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The CSIRO Project
by: Bilyana Ivanova, P. Eng.
Naval Architect

Robert Allan Ltd. designs include not only tugs and work boats but many other vessel types with unique requirements, designed for challenging operational conditions. Anticipating the demand for research vessels for near shore and deep sea service, Robert Allan Ltd. and Alion Science & Technology Corp, of Arlington Virginia recently formed a Joint venture to pursue work in this field. This joint venture, known as RALion, has been successful on many fronts.

In 2009 the Australian government allocated $120 million AUD to support an upgrade of their marine research infrastructure as part of the Super Science Marine and Climate initiative. Part of this initiative was to replace an aging research vessel with a modern, state-of-the-art vessel. Robert Allan Ltd's experience in ice class design, along with a portfolio of successful offshore vessels designs, coupled with Alion's experience in research vessel designs secured this interesting and challenging project. The Design team worked closely with the scientific team to produce an exceptionally environmental friendly, quiet and clean vessel design.

The new vessel, named the RV Investigator, has recently been delivered to the Australian science community CSIRO (Commonwealth Scientific and Industrial Research Organization) at its home port of Hobart, Tasmania. The RV Investigator allows scientists to get closer to the ice edge of Antarctica than ever before, operating continuously for 60 days at 12 knots with a range of 10,000 nm. The vessel accommodates 60 scientists and supports a broad range of scientific activities. The RV Investigator will operate with low levels of radiated noise to allow for enhanced science operations.

The RV Investigator's hull shape was designed to ensure any bubbles formed by the hull moving through the water (bubble sweep-down) would not interfere with the acoustic equipment. The soft nose stem and bow shape help to achieve this. RV Investigator achieved DNV-Silent-R notation, which puts her among the quietest vessels in the world. Extensive noise control and anti-vibration design measures such as double isolation of equipment, electric propulsion, a specially designed hull shape, and unique propellers allowed meeting these stringent DNV noise criteria.

The scientific and analytical capability on board includes CTD instrumentation for measuring temperature and salinity in the ocean and other properties. A gondola attached to the ship's hull is a hydrodynamically designed steel housing containing advanced sonar technology for 3D mapping of the seafloor. There are two drop keels that can be lowered or raised enabling hydrophones and transducers to work below the bubble layer, and the 360° camera provides detailed images of the underwater environment. Towed equipment allows collection of data and capturing of specimens down to a depth of 5,000 m. The weather radar, air chemistry and aerosol laboratories allow analysis of the interaction between the ocean and atmosphere.

The RV Investigator is truly a state of the art vessel and will serve the Owners well for many years. RALion looks forward to utilizing its experienced design team on future research vessels for other challenging applications.
Activities in Asia
by: Mavis Ye, P.Eng, Naval Architect

The Shipbuilding industry has always been strong and active in Asia, mostly for larger cargo vessels and workboats for the local industry.

The recent development of a vibrant export market in China in particular for all types of goods has resulted in an active market for high-performance tugs and similar workboats for both the domestic and worldwide markets. Vessels designed by Robert Allan Ltd. are well recognized and valued in Asia for their distinguished style and innovative design. ASD tugs including the Ramparts, Råstår and Z-Tech® class of vessels have proven to be very popular in the area and have created a strong international demand for these high value vessels. Major fireboats designed by Robert Allan Ltd. have worked in Singapore, starting with Robert Allan Ltd. for Hong Kong, Dongguan and Shenzhen have been well received.

Robert Allan Ltd. has had a long and successful history working in Singapore, starting with patrol, crew and supply boats in the 70’s, to current Ramparts, Råstår and Råmpage series tugs. A collaborative effort between PSA Marine, Cheoy Lee Shipyards (Hong Kong) and Robert Allan Ltd. led to the development of the award winning Z-Tech® series of tugs, of which 12 have been delivered to PSA Marine and 21 to the Panama Canal. More recently, Sembawang Shipyards has completed one of the most sophisticated research vessels in the world – the RV Investigator, recently delivered to the Australian Government, and design by a joint venture of Robert Allan Ltd. and Allion Science and Technology (RALion).

When the Ningbo Port decided to build two Robert Allan Ltd. Ramparts design in 2004, (the first time a Chinese port had selected a design from outside of China) the door was opened for a whole new market – the exceptional performance was highly praised by the Port and the aesthetically pleasing look caught people’s attention. Currently in mainland China, shipyards in Guangzhou, Shanghai, Zhenjiang and Tianjin are building Robert Allan Ltd. vessels, both for existing clients and on speculation. The dominant theme for all of these vessels is their high value in the export market, due to the recognized high standard of design and performance. The traits also tend to lead the yards to build these tugs to a relatively higher quality.

Robert Allan Ltd. and Cheoy Lee Shipyards in Hong Kong have enjoyed a long and prosperous relationship, with over 60 tugs built to date and more coming!

Looking forward, the workboat market in Asia is still very strong, and Robert Allan Ltd. is poised for an extended period of growth in the region. 😊

To Hybrid or Not to Hybrid?
by: Robin Stapleton MA.Sc., P.Eng, Electro-Mechanical Engineer

Should we make our workboat a hybrid? The general answer is – “maybe”. There is the potential to save significant amounts of fuel, but there is added capital cost, technology concerns and many varieties of hybrid to choose from. That’s where we at Robert Allan Ltd. can bring our expertise to help choose the optimal solution for each specific application.

Fuel consumption savings can be significant for a hybrid under the right conditions. The world’s first hybrid tugs, the Carolyn Dorothy and Campbell Foss, reportedly demonstrate ~25% real world fuel savings! A large variation in the propulsion system loading and then matching the hybrid system to the main operating conditions are the key to such savings.

Maturity of technology is a common concern with hybrids. That is being alleviated by the experience accumulated by the hybrid tugs, ferries and other workboats currently in service. Manufacturer’s hybrid products have moved from prototypes to proven and off the shelf products. Z-drive manufacturers are providing for PTI/PTOs directly on their drives, which simplifies the mechanical transmission system. Permanent magnet motors and electrically variable transmissions are being developed. Battery technologies are continually improving with better chemistries, cooling methods and economy of scale leading to higher power and energy densities, increased reliability and life and reduced cost.

The slow building of interest in hybrids has really exploded in 2014 with many hybrid projects coming to fruition worldwide including, ferries, tugs and offshore support vessels. Notable for Robert Allan Ltd. is the ART 80-32, 32 metre Rotortug recently delivered.

Robert Allan Ltd.’s focus as an independent consultant is always to ensure solutions have real benefits both environmentally and economically. We analyze and optimize hybrid systems for specific vessels and client’s applications.

Robert Allan Ltd. is dedicated to the development and implementation of hybrid and other alternative powering configurations where they benefit the environment and the owner’s pocket book! 🇨🇳

3. Schottel optional PTI motors on the back end of the SRP 3000 and 4000 for example.
Underwater Noise
by Andra Papuc, P. Eng.
Mechanical Engineer

Underwater noise caused by shipping is becoming an increasing concern for biologists and the maritime industry alike. Although much more research is still required to define the short and long term effects of shipping noise on marine life, it is becoming clear that the presence of additional noise from shipping can have negative consequences. As naval architects it is our responsibility to address this issue at the design stage and to implement solutions in a practical way.

The ocean is a very large and very noisy place. Many aquatic species use sound to communicate. Cetaceans (whales, dolphins, porpoises, etc.) use it to maintain complex social structures over large distances, especially for mating and contact. Sound is also used during hunting for distinguishing prey and for echo-location while navigating. Different species use different frequency ranges. For instance the dominant range used by Humpback Whales is 120-4,000 Hz. For Orcas, the range is 6,000-12,000 Hz, and for California Sea Lions it is 500-4,000 Hz. Pacific Blue Whales on the other hand communicate at low frequencies, 16-24 Hz.

Shipping noise is primarily in the 10-500 Hz range. Noise created by passing ships can mask other noises, confuse marine life and potentially exceed pain thresholds. Sound travels more than four times faster in water than in air and the intensity of sound waves is greater in water since the density of water is much higher than air. Even if a ship is not very noisy above the water, the situation may be very different below the surface.

There are many sources of noise from ships. Which are dominant in any particular case depends on the type of ship, application, and area of operation. Hydrodynamic turbulence around the hull or appendages, bow waves, stern wakes and slamming in waves can all generate noise. Propellers can be major sources of noise of course; particularly propeller cavitation and propeller singing. Cavitation noise results from the rapid collapse of water vapour bubbles forming in low pressure areas of the propeller blades. The noise from cavitation is ‘broad band’ in the sense that it extends over a wide range of frequencies. Singing on the other hand is very ‘tonal’; i.e. single frequency, and is the result of a propeller or blade ‘ringing’ like bell in response to an excitation from vortex shedding or other flow-induced excitation. Both cavitation noise and singing can be mitigated through careful and proper propeller design, and by the implementation of specially designed anti-singing propeller edges. Onboard machinery can also add significantly to underwater noise.

Other factors can amplify or dampen ship borne noise. In shallow and confined areas, sound levels can increase when the flow around the hull is influenced by shallow water effects. Underwater terrain features can lead to sound reflections that results in a noisier environment. Ice can have an effect depending on water depth. Noise can also vary with vessel age and state of maintenance.

So what can be done to reduce and mitigate underwater noise as the shipping industry continues to expand? The best place to start is at the design stage when there are opportunities to implement noise reducing measures at little or no extra cost to the ship owner. Depending on the application, optimizing hull form and propeller design with an eye to reducing noise can also result in lower vessel resistance, non-cavitating and more efficient propellers, and a quieter machinery installation.

To reduce noise from propulsion machinery, there are options like diesel electric powering where underwater noise may be reduced compared with a conventional diesel mechanical propulsion installation since the propeller shaft - which can radiate mechanical noise into the water - can be decoupled from the diesel engine. To minimize hydrodynamic noise from the hull or the propeller, CFD and other numerical modelling techniques can be used to evaluate and improve a design at an early stage. Designing for lower speed operation may also be an option, particularly for environmentally sensitive areas.

While designers work to find new, cost efficient and practical solutions and develop the necessary analytical tools to evaluate noise, what is lagging behind is any regulatory framework and perhaps awareness or interest. Current noise regulations are mainly focused on noise onboard ships and its effect on crew. In the underwater acoustic realm regulations pertaining to commercial shipping are starting to be developed and implemented although are not nearly as well defined.

Underwater noise mitigation presents the naval architect and ship owner with an opportunity to increase efficiency while minimizing the harmful effects of noise to marine ecosystems. As the general awareness of and concern for acoustic noise broadens locally and internationally, and the regulatory framework evolves, designing for quieter operation will garner the attention it deserves.
50 Years Ago: 1964 – It was a Very Good Year!

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

From where we sit today it is hard to imagine the offices of Robert Allan Ltd. 50 years ago (well maybe hard for many of you...for a few of us not so much!). But 1964 was in many ways a milestone year for the company; it had just recently been formally incorporated as Robert Allan Ltd. (1962) and had very recently (1963) moved out of my Grandfather’s basement into its first real office at the south foot of Granville St. I think there were 8 or 9 employees at the time. But what a prodigious amount of work those few did in 1964, all with just pencil and paper! The times were ripe for major re-development in the coastal forest and construction industries, replacing aging wooden tugs and barges with more modern and cost-effective steel vessels, all aided dramatically by a federal program in the coastal forest and construction industries.

In calendar year 1964 Robert Allan Ltd. completed designs for about 4 dozen new vessels (averaging almost 1 per week!), all of which were built, plus a number of design proposals. This output included some very unique new types of barges:

- **Evco 14** series - self-unloading bulk cement barges
- **Irving Shark** - combination oil/chip barge
- **Plymouth** - self unloading (dragscraper type) aggregate barge
- **Island Tarder** - 10,000 T Self-dumping log barge
- **Nootka Carrier & Nanoose Carrier** - 7000 DWT ocean-going newsprint barges (first of 5)
- various chip barges and other covered paper barges

The really remarkable part of the story however is the diverse fleet of tugs designed that year. In addition to a handful of near-coastal tugs like **La Dene, La Belle, and Captain Cook**, yarding tugs such as **La Prince**, and a couple of the new “under-tonnage” 41 foot tug designs that were just evolving, the following major, powerful (for the day!) tugs were designed, destined to redefine coastal towing in North America:

**Harold A. Jones** (shown above)
- Built for Vancouver Tugboat Company by Star Shipyards, New Westminster, B.C. in 1966
- 136 feet x 32 ft. x17’ draft
- 3500 BHP
- Twin screw

**Gibraltar Straits** (shown bottom left)
- Built for Straits Towing Ltd (Precursor to Riv’Tow Straits) by Victoria Machinery Depot, Victoria B.C.
- 141 feet x 34 ft. x18 ft. draft
- 3840 BHP
- Twin screw

**Haida Brave** (above)
- Built for Kingcome Navigation Ltd by Halifax Shipyards, Halifax, N.S. in 1966
- 141 feet x 34 ft. x18 ft. draft
- 4200 BHP
- Twin screw

In addition to doing the more or less conventional design package for all these tugs (which in those designs typically comprised about 20 drawings and a reasonably detailed specification, Robert Allan Ltd. did the complete production drawing set for the **Harold A. Jones**, which drawings still reside in our files!

The **Haida Brave** and the **Nanoose Carrier** (and sister barges **Nahmint Carrier** and **Haida Carrier**) were built to carry newsprint from Port Alberni to Los Angeles. The barges were also equipped to back-haul Bunker C as fuel for the paper mill in Port Alberni. This system was a model of tug-barge efficiency; a single tug with one barge in tow, and one barge each loading and off-loading. The accompanying newspaper article heralds the arrival of the **Haida Brave** in B.C. waters. This system is believed to be the world’s first ocean-going use of a tug-barge system in this “drop and swap” manner. This towing system and several others of the day were well-described by R.F. Allan in a paper[1] to the very first International Tug Conference in London in October 1969. The **Haida Brave** worked almost 8000 hours per year, stopping only for its annual checkup by the Canadian Steamship Inspection (CSI) service of the day. The system worked continuously until about 1980 after which the contract was lost to an under-cutter, and shortly thereafter the entire contract was terminated and the L.A. newspapers sourced their paper elsewhere.

These big tugs are at or near the end of their useful lives but have served their Owners and this coast extremely well, as noted in the 1971 article describing the rescue tow by **Gibraltar Straits** of a freighter off the (then) Queen Charlotte Islands. It is nice to see that at least one of them, the **Harold A. Jones** has been resurrected and given a new lease on life by the ITB Marine Group, and is now operating as the **Island Monarch** (photo below).

In these days of CADD and remarkably advanced design tools like FEA and CFD, it is difficult to imagine designing all those unique vessels with such a small team, all working on manual drawing boards. Undoubtedly there were also some “moonlighters” working for the company at that time too, as it was a common practise for draftsmen from the local shipyards to earn a few extra dollars in the evenings working for local consultants. However the reality is that all those designs were completed successfully and a great many of the resulting tugs and barges are still in active service.

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1. Tugs As Part Of A Transportation System And Techniques Of Barge Towing, Robert F. Allan; First International Tug Conference, Thomas Reed Publications, 1969
VSP Fireboat Warner L. Lawrence in Action

In September 2014, a fire broke out at the Port of Los Angeles burning about 150 feet of dock in the Wilmington neighborhood, threatening a nearby warehouse and causing the evacuation of two terminals. Along with about 150 LAFD firefighters on the scene, the Robert Allan Ltd. designed L.A. Fireboat 2 Warner L. Lawrence was also there providing substantial support from the water. LA Fire Department was very pleased by the boat’s performance in this emergency situation. Photographs courtesy LA Fire Department.

Women in Naval Architecture; the Changing Face of Robert Allan Ltd.

The business of Naval Architecture has for the most part always been a man’s domain. Over its 84 years of operation, Robert Allan Ltd. has only in the last 15 years or so seen this start to change, and markedly for the better. Our first technical female employee was Marie Curtis, hired in about 1984, who then went on to work at Seaspan. The rapid growth of our business in past few years has coincided with the presence of many very talented women émigrés from Eastern Europe and from Asia. Added to these were a number of Canadian born and trained naval architects from UBC and Memorial University. Rather suddenly we had a significant technical female presence in the office. Today, nine of our total 63 technical staff are women, bringing a diverse set of talents and experience to the company. Three of these are also amongst the new generation of employee owners of the Company.

Promoting Young Talent

Always encouraging young talent to enter into the maritime industry, Robert Allan Ltd. has maintained a permanent student work-term/position within our office for more than 20 years. This year, Robert Allan Ltd. was runner-up for the 2014 Young Corporation Award given by YoungShip International. This award is given annually to a company that has been particularly proactive in promoting young people, both within the company and in the wider industry.
RAindrops
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Front Cover: CSIRO Research Vessel Investigator leaving Hobart, Tasmania
Photo courtesy Walter Pless

Back Cover: RAstar 3200 Pilbara Apollo and RAmparts 3000 MacLeod
Photo courtesy Capt. S. Kaan Altug, Uzmar Shipbuilding

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