RINA AFFAIRS

DECEMBER 2014

The Newsletter of the Royal Institution of the Naval Architects

CHIEF EXECUTIVE'S COLUMN

A new Membership Management System has recently been installed at Headquarters. Some teething problems, not unexpected with a large IT project, have meant that the 2015 Annual Fees Renewal Notices were forwarded in December, rather than the usual November. As last year, Renewal Notices have been sent by email, with posted copies only to members for whom no email address is held. This gives a significant saving in printing and postal costs.

For members with access to a UK bank who pay by the preferred method of payment is the Direct Debit, payment will be taken when due on 1 January 2015, and no further action is required, [I would strongly urge other members to consider this method of payment for future years. It ensures that payment of membership fees is not overlooked, and avoids the need for me to write to members in June 2015, informing them that they are about to be removed from the Membership Roll for non-payment of fees, their journals having been stopped earlier. Direct Debit Mandate Forms are available from Headquarters]. I would remind members that resignations cannot be accepted from members with fees outstanding. Their membership record will show them as lapsed for non-payment of fees.

For other members, it is recommended that the facility to pay by credit card be used. Payment for all RINA conferences, publications and merchandise, as well as membership and registration fees, can be made by all major credit cards. The new Membership Management System will allow members to view their Annual Fees Renewal Notice, make changes and pay their Fees online by a secure link. Payment can also be made by bank transfer or personal cheque drawn on a GBP, Euro, A$, NZ$, Can$ or US$ account, but members should remember that the bank will make a charge for transfer and ensure that the full amount due is transferred.

The new Membership Management System will also enable members to view and make changes to their Membership Record online. I would urge members to check and update their personal details. At any one time, up to 200 members' current addresses are not known, resulting in correspondence and journals being returned, and back numbers being forwarded when new addresses are notified. The additional administrative, postage and printing costs are not insignificant. A charge is also made for returning journals from outside the UK. Changes of personal details can also be notified by letter, fax, email to Membership@rina.org.uk

Details of how to access the 2015 Annual Fees Renewal Notice and Membership Record will be forwarded in due course.

This year, members have the option of receiving *The Naval Architect* (+ *Warship Technology* + *Offshore Marine Technology*) in digital format only, with a corresponding reduction in the Annual Membership Fee. Members are also asked to review their standing order for journals and the Transactions (the *International Journal of Maritime Engineering*, the *International Journal of Small Craft Technology* and the *International Journal of Marine Design*). Members should also decide if they wish to subscribe to *Ship & Boat International* and *Ship Repair & Conversion Technology*. I would urge all members who do not already do so to consider taking these journals. They are all first-class journals and are widely acknowledged in the world maritime industry as leaders in their fields. More copies sent to members means larger circulations, which makes the journals more attractive to advertisers, which increases the Institution's income, which means lower Annual Fees!

On behalf of the Secretariat staff, I would like to wish all members a Happy Christmas and a prosperous New Year.

Trevor Blakeley

IN THIS ISSUE

2014 PAAMES Forum

The Institution was represented at the 2014 Pan Asia Association of Maritime Engineering Societies (PAAMES) Forum in Hangzhou by the Institution's Chief Executive who was an invited keynote speaker. He presented a paper on the *Role of a Professional Society in Promoting the Success of the Maritime Industry.*

The Forum was followed by the 2014 Advanced Maritime Engineering Conference.

Chief Executive, Trevor Blakeley, speaking at the 2014 PAAMES Forum

Delegated to the 2014 Advanced Maritime Engineering Conference

2015 ANNUAL GENERAL MEETING

NOTICE IS HEREBY GIVEN THAT IN ACCORDANCE WITH BY LAWS 37 AND 77, A SPECIAL GENERAL MEETING WILL BE HELD AT 8-9 NORTHUMBERLAND STREET, LONDON, WC2N 5DA ON 30 APRIL 2015 AT 11:00 FOR THE FOLLOWING PURPOSE:

1. To receive the Annual Report and the Financial Statement for the year ended 30 September 2014.

2. To consider and if felt fit, approve the following Resolution

Resolution: To re-appoint haysmacintyre as the Institution's auditors

Note.

1. All members have the privilege to attend the above meeting, but only Voting Members (all except Student and Junior Members) are entitled to vote on the Resolution.
2. Members entitled to vote on the Resolution may appoint the Chairman of the meeting as their proxy to vote on their behalf. Members may register their proxy vote by online (rina.org.uk/agm2015proxyform) or by post (rina.org.uk/agm2015proxyformprinted)
3. All proxy votes must be received not later than 1045 hours on 30 April 2015.

QUOTES OF THE MONTH

"When you want to know how things really work, study them when they're coming apart."
William Gibson

First rule of engineering; beware prototypes. Along with, avoid anything made by an engineer who doesn't have all his own fingers"
Simon R. Green

"To the optimist, the glass is half full, to the pessimist, the glass is half empty. To the engineer, the glass is twice as big as it needs to be."
Anon

News from the Divisions and Branches

Genoa Branch

At a recent meeting of the Genoa Branch at the University of Genoa, Ing. Andrea Marchese was presented with the 2014 RINA – d'Amico Student Naval Architect Award for his final year thesis "A Preliminary Design of a Water Ballast-Free Container Ship". The Award was presented by RINA Chief Executive, Trevor Blakeley.

The presentation was followed by a presentation to the Genoa Branch by Ing.Giuseppe Coronella, Executive Vice President, BU Offshore Fincantieri, and Ing Gianni Scherl, Senior Designer, BU Fincantieri, entitled "*Innovative projects for deep sea exploration*"

Natalie Desty AssocRINA

Natalie Desty AssocRINA has been awarded the Certificate of Appreciation for her service to the Southern Joint Branch as the Hon Social Secretary. The Certificate was presented by the Institution's Chief Executive, Trevor Blakeley, at the SJB Annual Dinner. Thanks to Natalie's efforts, attendance at the Dinner was up 25% from the previous year.

Natalie receives her Certificate from the Chief Executive

New South Wales Section

Rob Gay, Director of PriceWaterhouse Coopers, gave a presentation on *Reliability-centred Maintenance in a Maritime Environmen*t to a joint meeting with the IMarEST attended by 29 on 4 June in the Harricks Auditorium at Engineers Australia, Chatswood.

Neil Edwards, Principal of Edwards Marine Services, gave a presentation on *45 m Shallow-draft Pusher Tugs Building at Uzmar Shipyard in Turkey for South America* to a joint meeting with the IMarEST attended by 32 on 2 July in the Harricks Auditorium at Engineers Australia, Chatswood.

Selwyn Oliveira, Marine and Diesel Manager of Alfa Laval Australia, gave a presentation on *Ballast Water Treatment* to a joint meeting with the IMarEST attended by 12 on 6 August in the Harricks Auditorium at Engineers Australia, Chatswood.

Phil Helmore, Naval Architecture Stream Coordinator of the University of New South Wales, gave a presentation on *Performance of Propellers in Off-Design Conditions* to a joint meeting with the IMarEST attended by 30 on 3 September in the Harricks Auditorium at Engineers Australia, Chatswood.

Trevor Blakeley, Chief Executive of the Royal Institution of Naval Architects, presented a workshop on *Working towards Chartered Status* to a meeting attended by 24 on 22 September in the Harricks Auditorium at Engineers Australia, Chatswood.

Graham Taylor, Principal of Taylortech, gave a presentation on LNG —*The New Marine Fuel?* to a joint meeting with the IMarEST attended by 19 on 1 October in the Harricks Auditorium at Engineers Australia, Chatswood.

Phil Helmore

Letter to the Editor

Mr Thomas Cecil Letcher

Sir: In his work with J Samuel White, and the Wight Aircraft Company, Mr Thomas Cecil Letcher, who died in 1950, is recorded as being associated with the design of ships and naval aircraft. In addition, he designed a very elegant sailplane that was manufactured by E D Abbott, a coach building company in Farnham, Surrey in 1930.

I would like to identify two of the men in the picture - we know that Edward Abbott is the seemingly younger man standing on the starboard side of the glider, but the names of the others are unknown. One possibility is that Mr Letcher, the designer, might have wanted a record of his brainchild that was unusually advanced for a British machine at the time. I have been unable to trace photographs of the would-be owners who commissioned the design and manufacture, neither have the men been identified amongst surviving records of Abbott's own employees.

I would be grateful for any information which your members might be able to provide about Mr Letcher, and any photos of him and of J Samuel White's staff, or its spin-off activity, Wight Aircraft.

Nick Hughes
ndphughes@aol.com

E D Abbott sailplane

People in the News

Alan Cubbins

D F Hudson

Donald K Jones

Richard Sadler

Richard Sadler, FRINA, CEO of Lloyd's Register Group Ltd has been presented with the Maritime Fellowship Award.

The Maritime Fellowship Award is the highest honour bestowed by the Maritime Foundation to an individual who has made a truly outstanding contribution to stimulating public engagement in maritime issues.

The Award was presented by Countess Mountbatten of Burma, CBE MSC CD DL President the Maritime Foundation, who said "I cannot think of a more deserving candidate to receive the Maritime Fellowship Award 2014. It is only through the leadership and courage of people like Mr Richard Sadler that we can re-affirm our reputation as a maritime nation."

Richard Sadler said on receiving the award, "I am very honoured to receive this award. We all have an obligation to drive the industry towards better dialogue with government, to speak with one voice, and get government to recognise the importance of UK maritime and the need for a cohesive maritime strategy."

Dr Stuart Cannon

Dr Stuart Cannon, FRINA, research leader at the Defence Science and Technology Organisation, has been awarded the 2014 Vice-Chancellor's Award for Outstanding Contributions by Adjunct and Clinical Title Holders.

A widely-respected researcher in the field of maritime surface platform systems, the Award recognises his outstanding work enhancing the reputation of the Australian Maritime College and the University of Tasmania.

RINA – DSTO Award

The 2014 RINA - Defence Science and Technology Organisation Student Naval Architect Award for the best presentation at the Thesis Conference by a student member of RINA on a naval architectural project at the University of New South Wales has been awarded to Dauson Swied for his presentation *Investigation of the Hydrodynamic Efficiency of Reverse Bow Shape using 3D Printing.*

Publications in Japan

Yoshiharu Ishii, Director at Nikkoku Service Co. in Tokyo, has been appointed as the Japanese Advertising Sales agent, representing the Institution's full range of magazines.

Ishii San, who can be contacted at y.ishii@nikkoku-service.co.jp, takes over from Mr Michael Hall who represented the Institution's publications in Japan for 20 years.

RINA members receive 45 Years' Service Certificates

At the 2014 Southern Joint Branch Annual Dinner in Southampton, the Chief Executive presented 45 Years' Certificates to Alan Cubbins, D F Hudson, and Donald K Jones.

RINA-QinetiQ
Maritime Innovation Award

Innovation is key to success in all sectors of the maritime industry, and such innovation will stem from the development of research carried out by engineers and scientists in universities and industry, pushing forward the boundaries of design, construction and operation of marine vessels and structures.

The Royal Institution of Naval Architects – QinetiQ Maritime Innovation Award seeks to encourage such innovation by recognising outstanding scientific or technological research in the areas of hydrodynamics, propulsion, structures and material which has the potential to make a significant improvement in the design, construction and operation of marine vessels and structures.

The Award is made annually to either an individual or an organisation, in any country. Nominations for the Award may be made by any member of the global maritime community, and are judged by a panel of members of the Institution and QinetiQ. The Award will be announced at the Institution's Annual Dinner (tbc).

Nominations are now invited for the 2014 Maritime Innovation Award. Individuals may not nominate themselves, although employees may nominate their company or organisation.

QinetiQ

- Nominations may be up to **750 words** and should describe the research and its potential contribution to improving the design, construction and operation of maritime vessels and structures,
- Nominations may be forwarded online at **www.rina.org.uk/MaritimeInnovationAward**

  or by email to

  MaritimeInnovationAward@rina.org.uk
- Nominations should arrive at RINA Headquarters by **31 January 2015**
- Queries about the award should be forwarded to the Chief Executive at **hq@rina.org.uk**

RINA - Lloyd's Register
Maritime Safety Award

The safety of the seafarer and protection of the maritime environment begins with good design, followed by sound construction and efficient operation. Naval architects and engineers involved in the design, construction and operation of maritime vessels and structures can make a significant contribution to safety and the Royal Institution of Naval Architects, with the support of Lloyds Register, wishes to recognise the achievement of engineers in improving safety at sea and the protection of the maritime environment. Such recognition serves to raise awareness and promote further improvements.

The Maritime Safety Award is presented annually to an individual, company or organisation that in the opinion of the Institution and Lloyd's Register, is judged to have made an outstanding contribution to the improvement of maritime safety or the protection of the maritime environment. Such contribution may have been made by a specific activity or over a period of time. Individuals may not nominate themselves. Nominations are now invited for the 2014 Maritime Safety Award.

Nominations of up to **750 words** should describe the nominee's contribution to:

- safety of life or protection of the marine environment, through novel or improved design, construction or operational procedures of ships or maritime structures
- the advancement of maritime safety through management, regulation, legislation or development of standards, codes of practice or guidance
- research, learned papers or publications in the field of maritime safety
- education, teaching or training in maritime safety issues

Lloyd's Register

The closing date for nominations is 31 January 2015. The Award will be announced at the Institution's 2015 Annual Dinner.

Nominations may be made by any member of the global maritime community and should be forwarded online at www.rina.org.uk/MaritimeSafetyAward or by email to MaritimeSafetyAward@rina.org.uk

Queries about the Award should be forwarded to the Chief Executive at **hq@rina.org.uk**

2015 SPECIAL GENERAL MEETING

NOTICE IS HEREBY GIVEN THAT IN ACCORDANCE WITH BY LAWS 37 AND 77, A SPECIAL GENERAL MEETING WILL BE HELD AT 8-9 NORTHUMBERLAND STREET, LONDON, WC2N 5DA ON 30 APRIL 2015 AT 1130, TO CONSIDER, AND IF FELT FIT, APPROVE THE FOLLOWING RESOLUTIONS:

Amendments to the By Laws

Resolution 1: To make such amendments to the By Laws as are necessary to remove the distinction between Corporate Members (FRINA and MRINA) and non-Corporate Members in respect of voting.

Resolution 2: To make such amendments to the By Laws as are necessary to remove all distinctions between ex officio and elected members of Council in respect of voting and terms of office, be abolished.

Resolution 3: To make such amendments to the By Laws as are necessary to describe the activities of the Institution and members as "the science and practice of the design, construction, maintenance and management of marine vessels and structures".

Resolution 4: To make such amendments to the By Laws as are necessary to require the Board to annually elect/re-elect a member of the Board who is a member of Council as the Vice Chairman of the Board.

Resolution 5: To make such amendments to the By Laws as are necessary to require the Board to provide an Annual Report and Financial Statement which will be independently audited.

Resolution 6: To amend the By Laws where required to abolish Entrance and Transfer fees.

Amendments to the Regulations

Resolution 7: To make such amendments to the Regulations as are necessary to allow full electronic voting at Council elections

Note:

1. All members have the privilege to attend the above meeting, but only Voting Members (all except Student and Junior Members) are entitled to vote on the Resolutions.
2. Members entitled to vote on the Resolutions may appoint the Chairman of the meeting as their proxy to vote on their behalf. Members may register their proxy vote by online (rina.org.uk/sgm2015proxyform) or by post (rina.org.uk/sgm2015proxyformprinted)
3. All proxy votes must be received not later than 1045 hours on 30 April 2015

What is Naval Architecture?

Engineering may be defined as a 'profession directed towards the skilled application of a distinctive body of knowledge based on mathematics, science and technology, integrated with business and management, which is acquired through education and professional development. It is dedicated to developing and providing infrastructure, goods and services for industry and the community.' Correspondingly, the Engineer may be defined as 'one who has and uses scientific, technical and other pertinent knowledge, understanding and skills to create, enhance, operate or maintain safe, efficient systems, structures, machines, plant, processes or devices of practical and economic value.'

But how today should that branch of engineering called Naval Architecture be defined? What is a Naval Architect? The Royal Institution of Naval Architects can trace its origins back to the Society for the Improvement of Naval Architecture, whose formation in 1791 stemmed from a concern about the apparent superiority of French warship design. However, to simply define the naval architect as one who designs ships would of course be to ignore those who are involved in the many other aspects of maritime technology, including the education of naval architects,

Some years ago, I invited members to suggest suitable definitions of Naval Architecture or Naval Architect. The following was their response, together with definitions used by various organisations. Can members add to that today?

[My favourite (and amongst the shortest!) is "The Naval Architect is the true ship system engineer" – implying that the ship is the system.]

Chief Executive

…A FAIRLY COMPLEX SUBJECT.

Naval Architecture, especially in its engineering sense - which is the harmonious combination of those basic factors that produce seaworthiness, speed, safety, balance, buoyancy, comfort and utility - is a fairly complex subject.

Carl Lane, Penobscot Boat Works

…THE ORIGINATOR/MANAGER OF A SITUATION…

Naval Architecture (Ship Design Engineering) of some years ago, could be considered a euphemism, when shipbuilding was not an 'exact science' but more of an art. Today, a ship design engineer is trained to be the originator/manager of a situation, capable of promoting safety standards based upon sound analysis, experimental testing and in-service experience. He or she is far more than an "artisan." The application of computers in shipbuilding has replaced the cylindrical slide rule, known at the time as the 'barrel' (now a museum piece), and has made ship design and construction a mature technology.

Today's CAD/CAM systems not only enhance quality, they save time and costs. These systems, together with extensive use of Computational Fluid Dynamics, which solves complex fluid problems, and three-dimensional graphics, which are computer generated visualisations of a ship's structure, enable the ship design engineer to integrate solutions, from conceptual stage of a design to the fabrication of a ship/maritime

structure, while the concept is still on the design board.

Andrew G Spyrou FRINA

…CONCEIVE OF, DESIGN, TEST, BUILD, AND OPERATE…

Engineering is an open-ended process during which scientific knowledge is converted to useful products for the benefit of society. In order to perform this transformation, an engineer must be inquisitive and broadly educated, he or she must be knowledgeable in the sciences and in the language of engineering - namely mathematics, and he or she must be well educated in the fundamental courses common to all engineering disciplines - courses in: statics, dynamics, thermodynamics, fluid dynamics, materials, electrical theory, and experimental techniques.

Naval architecture is that field of engineering which addresses how we can apply our acquired wealth of knowledge to *conceive of, design, test, build, and operate* all types of ships and boats - recreational to naval, small to big, operating on or under the sea, sails to nuclear, etc.

US Naval Academy Annapolis

…COMBINES IMAGINATION, ARTISTIC INSTINCTS, AND PROVEN SCIENTIFIC PRINCIPLES…

Naval Architecture combines imagination, artistic instincts, and proven scientific principles, tempered by basic engineering considerations, in designing the means of ocean transportation of the future. The many types of ships, boats and vehicles needed to operate on, under, or above the ocean's surface provide the broad field in which the designer is to work. The challenge to the naval architect is to convert the functional requirements into an effective, workable, and cost-efficient design.

The Department of Naval Architecture, Ocean and Marine Engineering, US Naval Academy

…A GENERAL UNDERSTANDING OF ALL ENGINEERING DISCIPLINES…

Naval architects must have a general understanding of all engineering disciplines because they generally start the process of designing a ship. After they determine its basic size and shape, they address hull form and resistance, propulsion power requirements, ship structure, weight distribution, stability, and the efficient location of the many compartments throughout the ship.

American Society of Naval Engineers

…ALL ASPECTS OF LEARNING, DESIGNING, BUILDING AND SMOOTH RUNNING OF VESSELS…

Naval Architecture is a discipline, associated with other types of engineering needed for vessels to be completely independent units of floating objects in water, under various conditions of interaction of the wave and the wind in all aspects of learning, designing, building and smooth running of vessels; while a naval architect is a person who is fully and professionally educated in this discipline.

Shyama Prosad Ghosh, FRINA

…SHIP DESIGN ENGINEERING…

Naval Architecture is ship design engineering. A Naval Architect is a ship design engineer, responsible for the design of ships, ensuring structural strength for the ship to remain afloat, and stability to remain upright, to survive the forces of the seas and other hazards. The guiding principle of safety is paramount.

Andrew G Spyrou, FRINA

…DESIGN, CONSTRUCTION AND OPERATION ASPECTS…

May I suggest that Carl Lane's definition lacks certain essential ingredients: i.e. one who designs ships (Ca, 1885), extended to include other marine structures, i.e. one associated with one or more of their design, construction and operation aspects, strength is also rather important as are efficiency and economy in performance, first cost and operational costs.

D. Faulkner FRINA

…DESIGNING A SHIP AND PREDICTING ITS BEHAVIOUR…

The definition of 'naval architecture' has changed since the term first came into use. The earliest published use of the phrase 'naval architecture' appears to date from 1629, when *Architectura navalis* by Josephum Furttensbach, was published (in Latin) in Frankfurt, and immediately translated throughout Europe. It was essentially a how-to book on building various ship types (galleons, brigantines, etc.), and did not include any scientific principles underpinning ship design. The meaning of naval architecture was much different then, and encompassed a much broader range of topics. For example, the book L'Architecture Navale by Sieur Dassie, published in Paris in 1677, lists the following headings:

Dictionary of geometrical terms, Dictionary of nautical terms, Correct proportions (length/beam/depth/mast heights) of vessels of various ranks, Inventory of articles aboard a war vessel, War maneuvers, List of officers and sailors aboard a vessel and their functions, Construction of a galley and a longboat, Tables of longitude, latitude and tides of principal ports, Description of ports and anchorages in the East and West Indies.

Only a few chapters are devoted to what we would nowadays call 'naval architecture'; the rest deal with shipboard operations such as victualling, navigation and naval tactics. More importantly, in the words of an English naval architect, 'it does not appear that there was a single principle, deduced from science, employed to determine any of the conditions stated in that work'.

The first book that could be accurately called a work of scientific naval architecture was *Traité du Navire*, published by the French astronomer Pierre Bouguer in 1746. In it, he developed many of the fundamental principles of naval architecture still in use today, for example, the metacentric theory of stability, the use of beam theory in determining hull strength, and the trapezoidal rule. The book was the first great synthesis of naval architecture, as well - previous books concentrated on one aspect such as maneuvering. It was roughly the equivalent of Newton's Principia Mathematica in terms of its scope and effect on the world of ship design. *Traité du Navire* was divided as follows:

BOOK 1: GENERAL IDEA OF CONSTRUCTION

Section 1 - Shape of the Vessel and how to Trace it, Section 2 - Apparatus of the ship, including rudders, masts, cordages, Section 3 - Strength of the Ship, including its Wood and Ropes

BOOK 2: THE VESSEL CONSIDERED AFLOAT, BUT NOT MOVING

Section 1 - Weight of the vessel, its buoyancy and loading, Section 2 - Distribution of the weight of the vessel, including a description of the metacenter, Section 3 - Rolling and pitching of the vessel

BOOK 3: THE VESSEL CONSIDERED IN MOVEMENT

Section 1 - Examination of the shock of fluids; the wind on the sails, and the water on the hull, Section 2 - General solution to the principle problems of maneuvering, Section 3 - Properties the vessel must have to steer well, Section 4 - Qualities the vessel must have to

carry sail well, Section 5 - Properties the vessel must have to be fast and keep a straight course.

This format has remained essentially unchanged for naval architecture textbooks for over 200 years; the latest edition of SNAME's *Principles of Naval Architecture* is also divided into three books, each of which covers roughly the same topics.

Bouguer unfortunately does not provide us a definition of naval architecture. However, one quality of his book was its focus on modeling the ship in mathematical terms and predicting its behavior prior to construction; previous books mainly spoke of how to build the ship without attempting to say anything about how the ships would behave once built. So, one element of a definition of naval architecture should be the prediction of a ship's behavior and characteristics before it is built. In this respect, naval architecture is different from the art of the shipwright, which seeks to build the ship (or boat) but does not necessarily aim at discovering how it will behave once built.

The aspect of science should play heavily in the definition. John Fincham's book *A History of Naval Architecture (1841)* uses the phrase 'The Application of Mathematical Science to the Art of Naval Construction'. Unfortunately, his book covered naval battles more than it did science.

It also helps to look afield. Every issue of The Structural Engineer, the journal of RINA's former next-door neighbour, the Institution of Structural Engineers, carries the following definition: 'Structural engineering is the science and art of designing and making, with economy and elegance, buildings, bridges, frameworks and other similar structures so that they can safely resist the forces to which they may be subjected." Ships are more than just structural entities, of course, but the analogy with respect to hydrostatics, hydrodynamics, etc., is clear. Thus, another part of the definition should speak to the ability of the ship to safely and efficiently respond to its element, the sea (this is a broad-brush term for all navigable waters).

So - as a first cut attempt at a definition of naval architecture, pulling in the historical and analogous constituents, I propose the following: *'Naval architecture is the application of scientific and engineering principles to designing a ship and predicting its behavior and characteristics, so that it will safely and efficiently respond to its element, the sea.'*

Larrie D. Ferreiro FRINA

The science of designing ships and other waterborne craft.

Random House dictionary

A designer of ships.

The Concise Oxford Dictionary

A STUPID MECHANIC . . ..

If we survey a vessel, what an exalted idea we must form of the ingenuity of the carpenter, who framed such a complicated, useful and beautiful a machine? And what a surprise must we feel when we find him a stupid mechanic, who imitated others, and copied an art, which, through a long succession of ages, after multiplied trials, mistakes, corrections, deliberations and controversies, had been gradually improving? Many worlds might have been botched and bungled throughout an eternity, ere this system was struck out; much labour lost; many fruitless trials made; and a slow but continued improvement carried out during infinite ages in the art of ship building.

'Dialogues concerning Natural religion, Part V'
David Hume (Scottish philosopher 1711 – 1776)

...THE USE OF THEORETICAL AND EMPIRICAL KNOWLEDGE WITHIN THE SHIP DESIGN PROCESS…

A study of the development of naval architecture during the Scientific Revolution prompts the question 'what is scientific naval architecture?'

In focusing that study on the development of the theories and tools that allowed for a more scientific basis of naval architecture, and how they became incorporated into ship design, the important distinction between 'naval architecture' and 'ship design' must be made. A shipwright can design and build a perfectly good ship without the use of any theory and with little calculation or geometry, except for a few rules of thumb based on past experience. Naval architecture is the process that allows him to define and accurately predict the characteristics and performance of that ship before it is built.

To some extent, this split between naval architecture and ship design can be seen in SNAME's two publications, *Principles of Naval Architecture* and *Ship Design and Construction*. One deals with theoretical and empirical knowledge, the other with practical implementation. In this regard, 'rules of thumb' and use of geometry is only a small part of the picture - they are very good for giving a ship based on what has worked previously, but do not serve to predict how an entirely new ship will float, how strong it will be or how fast it will go.

Even today rules of thumb is used on a routine basis. When I designed destroyers and frigates, I used a set of L/B, B/T, etc., rules. Length-to-hull-depth ratio (L/D) was kept at 10-15, on the grounds that over 15 gave unusually high stresses and made the hull too flexible to maintain accurate weapons alignment (there were other reasons, too). Under 10 meant that the structure was not working efficiently, i.e., minimum thickness for local loadings governed, so the hull steel was thicker (therefore heavier) than what was needed for longitudinal strength. The ideal balance was a hull thickness that adequately met both local loads & hull girder loads. Now, shipwrights in the past also had these geometrical rules of thumb - but all they knew is that if L/D was too big they would get cracking and splitting in the wood.

'Scientific' naval architecture allows the designer to calculate the stresses and see beforehand if he has an efficient structure - in short, it gives him the rational basis for his gut reaction or experience. In this respect, modern ship design is begun by using the kinds of rules of thumb known to the most ancient shipwrights - but science and engineering 'inform' the designer throughout the design process, and allow him to accurately predict both the characteristics and performance of his ship before the first steel is cut. This differentiates 'naval architecture' from 'ship design', in a sense making naval architecture as a part of the ship design process.

A naval architect is therefore someone who uses those principles in that process (he/she is not necessarily a ship designer - lots of naval architects specialise in hydrodynamics, structures, etc., and not in the overall design). Therefore, another potential definition for naval architecture is:

'Naval architecture is the use of theoretical and empirical knowledge within the ship design process, to predict the characteristics and performance of the ship before it is built.'

And for a naval architect:

'A naval architect is one who uses theoretical and empirical knowledge as part of the design process, to predict the characteristics and performance of the ship before it is built.'

Larrie D. Ferreiro FRINA