Three-dimensional wave breaking in Australia’s coastal and open ocean regions has significant consequences for weather forecasting, marine safety, defence and renewable energy under severe weather conditions. No conceptual or computing framework exists for this fundamental process.

The Australian Research Council has commissioned a team of UNSW and French investigators to extend our recent advances in predicting wave breaking onset and strength of wave groups to forecast breaking in realistic directional wind seas.

This project will provide the basis for including reliable breaking wave information in forecast models, and will improve their accuracy.

Using state-of-the-art physical and numerical investigative techniques, the research will be conducted at the UNSW Water Research Laboratory in Manly Vale and in the UNSW School of Mathematics and Statistics, in association with the L'École normale supérieure de Cachan, Centre de Mathématiques et de Leurs Applications in Paris, France.

This is one of two 3-year research scholarships

1. Directional Wave Breaking – Modelling
2. Directional Wave Breaking - Measurements

offered within this research project leading to UNSW doctoral degrees.

The titles of the two complementary individual awards are:

1. Physical measurements of three-dimensional wave breaking: its underlying mechanisms and forces.
2. Three-dimensional numerical modelling of wave breaking initiation and incorporation of three-dimensional wave breaking in spectral models.

Specific experience and training that successful applicants will obtain during the course of their studies will include:

1. To help solve one of the today’s most challenging problems in ocean science and engineering: how do three-dimensional effects change present two-dimensional understanding of wave breaking and its impacts at the ocean surface?
2. Direct contribution to new techniques for predicting dangerous ocean waves during severe weather.
3. Expert training in fluid mechanics (waves and turbulence) with ocean engineering applications.
4. Specialist training in state-of-the-art flow measurement techniques.
5. Training in the advanced signal processing techniques required to extract and interpret non-linear fluid behaviour.
6. Opportunity to tutor undergraduate mathematics, fluid mechanics, computational methods and water engineering.
7. Training in the preparation of high level technical research reporting.
8. Opportunities to collaborate and participate in international research and technical meetings.

The proposed scholarship financial structure will be as follows:

1. A tax-free fellowship of $26,669 p.a. (indexed annually).
2. A taxable teaching fellowship of $8000 p.a., (subject to ongoing satisfactory teaching performance).
3. Possible remunerated participation in industrial research activities, (subject to ongoing satisfactory teaching and research performance).

Interested applicants must possess a good undergraduate honours degree in one or more of the following disciplines:

Applied Mathematics, Civil Engineering, Environmental Engineering, Physics, Mathematics or Mechanical Engineering.

Applicants must also be able to demonstrate a track record of working productively in a team environment.

Benefits
The award holder will receive an annual stipend as specified above. The tax free component (1.) is exempted from taxation by virtue of Section 23z of the Income Taxation Act. The amendment to the Taxation Laws Amendment Bill (No.1) 1997 allows for only three situations in which a scholarship may now be deemed tax liable. These are:
1. an amount received by a student from a person or authority upon condition that the student will (or will if required) become, or continue to be, an employee of the person or authority;
2. an amount received by a student from a person or authority upon condition that the student will (or will if required) enter into, or continue to be party to, a contract with the person or authority that is wholly or principally for the labour of the student;
3. an amount received by a student under a scholarship where the scholarship is not provided principally for educational purposes.

Tenure
The award is provided for three years for a PhD.

Additional Benefits
Additional benefits are anticipated within the scholarship but are subject to the agreement of the supervisor and available research funds.

**Leave Arrangements**
Leave during the course of tenure is negotiable up to 4 weeks per year and subject to satisfactory research performance and supervisor agreement.

**Overseas Study**
Overseas study is possible within the scholarship but is subject to the agreement of the supervisor and available research funds.

**Suspension**
An award holder may request suspension of his/her award for up to 12 months but suspension is subject to the formal approval of the Australian Research Council and UNSW. Where the suspension is due to illness a medical certificate must be provided. Before a scholarship can be restored after suspension the student will need to complete a Certification of Commencement (or Return) to Study form. Failure to resume studies after an approved period of suspension will result in termination of the award.

**Sick Leave** may be granted subject to the formal approval of the Australian Research Council and UNSW. Conditions are the same as for the APA, which prior to 2000 provides up to three months paid sick leave. From 2000, however, only two weeks paid sick leave per annum may be granted. A medical certificate must be provided.

**Maternity Leave** of up to three months may be paid subject to the formal approval of the Australian Research Council and UNSW.

**Transfer of Awards**
Masters awards may be converted to PhD awards or vice-versa provided the student’s progress merits it. The scholarship is not transferable to another institution.

**Employment**
Students are permitted to undertake employment only with the permission of their supervisor and Head of School. The employment must not interfere with their research or ability to complete their qualification in the minimum time.

**Relinquishment**
An award will be terminated two weeks after the thesis is submitted or at the end of the award whichever is the earlier or if the student has not fulfilled obligations or met the criteria for satisfactory progress. An award holder is required to give at least 14 days notice of the intention to voluntarily relinquish the award.

**Renewal**
Each year the supervisor or Head of School will be asked if renewal of the award is required and recommended.

**Obligations of Award Holders**
The student must advise their supervisor and the Graduate Research School within 14 days of any change to the information provided in connection with this scholarship. For example, a change of address, the intention to study overseas or suspend their award, or periods of illness. Students must advise the Graduate
Research School when they submit their thesis. It is recommended that the student contact the Graduate Research School prior to any change.

Students must diligently apply themselves to the successful completion of the degree, comply with the degree and scholarship conditions and must abide by the NH&MRC codes on human and animal experimentation, the guidelines established by the Australian Government's Recombinant DNA Monitoring Committee and rulings of the Safety and Ethics Committees of the University.

For further information or to apply, please contact m.banner@unsw.edu.au or W.Peirson@unsw.edu.au