The South African Institute of Marine Engineers and Naval Architects

SAIMENA

SCIENTIA RERUM NAVALIUM

The Two Oceans Journal

1st Edition 2018

National Council 2017/2018

President

Louis Gontier

Snr Vice President

Emiina Usher—Dzinic

Jnr Vice President

Not decided

Past President

David Fiddler

Honorary Secretary

Kevin Watson

Honorary Treasurer

Akash Singh

Grading Committee

Willem Deyzel

Fellows

Iain Armstrong

Keith Mackie

Neill Leeming

Org Nieuwoudt

Corporate and Associate Members

Jako Laubscher

Dirk Janse van Rensburg

Edward Pines

Mike Roberts

Cape Town Branch Chairman

Graham Dreyden

Durban Branch Chairman

Rogan Troon

CONTENTS

Page No

Editors:

Iain Armstrong and Org Nieuwoudt

2018 1st Edition

www.saimena.co.za

Presidents report

Welcome to everyone.

It has been an honour and a privilege to be President of SAIMENA. I was an engineering cadet back in 1978 when I started attending meetings and looked up to the people that were running SAIMENA. I decided then that I wanted to be a member and I never thought that I would be appointed President one day.

SAIMENA has done a lot for marine engineers in South Africa through ECSA ie in getting our qualifications recognized in the industry and ensuring our standards are maintained.

The branches in Durban and Cape town have always had strong committees and have ensured that the technical papers are topical and on most occasions more technical than sales. The social side has always been strong especially with the regular lunches, dinner dances and sporting events.

It has become evident in the last few years that there has been a steady decrease in numbers attending technical papers and the social events although some still remain very popular ie Annual dinner Dance.

Over the last 2 years SAIMENA has lost a number of it's members through retirements and people moving overseas, through death and general apathy. We have managed to get a number of new members but steadily our numbers are declining. We have looked at a number of ways to improve the situation but just increasing numbers does not mean people attend. We have found recently that it takes a personal phone call or e-mail to the various organizations in order to get a commitment to attend.

SAIMENA house Durban has been in limbo for the last few years since the announcement that we have to move due to development. We will get no compensation for the house but have an in principal /verbal agreement with the management of Berea Rovers that we will get use of the new facility when it is built at no cost to us but will not have a permanent room as we have now. This will further reduce our revenue as we used to get income from renting out our room.

WE will have to decide what we do with all the items inside the room as Berea Rovers do not want us to place any of it in the new facility. To date there has been no further info on when we will have to vacate the premises but it does not seem to be anytime soon.

I would like to thank Ivan Parsons for his dedicated service to SAIMENA over the many years and especially his time as Treasurer. He has managed to ensure that we remain with a healthy bank balance and that we always meet our tax obligations.

I encourage some of the younger members or members that have not always got too involved to go on committee and ensure we as a professional society grow and serve our industry needs.

I would like to see our female numbers increase and also our black engineers to be encouraged to participate and become President one day.

I thank you for your loyal support over the years during my tenure as Chairman and as President from 2014/2015. Due to the work load of our President Dave Fiddler, he kindly requested that I step in for 1 year during 2017 after which the Cape Town Branch will take Over.

.

Louis Gontier

.

Durban Branch Chairman's report

It is 2018 already, and on behalf of the committee of SAIMENA Durban Branch may I wish all a pleasant year.

2017 proved a difficult year as regards the presentation of papers.

A number of events were arranged during the latter part of 2017. Unfortunately, the meetings were generally poorly attended, particularly one at the Unicorn Training Centre. However, what may prove to be one of the last held at SAIMENA House which ended with a braai, and was fairly well attended, with the numbers swelled by some Unicorn sea staff.

Thanks to Louis Gontier and Southern African Shipyards for sponsoring and braaing the meal.

The construction at Berea Rovers has not as yet commenced.

At the Berea Rovers AGM, in September 2017, the developer stated that work would commence at the beginning of October, subject to final approval of plans etc by the municipality. No plans or real information was made available, other than a vague mention that Berea Rovers will be accommodated in the new development.

The committee is preparing to seek alternate venues for holding meetings, with a couple of options possibly available. The various artifacts and documents in SAIMENA House will be removed to storage, with the hope that a more permanent place for their display is found .

The developer has apparently taken over the payment of lights, water etc for the site. The other occupants at the various stables have or are in the process of moving off the site. Berea Rovers Club itself is battling financially due to dwindling membership and lack of facilities, sports fields etc. Revenue that was previously collected at rugby matches is also much reduced.

.

A successful annual Dinner / Dance was held at the Durban Country Club on Saturday 4th November 2017. The guest speaker, Mr Andrew Pike, gave a highly entertaining talk on his experiences in the marine industry. A special thanks is extended to Mr Quentin Foyle for arranging the dance, organizing sponsors and generally ensuring a memorable evening was had by all.

The annual SAIMENA Golf Day was held on Friday 10th November 2017 and reports indicate that it was a success.

On the social side, the Christmas luncheon was held at Royal Durban Golf Club. This was relatively well attended, but it was noticed fewer members attended as compared to previous years …

Rogan Troon – Durban Branch Chairman

Cape Town Branch Report

The last Branch meeting was held on 16 November 2017 at the Damen Ship Yards Cape Town and was very well attended by SIAMENA Members and Non SAIMENA members. The meeting was preceded by a guided tour around the shipyard which drew a lot of interest from all attendees.

During the activities at DAMEN, the SAIMENA EXCO Committee gathered to hold the final Committee Meeting for the year. At this meeting a unanimous vote was taken and Mr Willy van Niekerk was appointed as a SAIMENA EXCO Member to replace the previous member, who had resigned due to work responsibilities that resulted in him having to relocate to Johannesburg.

The EXCO decided that a social activity would be arrange in 2018 with the donation that was received from National in 2017, perhaps in the form of action cricket or similar.

On 28th November, I attended the wreath laying Ceremony at the grave of William Froude hosted by the SA Navy in Simonstown. All SAIMENA members were invited as well Students of the Lawhill Maritime School.

After a brief ceremony at the grave site the guests proceeded to the Lawhill school for some light refreshments afterwards monetary donation as handed over to Lawhill Maritime School on behalf of SAIMENA.

Open Events

The Golf day planned for November was postponed to 09 March 2018 due to little interest. The event will take place at Milnerton Golf club. We decided to partner with SAIMI to have a higher purpose for fundraising towards sponsoring maritime students and strengthen support.

The response from the industry role players are very good. To date we have 14 x 4 balls booked and the proceeds of this event will be in aid of sponsoring a relevant Maritime training institute or School during 2018.

EXCO Meeting

Next meeting 1st quarter of 2018 (date TBA)

Monthly Meetings and presentations

The first meeting is scheduled for 22 February and preparations are well underway. The Exco Members were asked to arrange relevant industry speakers and topics for each meeting for the rest of the year.

Once the he annual monthly meeting calendar for 2018 is finalised, the meeting dates will then be captured on the SAIMENA website in advance to spark interest early in the year and so that members can schedule their activities around these meetings well in advance.

Committee Members,Graham Dreyden- Chair, Cobus Visser- Treasurer, Pieter Grobbelaar- Secretary,Jacques Olwage- Member, Willy van Niekerk (Replaced Joshua Hunt- resigned in 2017)

Industry Relations and Event Representations by Chairman of the SAIMENA Cape Branch

Sept'17 - Annual Luncheon - Guest Speaker Professor Malek Pourzanjani CEO - SAIMI

Nov'17 - TOJ – contribution on Cape Branch article

Nov'17 –CPUT Maritime Education & Training Conference – Presentation on the Impact of Digitisation on the Marine Industry

Nov'17 – Monthly Meeting at Damen Ship Yard Cap Town

Nov'17 – William Froude Memorial Day and Lawhill Donation - Simonstown

Jan'18 – CPUT Department of Maritime Studies - Orientation/Induction Programme 2018

Graham Dreyden

Chairman SAIMENA Cape branch

The PLC

What is a PLC?

Basically, it's a solid-state, programmable electrical/electronic interface that can manipulate, execute, and/or monitor, at a very fast rate, the state of a process or communication system. It operates on the basis of programmable data contained in an integral microprocessor-based system.

The PLC was developed for the motor industry in order to speed up manufacture . The production line prior to the PLC was controlled by relays which proved to be very expensive and time consuming to change for a different model of car.

With the advent of the PLC (Programmable Logic Controller) expense and speed were massively improved and now PLC's are used throughout all industries.

How does it Work?

A PLC is able to receive (input) and transmit (output) various types of electrical and electronic signals and can control and monitor practically any kind of mechanical and/or electrical system. Therefore, it has enormous flexibility in interfacing with computers and machines, and is usually programmed in relay ladder logic

To know how the PLC works, it is essential that we have an understanding of its central processing unit's (CPU's) scan sequence. The methodology basically is the same for all PLCs. Next, the software program is scanned, and each statement is checked to see if the condition has been met. If the conditions are met, the processor writes a digital bit "1" into the output image table, and a peripheral device will be energized. If the conditions are not met, the processor writes a "0" into the output image table, and a peripheral device (using "positive logic") remains deenergized.

The PLC's Software Programme.

The PLC not only requires electronic components to operate, it also needs a software program. The PLC programmer is not limited to writing software in one format. There are many types available, each lending itself more readily to one application over and above another.

Upon power up, the processor scans the input module and transfers the data contents to the input's image table or register. Data from the output image table is transferred to the output module.

Next, the software program is scanned, and each statement is checked to see if the condition has been met. If the conditions are met, the processor writes a digital bit "1" into the output image table, and a peripheral device will be energized. If the conditions are not met, the processor writes a "0" into the output image table, and a peripheral device (using "positive logic") remains deenergized.

The software program is the heart of a PLC and is written by a programmer who uses elements, functions, and instructions to design the system that the PLC is to control or monitor. These elements are placed on individually numbered rungs in the relay ladder logic (RLL). The software's RLL is executed by the processor in the CPU module .

As the PLC's processor scans through the software program, each rung of RLL is executed. The hard-wired device that the software is mirroring then becomes active. The software is thus the controlling device and provides the programmer or technician the flexibility to either "force a state" or "block a device" from the system operation.

Power Supply

The power supply (PS) section gets its input power from an external 120VAC or 240VAC source, which is usually fused and fed through a control relay and filter external to the PS. In addition, the PS has its own integral AC input fuse.

This line voltage is then stepped-down, rectified, filtered, regulated, voltage and current-protected, and status-monitored, with status indication displayed on the front of the PS in the form of several LEDs . The PS can have a key switch for protecting the memory or selecting a particular programming mode.

The CPU Module

The CPU module can be divided into two sections: the processor section and the memory section.

The processor section makes the decisions needed by the PLC so that it can operate and communicate with other modules. It communicates along either a serial or parallel data-bus. An I/O base interface module or individual on-board interface I/O circuitry provides the signal conditioning required to communicate with the processor. The processor section also executes the programmer's RLL software program.

The memory section stores retrievable digital information in three dedicated locations of the memory. These memory locations are routinely scanned by the processor. The memory will receive digital information or have digital information accessed by the processor. This read /write capability provides an easy way to make programme changes. The memory contains data for several types of information. Usually, the data tables, or image registers, and the software program RLL are in the CPU module's memory. The programme messages may or may not be resident with the other memory data.

Input Module

The input module has two functions: reception of an external signal and status display of that input point, meaning reception of the peripheral sensors signal, and provides signal condition, termination, isolation and/or indication for that signal state.

The input to an input module is in either a discrete or analog form. If the input is an ON-OFF type, such as with a push button or limit switch, the signal is considered to be of a discrete nature. If, on the other hand, the input varies, such as with temperature, pressure, or level, the signal is analog in nature.

Peripheral devices sending signals to input modules that describe external conditions can be switches (limit, proximity, pressure, or temperature), push buttons, or logic, binary coded decimal (BCD) or analog-to-digital (A/D) circuits. These input signal points are scanned, and their status is communicated through the interface module or circuitry within each individual PLC and I/O base.

Output Module.

The output module transmits discrete or analog signals to activate various devices such as hydraulic actuators, solenoids, motor starters, and displays the status of the connected output points. Signal conditioning, termination, and isolation are also part of the output module's functions. The output module is treated in the same manner as the input module by the processor. .

Acknowledgements: Robert B. Hee and Iain Armstrong

OBITUARY

KENNETH LOWES

Ken was born on the 17th November 1938 in Gateshead which is on the River Tyne in the North East corner of England. He was a very proud Geordie.

From an early age and throughout his life Ken was a devout Christian and a great churchman who loved singing in choirs. At the age of twelve he was an accomplished violinist.

Having decided he wanted to join the Merchant Navy he began by serving an apprenticeship at the Wallsend Slipway and Engineering Company which is a shipyard on the River Tyne.

Upon completing his apprenticeship, he joined the British Merchant Navy with the Royal Mail Line as a junior engineer. After completing the required time at sea and passing all the necessary exams he quickly climbed the promotion ladder to become Staff Chief Engineer on board the passenger ship Andes. He was with Royal Mail from 1960 to 1969 when he changed companies to go with the Bowring Steamship Company as a superintendent engineer. He was with Bowring's from 1970 to 1978 traveling the world looking after company ships but the continuous travel made him look for a position that allowed more time with his family.

He had married Anne, a childhood sweetheart, in 1963 and they had three sons Keith who lives in Durban, Christopher living in England and Andrew in South Australia.

He found a position with the Salvage Association, an organization that was a technical arm of the London Insurance Market. He was first posted to Glasgow where he enjoyed his weekends sailing in the lochs with his family; he was a keen small boat man. He only spent two years in Bonny Scotland before being sent to Durban South Africa.

His area of operation was all the countries south of the Equator including the Indian Ocean Islands. Southern Africa was somewhat different and a lot less pleasant than Scotland, but Ken was not a complainer. He visited Madagascar to assist in refloating a ship that had gone aground in a most terrible area. He was there eighty days and came home to be hospitalized with a severe dose of malaria and a few other tropical diseases. He retired in 2003 but did not leave the shipping scene and became Chairman of the Missions to Seamen looking after the interests of seamen visiting South Africa.

He was a member of St. Paul's Anglican Church in Durban since he arrived in 1981and one of his greatest pleasures was singing in their choir. It was there that he met and chatted to Queen Elizabeth 2nd and Prince Phillip.

Ken enjoyed meeting friends in the pub on a Friday where he helped put the world to rights and chatted about the good old days and friends now gone

Sadly, Ken left us on 29th September 2017 after a long happy life with his family and the shipping industry have lost one of their most accomplished members.

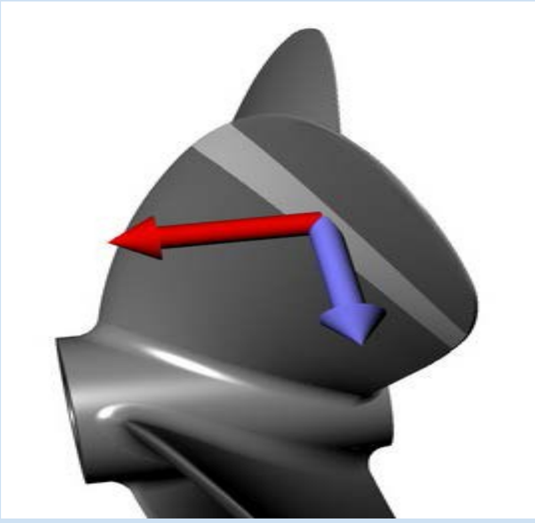
Ken was the salt of the earth and on the Tyneside he would be known as a "Grand Man"

Acknowledgements: Durban Branch

The Need for (understanding) Speed

To what level of detail should naval architects be evaluating propeller performance?

When it comes to the design of many vessels, naval architects are selling speed… or so one would think. Actually, they are selling speed ‘with conditions’. Those conditions are many, but a few of the major objectives and constraints are to deliver speed with: • High efficiency and minimal fuel consumption • Emissions within regulated limits • Acceptable cavitation to avoid erosion • Noise and vibration within habitable limits • Consideration of off-design dynamic power demands Successfully delivering speed for a client is rightly considered by naval architects as a systems engineering task. The big and high value decisions are best achieved by first properly specifying the connected performance of the hull-propulsor-drive system components. While it is common for naval architects to be intimately involved in the selection and integration of engines and transmissions — including their structural interface with the vessel — it is less common that naval architects are involved at the same level of design or engineering for propulsors. For many, the responsibility for successfully delivering the propulsor is off-loaded to a specialist or manufacturer, with little (if any) input over the final design given by the naval architect. For propeller-driven craft, it is now imperative that naval architects understand in greater detail about the propeller that is being proposed for their vessels. While their job is indeed to evaluate the system, everyone benefits when the naval architect is also involved in the specification and design of the propeller. Not only are client outcomes more successful (making everyone happy), but company risk is lessened, expectations are better shared with manufacturers, and hull form design can be influenced and improved.



Radial Definition of Blade Element Slices

So, what does it take for a naval architect to acquire the necessary engineering knowledge on behalf of a client? Let’s start to answer that question by reviewing the propeller design process. Stages of the propeller design process Propeller design follows an iterative process of refinement, often referred to as a ‘design spiral’. During this engineering process, the design matures across multiple evolutionary revisions. A ‘solution’ is identified at each stage that conforms to an increasing level of detail. The principal stages for propeller design are generally:

1. Identification of principal system characteristics
2. Determine optimum radial distributions of blade shape
3. CAD development of the propeller geometry
4. CFD and FEA analysis for advanced requirements
5. Validation by model testing

Principal system characteristics

Most naval architects are well versed and comfortable with the tasks in Stage 1, where the propeller's performance requirements are established. A software tool is used for this task, for example. A resistance prediction typically establishes the propeller's thrust requirement, and a propulsion system analysis predicts hull-propulsor interaction (such as wake fraction and thrust deduction) and the propeller's corresponding developed thrust. This stage also is typically where the propeller's principal characteristics and operating rpm are defined. An optimum combination of propeller parameters will be calculated and specified to meet not only the required thrust at speed, but to do so in a way that also meets diameter restrictions, maximum efficiency, thickness requirements (for class rules as needed), engine power constraints, and acceptable cavitation levels. With some software , an initial assessment of noise and vibration can also be conducted. At this stage, the propeller is described by the following characteristics: • Configuration (open or ducted) and style (e.g., B Series, Gawn, Kaplan, NACA) • Blade count, diameter, mean effective pitch, and blade area ratio .

Calculations to identify these characteristics are carried out using parametric-empirical methods (also known as [1D] methods). When applied correctly, they can be very capable tools to determine component characteristics for the purposes of system analysis (and to specify final propellers that are of a stock design). They will also provide the framework for continuing to higher -order, more-detailed propeller design or analysis.

Radial distributions of blade shape

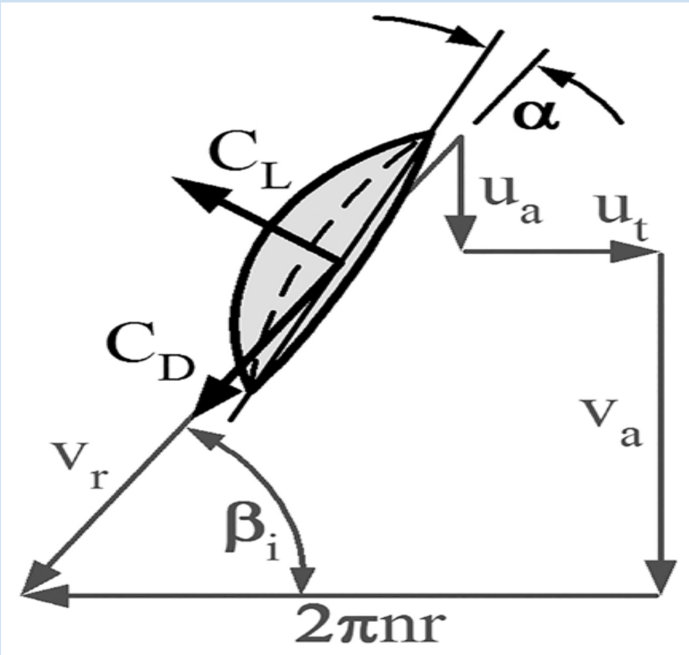
The next level of calculation detail — and the deepest level of propeller design probably needed by most naval architects — is conducted using a 'wake-adapted' propeller design tool. This simply means that it allows the user to define the velocities (i.e., the wake field) into the propeller with a greater level of precision. This is often referred to as a [2D] calculation, as it increases the order of detail from just the principal parameters and allows for radial refinement of propeller blade shape into 'element' slices. In the 'parametric' [1D] calculation in Stage 1, for example, the velocities are described by speed and wake fraction. In Stage 2, these are further refined within the propeller's radial coordinate system. For the purposes of the [2D] order of calculation, the full wake field is typically simplified into 'circumferentially average' velocities versus radial position. The [2D] analysis also predicts velocities that are 'induced' by the propeller rotation, both axial and rotational (tangential). These induced velocities are organised with the wake field velocities into a set of vectors that describe how the blade section foil shape 'flies' through the water. Note that proper [2D] propeller calculations must also consider additional flow corrections for blade thickness, curvature, and compression. It is at this angle of attack and inflow velocity that the lift and drag of the foil can be predicted, the body forces at each radial position determined, and the thrust and torque integrated for the entire propeller.

The calculation methodologies of this stage can also computationally determine optimised distributions of pitch and camber (mean line) to meet a thrust or power requirement. Cavitation checks are available on each radial section in more detail than the [1D] 'whole-propeller' review of cavitation percentage, for example, which can aid in the selection of specific chord length. A strength calculation based on enhanced beam theory offers additional blade thickness refinement. The design can be modified in the [2D] setting in a way that it cannot for a [1D] calculation, such as to 'unload' the blade toward the tip or hub (typically for hydro acoustic or vibration purposes). Finally, the optimised propeller is then evaluated for thrust, efficiency, power, cavitation, and additional performance metrics. If the performance of the propeller at the conclusion of this stage is sufficiently different from the results from the earlier Stage 1, a full KT-KQ curve can be developed and the system calculations can be repeated for improved speed predictions.

Companion to CFD or FEA

Many naval architectural firms actively promote the use of CFD for their projects. It may be fair to say that at this point in time all naval architects have considered it!

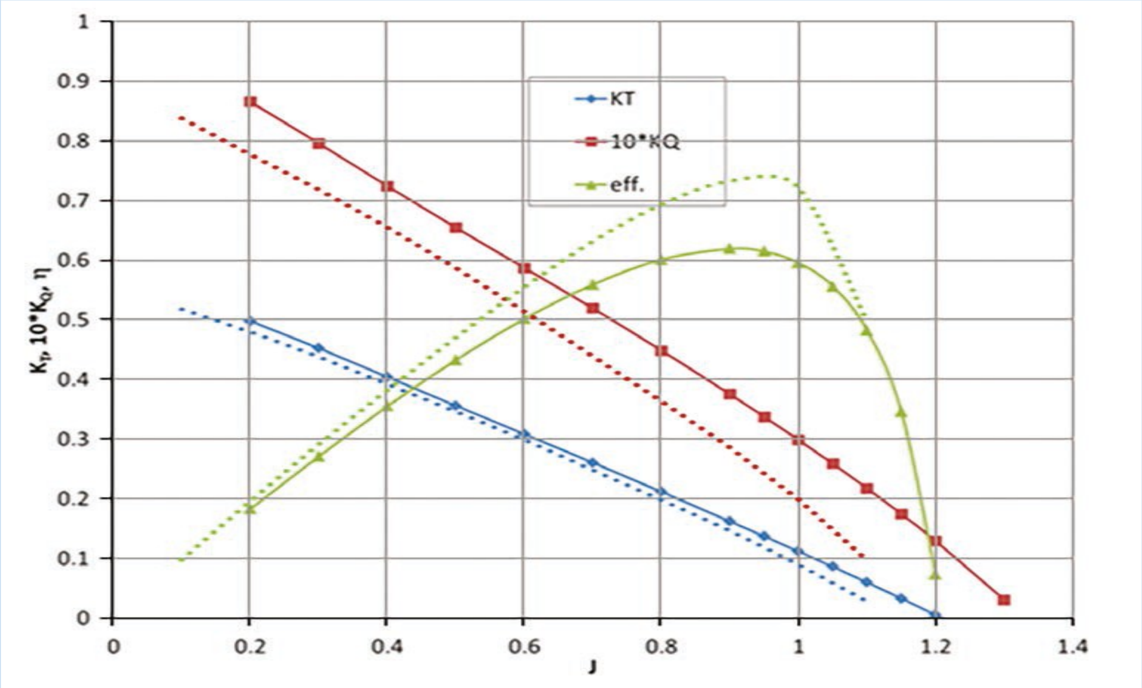
The use of CFD for even deeper analytical review is particularly valid where the ship's mission is highly sensitive to noise or vibration (such as military or cruise ships), where it is very heavily loaded and exhibits substantial cavitation, or where the business plan justifies searching for the last bit of efficiency. Finite element analysis (FEA) may also be justified during this stage. The objective of this stage would be additional refinement of not only the radial distribution of parameters (as was investigated with the [2D] calculations), but also for section foil shape details (e.g., camber and nose shape for an objective pressure distribution). The 'wake-adapted' [2D] analysis is often used to provide the preparatory staging for higher order analysis with FEA or CFD. For example, Prop elements can export a polar grid of the 'body forces' and velocities that can be applied as a highly-efficient propeller actuator disk replacement. In fact, employing a [2D] analysis before embarking on CFD can greatly increase its effectiveness by providing a more precise qualitative and quantitative foundation. Conducting CFD studies without a solid [2D] propeller code is like trying to run before learning how to walk — it can be done, but it comes with a lot of pain.



Blade element velocities

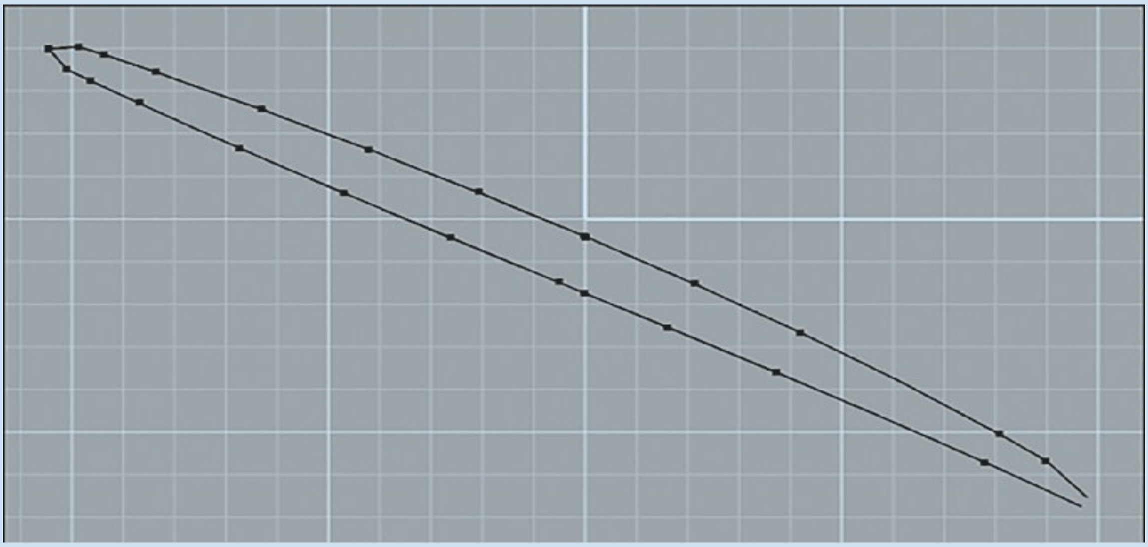
A case for greater involvement

Why should a naval architect be involved in propeller design at a more detailed level? Is it not the job of the naval architect to get the system right? And then hand it off to a specialist if needed? Valid questions. Let's consider a real case that we observed recently regarding CFD modeling of a propeller for an integrated self-propulsion study. The calculation report showed a KT-KQ curve — with no comparison to a baseline or validation model, just the set of curves. Are the curves correct? It is hard to tell. So, supporting calculations were run to provide a quantitative baseline check on the calculations. Guess what? Big problems: KT was pretty good, but KQ was greatly over-predicted. What caused the problems? It was the CAD function in the CFD code. It simplified the sections into a polyline-faceted geometry. This geometric treatment was never caught until the [3D] CFD calculations were checked against the [2D] benchmarks and an investigation started to determine why they were so different. After correcting the nose with geometry that was refined to better capture the curvature, the KQ calculation was much closer to the [2D] benchmark. Of course, checking higher order codes is not the only reason for naval architects to be actively involved with more detailed propeller calculations. It is precisely because naval architects are the "keepers of the system knowledge" that they need to be a partner in the propeller design process. A propeller design impacts the system. For example, let's consider a hull form that causes a 'shadowing' of water velocity behind a skeg. This disruption of uniformity in the wake field might cause excessive cavitation, radiated noise, and structural fatigue failure. Contracted propeller specialists or manufacturers typically only have design authority over the propeller, so they are limited to improvements that they can suggest to mitigate inflow problems



Validation study with [2D] propeller code

such things as increased skew, thicker blades, or reduced diameter (to lengthen the hydraulic transmission of pulses), all of which also have a fuel-efficiency penalty. On the other hand, the naval architect can do those things as well, but can also consider changing the stern lines, altering the shaft angle, looking to a different shaft rpm, and many other measures to improve the propeller component and the system. It is certainly appropriate in many projects to involve a propeller specialist, but it should always be done with knowledgeable interaction from the naval architect.



Inaccurate Polyline Simplification of Blade

Acknowledgements: Donald MacPherson, Hydro Comp Inc,

A Reminder to our Members and a Lesson to our Newcomers

WHY IS A SHIP CALLED A SHE ?

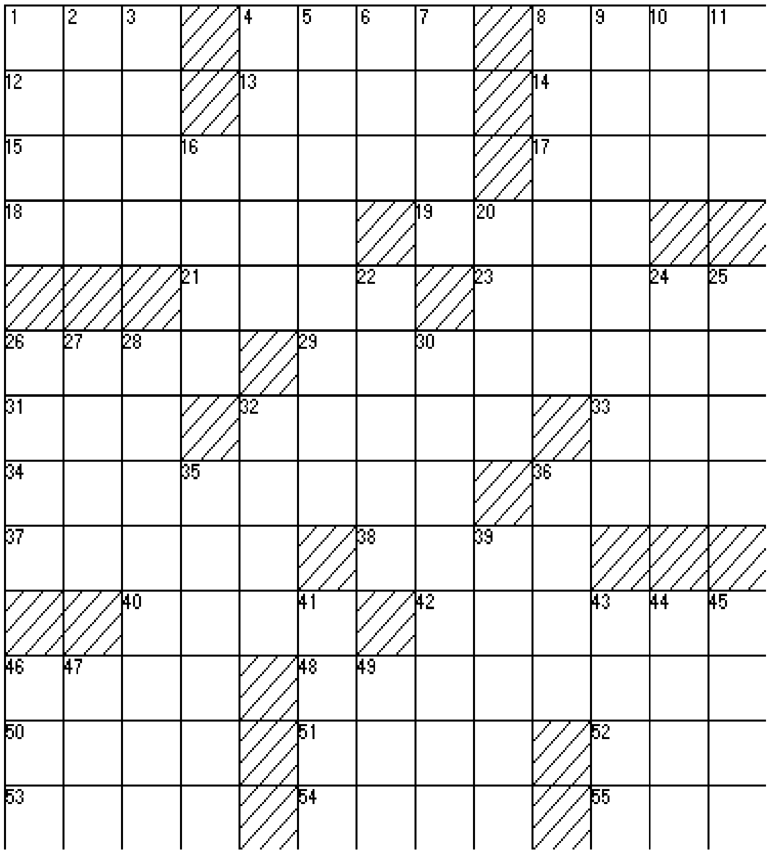
A Ship is called a ***'she'*** because there is always a great deal of bustle around her; there is usually a gang of men about, she has a waist and stays; it takes a lot of paint to keep her looking good; it is not the initial expense that breaks you, it is the upkeep; she can be all decked out; it takes an experienced man to handle her correctly; and without a man at the helm, she is absolutely uncontrollable. She shows her topsides, hides her bottom and when coming into port, always heads for the buoys.

Anonymous

TOJ Crossword

ACROSS

1. Relative biological effectiveness, abbr.
4. Type genus of the Gliridae
8. Millisecond
12. ___ of corn
13. Accounting inventory system
14. Trees or shrubs having winged fruit
15. In a way, energized
17. Covered with or tinged with gold or a golden color
18. Live in
19. Adventure story
21. Body fluids
23. Rounds of duty
26. Small; for travel on water
29. Something added to enhance food or gasoline or paint or medicine
31. Select
32. Attila
33. Former OSS
34. Any of numerous small slender long-tailed parrots
36. Villains
37. Fortify
38. Soul and calypso song
40. Site of the famous Leaning Tower
42. Athapaskan language
46. Jacob __, American journalist
48. A priori
50. An inflammatory disease involving the oil glands of the skin
51. Unit of weight used in some Mediterranean countries
52. Leaf or strip from a leaf of the talipot palm
53. These (old English)
54. Days
55. More (Spanish)



DOWN

1. Backside
2. Affliction
3. Greek goddess of discord
4. In a forest, open space
5. Knowledgeable
6. Nigerian City
7. Turfs
8. Grub
9. Neuralgia along the sciatic nerve
10. Fish
11. Cathode-ray tube
16. Becloud
20. Plant part
22. Wood-chopping tools
24. Enthusiastic
25. Oceans
26. Smacks
27. Malacopterygian
28. Extracted from the nightshade family
30. Explode
32. Supplements with difficulty
35. In a way, makes a showing
36. Rodent
39. Visits
41. Swiss river
43. Material
44. Fissures
45. Sorrels
46. Radioactivity unit
47. Water in the solid state
49. Calendar month

Hydrogen Fuel Cell Technology for Marine Propulsion

Due to regulatory pressures, fuel prices, emmisions. IOPP, IAPP requirements and so on, research into alternative fuels is an ever growing area of interest.

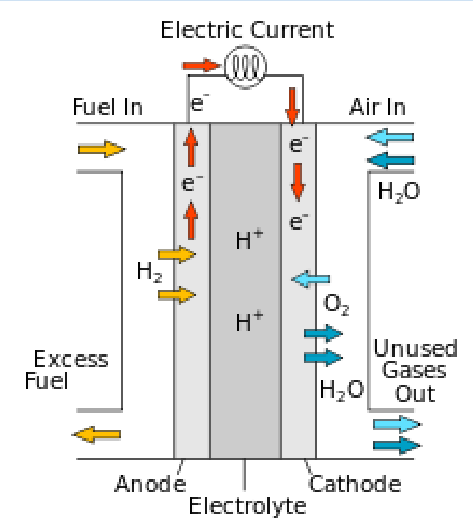
One area is the Hydrogen Fuel Cell Technology.

But first of all "What is a fuel cell"?

A fuel cell is an electrochemical cell that converts the chemical energy from a fuel into electricity through an electrochemical reaction

Fuel cells create a continuous supply of electricity by converting a continuous supply of fuel (in this cafe hydrogen) mixed with oxygen. Individual fuel cells only generate a small voltage but they can be stacked in series for a higher voltage or in parallel for higher amperage to generate whatever voltage/amperage you require. By products are water and carbon dioxide.

So How Does it work?



Referring to the above diagram you have an anode which is the hydrogen fuel, an electrolyte which can be potassium hydroxide, and oxygen or air which acts as the cathode.

The electrolyte allows positively charged hydrogen ions (protons) to move between the two sides of the fuel cell.

At the anode a catalyst causes the fuel to undergo an oxidation reaction that generate protons and electrons. The protons flow from the anode to the cathode through the electrolyte and at the same time, electrons are drawn from the anode to the cathode through an external circuit, producing direct current electricity. At the cathode, another catalyst causes hydrogen ions, electrons, and oxygen to react, forming hot water which is discarded as a by product.

Energy efficiency is about 50% but if you used the hot water by product for say a preheat for boiler water, that percentage will obviously increase.

The fuel cell is not a recent invention having been first referenced in 1836 then again in 1839 and sketched in1842. In 1939 a 5 Kw stationary fuel cell was developed, in 1958 it was modified by using a modified membrane as an electrolyte leading to the first commercial use of a fuel cell in 1959. A fuel cell was patented in the 1960's for use in US Spacecraft and provided electricity and water to that programme, and in 1991 a fuel cell was developed for use as a power source for automobiles.

OK that's all well and good but how can this power source be used on ships?

Pluses and Minuses of Fuel Cells

Hydrogen fuel cells are found in use on a number of yachts and pleasure motorboats but their use in the commercial merchant marines of the world are rare because of the high cost.

As development continues and sales increase with price decrease combined with the highly attractive feature concerning clean green emissions , it is bound to look more and more attractive and economically viable than trying to keep up with the regulatory requirements with the costs they incur. Also units can be placed at any convenient place on a ship whether used for propulsion or electricity requirements in general.

Trials are indeed taking place with a vessel using wind turbines and solar panels by day, and fuel cells by night using hydrogen extracted from seawater by electrolysis.

For ships the advantages are no harmful emissions, low noise operation, "put anywhere" generator positioning and low maintenance.

The disadvantages however are the volativity of hydrogen and the fuel tank technology needed to store the fuel. Also if liquid fuel is carried on board in tanks there is insulation to worry about along with refrigeration requirements to keep the hydrogen in its liquid state not to mention the tank material as liquid hydrogen is also very corrosive.

Liquid hydrogen bunkering facilities are few and far between at this time but as fuel cell technology gets more and more used, these services will become more and more common.

The only commercial vessel using fuel cell technology is the Norwegian registered OSV "Viking Lady" which generates 320 Kw of power from its fuel cells, uses hydrogen gas for its fuel and operates the cell at a temperature of 650 degrees Centigrade.

Viking Lady

Acknowledgements: Iain Armstrong

The Voicepipe

The passing of Ken Lowe is a sad loss to the Institute and our condolences go out to his family.

The certain loss at some stage of SAIMENA house in Durban will be felt especially to those members and companies who put in so much effort to create it. Although Berea Rovers have confirmed that SAIMENA can use their new club house as a meeting place for the Durban branch I feel that our members will have lost a part of the Institutes identity.

We also have quite a lot of paraphernalia not only from SAIMENA house in Durban, but also from Athenium house in Cape Town although over the years a lot has now disappeared. I feel it is very important for the institute to find a new home where it can proudly display its identity and history especially so because our present meeting place in Cape Town and the future meeting place in Durban do not allow us to mount or display our paraphernalia in their venues.

With that in mind I urge the Durban and Cape Town branches in collusion with council to earnestly pursue an objective to create a new SAIMENA house which is ours, where our stuff can be shown off, where our members feel a sense of belonging , where our identity is felt, and our pride restored.

It doesn't matter if the new SAIMENA house is in Cape Town or Durban. It is not a competition between the two branches, it is far too important for that.

During my time with SAIMENA, branches were established in Port Elizabeth, East London, and Walvis Bay. East London and Walvis Bay were short lived simply because of lack of support. Port Elizabeth lasted longer but also eventually succumbed to apathy. I remember one member saying we should just have the meetings in a pub and share a beer.

We are more than that , we are the only independent voice for Marine Engineers and Naval Architects in South Africa, and there is no other NGO that can speak for us. We must not allow this Institute to wither and die.

What can be done?

Perhaps a programme aimed at the ship repair and building industries to get them to acknowledge and hopefully implement a programme that their future hire and newly promoted project managers and superintendents have to be SAIMENA members. That local shipping companies have the same stipulation for new hire marine engineer officers, that companies employing naval architects have a requirement that those they hire are also SAIMENA members, perhaps the SAN could insist on SAIMENA membership for its newly promoted engineer officers and engine room artificers. Many will say it's not possible but don't knock it if you haven't tried it.

There is strength in numbers and for many years our institute membership has stayed stagnant at about 450. As time moves on this number will drop due to resignations, deaths and insufficient new members, to a point where the institute will become unsustainable.

We cannot allow this to happen and with that in mind I would like to suggest a forum whereby proposals or suggestions on improving membership or finding a new home for SAIMENA be sent to me at iainfran1@gmail.com

All genuine replies will be placed in this magazine with acknowledgements to the author.

The Editor

News Snippets

1. Yanmar are developing the use of a biofuel as a fuel for marine use. The biofuel is a mixture of palm oil (Refered to as RBDPO) and HFO. Test are ongoing using various ratios of RBDPO and HFO of about 2000 running hrs each, emission evaluation, fuel nozzle build up, effect of heat on the biofuel, and effect on load for various RBDPO to HFO ratios, and others are being evaluated.

2. Now that cruise lines have got millions of Americans hooked on the pleasures of cruising, they're looking for ways to hook millions more. According to Art Rodney, president of Disney Cruise Lines, over 90% of Americans who can afford to take a cruise have not done so

3. Some technologies that can make ships emissions more "green" are:
   Exhaust Gas Recirculation: In this system, NOx emissions from the engine is reduced by recirculation of exhaust gas from engine cylinder with scavenge air which lowers the temperature of the combustion chamber. Some part of the exhaust air is re-circulated and added to scavenge air of the engine which reduces the oxygen content of the scavenge air along with temperature of combustion cylinder. With this method NOx reduction of up to 80% can be achieved.
   Water in Fuel: The addition of water in fuel just before its injection into the combustion chamber can reduce the temperature inside the cylinder liner. An efficient system for this can result in NOx reductions of up to 30-35%.

4. Drive by wire: In a diesel-electric propulsion system the need for direct mechanical connections to propellers and gearboxes is removed and replaced by cable connections allowing for much more flexibility in location of the various components. Since these systems commonly involve multiple engines it is usual for them to be split over two or more engine rooms that in modern ships are isolated from one and another conferring redundancy in the case of one engine room being put out of action by some cause. The multiple engine set up also means that each engine can be smaller in size and therefore the requirement for a very large space to accommodate a single engine is removed allowing designers more freedom.

5. UK-based Automated Ships and Norway-based Kongsberg are looking to build the *Hronn*, the world's first unmanned and fully automated vessel for offshore operations. It will be designed for scientific industry, offshore energy, and fish-farming and will utilize the Trondheim's fjord area for trials.

6. THE MILLER CYCLE : In the Miller Cycle the charge air is compressed to a higher pressure than is needed for the engine cycle. A reduced filling of the cylinders is then controlled by suitable timing of the inlet valve which then permits some expansion of the charge air to take place within the cylinders. This expansion process allows cooling of the charge at the beginning of the cycle whereupon its density increases. This results in the potential for the power of a given engine to be increased. The practical application of the Miller Cycle, however, requires a turbocharger capable of achieving high compressor pressure ratios in association with high efficiency at these conditions. While initially developed with the aim of increasing engine power density, it has been found that the Miller Cycle can be used, by reducing cycle temperatures at constant pressure, to reduce NOX formation during combustion.

The Editor

Why is H.M.S. Queen Elizabeth not Nuclear Powered ?

This a a very interesting question. Britain has had nuclear powered submarines for over 50 years so she has the capability to power her new aircraft carriers with nuclear power ,so let's put forward a theory as to why H.M.S Q.E is conventionally powered.

The H.M.S. .Queen Elizabeth is the largest warship ever to be built for the British Royal Navy, and could see a resurgence of British naval power.

First of all what is she powered with?

She has two Rolls-Royce Marine 36MW MT30 gas turbine alternators, providing over 70MW and four diesel engines providing approximately 40MW, with the total installed power approaching 110MW. .

So getting back to the question, here are some reasons why:

1. To build a nuclear powered carrier is considerably more expensive than a conventionally powered one

2. Although the British Empire is long gone, the country still has many interests and commitments away from the UK, so if you use these carriers to show the flag for instance, the ship must be able to do so at the home bases of her allies. New Zealand is one amongst others that has a no nuclear policy so none of the US Nuclear powered ships can enter New Zealand waters whereas H.M.S Q.E can. Also the Suez Canal is a nuclear free zone which means getting to the east is quicker and easier than a nuclear carrier which would have to go the long way round. There is a nuclear free treaty for latin America including the Panama Canal, but it is not sure if this treaty includes the transit of nuclear vessels.

3. The advantage in nuclear power in terms of speed is not very much being about 3 or 4 knots faster and does not effect greatly the ability for H.M.S.QE to get to places quickly.

4. There is the argument that to train crews to operate a nuclear plant on the Q E would be very expensive and time consuming ergo there is not enough time to train crews, This argument could perhaps be combatted by the fact that Britain has operated nuclear powered submarines for over 50 years and it can't be that much a transition from submarine powered nuclear vessels to surface ones.

H.M.S. Queen Elizabeth

5. It is often touted that it is a big advantage to be nuclear powered as the vessel will not need to refuel .
This is a complete misnomer as if nuclear powered she would still have to refuel with avgas for her aircraft, victualling, and various other items not connected with her propulsive and electrical supply power plant.

6. Connected with the above , would be the need periodically to replace her fuel cells which is very costly and would take the ship out of service for lengthy periods of time of about three years.

7. As the new RFA ships are equipped and designed to bunker all types of fuels simultaneously and any carrier battle group has to have RFA support capability any way, no time is lost by bunkering given the probable areas of operation.
The US ships have to cover the vast distances of the Pacific and being nuclear is advantageous for that scenario.

RFA Tiderace

8. The CODLAG (combined diesel-electric and gas turbine) arrangement adopted by the carrier is both efficient, reliable and allows great design flexibility. By using electric motors to drive the propellers, the diesel and gas turbine generators can be placed where convenient, rather than having to sit on the shaft line,.

9. The reactor of a Nuclear powered carrier is estimated to have a life span of around 30 years or shorter whereas the QE has a design life of 50 years. Experience with the nuclear submarines has shown that the estimated period before a midlife refit including the renewal of the reactor core is much shorter and more expensive than originally envisaged.

10. Start up time for a nuclear powered vessel is extensive but being diesel and gas turbine powered means HMS QE could be shut down and started up again in a much shorter amount of time.

Now having made mention of some of the advantages of HMS QE not being nuclear powered, here are some of the disadvantages.

1. Due to being slower and not having a steam or electro magnetic catapult, the amount of lift for aircraft is reduced resulting in a lower payload, however the ski lift and the use of VTOL aircraft makes less critical the need for a catapult although should the electro magnetic catapult be fitted at some time in the future, the spare electrical capacity of HMS QE will be more than enough.

2. If a whole carrier battle group was nuclear powered I would say that is an advantage due to the probability that fewer RFA ships would be required and even greater flexibility is achieved especially if the RFA ships are also nuclear powered.

3. The need for fuel tanks takes up space that could be used to carry additional aircraft.

4. There is not the increased space for accommodation which could increase the compliment of say marines.

There are, I am sure, many other advantages and disadvantages if HMS QE and HMS Prince of Wales were nuclear powered including of course the environmentalist concerns, so any further input on your thoughts would be gratefully received and if found with merit, published in the TOJ.
Here are a few other facts about the ship which can be regarded as quite interesting.

1. The two Stbd. Side islands instead of the single one was first devised by the Royal Navy and assists in aircraft take off and landing due to the decreased turbulance on deck that the single island design causes.
   However communications between ships officers and the flight command are now separated by the islands and some say this may cause a problem.

2. The island configuration allows hanger lifts to be installed out of the way of flight operations.

3. The ship can produce 500T of fresh water per day

4. The ships radar can track 1000 targets simultaneously.

5. The Phalanx anti missile/aircraft defence weapon can fire off at 3000 rounds per minute.

6. The carrier is only the second ship ever in the Royal Navy to have the title Queen.

HMS Queen Elizabeth 1943 (Courtesy: Maritime Quest)

Battleship HMS Queen Elizabeth predecessor to Carrier HMS Queen Elizabeth

Acknowledgements: Iain Armstrong

Wind Propulsion: The Flettner Sail and The Sky Sail

Methods that use the wind to provide energy to drive ships include a variety of techniques. Typically these embrace Flettner rotors, kites or spinnakers, soft sails, wing sails and wind turbines.

The Flettner rotor made its first appearance in the 1920s and utilises the Magnus effect of fluid mechanics, where if wind passes across a rotating cylinder a lift force is produced.
This force has a linear relationship with wind speed and, unlike conventional sails or aerofoils, a true cross-wind relative to the ship will produce a useful forward thrust at any ship speed even when this is greater than the wind speed.

For a large ship, Flettner rotors can provide a small but signicant proportion of the total propulsive power. However, the vorticity produced by a rotor is complex and a full understanding of the mechanisms is still evolving, principally through the means of computational fluid dynamics.

The vorticity in the wake of a rotor raises the issue of vortex interaction if more than one rotor is fitted to a ship. This requires exploration for a particular design, particularly with respect to any interference with the ship's superstructure or high freeboard under certain wind conditions.

When wind passes the spinning rotor sail, the air flow accelerates on one side and decelerates on the opposite side. This creates a thrust force that is perpendicular to the wind flow direction. Although it takes energy in the form of electricity to spin the sail, the thrust it produces means the engines can be significantly throttled back, so it reduces overall fuel use and emissions.Two Flettner rotor vessels, were built in the nineteen twenties, one of which managed to sail across the Atlantic to New York in 1926. But this early twentieth century attempt to harness the wind for ocean travel failed to compete with diesel power. Rotor sails at that time were too heavy and the costs too high for them to yield the expected fuel savings.Modern Flettner rotor sails are made using the latest intelligent lightweight composite sandwich materials, and offers a simple yet robust hi-tech solution, although they could still cost nearly US $3 million to install. A 240 metre-long tanker is planned to be retrofitted with two modernised versions of the Flettner rotor that are 30 metres tall and five metres in diameter. In favourable wind conditions, each sail can produce the equivalent of 3MW of power using only 50kW of electricity. Expectations are an average reduction of fuel consumption on typical global shipping routes by 7% to 10%, equivalent to about 1,000 metric tons of fuel a year.

Rotor sails are generally effective if the wind is moving faster than 18 kilometers per hour—roughly 10 knots—and is blowing across the ship's bow at an angle of at least 20°. Ships often encounter such conditions on northern Pacific and northern Atlantic shipping routes, The surface of the rotating cylinder drags air with it, which deflects the air pas-ing by the cylinder. Because the cylinder pushes the air to one side, the air must in turn push the cylinder the opposite way, thanks to Isaac New-ton's dictum that every action has an equal and opposite reaction. Thus, the rotating cylinder expe-riences a lift force perpen-dicular to the direction of the wind.

Another system is the Sky Sail:
Efficiency of the Sky Sails system has been tested for up to eight hours a day in winds of up to force five recently . The system was hailed as a success, with calculated savings of up to 2.5t of fuel/$1,000 a day. With larger sails of up to 600m², fuel savings of between 10% and 35% are considered possible.

Within the framework of the pilot phase, the SkySails-System is being explored on board the MS "Michael A." and the MS "Beluga SkySails" during regular shipping operations.

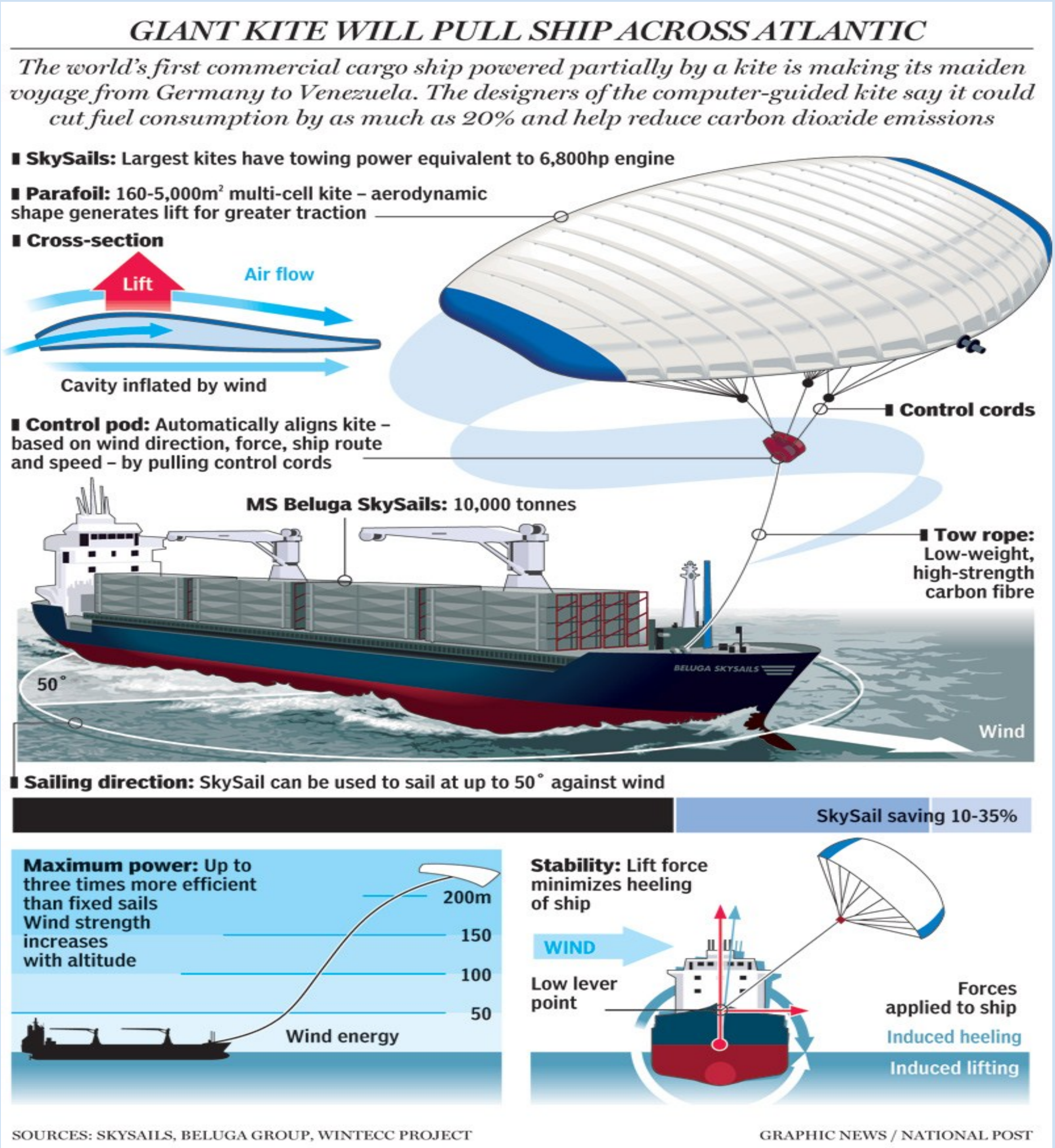
The ship was launched in December 2007, and held sea trials in the North Sea in January 2008, Throughout these trials the sys-tem's level of robustness and reliability is first of all being elevated to that demanded by our customers and its suitability for daily use established.

Subsequently the system's performance will be evaluated extensively and optimized. On both ships – the "Michael A." and the "Beluga SkySails" – the SkySails-System has been put into operation successfully.

The customer vessels remain in regular commercial operation throughout the pilot phase. Initially, two to three SkySails engi-neers will be aboard of each ship. All components are being long-term tested during use of the SkySails-System on board. The results immediately flow into the process of improving and optimizing the product..

.

Winds at high altitudes provide abundantly more energy than winds at surface level. Thus the use of energy-rich high-altitude winds represents the next generation of wind power. Large and fully automated kites are the key technology through which energy can be generated from high-altitude winds.



Acknowledgements: SkySails and Norsepower

Notice to Advertisers

As you may have noticed, ToJ carries an advertisement in this electronic edition for the first time.

After consultation, the SAIMENA Council approved a request to accept paid advertising, and agreed to continue accepting adverts on a regular basis.

The ToJ circulation list is essentially our individual membership, and we are aware that copies do make it into the hands of our friends and colleagues. Adverts are accepted on the basis that the interests of our members are served by highlighting goods or services which are relevant to our respective disciplines.

ToJ will accept advertising at R 500 per page per edition, and two editions per year are planned.

ToJ is our Institute's magazine, and while the advertising is a welcome and unexpected contribution, we may need to limit the number of pages set aside for advertising in any one edition to maintain the essence of our little publication.

We look forward to developing some new relationships!

Kind Regards

The Editors