floating models under different wave conditions.

The Towing Tank in-house model making team compliment the facility who are used as specialists in the production of scale models that are used during experiments conducted in the Model Test Basin.

Both the Towing Tank and Model Test Basin are unique facilities in Australia that are available for the test and evaluation of vessel dynamics, seakeeping, propulsion systems, wave wake and stability engineering projects.

CAVITATION RESEARCH LABORATORY

The Cavitation Research Laboratory is used to test the hydrodynamic behaviour of submerged structures such as ship hulls.

The facility is for engineering projects that investigate marine propulsors and control surfaces, as well as mechanisms for air entertainment about ship hulls, the effects of propellers and control surfaces in mixing and bubble breakup, and subsequent dispersion and dissipation of bubbles in the ship wake.

The cavitation tunnel is used in testing and evaluation of any cavitation induced vibration and any adverse effects on propulsion and auxiliary ship systems, and passenger comfort.

HIGH PERFORMANCE COMPUTING CLUSTER & COMMON USER FACILITY

The computer cluster is utilised to support scale model experiments/testing of the new vessels in the Towing Tank or Model Test Basin. The support is delivered using the Computational Fluid Dynamics (CFD) simulation tool. CFD provides a detailed insight into flow properties to a high degree of accuracy, either as a standalone tool or complimentary to physical model testing.

CFD provides detailed information on:

- Accurate simulation of flow around maritime structures, such as boats and offshore structures
- Performance evaluation from small appliances to full-scale system including scaling effects
- Hydrodynamic studies in collaboration with experimental facilities (Towing Tank, Model Test Basin)
- Forces and moments of ship-ship interaction
- High-fidelity analysis using Large Eddy Simulation (LES) for small-scale flows such as spray patters around periscopes
- State-of-the-art numerical tools: ANSYS CFX and FLUENT, OpenFOAM, and STAR-CCM+

As part of the DMIDP Stage 1 development an upgrade of this facility is underway with enhanced capacity and speed (64 SGI 8200 nodes with 8 cores each).

This upgrade is being integrated into a Common User Facility to create a Defence Security Compliant Zone 2 and 4 collaboration environments, incorporating Defence Protected Network (DPN) and Defence Secret Network (DSN) connectivity.

EMISSION AND ASSET MANAGEMENT FACILITIES

Several facilities are coalesced around an emission measurement and asset management theme. Facilities are in place that evaluates emissions, asset degradation (e.g., hull corrosion/erosion), condition monitoring, and optimization of maintenance activity.

AUTONOMOUS MARITIME SYSTEMS

AMC Search is at the forefront of Autonomous Maritime Systems (AMS) and has specialist capabilities in training, consultancy services and AUV/USV charter.

These services are delivered by providing commercial access to the AMS expertise based at the AMC which includes the Autonomous Maritime Systems Laboratory (a R&D unit focused on AMS) and a fleet of surface and subsurface autonomous maritime systems. These systems include a Hydroid REMUS 100 AUV, ISE Explorer AUV, Iver4-580 AUV, WAM-V 16 USV and number of BlueROV and bespoke scale USV systems.

Since 2017 AMC Search has been providing training to the Royal Australian Navy on the operation and technical support towards AMS. In July 2020, AMC Search was awarded a 3 year, $4.7m contract by Navy as its preferred AMS training provider. AMCS continues to receive outstanding reports from Defence on the quality, effectiveness, and management of this service. AMC Search has also established an AMS training and technical engineering support service for Defence Science and Technology Group (DSTG). Specifically, we are designing and manufacturing a bespoke integrated AUV senor module for use on our ISE Explorer AUV for DSTG. This technology will be used by DSTG with AMC's support to trial and test a number of AUV sensors.

To deliver these and other services the Autonomous Maritime Systems Laboratory employees highly specialised staff. These staff members and their specialist AMS skills and experience can be accessed to support project work. To date AMSL staff have been contracted to support numerous projects including commercial AUV surveys, deep ocean exploration, hydrographic surveys, underwater unexploded ordnance search, AMS system reviews, regulatory support and technical sensor integration.

AMS is a rapidly emerging technology that could be of immense value to the maritime industry moving forward, for example in the areas of automation and inspections/maintenance programs.

AMS-TEC

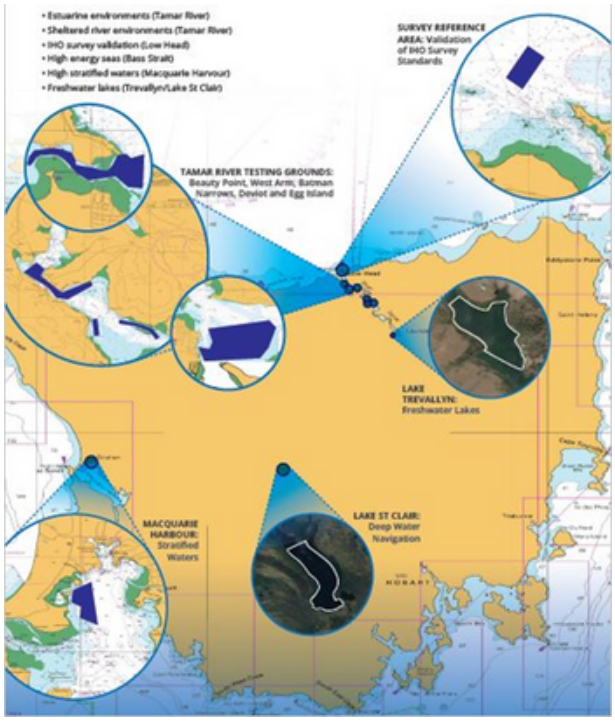
AMS-TEC is Australia's centre of excellence for testing and evaluating AMS technologies in temperate and high energy marine environments.

Located at the Beauty Point Campus and integrated into the Defence and Maritime Design and Innovation Precinct at the Australian Maritime College in Tasmania, AMS-TEC provides:

- Controlled environments for AMS operators, designers and manufacturers to test and evaluate systems in multiple marine environments including estuarine, sheltered and high energy sea states.
- A centralised controlled location for AMS operators to undergo training on how to operate and plan missions with AMS technologies.
- Access to AMCs specialist engineers, sensor integrators and platform developers to support test and evaluation activities where needed.
- Access to real-world infrastructure to test and evaluate AMS sensor payloads including wharfs, moored vessels and different bottom types.
- Other services including providing access to specialised AMS support vessels, workshops and laboratories.
- Access to digital twins, simulation services and special order surveyed areas to test and evaluate AMS.

The Testing Grounds

- Estuarine environments (Tamar River)
- Sheltered river environments (Tamar River)
- IHO survey validation (Low Head)
- High energy seas (Bass Strait)
- High stratified waters (Macquarie Harbour)
- Freshwater lakes (Trevallyn/Lake St Clair)

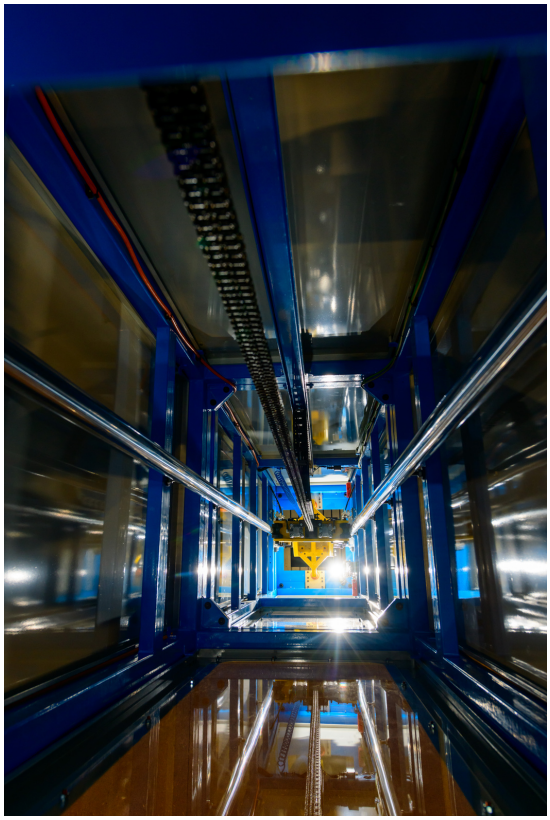


UNDERWATER COLLISION RESEARCH FACILITY

The Underwater Collision Research Facility (UCRF) is used for structural and materials research, and incorporates a unique, vertical drop test-rig for the investigation of crashworthiness of underwater vehicles, providing new knowledge for understanding the structural survivability of submarines and underwater vehicles, and sub-surface structures.

The UCRF interfaces with hydrodynamic research and progresses frontiers in the design and operation of Submarines and AUV's.

Stage 1 of the DMIDP development is currently delivering a range of complementary materials characterization test equipment to facilitate more experimentation capability, e.g., strain rate testing, non-intrusive acquisition of surface strains and deformations, and high accuracy force and pressure measurements for wave and military loadings on naval structures.

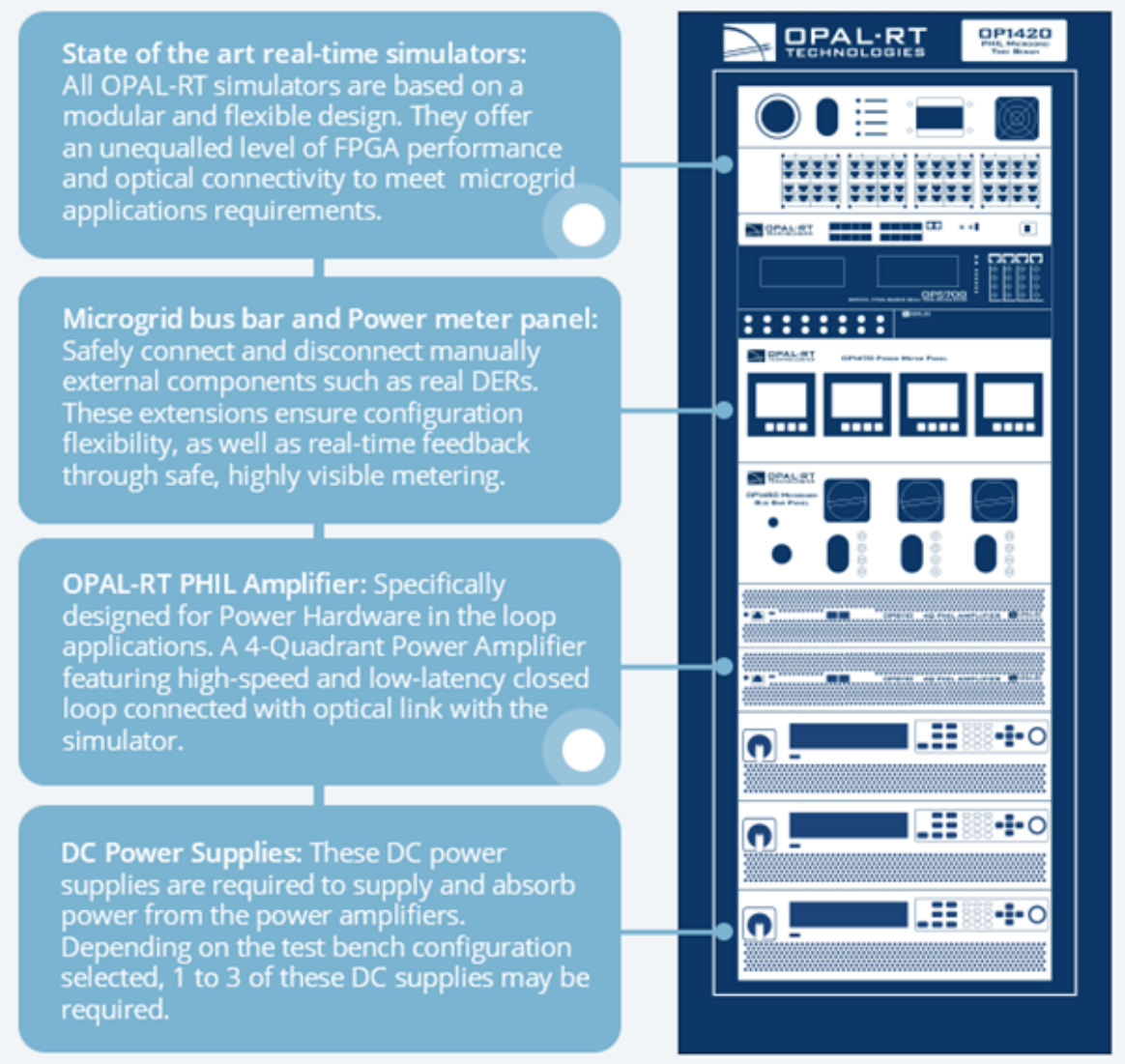


REAL-TIME POWER SYSTEMS MODELLING & SIMULATION COMPETENCY CENTRE

The Real Time Power Systems Modelling and Simulation Competency Centre uses hardware that enables rapid and cost-effective assessment of complex power systems, i.e., generation and storage (batteries, fuel cells, supercapacitors, etc.), electrical devices (motor drives, inverters, etc.) and electronic systems (control/management, monitoring).

This includes ship and submarine-based power systems and through T&E can 'future-proof' electrical system design and modifications by simulating complex systems to identify issues and non-compliances before real systems are built.

The system comprises an OPAL-RT micro-grid test bench tower, complementing ICT hardware, software, and peripherals, and installed 3-phase power.



CENTRE FOR RENEWABLE ENERGY POWER SYSTEMS (CREPS)

CREPS is a purpose-built renewable energy laboratory located at the UTAS School of Engineering in Hobart providing a complementary capability to the RTPS.

It is used for simulation, modelling and analysis in energy and power systems applications, focussed on optimizing the efficiency and overcoming challenges relating to energy transfer and conversion.

CREPS has collaborated with the US Office of Naval Research to explore the low load capabilities of modern diesel engines and how the maximum amount of renewable energy could be integrated into a hybrid remote power system, and how to improve the fuel efficiency of diesel generators.

DEEP LAKE RESEARCH FACILITY

Since 2019, AMC has been exploring, in support of Thales Australia and AMOG Consulting, how the unique environmental characteristics and isolation of Tasmanian lakes can be exploited for the calibration and testing of sonar arrays, and potential future hydrodynamic and acoustic research.

Phase 1, involving surveys and site selection, has been completed, with Phase 2 anticipated to commence later in 2022 and involving the pre-positioning of sonar array test equipment at the DMIDP staging area.

TOUR SCHEDULE

The Australian Maritime College will host the technical tour for the University of Melbourne, OMAE Conference giving delegates a introduction to the world-class facilities and an opportunity to learn how they can be utilised in future projects.

Following the technical tour, delegates will have an opportunity to visit the Queen Victoria Museum and Art Gallery (QVMAG), which is Northern Tasmania's home of art, history, and natural science. The location features collections of natural sciences displays, transport and railway memorabilia, blacksmith workshops, and the iconic Launceston Planetarium and artefacts from Australia's oldest merchant shipwreck.

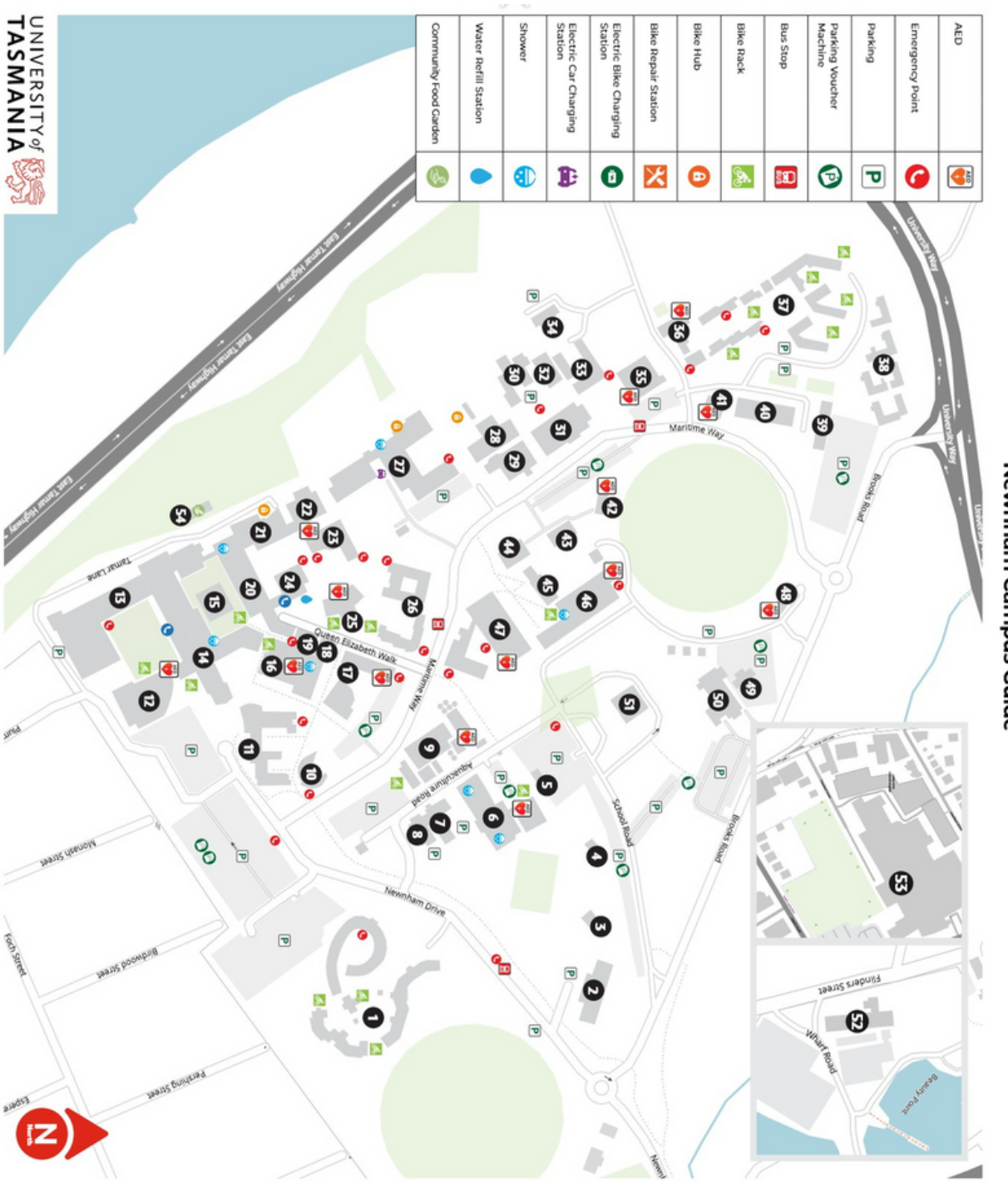
Fee: AUD $335
Date: Friday, 16th June 2023
Capacity: 20 people maximum

Schedule:

07:30	Meeting at MCEC to depart for the Melbourne Airport
09:25-10:35	Flight to Launceston
11:00	**Arrive at Australian Maritime College**
	Welcome and morning tea
11:30-13:30	**Technical tour of facility followed by lunch**
13:30	Bus transfer to Queen Victoria Museum at Inveresk
13:40-15:15	**Tour of Queen Victoria Museum at Inveresk**
15:15	Bus transfer for the Launceston airport
16:20:17:25	Flight to Melbourne
17:40	Bus transfer to MCEC

Final tour arrangements and timings will be finalised and will be released to delegates prior to the OMAE Conference.

NEWNHAM CAMPUS MAP



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