

RAindrops

Robert Allan Ltd. Information & News Issue 14

Perspectives on LNG

The SAGE Team

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ROBERT ALLAN LTD.
NAVAL ARCHITECTS AND MARINE ENGINEERS



LNG Momentum

by: Mike Phillips, P.Eng.
Naval Architect

Things are getting exciting in the field of LNG fuelled vessel design at Robert Allan Ltd. Not only is the first of a series of three high-performance dual fuel *RAstar 4000-DF* escort tugs designed by Robert Allan Ltd. for Østensjø Rederi AS nearing completion at Gondan Shipyard in Spain, but our company has also been busy with creating new and innovative LNG fuelled vessel designs. Specifically, the design of a new *RAstar 3800-DF* tug for Ningbo Port Company Ltd. is near completion, and our design team has been working hard on improvements to our unique *RANGLer* series of purpose-designed LNG fuelled tugs, a class of sub-500 GT LNG fuelled tugs, and larger offshore service vessels (OSV) like our *RAmpage* class as well. This experience with LNG as a fuel has also recently been drawing customers to us for

other applications such as push boats and even bulk carriers.

Needless to say, momentum is building and we have been welcoming the design challenges. Not only does each customer bring to us a unique set of requirements that challenges us to create innovative solutions specifically tailored to their needs, but options in equipment (engines, cryogenic systems, etc.) have been steadily improving which are giving us and our customers additional choice as well as tantalizing opportunities for further innovation. LNG fuelled vessels are evolving quickly, and we expect that trend to continue well into the future as the market for these types of vessels expands. With a growing portfolio of LNG fuelled vessel designs and a mature understanding of the design risks and challenges associated with LNG, we are always looking forward to the next challenge in designing vessels for the future.



The Role of CFD in Tug Design

by: Bart Stockdill, P.Eng.
Technical Manager, Hydrodynamics

I joined Robert Allan Ltd. in 2004 fresh out of a master's program in Computational Fluid Dynamics (CFD) and mechanical engineering. At that time we did not use CFD since it was too expensive and time intensive for tugboat design. Over the next few years computing power got cheaper and CFD software became friendlier and easier to use. In 2009, we started doing CFD, mainly to support R&D projects. The timing was good since things had slowed down a bit with the recession. This gave us time to develop simulation techniques for hull resistance and self-propulsion and to validate them against real world data from sea trials and model testing.

CFD took a while to find its way into the day-to-day design process, particularly since early projects often took longer than expected due to technical challenges. This

was no surprise since there is always risk when you try something new, especially in CFD. Today it is hard to imagine developing a new design without it.

The *RAstar 4000* Dual Fuel (LNG and Diesel) tug design was supported by extensive CFD analysis, perhaps more so than any of our other designs to date. Self-propulsion simulations were carried out to optimize the incline angle of the z-drives and validate manufacturers' bollard pull predictions. Resistance and self-propulsion simulations calculated the maximum free running speed. Gas dispersion simulations guided the design of the LNG vent pipe. Escort simulations calculated the steering and braking performance.

It is critical that the gas cloud stays clear of combustion sources on the tug during an LNG release. This could occur in an emergency situation such as a fire in the LNG compartment. Cold gas is denser

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than warm gas and therefore has a tendency to sink, as shown by the plume on left side of Figure 1. Robert Allan Ltd. has designed a novel air injection system guided by CFD analysis that mitigates this problem. By injecting warm air into the vent pipe, the temperature of the gas can be raised enough to increase its buoyancy and avoid sinkage onto the aft deck; see right side of Figure 1.

CFD was also used to predict the escort steering and braking performance of the *RAstar 4000-DF* at 8, 10 and 12 knots and to ensure that escort stability criteria were met. The ability of CFD to capture detailed hydrodynamics is well demonstrated by the skeg vortex in Figure 2. This vortex is a result of generating high steering (lift) forces with the skeg; it is similar to the wing tip vortices generated by aircraft.

The *RAstar 4000-DF* project shows that CFD has become an important part of the high-performance tugboat design process. CFD will continue to support that process well into the future, probably in ways we cannot imagine now. As computing power and software continues to improve, many of the simulations that we find challenging today will become easier and cheaper. But at the same time we will be tackling new areas of simulation, such as seakeeping and manoeuvring, both of which are just now beginning to come within reach. In the end, we want to continuously strive to improve our designs and design processes, and there is no doubt that CFD will help us do that.

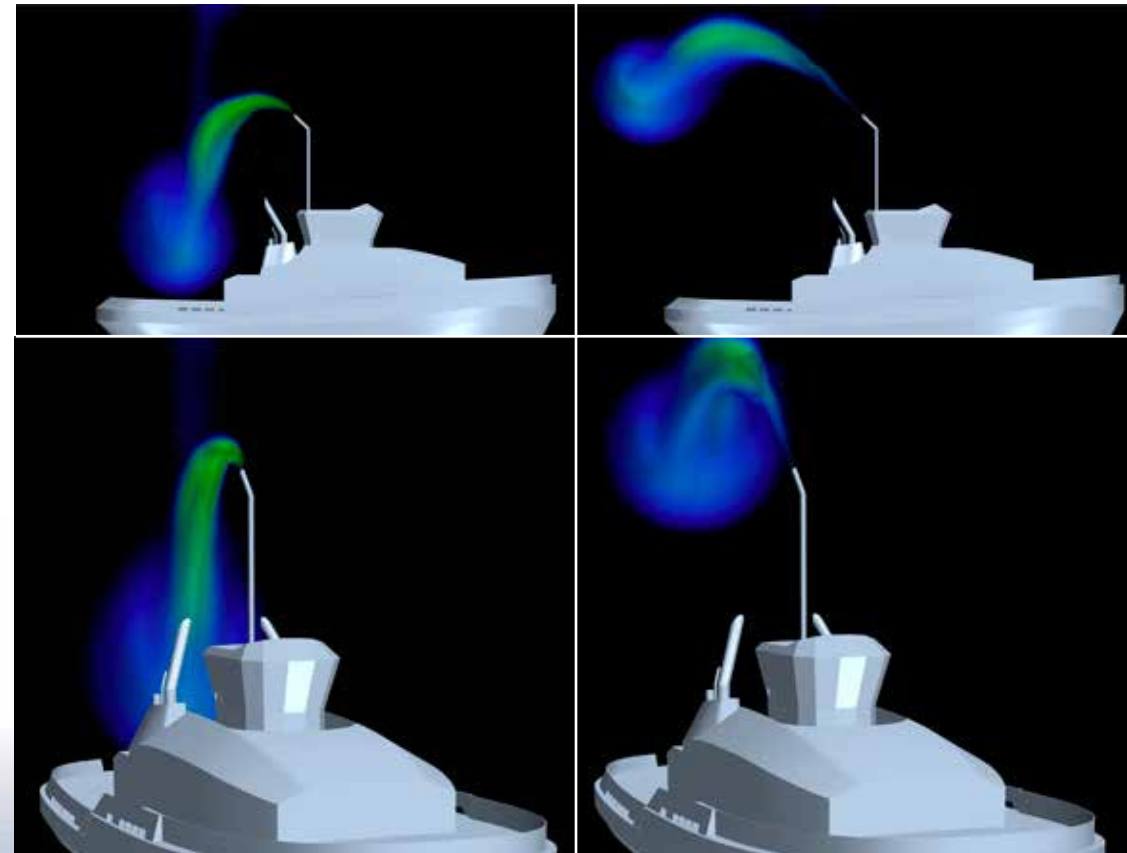
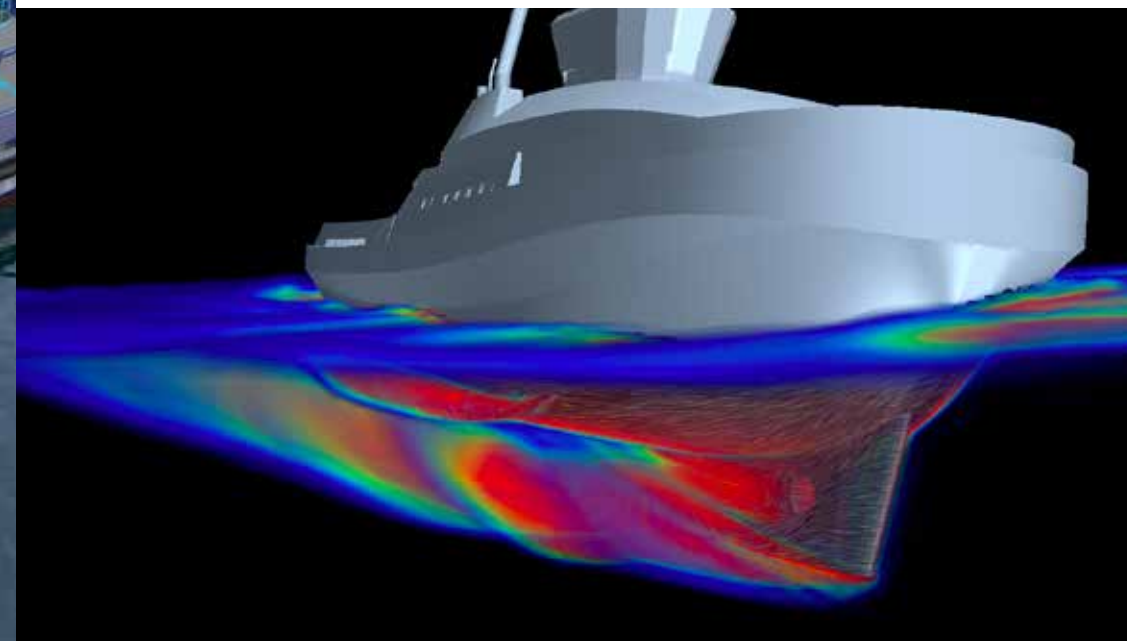


Figure 1: *RAstar 4000-DF* CH₄ Gas Release with Standard Vent Mast (left) and Air Injection System (right)



Figure 2: *RAstar 4000-DF* Escorting at 8 knots, 25° Yaw and 6° Heel, Skeg Vortex Visible on Starboard Side



The SAGE Team

Guiding the Future with an Eye to the Past

by: Robert G. Allan, P.Eng.
Executive Chairman of the Board

The world of ship design has changed dramatically in the past decade or so. Today we regularly use powerful tools such as Finite Element Analysis and Computational Fluid Dynamics to analyze and refine many aspects of our work. 3-D modelling of structures and vessel arrangements are routine today, and enable us to visualize the complete ship before any construction is contemplated. However such tools were simply not available either practically or economically to a relatively small consulting firm such as Robert Allan Ltd. 10-15 years ago. Although this company was the first in the marine industry in Canada to experiment with CADD in the early 1980's, even the basic tools of design are much advanced over what was available to us at that time (was it really 35 years ago?!). It wasn't so long ago (or maybe it was?) that the drafting board and slide rule were still our main tools. The CPU's were in our skulls.

Today's designers and engineers must master these new tools and be able to use them effectively and efficiently, ideally all with the purpose of making both the designs and the design process more efficient. But those with the knowledge of these new tools may not yet have the depth of experience to understand how and where in the design process they can prove to be most effective. Spending a lot of analytical time on non-critical areas of a design is expensive and likely non-productive. In these situations and in many others we are very fortunate at Robert Allan Ltd. to have a key group of senior employees who are still loving their roles as naval architects and engineers such that they have decided to defer retirement for "a while yet"! We call this group of talented and well-experienced professionals our SAGE team, as not only do they have some of the "wisdom of the ages", but collectively they are also **Some Awfully Good Engineers**. At Robert



Allan Ltd., we are extremely fortunate to have this cadre of talent and experience who offer their individual and collective lifetimes of ship design, engineering and shipbuilding knowledge and experience to help guide the next generation of talented young engineers and designers in our office.

The mentoring and guidance offered by this group is invaluable to the growth and development of the next generation of well-qualified engineers and naval architects in our company. It is next to impossible to replace the collective memory and knowledge of this group... as long as their memories last! 🚢

The SAGE Team today consists of the following:

		Years	
		Experience	At Robert Allan Ltd.
Rob Allan	Naval Architect	45	43
Fuzz Alexander	Mechanical Engineer/ Power Generation Specialist	51	11
Ken Harford	Mechanical/Marine/ Acoustical Engineer	46	28
Hans Muhlert	Naval Architect	46	46
Rollie Webb	Marine Engineer/Shipbuilder	42	8



RAMpage 5500-ZH Diesel-Hybrid built by Keppel Singmarine for Seaways International



Two Z-Tech® 2400's built by Eastern Shipbuilding Group for operation by G & H Towing Co.



RAsar 3200 built by Cheoy Lee Shipyards



Several more *RAMparts 3200-CL*'s built by Cheoy Lee Shipyards



TundRA 3600 built by Ocean Group



25th *RAMparts 2400-SX* built by Sanmar



TRAKtor 3200-V built by Astilleros Zamakona for Boluda Towage and Salvage



ATB push tugs design package for ITB Marine Group



Experience in the Parana Paraguay Waterway

by: Pedro Ventura
Contracts Manager (South America)

Paraguay is currently the country with the third largest fleet of river barges in the globe and growing fast. That fact is directly related to the growth of soybean and iron ore production in the region. Paraguay has no direct access to open seas, depending almost entirely on waterway transportation to export commodities to other nations.

Companies have operated in the Parana Paraguay Waterway for decades, transporting all sorts of products, relying on second hand towboats and barges from the Mississippi River system.

Noticing that these older vessels were designed for the North American river systems, and not necessarily for their needs, recent market entrants are turning their attention to new custom designed vessels. A new trend in the market is observed where most operators are now beginning to move in that same direction.

Robert Allan Ltd. has been involved with inland waterway transportation from its very early years, especially with very shallow-draft vessels in Canada's northlands. In the last decade, the company has taken a prominent role in the development of new vessels for South American rivers; defining more appropriate configurations, designing customized and much more efficient vessels, and supporting our clients during operation.

When developing a new project our team is presented with three main requirements:

- Enable our client to make informed decisions on their fleet concept
- Reduce the long term cost of the project
- Mitigate the risks to implementation and sustained operation

Each operation is different, thus the intended vessel needs to be customized. From flotilla sizes to river hazards, our team is prepared to develop the solution that fits each specific operation's needs.

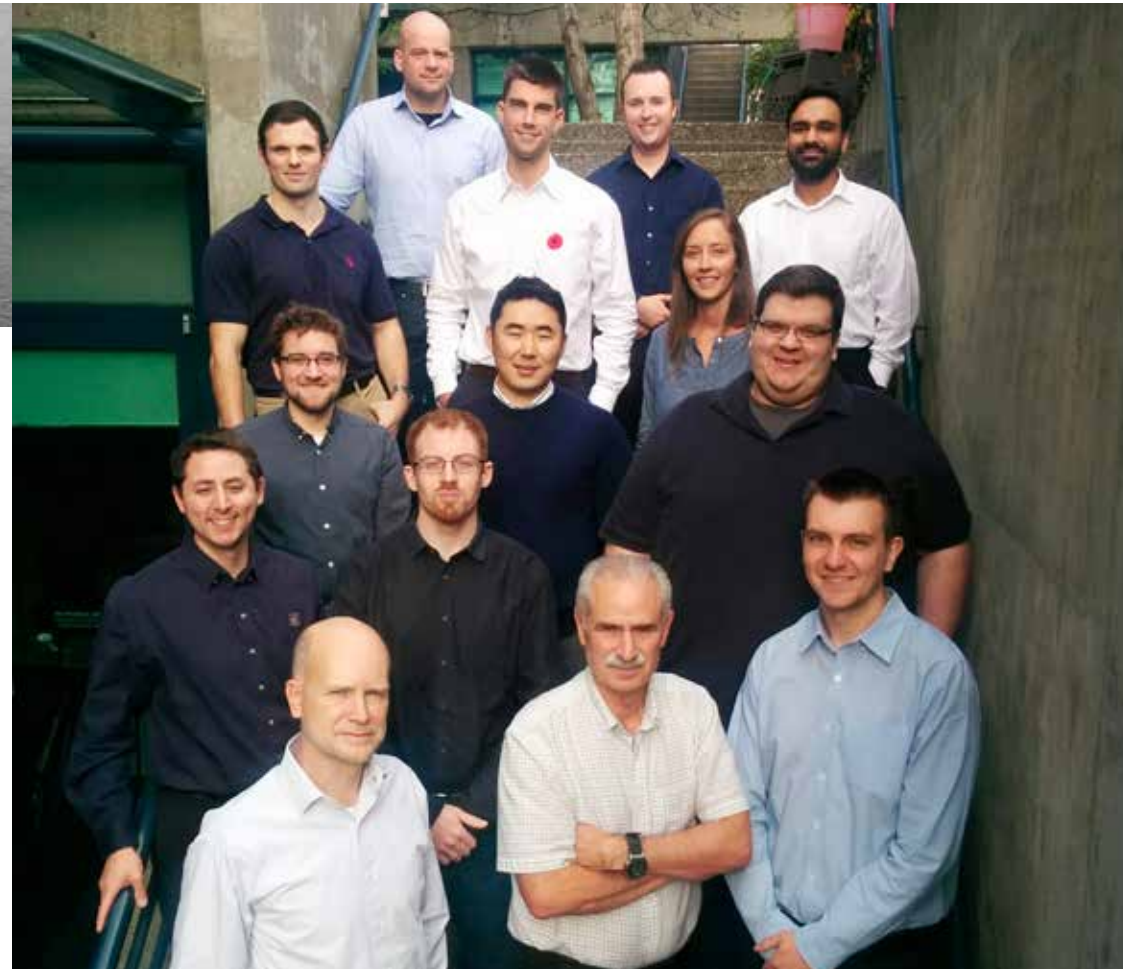


Fostering New Talent

by: Grant Brandlmayr
Manager, Design Services

For over 20 years, Robert Allan Ltd. has maintained a permanent student work term position within the office. This rotating position is typically offered three times a year to one or more students of Naval Architecture or Mechanical Engineering within universities in Canada. Our work term student program has expanded over the past two years to include the UBC NAME (Naval Architecture & Marine Engineering) program which is a one year Master's Degree in Naval Architecture. Up until that time, applications have primarily been received from University of British Columbia (Undergrad program), University of Victoria and Memorial University of Newfoundland.

Robert Allan Ltd. has a large number of current employees who were a part of



the student work term program and in some cases did more than one work term. These include:

Scott Borstad	UVic
Greg Bossons	UBC
Matthew Buat	UBC
Chandan Deol	UBC
Tony Diez	Memorial University
Robert Gage	UBC
Erik Johnston	UBC
Daeok Kwak	Memorial University
Andra Papuc	UBC
Michael Phillips	Memorial University
Brendan Smoker	UVic
Barton Stockdill	UVic
Allan Turner	UVic
Scott Wilson	UVic

An amazing number of these people who had their introduction to Robert Allan Ltd. as students have recently also joined the ownership group. They are: Erik Johnston, Andra Papuc, Michael Phillips, Barton Stockdill and Allan Turner.

The original reason for implementing this program was to provide students the opportunity to get meaningful work experience in an active consulting/design office environment. That original premise is still relevant today for the students, but another clear result has been the ongoing growth and stability of Robert Allan Ltd. as evident by the number of students who have elected to build their professional careers with, and to help grow this long-established company. 🚢

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On the cover is *Ocean Taiga*, the second of a pair of *TundRA 3600* icebreaking escort tugs for Group Ocean of Quebec City, Canada.

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