

visual appearance, such a program will be fundamentally user-friendly.

- The way ship designers reason about compartments shows a duality. It can either be viewed from the compartment as such, with its boundaries (or their coordinates) as primary parameters, or from the bulkheads and decks which divide a ship hull into spaces. Our software supports both views, as well as a mixture.
- SOLAS rules for probabilistic damage stability are based on a schematic subdivision model (by so-called 'zones'), which has shown to lead to confusion and inconsistencies, because reality differs from this approximation. Fortunately, the theory of probabilities also allows for a realistic subdivision model, as has been adopted in PIAS, avoiding these inconsistencies. Obviously, to satisfy the occasional classification society that insists on conventionality, a zone-based method is also present.
- Two types of data exchange standards are commonly applied: either canonical, scientifically-based cathedrals of Product Data Technology, such as STEP, or standards that just support the transport of shape, such as DXF, 3D PDF, X3D and

JT. The first require a steep and expensive development path, and the second don't contain the constituting components and their functional parameters. Fortunately, there is an alternative where higher-level product elements are exchanged, see [2]. This concept provides a feasible and practical tool for interfacing between heterogeneous software products.

To generalise, user-friendliness can be improved by looking beyond User Interfaces, naval architectural conventions and coincidentally available mathematical methods. It requires a fundamental understanding of the underlying tasks and goals, as well as the preparedness to deviate from convention – but not too much.

Disclaimer

I realise that some of my statements are a bit outspoken. An earlier version of this article was full of relaxations and exceptions; however, in that way it became illegible. So, I saved them to this end: This article draws conclusions, based on general impressions and experiences. The examples are real, however the reference to the different classes of persons – ship designers, software users,

software developers – are generalised, with many positive exceptions of persons, programs and companies.

About the author

Herbert Koelman founded SARC in 1980, and is still engaged at SARC as director & principal developer. Since April 2018 he has been part time professor of Maritime Innovative Technologies at MIWB, a bachelor school of maritime operation, engineering and design in the Netherlands. SARC is the supplier of PIAS ship design and LOCOPIAS onboard loading and stability software, www.sarc.nl. [NA](#)

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2. H.J. KOELMAN. Computer Aided Ship Design 2030 – I Can See Clearly Now. Proc. HIPER'17, Zevenwacht, South-Africa, www.sarc.nl/wp-content/uploads/2017/10/Koelman-Hiper-2017.pdf.

From propellers to underwater noise

By anticipating the maritime industry's future problems, HydroComp has managed to successfully negotiate a changing landscape. Its newest initiative focuses on the issue of ship noise pollution

Even for experienced ship designers, coming to grips with propellers and their characteristics can sometimes be a daunting challenge. "It's a very messy physics problem," says Donald MacPherson, technical director, founder and co-owner of US-based software providers and consultants HydroComp.

"There's a lot going on. You can take two ships that are almost identical with two propellers that appear roughly the same. However, someone with a trained critical eye can look at the blade shape and edges, and quickly see the differences. I just happened to have a knack for finding 'the signal in the noise' and to see the whole system come

together. From early in my career, as soon as an employer or client learned I was not intimidated by propellers, I became the 'propeller guy' wherever I went."

HydroComp began trading commercially in 1984, initially as a small company that had been subcontracted to provide computer calculations for the shipyard where MacPherson was primarily employed as a naval architect. Gradually, the company became a full-time undertaking and in 1987 it released the first iteration of its NavCad software for speed and power performance analysis. Thirty-two years later it remains HydroComp's flagship product.

At the same time, MacPherson's mastery of the 'black art' of propellers meant he was in growing demand for special consultancy work and these continue to form the two main facets of the business: products and services.

"The split between the two varies from year to year, explains MacPherson. "Under services we include training, consulting and novel research. Right now we're doing a number of projects, including forensic studies for a ferry repower, development of a new surface-piercing propeller performance model for a high-speed craft system simulation, industrial mixer propellers, and a variety of small propulsor units for the submersible community."

In addition to NavCad, the company also has PropCad (for preparation of design drawings and construction data for propellers and thrusters), PropElements (for detailed propeller design) and PropExpert (a propeller selection tool for smaller vessels).

Evolving markets

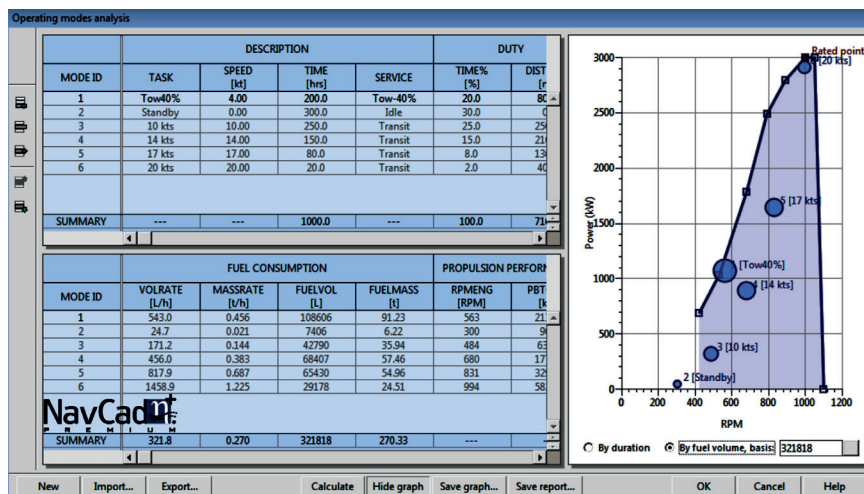
Jill Aaron, HydroComp's managing director and co-founder says the company's customer base has changed in recent years: "It used to be exclusively naval architects and marine engineers. Then our propeller expertise became a valuable asset for an emerging propeller and propulsion equipment manufacturer market. But as we've grown in terms of our product lines, we are now serving so many different interests that it can sometimes be hard to know where to put our energies.

"But naval architects remain our tried-and-true market. Like everyone, we were affected by the decline in offshore oil and gas, but then yachts really took over, and then cruise ships and polar vessels. We are fortunate to have diverse markets, and not to be locked into one particular segment or geographical region."

The challenge, MacPherson admits, for HydroComp and other CAD providers, is how to persuade a very conservative industry to look at the design process differently. Habitually, the option of a diesel engine, shaft drive, gear-box and conventional propellers will always be seen as the safe, risk-free option, with time pressures often leading them to forego exploring the wider possibilities.

"The innovation process is all about idea, research and implementation," says MacPherson. "But while you can point to a lot of research activity, we want to provide that path to innovation with implementation. By that I mean a pipeline to market, which must go through naval architects. At the moment they don't have a convenient way to investigate, say, sail assist or an asymmetric hybrid propulsion system – or any other emerging innovation for that matter – and we hope to address that."

In 2017, HydroComp was heavily involved in the hullform optimisation for an LNG-fuelled ro-pax design. This project, in partnership with Greek engineering company NAP Engineering,



More than 30 years after its original launch, NavCad remains HydroComp's most popular offering, but it's just one of a portfolio of products and services

was part of the EU-sponsored Poseidon Med II project for shipowner Blue Star Ferries (see *TNA*, January 2018). According to MacPherson it's a pointer to his company's future direction.

Moreover, with the industry now being forced to wake up to IMO's energy efficiency targets and other emission regulations, and the growing body of opinion that it will be hard to find significant improvements in fuel efficiency with conventional drive systems, for perhaps the first time there's real pressure to find alternative solutions.

Quantifiable pollutants

"It's not just with carbon and sulphur; a few months ago the UN had a meeting about establishing noise as a quantifiable pollutant," notes MacPherson. "This is an important and growing area of research that we hope HydroComp can provide technical leadership as not all approaches to noise mitigation are obvious.

"Some might include strategic decisions that are best served early in the design, such as hull form modifications for improved inflow or even the practical availability and characteristics of a quiet propeller. Others might be operational, such as speed reduction or route changes. Fortunately, all of these could be readily evaluated with the right tools, and we are working on solutions to make that happen for naval architects."

As part of its involvement with the Green Marine, a predominantly North American

non-profit organisation that sets voluntary environmental targets for the maritime industry, HydroComp has been heavily involved in an initiative to provide design-side tools to help naval architects effectively mitigate underwater radiated noise (URN). Using NavCad's 'Vessel-Propulsor-Drive' system simulation model, the aim is to address URN problems before the ship hits the water.

MacPherson says that, like propellers, URN is one of those areas of research for which he and HydroComp have a particular passion. "We're working with a university in the UK, and also with a few agencies and design offices in Canada.

"There are ways to assess propeller-driven noise in model tanks and with expensive computational studies, but only the largest shipping companies may have the critical mass to take on such studies, then implement on one ship to see how it goes. Those firms dealing with the remaining 99% of maritime activity currently have no opportunity to do that.

"Naval architects need practical engineering tools to deliver meaningful benefits to their projects and clients. We want to get tools into their hands so they can credibly investigate URN while simultaneously considering how to reduce 'cost of ownership' with new and emerging technologies such as sail assist or energy-saving devices like wake-equalizing ducts. Those are the companies that we look to serve." **NA**