### Title:
Models and Algorithms for Scheduling Ships through the Navigation Channel at a Tidal Port

### Type:
2017 John Bicknell Scholarship

### Value & Duration:
The John Bicknell Scholarship is equivalent to a University of Tasmania Elite scholarship (current APA rate + $7,500 top-up per annum), with additional operational funds of up to $5,000 per annum) for a term of 3 years (with a possible 6 month extension). The scholarship is available to domestic and international applicants, and the awardee must meet or exceed the criteria of a University of Tasmania Elite award. It is awarded on an annual basis, subject to funds being available.

### Closing date:
11:59pm (AEST), Tuesday 31 January 2017

### The Research Project:
This project is motivated by the reality found at many tidal ports (e.g. Hedland, Shanghai, Hamburg, Antwerp), where many deep-drafted ships have to take advantage of tides when they transit through the navigation channel to and/or from the port basin. Optimally, scheduling the ships through the navigation channel, by letting them make the most of tides, will increase the port’s throughput/productivity and improve port-stay duration, which will benefit shipping companies. In contrast in 2008, in the port of Antwerp, more than 1,500 ships had to wait for high tides to enter into port. In fact, around 7 out of 10 ships were affected by the tide fluctuations before the dredging of the Scheldt River in 2010.

This project aims to develop models and algorithms for the optimal scheduling of ships through the navigation channel with time-varying water depths caused by tide conditions, in order to maximize the productivity/profit of the port. This research objective will be achieved by conducting the research in the following two modules:

- **Module 1: mathematical optimization models and algorithms for ship scheduling through the channel**

This module quantifies how much the productivity of the port can be improved through development of mathematical models and algorithms. To model the influence of tides on ships’ entrances and/or departures in a *general sense (PhD training)*, we will investigate the *geographical/hydrographical conditions and operational policies of all the main tidal ports in the world, for all types of ships including containerships, bulk carriers and tankers*. The restrictions posed by the numbers of berths and tugs will also be considered. In terms of methodologies, mathematical programming and constraint programming models will be developed. Both general-purpose commercial optimization solvers (CPLEX, Gurobi) and dedicated solution algorithms will be evaluated.
Module 2: Auction mechanisms for channel usage

In shipping practice, some ships might desire to sail through the channel in a given high tide window without additional waiting time even if additional port charges are required, which makes tidal windows a valuable resource. The port authority could consider auctioning tidal windows and making additional profit through the auction by providing an online auto-auction platform, allowing the ships to iteratively bid for certain tidal windows, preferably based on their sailing schedules.

Eligibility:

The following eligibility criteria apply to this scholarship:

- The scholarship is open to Australian (domestic) candidates and to International candidates.
- The PhD must be undertaken on a full-time basis.
- Applicants must already have been awarded a first class Honours degree or Research Masters degree with at least a Distinction result.
- Applicants must be able to demonstrate strong research and analytical skills.

Funding:

This PhD scholarship is funded by the commemorative John Bicknell Scholarship.

Application Process:

Applicants requiring more information or who are interested in this specific project should contact the Primary Supervisor listed below.

To determine eligibility, applicants should visit the Apply Now website and complete an Expression of Interest, which may be found here. Please ensure that a complete list of any publications and awards are included, as well as details of relevant industry experience (including employer name, type of business, employment dates and principal responsibilities). International applications will also need to provide evidence of their English proficiency (such as an IELTS certificate). It is the responsibility of the applicant to obtain supervisor agreement prior to submitting an Expression of Interest, and to ensure that all supporting documentation is submitted prior to the closing date.

Please specify the name of the project advertised into the Project Title field, and indicate under Scholarship Support that you wish to be considered for a living allowance scholarship.

More information:

Please contact Dr Yuquan Du (Yuquan.Du@utas.edu.au) for more information.