

***Rachel Jean Pawling***

**BMT DSL Research Fellow for Naval Design**

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**Key Points**

- Internationally recognised researcher in innovative ship and submarine design methods and applications
  - 8 published journal papers, 2 of which have been awarded institutional medals
  - 1 journal paper in press.
  - 2 in preparation (drafted) and 1 in outline form
  - 48 papers presented to refereed conferences, including regular papers to 6 of the leading international conferences
  - Organisation of two 2-day workshops with attendance from industry and academia and editing of three workshop proceedings (2013-2015)
  - A range of individual and multi-disciplinary team-based work over multi-year projects
  - Major contribution to 8 major research projects (UCL income over £2.5M and main worker on 10 consultancy projects (UCL income over £270k)
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**Research Interests**

My principal research interests lie in two main areas; developments in design methodology; and solutions to engineering problems of interest in the maritime domain. My future research plans build on past activities in these two areas.

The methodological research focuses on the development of processes and tools for computer aided ship design in the preliminary stages. This includes the use of simulation in ship design, the handling of complexity, uncertainty and knowledge in ship design, and the development of new user interface concepts for exploratory design processes. Future studies will follow on from my current and PhD research, particularly in the areas of; computer-aided sketching approaches to preliminary ship design; the application of knowledge-rich computer tools and improving the use of systems engineering approaches in ship design via improved tools including exploiting recent internet based design developments.

This methodological research is seen as an area for potential collaboration both with other design domains, such as architecture and a range of engineering disciplines, and also with other research areas, such as human-computer interaction and virtual reality. This research is also seen to have potential longer term impacts on the teaching of design at university level, and this has started to influence my lecturing to NA and ME MSc students. The methodological research, specifically in the application of risk and probabilistic based methods to computer aided design continues to be developed through collaborative EC FP7 funded projects.

My solution-oriented research interests include; future offshore infrastructures including renewable energy, marine mineral and food resources, emissions reduction and energy efficiency in ship design, novel hullforms, such as multihulls, all-electric weapons systems, and unmanned vehicles for a range of naval and civilian tasks and their impact on ship and submarine design.

My near-term research plans are focussed on my BMT DSL Fellowship and the second ONR funded 5 year NICOP project (with the University of Michigan and TUDelft, commenced 2015). A range of activities have been identified for the second year of the BMT fellowship, including; producing “white papers” on specific subjects (such as minewarfare and uncertainty in ship design) to provide an alternative viewpoint to feed into BMT planning, and assessment of and input into BMT early stage ship design tool and method development. The NICOP project will see the development of new ship design processes and their demonstration with example tools. Although much of my research has been applied to naval ship design, there are seen to be areas of wider application to civilian vessels, specifically to complex and bespoke vessels, such as superyachts and support vessels for future offshore infrastructures.

Over the longer term, I am particularly interested in the future of engineering education, in two main aspects. The first is how to properly integrate modern computer and numerical approaches into the holistic problem of engineering design education to develop future engineers who are not only able to solve predefined numerical problems, but are able to define which numerical problems need to be solved. The second aspect is how to improve the diversity and inclusivity of engineering as a discipline, both to improve opportunities for minority or disadvantaged groups and also to help ensure a plurality of views and approaches are available to help solve the problems of the future.

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### **Major Research Projects – Total UCL Budget Approximately £2.5M**

**2015 – :** Co-investigator on ONR funded NICOP project on distributed systems, including supervision of a Post-Doctoral Research Assistant, starting in September 2015, running for 5 years with a UCL budget of approximately \$500k (UCL PI: Prof. David Andrews).

**2013 – :** Research Associate and named researcher on the EPSRC funded “Shipping in Changing Climates” project continuing the investigation of potential reductions in the Carbon Dioxide emissions of shipping, UCL budget approximately £500k (PI: Dr. Tristan Smith).

**2012 – 2015:** Research Associate and named researcher on the EU FP7 funded “FAROS” project, investigating a probabilistic approach to integration of human factors into ship design, UCL budget approx. €250k (UCL PI: Prof. David Andrews).

**2011 – 2015:** Research Associate on the ONR funded NICOP project “Preliminary Ship Design General Arrangements” investigating the general arrangement design methods, UCL budget approx. \$560K (UCL PI: Prof. David Andrews).

**2010 – 2013:** Research Associate and named researcher on the RCUK / EPSRC funded “Low Carbon Shipping: A Systems Approach” project investigating the potential for reductions in the Carbon Dioxide emissions of shipping, UCL budget approximately £560k (PI: Prof. Paul Wrobel).

**2009 – 2012:** Research Associate on the EU FP7 funded “FIREPROOF” project, investigating a probabilistic approach to the fire safety of passenger ships, UCL budget approx. €200k (UCL PI: Prof. David Andrews).

**2004 – 2007:** Research Assistant on EPSRC funded project “Guidance on the Design of Ships for Enhanced Escape and Operation”, investigating the integration of the simulation of personnel movement in the ship design process, including management of the Research Student involved, UCL budget approx. £240K plus £15K from SSG (UK MoD) (UCL PI: Prof. David Andrews).

**2001-2003:** Support to SSA ITMC LINK funded project to investigate “Design for Production application of Design Building Block methodology”, UCL budget approx. £110K (UCL PI: Prof. David Andrews).

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### **Contractual Research and Design Work – Total UCL Budget Approximately £270k**

**2015:** Concept design study for COTECMAR (Colombian MoD) (£10k UCL tasking)

**2013 – 2014:** Continuing support to Naval Design Partnership (UK MoD) in the development of the LAURA standard (£9.7k total UCL tasking).

**2012 – 2013:** Support to Naval Design Partnership (UK MoD) in the development of an international standard for the launch and recovery of manned and unmanned craft (LAURA) (£23.5k UCL tasking).

**2009:** Concept design study and options survey for Naval Design Partnership (UK MoD) (£7.4k UCL tasking).

**2008:** Awarded study contract by EU WEGEMT VISIONS Programme “ConNECT – Concept of Novel Effective Cargo Transport” July 2008 (£9k UCL tasking).

**2007:** Awarded study contract by EU WEGEMT VISIONS Programme “Visionary Concepts for Vessels and Floating Structures” June 2007 (£14.5k UCL tasking).

**2006:** Partner in bid by Canadian defence contractor for “Joint Support Ship” study for Canadian Armed Forces (£12k).

**2003:** Contract from US Navy Office of Naval Research on adaptation of UCL-GRC design tool SURFCON to US LSC studies (\$158k UCL tasking).

**2003:** Concept Design Study on Mothership Concept for MoD Future Business Group in partnership with BMT-DSL (£25k UCL tasking).

**2002:** Application of Design Building Block Methodology to design investigations on Future Surface Combatant FSC/FBG DPA MoD (£38k UCL tasking).

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### **Other Work and Collaboration**

**2015-16:** Naval architectural support, with Ema Muc-Pavic (MRG), to the UCL Bartlett School of Architecture’s “Flood House” project; a floating structure deployed for two months in the Thames Estuary to investigate future floating home concepts. <http://flood.house/>

**April-June 2016:** Collaboration with Associate Professor Henrique Murilo Gaspar of NTNU Ålesund on information visualisation methods during his 3-month placement at UCL

**2016:** Invited attendance and presentations to the NATO AVT 238 (RTG) research group on “Early stage warship design & procurement for operational effectiveness and affordability”

**2007 – :** Representative on UCL team contributing to the MoD Virtual Ships Advisory Group (ViSAG).

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### **Regular Conference and Journal Submissions**

Commencing in 2003, papers are presented at the International Marine Design Conference (IMDC) (triannual), RINA Warships conference (annual), RINA International Conference on Computer Applications in Shipbuilding (ICCAS) (biannual), International Conference on Computer Applications and Information Technology in the Maritime Industries (COMPIT) (annual) and IMarEST International Naval Engineering Conference (INEC) (biannual).

### **Publications by Research Themes;**

My publications are grouped by research theme; Design Methodology; Safety, Survivability and Human Factors; Low Carbon Technologies; Unmanned Vehicles; Electrification of Ships; Integrating Marine Engineering and Ship Design and Design Studies

## ***Design Methodology***

### **Journal Papers**

- McDonald, T, Andrews, DJ & Pawling, RG, “A Demonstration of an Advanced Library Based Approach to the Initial Design Exploration of Different Hullform Configurations”, *Computer-Aided Design*, Vol. 44, Issue 3, March 2012, pp. 209-223.
- Pawling, R & Andrews, DJ, “Design Sketching for Computer Aided Preliminary Ship Design”, *Ship Technology Research / Schiffstechnik*, Vol.58, No. 3, September 2011, Institute of Ship Technology and Ocean Engineering, ISSN 0937-7255.
- Andrews, DJ & Pawling, R, “A Case Study in Preliminary Ship Design”, *International Journal of Maritime Engineering*, Vol.150 Part A3, 2008. Discussion and Authors' reply *IJME*, Vol. 151, Part A1, 2009 - awarded RINA “W H C Nicholas Prize 2009” for the best paper on the subject of ship design by an author under 30 (R Pawling).

### **Conference Papers**

- Calleya, J, Pawling, R, Ryan, C & Gaspar, H. M., “Using Data Driven Documents (D3) to Explore a Whole Ship Model”, presented to the IEEE 11th International Conference on System of Systems Engineering (SoSE) 2016, June 12-16, Kongsberg, Norway
- Esbati, S, Piperakis, A.S, Pawling, R.J, Andrews, D.J , “Design for Support in the Initial Design of Naval Combatants”, *International Conference on Computer Applications in Shipbuilding (ICCAS)*, RINA, Bremen, September 2015.
- Pawling, R.J, Piperakis, A.S, Andrews, D.J, “Developing Architecturally Oriented Concept Ship Design Tools for Research and Education”, *International Marine Design Conference (IMDC) 2015*, Tokyo, May 2015.
- Esbati, W, Piperakis, A.S, Pawling, R.J, Andrews, D.J, “Evaluation of Supportability in the Preliminary Design of Naval Ships”, *International Conference Warship 2015: Future Surface Vessels*, RINA, Bath, June 2015
- Collins, L.E, Andrews, D.J, Pawling, R.J, “A New Design Approach for the Incorporation of Radical Technologies: Rim Drive for Large Submarines”, *IMDC 2015*, Tokyo, May 2015.
- Purton, I.M, Pawling, R.J, Andrews, D.J, “The Use of Computer Tools in Early Stage Design Concept Exploration to Explore a Novel Submarine Concept”, *IMDC 2015*, Tokyo, May 2015.
- Pawling, R., Morandi, R., Andrews, D., Shields, C., Singer, D., Duchateau, E., Hopmann, H., “Manifestation of Style and its Use in the Design Process”, *13<sup>th</sup> International Conference on Computer Applications and Information Technology in the Maritime Industries (COMPIT)*, Redworth, UK, 12-14 May 2014
- Pawling, R., Andrews, D., Piks, R., Singer, D., Duchateau, E., Hopman, H., “An Integrated Approach to Style Definition in Early Stage Design”, *12<sup>th</sup> COMPIT*, Cortona, Italy, 15-17 April 2013.
- Andrews, D.J.; Duchateau, E.A.E.; Gillespe, J.; Hopman, J.J.; Pawling, R.G.; Singer, D.J., “State of the art report: Design for layout”, *International Marine Design Conference (IMDC) 2012*, Glasgow.
- Andrews, D. J.; Percival, V.; Pawling, R.; “Just How Valid is the Ship Design Spiral Given the Existence of Cliffs and Plateaux?”, *IMDC 2012*, Glasgow.
- Pawling, R, & Andrews, DJ, “Design Sketching – The Next Advance in Computer Aided Preliminary Ship Design?”, *COMPIT 2011*, Berlin, May 2011.
- Andrews, D, McDonald, T & Pawling, R, “Combining the Design Building Block and Library Based Approaches to improve Exploration during Initial Design”, *COMPIT 2010*, Gubbio, Italy, April 2010.
- Andrews, D J & Pawling, R, “The Impact of Simulation on Preliminary Ship Design”, *IMDC 2009*, Trondheim, Norway, May 2009.

- Andrews, D, Casarosa, L & Pawling, R, "Interactive Computer Graphics and Simulation in Preliminary Ship Design", COMPIT 2008, Liege, Belgium, April 2008.
- Andrews, DJ & Pawling, R, "Research into the Use of Computer Aided Graphics in Preliminary Ship Design", International Conference on Computer Applications in Shipbuilding (ICCAS), RINA, Portsmouth, September 2007.
- Andrews, DJ & Pawling, R, "The Application of Computer Aided Graphics to Preliminary Ship Design", IMDC 2006, Ann Arbor MN, May 2006.
- Andrews, DJ & Pawling, R, "SURFCON – A 21<sup>st</sup> Century Ship Design Tool", IMDC 2003, Athens, May 2003.

### **Public Lectures**

- Pawling, R, "From Frigates to Support Ships – A New Approach to Sketching in Computer Aided Ship Design", Presented to a meeting of the RINA London Branch, December 12<sup>th</sup>, 2007.

### **Safety, Survivability and Human Factors**

#### **Journal Papers**

- Pawling, R, Grandison, A, Lohrmann, P, Mermiris, G & Pereira Dias, C "Methods and Tools for Risk-Based Approach to Fire Safety in Ship Design", Ship Technology Research / Schiffstechnik, Vol 59(3) pp38-49, 2012, ISSN 0937-7255
- Andrews, DJ, Casarosa, L, Pawling, R, Galea, E, Deere, S & Lawrence, S, (2008) Integrating personnel movement simulation into preliminary ship design. IJME, Vol.150 Part A1, Discussion IJME, Vol 150, Part A3, 2008 - awarded RINA "Samuel Baxter Prize 2008" for the best paper on the subject of ship safety by an author under 30 (R Pawling).

#### **Conference Papers**

- Piperakis, A, Pawling, R.J. & Andrews, D.J, "The Integration of Human Factors into Preliminary Risk-Based Ship Design", International Conference on Computer Applications in Shipbuilding (ICCAS), RINA, Bremen, September 2015.
- Pawling, R.J, Harmer, S, Campbell, J.D.C, Launchbury, C, "Survivability: The Human Element", International Conference Warship 2015: Future Surface Vessels, RINA, Bath, June 2015
- Mermiris, G., Grandison, A., Themelis, N., Pawling, R., Lohrmann, P., "Fire Risk Modelling", International Marine Design Conference (IMDC) 2012, Glasgow.
- Piperakis, A.S., Andrews, D.J., Pawling, R.J., "An Integrated Approach to Naval Ship Survivability in Preliminary Ship Design", International Conference Warship 2012: the Affordable Warship, RINA, Bath, June 2012.
- Pawling, R., Grandison, A., Lohrmann, P., Mermiris, G., and Dias, C. P., "The Development of Modelling Methods and Interface Tools Supporting a Risk Based Approach to Fire Safety in Ship Design", 11<sup>th</sup> COMPIT, Liege, Belgium, 16-18 April 2012 – awarded the GL COMPIT 2012 award for special scientific achievements (R Pawling). Reprinted in Hansa and MITE magazines.
- Andrews, D J, Casarosa, L & Pawling, R, "Integrating Simulation and Computer Aided Ship Design Software and Processes", International Conference on Computer Applications in Shipbuilding (ICCAS), RINA, Shanghai, September 2009.
- Andrews, DJ, Casarosa, L, Pawling, R, Galea, E, Deere, S & Lawrence, S, "Integrating Personnel Movement Simulation Into Preliminary Ship Design", Human Factors in Ship Design, Safety and Operation, RINA, London, March 2007, reprinted RINA International Journal of Maritime Engineering 2008.
- Andrews, DJ, Casarosa, L & Pawling, R, "Integrating the Simulation of Operations into Preliminary Ship Design", NAV 2006, Genoa, June 2006.

- Andrews, DJ, Boxall, P, Casarosa, L, Deere, S, Galea, E, Gwynne, S, Lawrence, P & Pawling, R, "Integrating Ship Design and Personnel Simulation", WMTC 2006, IMarEST, London, March 2006.
- Andrews, DJ, Pawling, R & Casarosa, L, "Integrating Ergonomics into Ship Design", CETENA Human Factors Conference, Genoa, October 2005.

### **Other Publications**

- Pawling, R. & Puisa, R., "Mitigating Human Error By Design", The Naval Architect, September 2014, London: RINA
- Editor of the "Proceedings of the Second FAROS Public Workshop", published by AALTO University, Finland, ISBN: 978-952-60-5873-3 (print) 978-952-60-5872-6 (PDF)
- Editor of the proceedings for the first FAROS Public Workshop, published on-line via the project website. <http://faros-project.eu/>

### **Low Carbon Technologies**

#### **Journal Papers**

- Calleya, J, Pawling, R, Grieg, A, "Ship Impact Model for Technical Assessment and Selection of Carbon Dioxide Reducing Technologies (CRTs)", Ocean Engineering 97 (2015) pp. 82-89 DOI: <http://dx.doi.org/10.1016/j.oceaneng.2014.12.014>

#### **Conference Papers**

- Pawling, R.J, Suárez de la Fuente, S, Andrews, D. J, "The Potential Use of Energy Saving Technologies in Future Patrol Combatants", International Conference Warship 2016: Advanced Technologies in Naval Design, Construction and Operation, RINA, Bath, June 2016
- Calleya, J, Pawling, R.J, Greig, A, "A Data Driven Holistic Early Stage Design Process to Design Profitable Low Emission Cargo Ships", IMDC 2015, Tokyo, May 2015.
- Calleya, J., Pawling, R. & Greig, A., "Ship Design and Emissions Abatement Options Considering EEDI", Int. Conf. Influence of EEDI on Ship Design, RINA, London, September 2014
- Calleya, J, Pawling, R, Smith, TWP & Greig, A, "Ship Design and Evaluation for a Greenhouse Gas constrained future", Presented to The Environmentally Friendly Ship, Royal Institute of Naval Architects, 28-29 Feb. 2012. Also reprinted as: "Calibrating the Future", The Naval Architect, Royal Institute of Naval Architects, January 2013.
- Calleya, J, Pawling, R, Greig, A, & Bucknall, R, "Assessing The Dependence Of Carbon Dioxide Emission Reduction Potential Of Natural Gas On The Size And Topology Of Container Carriers And Other Ship Types", Gas Fuelled Ships Conference 2011, Rotterdam, The Netherlands, October 2011.
- Calleya, J, Mouzakis, P, Pawling, R, Bucknall, R & Greig, A, "Assessing the Carbon Dioxide Emission Potential of a Natural Gas Container Carrier", International Conference on Technologies, Operations, Logistics and Modelling for Low Carbon Shipping, LCS 2011, Glasgow, 2011.

### **Unmanned Vehicles**

#### **Conference Papers**

- Robb, M., Lewis, D., Burgess, A., Thompson, M., Pawling, R. & Carette., "The Application of Side Planers and Capture Lines for Launch and Recovery of Offboard Assets from Naval Combatants", ASNE Launch and Recovery Symposium, Maryland, November 2014
- Pawling, R & Andrews, DJ, "Large Unmanned Vehicles and the Minor War Vessel", International Conference Warship 2013: Minor Warships, RINA, Bath, June 2013.

- Pawling, R & Andrews, DJ, "A Submarine Concept Design – The Submarine as an UXV Mothership", International Conference Warship 2011: Naval Submarines and UUVs, RINA, Bath, June 2011.
- Pawling, R & Andrews, DJ, "Three Innovative OPV Designs Incorporating a Modular Payload for UXVs", International Conference Warship 2010: Advanced Technologies in Naval Design and Construction, RINA, London, June 2010.
- Pawling, R & Andrews, DJ, "The Ship Design Challenge of Naval Unmanned Aerial Vehicles", International Conference Warship 2009: Air Power at Sea, RINA, London, June 2009.

### ***Electrification of Ships***

#### **Conference Papers**

- Whitelegg, I., Pawling, R. J. & Bucknall, R. W. G., "The impact of pulse loads on electric warship power systems", Presented to the SNAME Maritime Convention, Texas, October 2014
- Andrews DJ, Bucknall, R, Pawling, R, Greig, A & McDonald, T, "The Impact of Integrated Electric Weapons on Future Warship Design Using Conventional and Unconventional Hullforms", Engine as a Weapon (EAW) 2011, IMarEST, London.
- Andrews, DJ, Bucknall, R & Pawling, R G, "The Impact of Integrated Electric Weapons on Future Warship Design", INEC 2010, IMarEST, Portsmouth.
- Andrews, DJ, Greig, A & Pawling, R, "The Implications of an All Electric Ship Approach on the Configuration of a Warship", Proc. International Naval Engineering Conference (INEC) 2004, Institute of Marine Engineering, Science and Technology (IMarEST), Amsterdam.

### ***Integrating Marine Engineering and Ship Design***

#### **Conference Papers**

- Fitzgerald, M.D, Pawling, R.J, Groom, J, Andrews, D.J, "A Holistic Approach to Machinery Choice in Early Stage Ship Design", IMDC 2015, Tokyo, May 2015.
- Fitzgerald, M. D., Andrews, D. J. Pawling, R. J., "Considerations In A Holistic Investigation Of The Feasibility And Potential Advantages Of Gas Turbine Based Propulsion For Future Container Ships", Int. Conf. Design & Operation of Container Ships, RINA, London, May 2014
- Greig, A, Muc-Pavic, E & Pawling, R, "Marine Engineering challenges for Trimaran Small Waterplane Area Centre Hull (TriSWACH) Warships", International Naval Engineering Conference (INEC) 2014, IMarEST, Amsterdam, May 2014
- Greig, AR, Coombes, J, Andrews, DJ & Pawling, R, "Modelling the Heat Distribution in a Warship", WMTC 2009, IMarEST, Mumbai, India, 2009.

### ***Design Studies***

#### **Journal Papers**

- Muc-Pavic, E, Pawling, R, & Salha, A, "Modelling of Support Systems for Offshore Wind Farms", RINA International Journal of Marine Design, Trans. RINA, Vol 157, Part C1, 2015
- Andrews, DJ & Pawling, R, "Concept Studies for a Joint Support Ship", Journal of Naval Engineering, Vol. 44, Book 2, 2008

#### **Conference Papers**

- Muc-Pavic, E, Salha, A & Pawling, R, "Modelling of Support Systems for Offshore Wind Farms", RINA conference on Design and Operation of Offshore Wind Farm Support Vessels", RINA, London, January 2014
- Andrews, DJ & Pawling, R, "Concept Studies for a Joint Support Ship", International Conference Warship 2007: The Affordable Warship, RINA, Bath, June 2007, Reprinted in Journal of Naval Engineering, Vol. 44, Book 2.

- Andrews, DJ, Pawling, R, “Innovative Ship Design for High Speed Adaptable Littoral Warfare”, Int. Conf. Warship 2006: Future Surface Warships, RINA, London, June 2006.
  - Andrews, DJ & Pawling, R, “Fast Motherships - A Design Challenge”, Int. Conf. Warship 2004: Littoral Warfare & the Expeditionary Force, RINA, London, June 2004, reprinted in RINA publication “Warship Technology”, 2014
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### **Papers in Planning and Preparation**

- *Pawling, R, Percival, V & Andrews, D, “A Study Into the Validity of the Ship Design Spiral in Early Stage Ship Design”, accepted after revision by SNAME Journal of Ship Production and Design, for publication in August 2016*
  - *Contributor to the IMarEST Encyclopedia of Marine and Offshore Engineering, chapter “Introduction – What Makes a Warship?”, submitted to publisher with publishing date planned for late 2016.*
  - *Journal paper developed from work carried out in the second NICOP programme, entitled “A Network Based Internal Blast Vulnerability Assessment Model for Preliminary Naval Ship Design”, target journal is RINA IJME*
  - *Journal paper developed from FAROS work described at ICCAS 2015, provisionally entitled “Incorporating Human Factors in Preliminary Risk-Based Cargo Ship Design”, target journal is Ocean Engineering.*
  - *Journal paper developed from work described at IMDC 2015, with further development in collaboration with NTNU, planned to submit late 2016. Target journal may be non-marine due to inter-disciplinary nature of this research.*
  - *Technical notes being drafted for publication in RINA IJME to encourage discussion on specific aspects of ship design practice, for concepts not yet mature enough for a complete paper.*
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### **Refereeing**

Refereeing provided to the following journals: Proceedings of the Royal Society A; Ocean Engineering; RINA International Journal of Maritime Engineering, SNAME Journal of Ship Production and Design.

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### **Teaching and Administration Experience**

**2016 – :** Increased support to NAME MSc course, including assisting with supervision of the OPV Design Exercise, development of future tools and lecture material for the Ship Design Exercise.

**2014 – *ongoing*:** Second supervisor to PhD student on EPSRC CASE funded research into “The Future Boundaries of UXV Technology”.

**2013 – *ongoing*:** Lecturer to NAME MSc students, MTEC Marine Engineering and Naval Architecture students on “Main and Auxiliary Machinery: some practical considerations” (90 minute lecture to each group), “Aesthetic Considerations in Ship Design” (60 minute lecture to NAME MSc students), “General Arrangements” (120 minute lecture to NAME MSc students) and “Emissions Reduction in Ship Design” (60 minute lecture to NAME MSc students). Joint lecture on “Architectural Considerations in Ship Design” with Prof. David Andrews (120 minute lecture to NAME MSc students).

**2013 – *ongoing*:** Second supervisor to PhD student on EPSRC CASE funded research into “Design for Support”.

**2012 – *ongoing*:** Second supervisor to PhD student on EPSRC funded research into “Novel Ship Architectures and Ship Performance Implications Through the use of Advanced Gas Turbine Based Power Plants”.

**2012 – 2016:** Second supervisor to PhD student on IMPACT funded research into “The Design of a UXV Mothership Submarine”, thesis examined successfully in July 2016.



**2010 – 2014:** Second supervisor to PhD student on the “Low Carbon Shipping: A Systems Approach” project, thesis examined successfully in February 2014.

**2007 – 2010:** Supervised undergraduate lab on the behaviour of a planning craft, including use of the departmental towing tank apparatus and marking of the student reports.

**2007:** Lecturer in undergraduate “Mechanics of Marine Vehicles” course, including 8 hours of lectures and 2 hours of tutorials.

**2006 – *ongoing*:** Population and assistance in maintaining equipment database for MSc Ship Design Exercise, including warship combat system and machinery installation data.

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### **Work Experience**

**2014:** Awarded two-year BMT Fellowship in Naval Ship Design, total value £50K.

**2009:** Returned to UCL as a Post-Doctoral Research Associate to continue research into applications of the Design Building Block approach.

**2008 – 2009:** Employed by Graphics Research Corporation (GRC) Ltd on developing user applications based on the EPSRC funded research into personnel movement and developing training for new PARAMARINE-SURFCON users.

**2004:** Assisted Graphics Research Corporation (GRC, now Qinetiq), with Paramarine training for MTG (the main naval ship design agency in Germany) in Hamburg, Germany.

**2001 – 2008:** Research Assistant in the UCL Design Research Centre (DRC), Department of Mechanical Engineering, UCL. Main research areas were the application of the Design Building Block approach and applications of the PARAMARINE-SURFCON software to ship studies.

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### **Education**

**2001 – 2007:**

University College London

Ph.D. entitled “The Application of the Design Building Block Approach to Innovative Ship Design”, Ph.D. Awarded July 2007

**1997 – 2001:**

University College London

MEng in Naval Architecture and Marine Engineering

Graduated in 2001, Second Class Honours, Upper Division

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### **Professional Memberships**

Associate Member of the Royal Institution of Naval Architects (RINA).

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### **Additional Qualifications and Awards**

**2001:** Awarded “L.J. Rydill” MEng prize for best third year individual project, Awarded “RINA-BAE Systems Naval Architect Award” for best ship design project.

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