



# Master of Engineering Studies in Yacht Engineering

The Faculty of Engineering at the University of Auckland is offering a new one-year taught Master's degree in Yacht Engineering in 2012. The programme aims at advancing knowledge and research experience in topics related to yacht engineering in order to support research and development within the yachting industry.

Students will be able to join the programme either in March or July of each year. The programme will emphasise the aerodynamics and hydrodynamics of both powered and sailing craft, the consequent loads, stress analysis, structural materials, design and the associated manufacturing processes.

Graduates of the MEngSt Yacht Engineering specialisation will be equipped with the technical, engineering, economic, and regulatory knowledge required for innovation in the yacht engineering field. These graduates will be expected to seek employment as design and/or research engineers within the yacht and small craft industry or the high performance yacht racing sector.

*"I would like to provide my support towards the master's degree in yacht engineering. Auckland has a strong sailing history and New Zealand is a country at the leading edge in the marine industry. So I think this degree in yacht engineering constitutes a nice opportunity for students who are willing to work in the yacht industry."*

*Julien Pilate*

## Programme Overview

The Yacht Engineering specialisation is intended to be of significant interest to engineering graduates from The University of Auckland, other universities within New Zealand, and graduates from overseas, especially Europe. The 120-point degree will be available as a taught master's degree.

The programme will include five 15-point taught courses, and one 45-point project spread over two semesters. The programme is designed to start in either in March or July to allow students from the northern hemisphere to enrol in July.

<b>First Semester (March – June)</b>	Research Project over two semesters (45 points)
Aerodynamics and Hydrodynamics	
Materials and Yacht Structures	
Small Craft Design and Manufacturing	
<b>Second Semester (July – November)</b>	
Small Craft Naval Architecture	
Computational Fluid Dynamics	



## Taught Courses

### **MECHENG 771 Aerodynamics and Hydrodynamics** (15 points)

Sail aerodynamics, thin aerofoil and lifting line theories, hydrodynamic forces and moments, velocity prediction programmes, experimental methods in wind tunnel and towing tank testing.

### **MECHENG 772 Materials and Yacht Structures** (15 points)

Steel, aluminium and composite materials, stress analysis, finite element methods, slamming loads.

### **MECHENG 773 Small Craft Design and Manufacturing** (15 points)

Hull and component design, CAD/CAM, manufacturing methods, system design, product specification and selection, project management, regulatory bodies and rules.

### **MECHENG 774 Small Craft Naval Architecture** (15 points)

Hydrostatics and stability, sea keeping, manoeuvring, multi-degree of freedom systems, coupled motions, strip theory, resistance components and scaling laws, propulsion methods, propeller design, advanced marine vehicles including hydrofoils and jet propulsion.

### **MECHENG 711 Computational Fluid Dynamics** (15 points)

The objective of this course is to equip engineers with the skills necessary to apply computational fluid dynamics methods to the solution of problems or the design of equipment involving fluid motion and/or energy transfer.

### **MECHENG 775 or 776 Yacht Engineering Research Project**

(45 point course spread over two consecutive semesters)

Each student is required to complete an individual project and submit a report on a topic assigned by the Head of Department. This is a piece of basic research carried out under a supervisor. The student is expected to put 450 hours of effort into the project.

## Admission

### Entry requirements

In order to be admitted to this programme you must have either

- Completed the requirements of a four-year Bachelor of Engineering or Bachelor of Engineering (Honours) from either a New Zealand or an overseas university with excellent grades (ie, with 1st or 2nd class honours).
- Completed the requirements of an approved bachelors degree, at a level deemed satisfactory by the Dean of Faculty of Engineering and have at least three years' relevant work experience in the yachting or marine industry.

Note: If you have a degree with significant engineering content, such as a Bachelor of Naval Architecture, then this may be considered equivalent to a Bachelor of Engineering for the purposes of entry to the Yacht Engineering specialisation, and advice should be sought from the Programme Director.

Generally entry to a masters degree requires the completion of a four-year bachelors degree with honours, but some accelerated three-year engineering honours programmes may be considered equivalent for the purposes of entry to the Yacht Engineering specialisation. Advice on particular degrees should be sought from the Programme Director.

## Fees

The tuition fees for a Master's Degree in Engineering at The University of Auckland in 2011 were approximately NZ\$8000 for domestic students and NZ\$33,720 for international students.

## Cost of Living in New Zealand

A student can live modestly on about NZ\$300 per week for rent, food and entertainment, and quite well on NZ\$450 per week.

## Graduates from this programme are expected to have the following attributes and skills:

- An understanding of aerodynamics, hydrodynamics, material properties, computational fluid dynamics, stress analysis, and design synthesis used in the yachting industry.
- An understanding of manufacturing processes used in the yachting industry, so that they can aim for sustainability and safety in their designs.
- An ability to apply knowledge of yachting technology to commercial situations.
- High levels of critical analysis.
- Synthesis of knowledge.
- Problem solving.
- Willingness to learn and continue to learn throughout life.
- Computer technology skills.
- Organisation and time management skills.
- Independent judgement.
- Effective oral and communication skills.
- Ability to work in a team.

*"New Zealand has created an enviable international reputation in all aspects of sailing and yachting activities. The possibility that this new degree will be available directly links into the positive position NZ has achieved with all aspects of marine commercial and leisure subjects. I continue to be fully supportive of this program and wish to reconfirm my interest in assisting in its creation and international promotion.*

*I believe there will be a high level of demand for this Masters program from abroad and diverse range of students. As you know, I remain keen to teach a module on super yacht design, a specific subject not available as far as I am aware, at any other facility."*

*Ron Holland, Ron Holland Design*



# Leading the World - The Yacht Research Unit

The Yacht Research Unit (YRU) at the University of Auckland has led the world in many innovative areas. This reputation brings leading yacht designers seeking the best possible advice. Undertaking research at the YRU has fast-tracked many graduates into leading yacht design positions worldwide.

## Unique abilities in demand

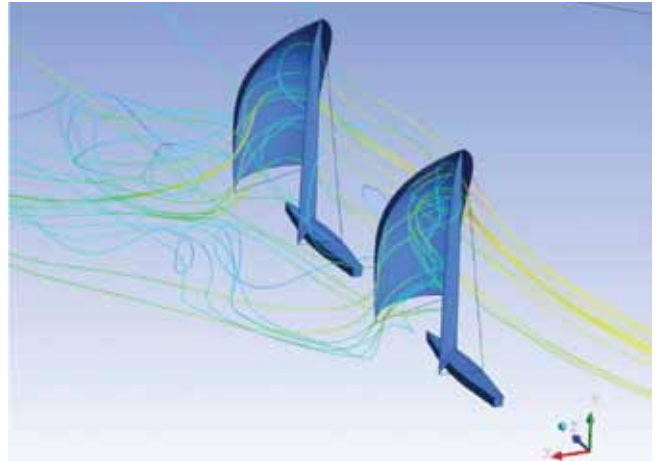
From testing the sails that led Team New Zealand to its first ever America's Cup victory in 1995, to providing advanced sail analysis for many Volvo Open 70 yachts, the YRU has developed a unique pedigree in yacht engineering research. For over 20 years the YRU has provided research breakthroughs and excellent professional services. More major regattas have been won by syndicates using the YRU's consulting and commercial services than any other yacht research unit in the world.

## A track record of success

The YRU was established in 1987 with the primary function of coordinating and promoting yacht research and engineering within the University of Auckland. Since that time the impact of the YRU and the Faculty of Engineering has been phenomenal. Some world firsts include obtaining successful computational solutions for the coupled structural/aerodynamic behaviour of sails; the application of computational fluid dynamics to the flow around spinnakers; construction of a wind tunnel with twisted flow for testing sails; including advanced optimisation methods into a velocity prediction program; development of a real-time velocity prediction program; advancing the theory and development of a visual sail position and rig shape system.

*"As someone interested in the marine industry I find it exciting that in this course, New Zealand and appropriately the City of Sails, is taking more ownership in the field – and not before time. The content of the courses seems sound and about right. Having said that, I want the course to pass on the flamboyance and flair that New Zealanders have brought to the world of yachting. To my mind this course in a place like Auckland is so well placed to be the best in the world, that you should expect and plan for that to be the case."*

*Keith Alexander, University of Canterbury*



Leading up to the America's Cup in 2007, The University of Auckland arguably had more graduates in Valencia working in key positions in teams than any other university in the world!

In 2008 the YRU was appointed Emirates Team New Zealand's (ETNZ's) "Official Scientific Advisor". ETNZ has offered several scholarships to support students studying in the YRU. Since 2003 the world-leading High Performance Yacht Design Conferences have been hosted by the YRU with the NZ Division of the Royal Institution of Naval Architects (RINA).

## Current research topics include:

- The effect of yacht motion on the unsteady aerodynamics of sails.
- The aerodynamics of double-surface sails.
- Development of an inverse design process for sails.
- The effect of heel on the aerodynamics of upwind sails.
- An archaeological and engineering study of prehistoric Pacific migration - canoe performance and navigational intelligence.
- Pressures on sails using CFD, TFWT and full-scale measurements.
- Computational investigation of hull hydrodynamics.
- Optimum span-wise loading on an upwind sail for a given yacht.
- Study of blockage effects in an open jet twisted flow wind tunnel.
- Optimum design of fin keels for AC yachts.
- An unstructured mesh optimized for downwind yacht sails.
- Interference effects between yachts.

## Competitive success

The YRU has played a leading role in creating many of the world's most famous and successful high performance yachts and has an enviable track record:

- Two America's Cups (1995 and 2000).
- America's Cup development work with BMW Oracle, Emirates Team NZ, Team Shosholoza, Alinghi.
- Seven 24 hour monofull records since 2002.
- Three Volvo Ocean Races since 2001.

## Other notable recent yacht projects include:

- ICAP Leopard3, Mean Machine TP52, Hugo Boss (Open 60), Paprec-Virbac 2, Ecover, Pindar (Open 60s), JK100 Speedboat and JV72 "Ran".

## YRU facilities and capabilities

- **Twisted Flow Wind Tunnel (TFWT)** This allows accurate and repeatable analysis of sail performance.
- **Real-time Velocity Prediction Program (RT-VPP)** This system adjusts the model yacht position in the wind tunnel in real time, so that it behaves exactly as it would at full scale.
- **Visual Sail Position and Rig Shape (VSPARS) system** VSPARS is able to track mast deflection and sail shape in real time.
- **Rig Studies** High speed TFWT operation allows large scale design of rigging.
- **Flow Visualisations** Smoke in the wind tunnel is useful for understanding flow over sails.
- **Appendage Studies** Computational studies of the geometries of keels, rudders & bulbs.

## Other applications and synergies

Researchers in the YRU can apply their knowledge of CFD, aerodynamics and hydrodynamics, wind engineering and wind tunnel testing to:

- Wind turbines - power estimation, flow velocities, wake structure.
- Cyclists - aerodynamic drag reduction (force balance testing).
- Buildings - pressures, cladding & loads, dynamic response.
- Automotive & motorcycle aerodynamics and flow visualisation.
- Environmental studies - pedestrian level winds and emissions from chimneys.



## The world's premier Yacht Research Centre

### The best are getting better

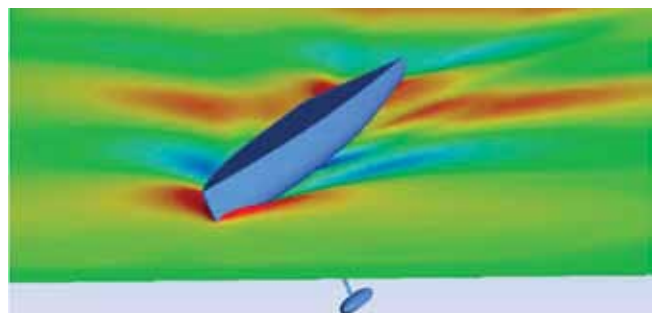
Building on recent successes and leveraging existing world-class R&D the University of Auckland and partners are planning to build an integrated, first-of-its-kind, Centre of Excellence combining aerodynamic and yacht facilities under one roof. The Yacht Research Centre will house the world-leading Twisted Flow Wind Tunnel, a large Boundary Layer Wind Tunnel, a Towing Tank, a Computational Fluid Dynamics Centre, a Design Centre for industry, as well as meeting, lecture and break-out rooms. Synergies with research into power boats, wind, vehicle aerodynamics, sports (e.g. cycling, rowing, sailing) and energy (wave, tidal, wind) will provide multidisciplinary study yielding novel research outcomes and pragmatic solutions.

## Alliances with the marine industry

Integration with the local marine industry, coupled with strategic partnerships with racing syndicates, such as Emirates Team New Zealand, will provide the deep industry collaboration required to enhance innovation, and provide the designers and researchers to strengthen New Zealand's marine industry in the future.

*"The NZ Marine Industry Association and Industry Training Organisation are in support of you adding a new specialisation to the existing taught master's engineering studies, in the one-year Masters Degree in Yacht Engineering."*

Chris van der Hor - NZ Marine ITO



## The University of Auckland

The University of Auckland is New Zealand's leading and largest university. It is ranked in the top 100 of the QS World University Rankings and is the highest ranked New Zealand University in the Times Higher Education and Shanghai Jiao Tong Academic Ranking of World Universities. The University of Auckland is an international centre of learning and academic excellence. It is New Zealand's pre-eminent research-led institution and has key linkages with many of the world's top research intensive universities.

Based in the heart of New Zealand's largest and most diverse city, The University of Auckland has the most comprehensive range of courses in the country. The University's mission is to be a research-led, international university, recognised for excellence in teaching, learning, research, creative work and administration.

### In a snapshot the University of Auckland:

- Comprehensive university with full range of professional schools to PhD level.
- 41,000 students and 5,400 staff including 4,700 international students from over 100 countries.
- 2,750 academic staff in eight Faculties.
- About 10,700 postgraduate students including 2,100 at doctoral level.
- More than 60 research units, centres and institutes.
- More than 6,500 research articles, books and conference papers published annually.
- 200 active patent families and about 630 granted patents or pending patent applications globally.
- External research funding of NZ\$218 million pa in 2010.

The University actively seeks to work with government, energy companies, other universities, research organisations and commercial consultancies in yacht research, development and education.



### For further details please contact

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