RAIndrops

Robert Allan Ltd. Information & News Issue 2

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ROBERT ALLAN LTD.

NAVAL ARCHITECTS AND MARINE ENGINEERS

Demand for Design

by Mike Fitzpatrick
Vice President, Projects

After a brief slowdown in 2009, the demand for design and engineering services has rebounded to early 2008 levels and is still growing. Robert Allan Ltd. has continued to grow to meet this demand by adding key staff and expanding office and computing facilities. This growing demand is spreading worldwide and includes specialized research vessels and larger offshore vessel designs in addition to our core tug, barge, and fireboat designs. We have been collaborating with owners, operators and equipment manufacturers to create innovative solutions to marine transportation and port development challenges.

As growing demand for design services is generally a leading indicator for increased shipbuilding activity, we expect this high level of design activity will be good news for our shipyard clients.

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RAindrops Issue 2
May 1, 2011

On the cover
A US Navy ***Z-Tech 4500*** hitching a ride to new stationing in Japan

Advanced Engineering

by Jim Hyslop
Manager, Project Development

Over and above our traditional Naval Architecture and Marine engineering Services, we have been actively expanding our capabilities to meet the demands of an ever evolving client base in an increasingly competitive business market.

Recent investments in Computational Fluid Dynamics (CFD) software, hardware and training have enabled us to examine a multitude of solutions to a host of predictive analyses including: wake and wash, powering and fuel economy, and seakeeping. In the past this could only be accomplished with an extensive and expensive model testing program, whereas now we can test, modify and re-test in a relatively short time frame. By examining a broader scope of solutions, we are assured of accurate results.

Robert Allan Ltd. is at the forefront of the technology that is behind today's modern designs. As a result of our involvement as Naval Architects for the world's first hybrid tug, the ***Carolyn Dorothy*** (below), we have learned many valuable lessons in this new form of propulsion. We have established a proven track record in the field and are continuing to refine and enhance our capabilities in this area. Our in-house tools and excellent rapport with equipment suppliers enables us to be in sync with all the latest advancements, and tune the design for the best combination of safety, efficiency and profitability.

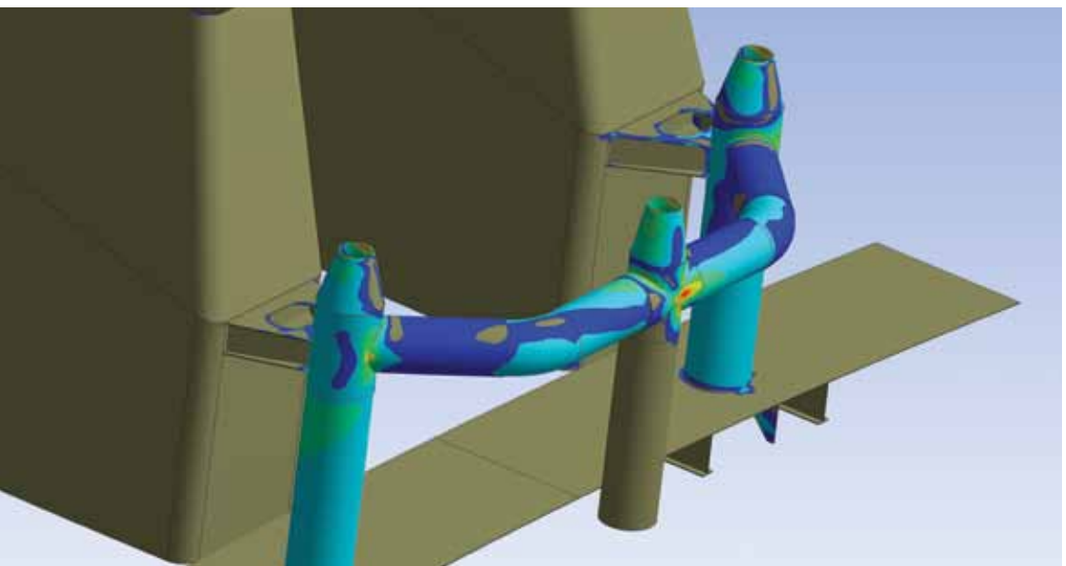
We welcome the challenges of continually improving our designs and maintaining our position as a leader in the commercial naval architecture field.

Recent Deliveries

In March 2011, the Kuwait fireboat ***Mojaweb*** (seen at right), a ***RAstar 3900*** was delivered to the Kuwait Fire Services from builder Simulation Tech Inc. (STI) of South Korea after having successfully finished its sea trials.

When is a fireboat a tug? When is a tug a fireboat? The fitting of fire-fighting capacity on harbour tugs is very common, but typically those installations are limited to up to the capacity of the Class Society Fi-Fi 1 designations with a total pump capacity of 2,400 m^3/hour. However when an Owner requires a major terminal support tug with significant towing and ship-handling capabilities, AND a Fire-Fighting II capability of 8,400 m^3/hour, the result is an exciting combination of the best attributes of both vessel types. Robert Allan Ltd. is internationally recognized for the many unique high-performance tugboats built to its designs, and is also gaining a worldwide reputation for significant major fireboats. With this background Robert Allan Ltd. was an easy choice for Kuwait Fire Services to make for the development of a new design for a major fire-fighting tug for operation in the Kuwait Port of Shuwaikh.

In April 2011, Hike Metal Products Ltd. of Wheatley, Ontario delivered the ***RAnger 2700*** fireboat ***Christopher Wheatley*** to the Chicago Fire Department. The vessel is named in honour of a 31 year old Chicago firefighter who died in an August 2010 Chicago area restaurant fire. The vessel name being the same as the shipyard location whilst remarkable is a coincidence. The ***Christopher Wheatley*** is intended to replace the 1949 built ***Victor L. Schlaeger***, the city's only fireboat. The design of the fireboat had many challenging constraints resulting in the "unique" appearance: icebreaking, shallow draft and obviously, a strict air draft in order to pass under the City's many low bridges. The vessel's 15,000 gpm (3400 m^3/hour) pumping capacity is provided by two pumps driven by independent Caterpillar C32 engines rated at 1000 HP (746 kW) at 1800 rpm. The same model engines are also used for propulsion but with a 1450 HP (1080kW) rating at 2300 rpm. The vessel is fitted with conventional propellers and rudders and has an overall speed of 15 knots.



The Panama Canal Authority ***Z-Tech 6500*** tugs continue to be delivered (one every 6 weeks approximately) with ***Calovebora***, ***Chanuinola I***, ***Sixaola*** (back cover) and ***Teribe*** having arrived in Panama. ***Sajalices***, ***Pequeni*** and ***Belen*** are at various stages of the 9700 mile journey from the builders, Cheoy Lee across the Pacific. With a total order of 13, six more to go!

The ***RAmparts 2400 Gaiac*** was recently delivered by President Marine of Singapore to S.O.R.A., a division of Compagnie Maritime Chambon, of Marseilles, France. ***Gaiac*** is a repeat order for both the shipyard and Robert Allan Ltd. and will join ***Kaori*** delivered in 2004 working the port of Noumea in New Caledonia. ***Gaiac*** will complete the delivery voyage from Singapore to New Caledonia on her own bottom, a voyage of some 4,700 nautical miles. "Gaiac" is the French word for the wood we know as Lignum Vitae: a very hard wood traditionally used for pulleys, bearings, etc. and sometimes referred to as "holy wood" or the "wood of life".

FEA

by Norbert Schumacher, EIT
Mechanical Engineer

The new fire-fighting tug ***Mojaweb*** (above), built for Kuwait Fire Services has 7 fire monitors, each of which can throw 185 tonnes of water per minute. It features three monitors at the aft end of the deckhouse each of which can douse a fire with 2460 tonnes of water per hour. These massive FFS 2400 monitors, weighing half a ton each, can simultaneously generate 3.4 tonnes of reaction force at a height of over 4 m above the main deck, under operation.

This fireboat also features 4 monitors on the wheelhouse top. Two of these are FFS1200 monitors, generating 1.7 tonnes of force each. The remaining two are FFS600 monitors which generate 774 kg of force each.

Naturally it is important that the piping is well supported and can handle the loads to which it is subject. To ensure that there are no surprises when these monitors are turned on, a finite element analysis was conducted to verify the piping and supporting structure for all the monitors. To save computation time, two partial models were used.

The aft monitor model is the most interesting of the two. The piping is supported by the tow post on centerline and bracketed to the deckhouse. The figure below shows a snap shot of one of the load cases checked in the analysis. Under this condition, two of the monitors are operating to starboard, and one is operating to port.

The tow post was also analysed as is standard Robert Allan Ltd. practice for highly loaded structures where the design deviates from a previously proven solution.

Barge Flotilla Wake Wash Prediction with CFD

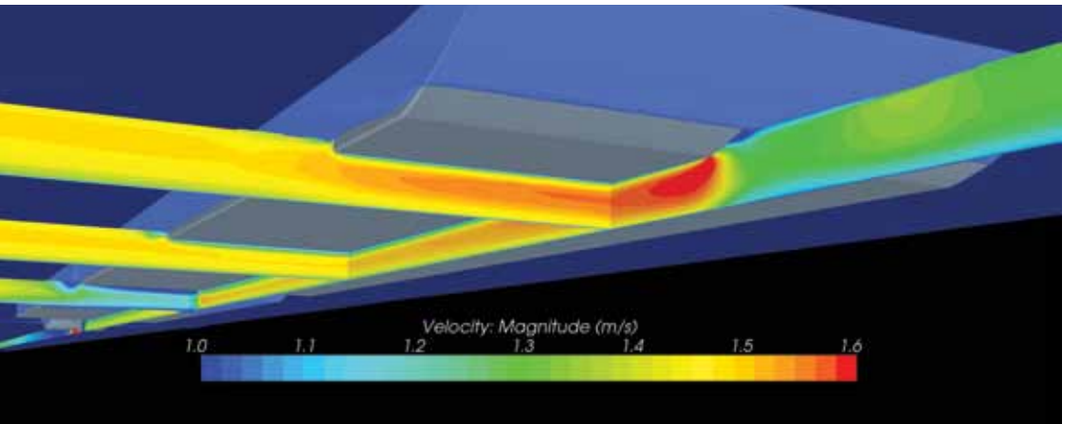
by Bart Stockdill, M.A.Sc., P.Eng.
Mechanical Engineer

Though CFD (Computational Fluid Dynamics) is now used routinely as a virtual towing tank for predicting hull resistance, its versatility makes it a useful tool for many other applications as well. A recent project looked at the wake wash characteristics of a tug and barge flotilla proposed for river transportation of coal. The wake wash data was needed for a Social and Environmental Impact Assessment, particularly to evaluate the impact of flotilla wake on small ferries, canoes and riverbank erosion.

In deep water, the wake wash characteristics depend mostly on vessel speed. In shallow water however, water depth can have a significant influence on the wake height and wavelength due to flow interactions between vessel hull and the riverbed. This is particularly pronounced for a barge flotilla due to its wide beam and flat bottom which presents a large cross-sectional area impeding the flow of the river. As the flotilla moves forward, the water ahead of it is displaced around the sides and bottom of the barges. This results in water piling up ahead of the barges and creates a surge in water level. As the water moves around the barges, the current speed increases resulting in a water surface depression. Because the water level change associated with these depressions is less than 15 cm and extends 150 meters off the beam, they cannot be seen by the naked eye. The power of CFD is that it allows the water surface elevation to be plotted, particularly at areas several hundred metres away from the flotilla.

Indeed, it is the large surface depressions that have the most impact on the environment. By exporting the water surface profile from the CFD model at various distances away from the flotilla, the water elevation change as seen by a stationary observer watching the flotilla pass by can be determined. While the change in water level is relatively benign, less than 0.5 m over 5 minutes, it is still noticeable, particularly in narrow and shoaling areas of the river.

Several flotilla speeds and water depths were simulated, including a narrow channel with shallow water on either side. By using CFD analysis, adjustments to flotilla speed and configuration can be made at the concept design stage to minimize environmental impact and so avoid costly surprises once the flotilla is in service.



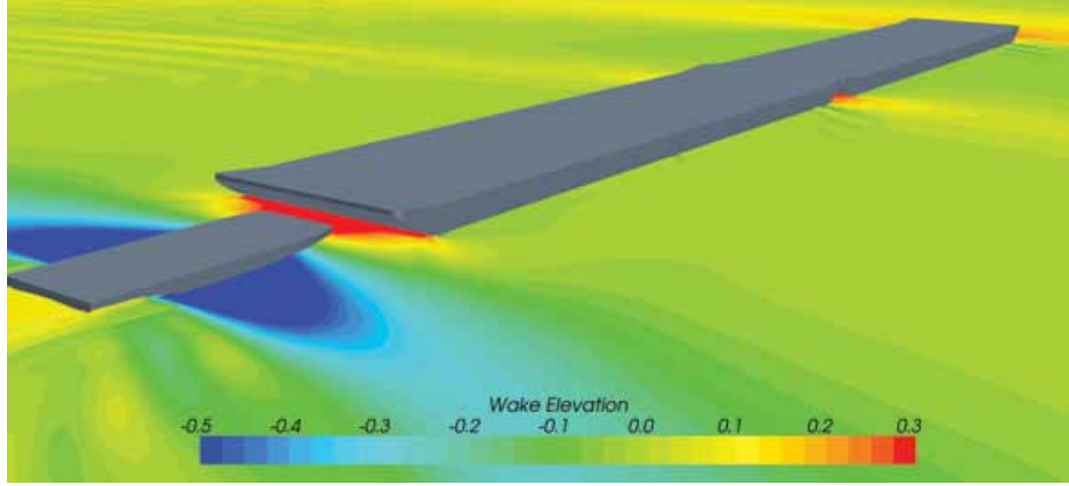
Student Work Term Program

by Grant Brandlmayr
Manager, Naval Architecture

For more than fifteen years Robert Allan Ltd. has maintained a permanent student work term position within the office. This rotating position is offered typically three times a year to one or more students of Naval Architecture or Mechanical Engineering. Preference is generally given to senior students enrolled in a co-operative education program in Canada who show strong interest in a career in the ship design or shipbuilding industry.

Applications are primarily received from the following institutions:

- University of British Columbia
- University of Victoria
- Memorial University of Newfoundland



Applications are also occasionally received (and welcomed!) from other institutions in Canada, the USA, and occasionally from overseas.

The original reason for implementing this program was to provide students the opportunity to get meaningful design experience in an active consulting design office environment. This experience for a student is invaluable as part of their education. Without industry providing such opportunities for the Universities to place students the system would lack the interaction between the student and employer that is critical part of the learning process. It is certainly our experience that both the student and the employer benefit and learn from this experience.

Shipyard Tour

by Xuhui (Bill) Hu, P.Eng.
Senior Naval Architect

In early March, I paid a whirlwind visit to a few shipyards in Singapore and China where about 20 vessels to Robert Allan Ltd. designs are at various stages of construction.

At PM Coast Maritime, Singapore, a ***RAmparts 2400*** tug is about to be handed over to the owner, Compagnie Maritime Chambon, a repeat client. In the mean time preparation for construction of two ***RAstar 3200*** tugs is well under way.

On the same street, ASL Shipyard is working hard to build two ***ASD 32/75*** Shallow Draft tugs for Riverwijs-Dampier Pty. Ltd. of Australia. The first tug in this series will be de livered later this year.

Flying over to the south corner of China, a ***RAnger 4600*** Fire-Fighting Vessel for Dongguan Fire Department is shaping up well at Wang Tak Engineering and Shipbuilding Co. Ltd. Upon completion, the vessel with three Fi-Fi pumps of 3600 m^3/hr each will be the most powerful vessel of this type in China. Sea trials are scheduled to take place in the summer.

In the same town where Wang Tak's yard is located, GMG International Shipbuilding and Trading Co. is building a ***RAmpage 4500*** tug for Atlantic Offshore Service LLC of Dubai. Hull construction is well in progress and the vessel will be delivered to the owner later this year.

My last destination was at long time Client of Robert Allan Ltd., Cheoy Lee Shipyards (seen below with with Mr. Jupiter Gonzalez, inspector of ACP). The yard is filled with tugs designed by Robert Allan Ltd.: The last 7 of 13 tugs of ***Z-Tech 6500*** series for Panama Canal Authority; 2 ***RAmparts 3200*** CL tugs for Ocean Spray, India; 3 ***RAmparts 3000*** tugs for HUD, Hong Kong.

It's been a pleasure to work with these shipyards from day one of each of these projects. It is certainly additionally pleasant to visit these yards again, meet our partners and see the real vessels which began their life from drawing boards of this office.

Research Vessels

by Roland (Rollie) W. Webb
Senior Project Director

The first issue of RAindrops included a short article on the recent creation of RALion, a Joint Venture of Robert Allan Ltd. and Alion Science & Technology Corporation of Washington and Ottawa. This alliance was created in anticipation of a significant, long term fleet renewal program for the Canadian Coast Guard that is just getting underway. Alion has a great depth of experience and capability in areas that are complimentary to Robert Allan's strengths and a Joint Venture approach for competing for the Coast Guard work was considered as a winning strategy.

Robert Allan Ltd. has a long history of performing design work for Canada's Coast Guard throughout the 1970's and 80's. Since that time very few new vessels have been required by this customer and Robert Allan Ltd. focussed their attention elsewhere.

The recent approval of a long term Fleet Renewal Plan for the Coast Guard has resulted in new design opportunities which we have capitalized on. In 2009 Robert Allan Ltd. was awarded the design contracts for two versions of Inshore Science Vessels to be used for Fisheries Research. Three vessels of these designs are now under construction and will enter service in 2011. Robert Allan Ltd. then won a second contract for the design of two versions of new Pollution Response Vessels which has now been completed and 15 vessels of each design were ordered for delivery by mid-2011. The majority of these vessels have now entered service and will be based at strategic locations along Canada's coastal and inland waters.

On October 1st our new Joint Venture, RALion was awarded its first contract to design a new class of Offshore Fisheries Research Vessels (OFSVs) for the Coast Guard. Three vessels will be built to this design with construction contracts to be in place in early 2012. The concept design was recently accepted by the Coast Guard, tank testing is scheduled in June and the full package will be delivered by this fall. Details of this design are still being worked out and more information will be available in a later edition of this newsletter.

In January of 2011 RALion scored again, winning its second major contract. Supporting our long term customer Teekay Shipping (Australia) and their selected shipyard Sembawang Shipyard Pte. Ltd., RALion will design a new 89 meter Oceanographic Vessel for Australia' Commonwealth Scientific and Industrial Research Organisation (CSIRO). This very large and capable vessel will be delivered by the Teekay Sembawang team in 2013. This new vessel will be truly 'World Class' and will set a whole new benchmark for quiet research vessels.

Silence Please!

by Ken D. Harford, P.Eng.
President

Great strides have been made in the reduction of noise levels on workboats. Techniques common to the automobile industry, luxury yachts and cruise ships are gradually being accepted in workboat construction with great success. Even tugs with very high power plants in relatively small hulls have been built to meet IMO A 468 (XII) Code on Noise Levels on Board Ships. This code was adopted in November 1981 "…to provide standards to prevent the occurrence of potentially hazardous noise levels on board ships and to provide standards for an acceptable environment for seafarers." It was intended to apply to "new ships of 1,600 tons gross tonnage and over" but has been applied to much smaller vessels including tugs where the challenge of attenuating the noise and vibration from the main propulsion system is much greater than on the larger, relatively low powered ships. This Code sets the Maximum Acceptable Sound Pressure Level for Cabins at 60 dBa. Many Robert Allan Ltd. designs including high powered tugs are being built to meet the Code requirements, and certain classification society Comfort Class notations.

The shortage of qualified crews in many regions is forcing operators to pay greater attention to the living environment on ships. Safety standards require that crews are able to get adequate rest. In order to attract good crews, the ships must provide a good living environment for crew comfort and adequate rest. Low noise levels are an important part of that environment and thus are an essential part of designing and building new ships today. The time for considering cost/effective noise control is in the concept design stage, not during trials.

There are many techniques, materials, and equipment being sold for reducing noise on ships. The role of the designer is to integrate the available technology into the ship design in a way that achieves maximum value for the expenditures on noise control reduction measures. Extensive experience with marine noise control over the last 40 years has provided Robert Allan Ltd. with the good judgement required to incorporate the most effective measures into the design of a vessel in a practical way.

Achieving low noise levels on tugs requires not only attention to details in the design, but also the execution of the noise control measures during construction is critically important. Seemingly innocent compromises during construction can result in "acoustic short circuits" that will severely compromise the effectiveness of the noise control measures.

The ***AVT 3500*** Class ***Messico*** (above) designed by Robert Allan Ltd. and built by Astilleros Armon S.A. for Rimorchiatori Riuniti S.P.A. satisfies the RINA Comfort Class notation providing the crews with the highest standards for working on tugs today.

RAVE Concept

by: Dr. Oscar Lisagor, P.Eng.
Vice President, Naval Architecture

Robert Allan Ltd. in collaboration with Voith Turbo Schneider Propulsion GmbH & Co. KG introduced the ***RAVE*** as a concept offering improved characteristics and performance of a Voith Water Tractor (VWT) for specific applications.

The critical characteristic of this concept is the two ***VSP*** units located axially along the tug hull.

Two ***VSP*** drives have small influence on performance when acting in one direction. Due to close proximity of the propellers in a VWT arrangement, interaction losses occur for thrust in transverse direction. ***RAVE*** model tests (opposite page, bottom) results and CFD analysis (opposite page, top) shows that two in-line propellers have no visible thrust deduction due to interaction in any direction including longitudinal. This feature creates capability of maximum thrust generation through 360 degrees. The ***RAVE*** propulsion arrangement has distinct benefits for both ship assistance and escort that includes the following new capabilities:

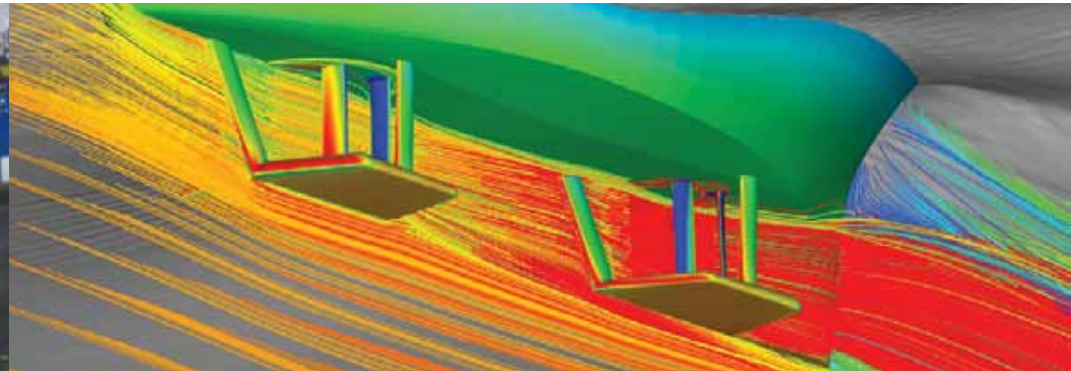
- Tug can apply force through the hawser when under way by sidestepping without orientating the tug along direction of force. It is possible to control the assisted vessel position in confined spaces or canals with very narrow passage.
- Tug can operate alongside the assisted vessel in transit using attachment of one line, and be capable to apply practically the same force inboard by fender contact, outboard by hawser (running through a staple located close to the midship) or along direction of movement if towing or braking is required.
- During docking operations (breasting), tug can apply direct pressure in any orientation to the vessel. If force is applied sideways, pressure to the attended vessel is minimal and tug can use maximum thrust without danger of damage to the assisted vessel.
- During assistance and when force is applied, tug can perform manoeuvres, or change orientation without any change to the applied force.
- A tug can be sucked to the hull when working in proximity to the bow of an assisted vessel, where pressure distribution changes dramatically in a short distance along the hull. The ***RAVE*** has the capability to quickly (in 3-5sec) apply side thrust and sidestep from such a dangerous zone, parallel to the direction of movement.
- Indirect steering is more effective than with drives in a side-by side configuration. By locating one drive just behind the skeg more steering force can be generated. Model tests of a similar skeg–drive arrangement show that maximum generated steering force is at least 50 % higher than generated by a single skeg of the same area. As a result skeg size can be reduced. Reduction of the skeg area is a significant benefit for ship assist tugs, particularly for manoeuvrability and sidestepping.
- The ***RAVE*** has capability of stationkeeping in any tug orientation to the current, wind and wave direction and also to hold station against Fi-Fi monitors reaction force.
- During open sea sailing in heavy seas, roll stabilization is available without significant investment and without installation of additional and costly roll stabilization devices. The in- line arrangement of propellers makes this system very effective.
- Less trim impact because of even weight distribution along the vessel and improved stability because of low position of CG. Stability is especially critical for tugs with significant bollard pull, above 60 tonnes.
- Seakeeping is improved because of pitch and heave reduction. This reduction of motion is the result of damping effect of the propeller guard. The new configuration allows uniform distribution of these damping forces along the hull.

Many ***RAVE*** design variations are possible. A ***RAVE*** of compact size with length around 24-26 m can have 40-50 tonnes of bollard pull. A medium size ***RAVE*** with length of 28-32 m can accommodate a propulsion system sufficient to generate 60-70 t of bollard pull. A ***RAVE*** designed for ship assistance and for long range escort of large tankers more likely will be of 34-38 m long with propulsion sufficient to generate bollard pull up to 90 tonnes.

Extensive tests of the hydrodynamic characteristics of the ***RAVE*** tug concept have recently been carried out numerically and experimentally.

Two model test series comprised resistance and propulsion tests as well as bollard pull measurements, escort performance prediction, manoeuvrability and directional stability evaluation. Also extensive CFD calculations and simulation of operations and preparation of possible design options had been performed to date.

It was proved that the ***RAVE*** concept offers improved characteristics and performance of a VSP-powered tug in comparison to the conventional Voith Water Tractor in many potential applications. In particular the ***RAVE*** configuration minimizes the effect of the contradictory characteristics required for escort towing and ship assistance. The ***RAVE*** concept has very significant potential to enhance ship-handling safety and reliability in the near future, and more concepts embodying this unique configuration are under development.



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