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INTRODUCTION

Acknowledged amongst the cognoscenti

I first met Robert Allan at ITS '96 in Seattle and we have met on numerous occasions subsequently, in some far flung corners of the world, from his home town of Vancouver to Cape Town. We have been in regular email contact – thanks to his dexterity with that mysterious fruit, the Blackberry. Since that first meeting, I do not believe that an issue of International Tug & Salvage has gone by without containing at least one mention of Robert Allan Ltd.

Let me hasten to add that this is not through any form of favouritism on my part. It is simply that the magazine and Rob's company have something very much in common being somewhat devoted to tugs. However, as this supplement undoubtedly demonstrates, he and his large team of skilled naval architects and engineers have other interests, as well. These include fireboats, catamaran fast patrol boats, ATBs and OSVs. However, it is in the field of state-of-the-art tug design that he is acknowledged, amongst the cognoscenti, to be the leading authority. It is not pure chance that the firm has been so prolific over the past few years.

Some tugs one sees around the world have been designed on the back of an envelope during discussions between the old tug skipper and the local builder, and many more just look as if they have. Robert Allan Ltd, more than any other organisation, has taught us a great deal about the science of tugs and towing, and how important a true understanding can be in safe and efficient operation.

Despite all this success and deserved acclamation, Rob Allan himself is essentially a modest man and never pushes himself forward. To the contrary, he sometimes seems reluctant to publicise his achievements. Needless to say, an awful amount of persuasion over a few beers in a Singapore bar was needed in order to convince him to co-operate with the production of this supplement. Our persuasive efforts were well worthwhile. I hope you agree.

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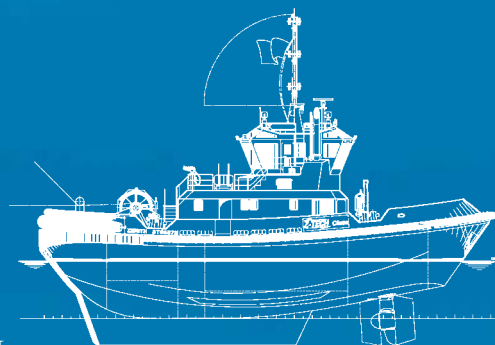
“The innovative tug is a ‘concept’ more than a design”

Robert Allan

The combination of Robert Allan tug boat designs and SCHOTTEL Rudderpropellers has proven itself to be an extremely successful arrangement resulting in optimal manoeuvrability, the highest possible bollard pulls for Rudderpropeller installations and simplified installation of mechanical parts.

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Innovators in propulsion technology

Three generations of fine design

In the field of tug design, one company has become pre-eminent almost to the point of dominance. Robert Allan Ltd designs good tugs, but these attributes do not fully explain the 77-year-old Canadian firm's extraordinary success. In addition, whilst it may be tempting to label it the tug-design company, Rob Allan is quick to point out the variety of recent and current designs in other fields.

The practice was originally formed in 1930 by the current president's grandfather, Robert Allan Sr, who came to Vancouver in 1919 from Ayrshire, Scotland, having first qualified with a BSc in naval architecture from the University of Glasgow. With him he brought his three-year old son, Robert F Allan. Father and son started working together in 1945 – the son, then aged 26, adding a combination of skills learnt from mechanical engineering studies at the University of British Columbia (UBC) and experience at several local shipyards during the war years. In the late '50s and early '60s, Allan the younger began to take over the running of the business, which was eventually incorporated as Robert Allan Ltd in 1962.

By this time, the prospects of a third generation of naval architects were beginning to be realised when Robert (Rob) G Allan came along. After initially studying at UBC, the youngest Allan went back in 1968 to the country of birth of both his father and grandfather to study naval architecture in Glasgow. At the time, there were no suitable university courses in Canada and family history pulled the young man towards Scotland rather than several available opportunities in the USA.

In the early 1900s, when his grandfather studied naval architecture, the graduating classes were huge, generally 100-plus students. In 1971 he was one of a class of a half-dozen graduates. Shipbuilding in the UK was probably at its lowest-ever ebb in those days. Nevertheless, Rob spent two years there after qualifying, working with Burness, Corlett and Partners, one of the country's leading naval architectural practices. However, his homeland beckoned and in 1973 he returned to Vancouver and was welcomed with open arms into the family firm, which was then entering a particularly busy phase. A joint venture in Singapore saw the design of a number of fast ferries and crew boats and a little later a series of shallow draft supply boats was commissioned.

Regrettably, Robert F's health started to decline in the late '70s, forcing the young Rob to take over the family firm. In 1981, shortly after becoming the first Canadian to be elected as a Fellow of the New York-based Society of Naval Architects and Marine Engineers (SNAME), the ailing man died, bequeathing the title of president to his son. (Some 20 years later Rob was to be similarly elected a Fellow of SNAME and he also became a Fellow of the Royal Institution of Naval Architects in London.)

Having less than 10 years under his belt with the company, the now new president initiated a bold change – a switch to computer aided design.

"When I joined the business, we were still doing all manual drafting," says Rob. "There were no more wooden boats being designed and the drawing of steel boats doesn't quite have the same charm."

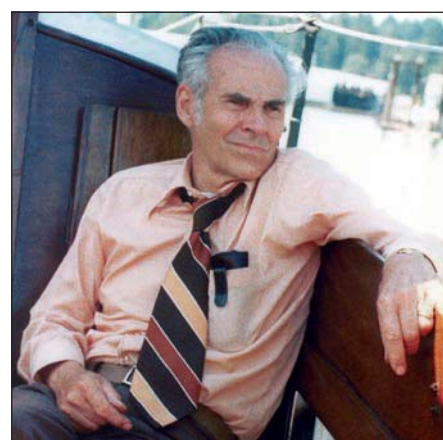
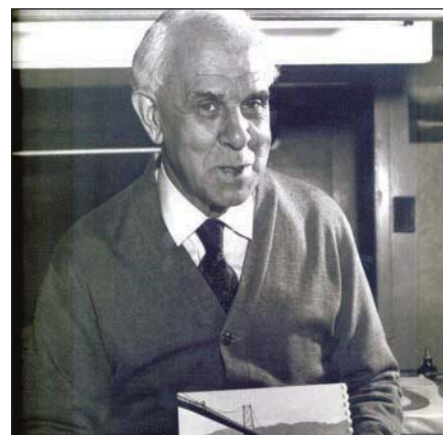
In 1933 it was wooden boats that gave grandfather Allan a timely boost. He was commissioned to design the 60ft yacht *Meander* for a Vancouver businessman. The motor yacht was launched in 1936 and can still be seen today in fine condition. But it was design work for a second notable motor yacht, *Fifer*, that set the company well on its financial feet. The luxurious 100ft ocean cruiser was launched in 1939 at Burrard Drydock and was immediately pressed into wartime service. These two yachts may have kick-started Robert Allan Sr's career in naval architecture but it was for the rapid development of fishing vessel designs that he was, perhaps, best known.

During the 1940s and 1950s there were dozens and dozens of drawings for wooden seiners, trollers and gillnetters generated in the basement of the family home.

"These drawings are real studies, works of art," Rob remarks. "The days of this type of work are long gone, you can't afford to do drawings like this anymore." It was said by veteran boatbuilders that it was practically impossible to distinguish between the drawings of Rob's father and grandfather.

"Dad was pretty conversant in both wood and steel ship design," he continues, "but he really came into his own in the late '50s and early '60s when the towing industry started to rebuild its fleet."

In fact, the company's involvement with tugs had its roots in the British Columbia lumber industry with the design, during the mid 1950s,



Right: Three generations of ship designers – all called Robert Allan.

Below: The design of the 100ft yacht *Fifer* put the company well on its financial feet.



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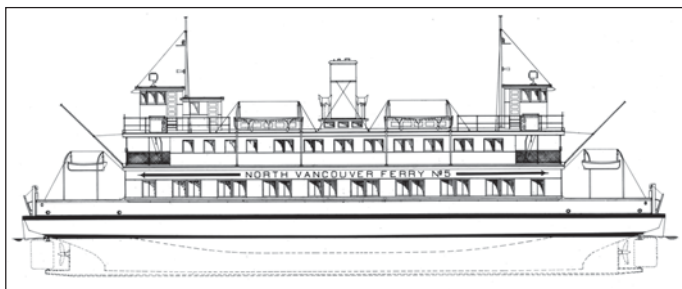
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Left: The 150ft double-ended North Vancouver Ferry, which was designed in 1940 and survived into the new millennium as a restaurant.
Below: Four important vessels in the RAL history.

of a number of coastal towing tugs of which the 35m *Ocean Master* was a notable example. During the 1960s, the Canadian government offered a 40 per cent shipbuilding subsidy. The local coastal towing industry took this opportunity to replace much of the wooden fleet and RAL was awarded around 75 per cent of the design work involving, says Rob, "literally hundreds of barges and dozens of tugs".

It was at this time that the company established the principles of the 'compact tug' with a number of twin-screw two-man day boats built for the Vancouver-based operator, CH Cates & Sons, starting with the 13.7m, 600hp *Charles H Cates XX*. This vessel incorporated the owner's concept that a tug must be simple, highly stable, manoeuvrable, and able to move laterally at a good speed when pushing an attended ship. Its fundamental characteristics were its shallow draft, single hard-chine hull form, simple yet highly functional machinery installation, and a power/displacement ratio of approximately 8.1kW/tonne. Over the next 12 years, Cates built six more new tugs of varying sizes in this same general style, each new vessel embodying the successful characteristics of its predecessors, and incorporating those refinements which were considered to enhance performance, efficiency and reliability. The hull form evolved to a double chine, and ultimately skegs were eliminated altogether.

The last four tugs of the twin-screw type were virtually identical 1,800hp tugs, having a length overall of 18.28m, a moulded breadth of 6.70m and a bollard pull in excess of 25 tonnes. All of these tugs are manoeuvrable, responsive, and very cost-effective platforms and are characterised by extremely low projected lateral areas below the waterline. Interestingly, this hull design has subsequently become the basis for a whole series of harbour tugs now operating throughout Turkey. The limited size and power of these vessels, however, could not keep pace with the growth in ship size calling at the Port of Vancouver and larger, more powerful tugs were ultimately required. Increased manoeuvrability and control in the propulsion systems were desirable.

In 1981, the second Z-drive tug to be built in North America was designed and built for Cates – basically a 23m, 2,400hp version of the earlier twin-screw versions. The hull, although obviously larger, was designed to incorporate all of those features which had distinguished the earlier conventional models, namely a very high standard of stability, low lateral resistance and a centroid of lateral area forward of midships.

The success of this tug, named *Charles H Cates II*, and the obvious benefits of the higher power and manoeuvrability offered in the Z-drive configuration led to orders for two subsequent tugs, *Charles H Cates I* in 1985, and *Charles H Cates III* in 1989. These two latter tugs, though outwardly essentially identical to the original, incorporated all-electric steering motors and winch drives, utilising frequency-modulating motor controllers to achieve fully variable speed control from standard AC motors. This design change led to a much cleaner, simpler machinery installation, with greatly reduced maintenance requirements.

It will surprise nobody to learn that the first Z-drive vessel in North America is thought to be a Robert Allan Ltd design. *Phyllis Yorke*, featuring triple Harbourmaster units, was delivered in 1970, another decade of growth. In addition to continued work for the local coastal towing industry, the firm was kept busy with a large amount of design work serving the Beaufort Sea and Mackenzie River – largely with shallow-draft icebreaking workboats and river tugs.

The success of the Cates compact (under 25m), Z-drive tugs of the '80s attracted significant attention outside Canada, and several variants on the design have subsequently been built in the USA. These included *Eleu* in 1989, a 2,600hp version of *Cates III* for Hawaiian Tug & Barge Corp, which was followed in 1996 by *Mamo*, a 3,200hp sister for the same client.

The 3,000hp *Vancouver* (presumably

identified with the Oregon city of the same name) was built in 1992 for the Shaver Transportation Company, and the 3,600hp *Wynema Spirit* appeared in 2001 for Brusco Tug & Barge. To accommodate the increased power, the latter tugs were increased in beam, and also lengthened slightly to provide larger day-room accommodation.

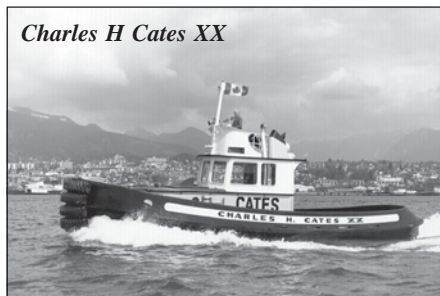
The essentials of the design, however, were unaltered, and the latest of these tugs continues to attract a lot of attention for their power and agility. Rob justifiably asserts: "This class of tug can very rightly lay claim to being the first anywhere with a very compact, one-man wheelhouse."

In 1992 Seaspan International Ltd, now alongside Cates as part of the Washington Marine Group, elected to challenge the status quo for ship-assist services within the confines of Vancouver Harbour. Two 24.7m Niigata Z-peller tugs were built, *Seaspan Hawk* and *Seaspan Falcon*, designed in a co-operative effort between Seaspan technical staff, Robert Allan Ltd, and Vancouver Shipyards. These tugs are sufficiently large to be able to work in the more exposed conditions of the Roberts Bank Coal Terminal, and yet are still small enough to work efficiently in the harbour.

The success of *Hawk* and *Falcon* generated numerous enquiries for a comparable size and power of tug, but generally clients were looking for more crew accommodation and more power. This led in 1998 to the development of the ASD 24/50 Class for Le Groupe Océan of Quebec City. Four tugs of this Class have been built to date, with 53 tonnes bollard pull, two for the company's own operations in the Port of Montreal, and two which have been sold to other operators. This group of tugs was followed by several derivatives of the Class, two built by Astilleros Detroit Chile in South America.

In 1993, an association was being formed with Atlantic Towing and the Irving Group in the Maritime Provinces on the other side of Canada. This resulted in escalating Robert Allan

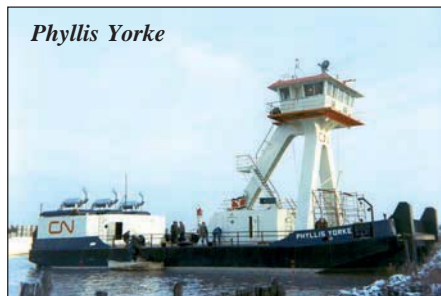
Charles H Cates XX



Charles H Cates III



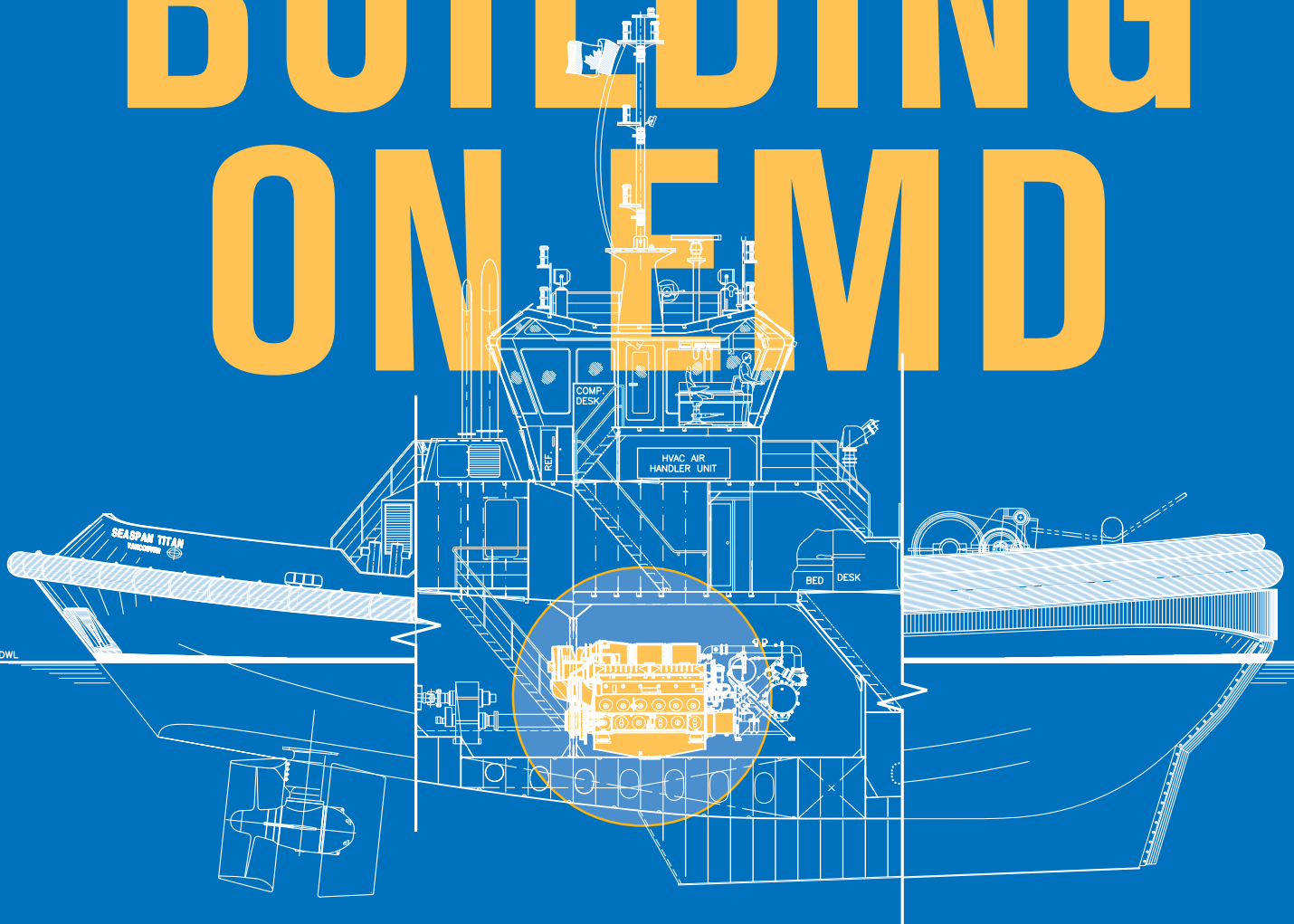
Phyllis Yorke



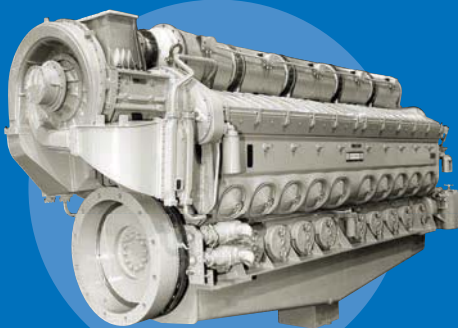
Eleu



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developed. The customer required its two new tugs to carry out escort duties at its Come-by-Chance oil refinery. It incorporated a skeg-shaped box keel from near the bow to amidships. Cutting it short at this point prevents disturbance to the water flow reaching the stern mounted thrusters.

Furthermore, the addition of the escort skeg appears not to have affected the 'straight-line' performance of the vessels, which stays at 51 tonnes bollard pull and 14 knots free-running speed from the original Cat/Rolls-Royce Aquamaster propulsion combination.

Rob advises that the addition of such a skeg is not a panacea to convert any old tug into a capable escort tug. "It is merely a device to increase the lifting forces generated in the indirect mode, and to shift the centre of lateral resistance more forward where it needs to be for escort work. Tugs must still possess exceptional stability and very strong construction in order to entertain this work."

Tug one in the series, *Atlantic Spruce*, was also sold in 2000 by Atlantic Towing to the Norwegian operator, Ostensjo, an important name in the Robert Allan Ltd story, following the retro-fit of an identical escort skeg under Rob's personal guidance. Other significant events in the further promotion of the company's tug design skills came with the purchase by Louisiana-based operator, Otto Candies, of *Atlantic Ash*. This company has also bought a

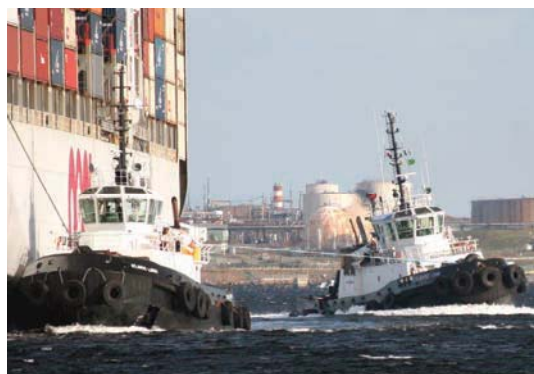


in whatever theatre they have been called in to operate. However, versions built for the Panama Canal Authority delivered in the third quarter of 2001 have 2212hp Deutz engines, Schottel thrusters and a revised superstructure (lowered and shortened) to meet the Authority's unique requirements.

A year earlier, a modified hull form for Newfoundland Marine Energy Ltd was

Top: 24.7m Niigata Z-peller tugs were built, *Seaspan Hawk* and *Seaspan Falcon*.
Left: Shaver's *Vancouver* built in 1992.

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Life sparkles when we are successful. We are delighted to congratulate Robert Allan Ltd. for leading the way in a new wave of high-performance tug designs and we extend our best wishes for a successful future. At the end of the day, good co-operation and support for each other is what **matters**.

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company design built by Sanmar in Turkey. *Atlantic Hemlock* turned a few heads in Europe when it made a surprise appearance in the ITS 2000 tug parade in St Malo.

It was at this same Convention that the several years of intense research and development that RAL had put into the development of *Ajax* came to light. One of the world's most powerful dedicated escort tugs, built in Spain for Østensjø Rederi AS, this 41.60m, 7,200kW Voith Schneider tractor tug incorporates a number of design features that distinguish it as a truly unique and state-of-the-art tug for the demanding escort service for which it was designed. According to Rob, few can claim to having been the result of such an extensive process of research and development to ensure optimum performance. He continues: "The operational criteria for *Ajax* dictated a tug of relatively compact dimensions in order to be suitable for more routine ship handling operations. A maximum length of about 40m was required."

As a consequence of model testing, refinements to the hull form were made and a further, more comprehensive set of self-propelled model tests were performed to determine the escort towing capability of the design. A notable feature, not used on any previous tug, was the provision of significant sponsons on the sides, which impart a high degree of stability when the tug is heeled over during escort towing operations, without causing excessive drag in normal operations. "*Ajax* provides the highest steering force capability of any tug afloat, with a significant reserve of stability," said Rob at the time of delivery.



Much of the export-led success of the last decade or so can be attributed to the many papers on tug design presented by Rob to learned societies such as SNAME and RINA and more regularly at the International Tug & Salvage Conventions.

Indeed, his first exposure came whilst in his first six months of employment at Burness Corlett. His father was due to present a paper at ITS '71 in London but was unable to travel so 'young Rob', given just a week's notice, gave the lecture himself with, according to the records, considerable acclaim from senior figures in the industry.

Turkey figures notably in the Robert Allan Ltd story and much of this success can be directly attributed to the exposure given by these papers. He explains: "The trigger was Ali Gurun [of Sanmar Ltd, Istanbul] phoning me out of the blue one day, when he was still a student, asking for some information on the early papers I had written on the subject of escort tugs. Further to this initial contact, he subsequently called me in 1995 and asked what designs we had for small harbour tugs. I showed them, amongst other options, the Cates 1,800hp, 60 footers (18.28m), and we 'did a deal' very shortly thereafter. I sold them the existing plans and did a few sketches of recommended modifications because, at that time, they didn't have the resources to pay for a major design effort. Subsequently we were contacted by one of the Tuzla shipyards who bought a set of plans for a little 45ft (13.7m) yarding tug, and then by Uzmar who wanted a new 25m twin screw design which resulted in *EGE-II*. Not long after that, Sanmar required a similar 25m design – the Dogancay series.

"Then we did a 20m boat for Uzmar (TS-30 class) and Yardimci wanted a similar 20-21m twin screw design. These boats have all now been built in multiples, with I think more than 20

Left: A Ramparts 3200 built in Turkey by Sanmar for Abu Dhabi.
Right: A Rampage 5000 built by Keppel Singmarine for Bourbon.

versions of the 60 footers." Today, things have moved on, with Z-drive designs in Turkey being built and the 32m RAmports model is proving exceptionally popular – Sanmar has delivered several to Italy with more on order.

In many ways, Singapore has become 'the new Turkey' in Robert Allan Ltd's very recent history. It was during a visit to Rob in Vancouver that the editor made an off the cuff remark to the effect that what the world needed was a tug with the operational attributes of both the ASD and true tractor configurations. A somewhat awkward silence followed. "Watch this space," was the reply. Not long afterwards the news was released by the PSA in Singapore of its co-operation with Robert Allan Ltd to produce the multiple award-winning Z-Tech concept.

Of all the world's innovative tug concepts, this has undoubtedly proved the most successful with a couple of dozen built or on order at Cheoy Lee's yard in China and more under construction at Main Iron Works and Conrad in the US. The concept's standing was given a momentous boost when the Panama Canal Authority put in an order for 10. The first three have been commissioned and are reported to be proving highly successful.

Other yards in Singapore such as Keppel Singmarine and ASL have been busy recently building RAL designs for customers such as Bourbon and Svitser.

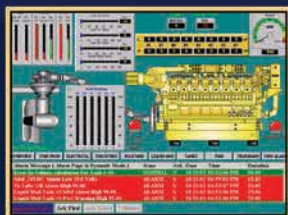
The company's very recent history is covered in the following pages but mention should be made here of a logical decision taken in the last five years to progress towards a form of standardisation. As Rob points out, much of the company's work is still in the custom-design of vessels to suit the specific needs of its clients. However, with such an extensive inventory of designs available it became logical to 'package' these designs in a way that could reduce both the time and cost required for new design development. The advantages of marketing these designs under recognisable trade names also became immediately obvious. The terms RAmports, RAmpace and RAsta are now instantly recognised in tug circles. To discover more, please read on.



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Talented people guarantee future

A company with three generations of ownership under one family name can easily get identified too closely with that single name. Although there is certainly a Robert Allan at the helm, Robert Allan Ltd has for many years been much broader based and capable than can be credited to any one person. It is appropriate therefore to recognise the entire team who make up this organisation, and the fact that their collective talents have enabled the company to become a leader in small commercial vessel design. Furthermore, they are the future.

Hans Muhlert is vice president of engineering and is responsible for the day-to-day operation of the engineering office. He has been with Robert Allan Ltd since 1970. His skills as a naval architect and as a design manager are exceptional, and he takes great pride and care in mentoring the next generation of young naval architects in the finer details of workboat design.

Ken Harford is the engineering manager, a 16-year veteran of Robert Allan Ltd, and directs the activities of the mechanical engineering and systems engineering groups. Ken is an exceptionally talented engineer, who combines those skills with considerable business acumen and a vast amount of experience in dealing with shipyards and the construction process.

Carol Nilson, the office manager, has been with the company since 1972, and manages the accounts department and all human resources. Carol has quietly and most capably kept the 'business' of Robert Allan Ltd running smoothly for more than 25 years.

These three, together with Rob Allan, are the senior management group of the company, each responsible for distinct areas of the business, and whose collective skills have formed a very capable team in running the business.

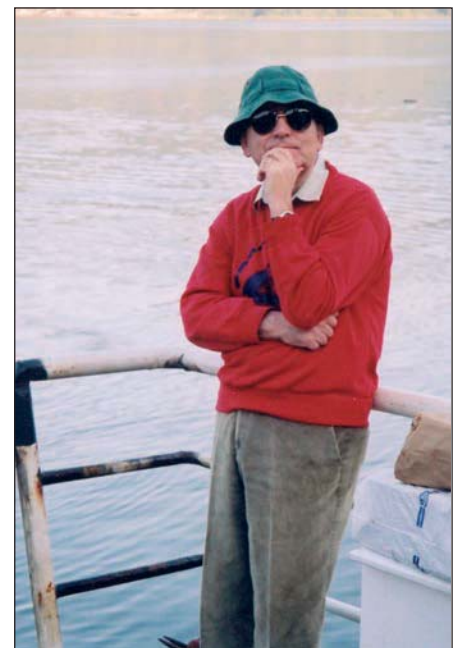
The recent additions of Brig Henry as general manager and John Conlon as the Q/A manager round out the management



team, and help to reduce the daily individual workload of running a hyper-active office.

Whereas in the past the three senior engineers would direct the detail of every new design project in the office, in recent years a lot of responsibility has been delegated to the 'next generation' of technical staff. The response has been exceptional, and has contributed greatly to much of the recent growth of the company. A team of a dozen well-qualified project managers now deal with the daily technical development of each project and the client contacts. The three seniors act in the role of 'principals-in-charge' and oversee project development at a higher level.

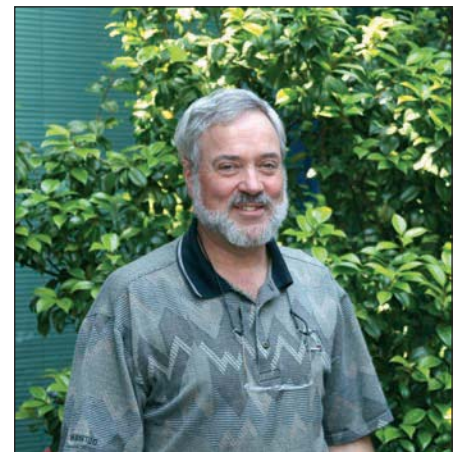
The staff at Robert Allan Ltd currently number 56, and reflect the reality of the 'Canadian mosaic' with a veritable United Nations of nationalities in the technical and administrative departments. In addition to a core of born Canadians, there are individuals on the staff from Australia, China, Bulgaria, Croatia, Norway, Serbia, the Czech Republic,



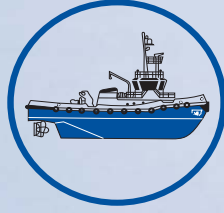
Top: Rob Allan aboard a ship (of the desert) not designed by Robert Allan Ltd.

Middle Right: Hans Muhlert in pensive mood.

Right: Ken Harford. Left: Carol Nilson (second from left) and her administrative team.



MED MARINE



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European Tug Owners Association



Latvia, Romania, Singapore and Spain. This cultural diversity enables the company to assign project managers who can speak to many of its clients in their native language. Particularly with the number of recent projects in China and Southeast Asia, the ability to communicate in Chinese has been a great asset. Similarly with major tugs currently building in St Petersburg, the ability to communicate in Russian has also been invaluable.

Rob thinks that forecasting the future is a bit of 'mug's game'. Robert Allan Ltd has always been a reactive business, responding as quickly as possible to assist its clients with the development of professional design solutions to meet their needs for ever-improving workboat, barge and 'unusual craft' designs. However, the market has changed for the company dramatically in recent years, and consequently so has the business. From a 'father and son' operation serving a very local marine industry in the basement of the family home in the 1950s to its present status as a name recognised internationally for progressive working boat designs, the firm has always remained closely identified with the Allan family.

"As I reach my sixth decade this year, I am carefully pondering the future of the family business," says Rob. "None of my three fine sons will carry on in the family tradition, having each chosen unique and exceptional careers in pursuit of their own talents and interests.

"It is my profound wish, however, that this company continues to serve its clients for many years to come and, although retirement is a long way off on my personal horizon, it is essential for me to plan for the transition of this business to the next generation of ownership. I have been exceptionally lucky to have the dedicated and unflinching support of exceptional people like Hans Muhlert, Ken

Harford and Carol Nilson for many years, through some tough times and more recently through these most demanding of busy times and exceptional growth.

"There is a cadre of exceptionally talented engineers and designers in this firm, who are

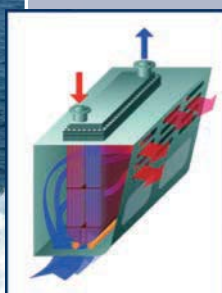
proving their capabilities every day to carry on the tradition of excellence in design for which the firm is noted. I am working with those people to investigate the best option for their future personal success, and the future and on-going success of the Robert Allan Ltd name.



Top: Brig Henry (left) and John Conlon.
Right: The technical team of naval architects and marine engineers.



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From experience – an impressive range

Robert Allan Ltd has been involved in the design of tugboats almost since the earliest days of the company's foundation back in 1930.

TUGBOAT DESIGNS

Most notably this activity took place in the 1960s and 1970s when the west coast of Canada was actively re-building its early coastal towing fleet, replacing the first generation of wooden log-towing tugs with modern diesel-powered, steel tugs. More recently, however, commencing in the early '90s, the firm established a worldwide reputation for the design of a unique series of high-performance Z-drive tugs of all sizes and powers, from the first 'compact' tugs to large, powerful tugs for offshore terminal support.

With such an extensive inventory of designs available it became logical to 'package' those designs in a way that could reduce both the time and cost required for new design development. That objective led to the various 'branded' series of designs, all beginning with the letters RA, for obvious reasons. The advantages of marketing these designs under recognisable trade names also became immediately obvious. The current range of Robert Allan Ltd tug designs comprises:

ASD Class

The ASD designation is used by the company to denote the design of an azimuthing stern drive (ASD) Z-drive tug developed uniquely for a client in response to a specific set of performance and operational requirements. Designs are designated as ASD length/bollard pull, such as ASD 30/60 (30m, 60tonne BP). This designation is used when the design is not based on one of the more standardised tug designs.

RAscal Class – line-handling tugs

The RAscal Class tugs are a series of high-performance, but relatively simple, line-handling tugs, all under 24m in length. These tugs can be either Z-Drive or of twin-screw configuration and are identified by their length and propulsion type, eg RAscal 2000-Z (20m, Z-drive), or RAscal 2200-T (22m, twin-screw).

RAmparts Class – Z-drive tugs

The RAmparts Class tugs are a series of well-proven, standardised Z-drive tug designs. Each of these designs has been developed from a



RAmparts 3000



RAmparts 2500



successful prototype vessel or series of vessels, and refined to emphasise ease of construction. The primary target for these designs are shipyards looking for proven, high-performance tug designs to offer to clients in response to direct enquiries, although many have also been offered directly to tug operator clients as well. These designs are available in fully developed steel part 'kits', using ShipConstructor 3-D modelling software.

The vessels are identified by length, eg RAmparts 3000 (30m long), and there is a range of powers which can be accommodated within each. All of the designs are available in a typical ship-handling configuration, with a modest size of skeg, or in an 'escort' configuration with a much deeper skeg for enhanced indirect steering force capability. All designs are available in metric dimensions, and some are also available in Imperial dimensions.

Currently the following are available in fully developed design packages:

- RAmparts 2400
- RAmparts 2500
- RAmparts 3000
- RAmparts 3200
- RAmparts 3400

RAstar Class offshore/escort tugs

The RAsstar designation is reserved for a unique new class of ASD tugs, designed with a sponsoned hull form, which has been proven in both model and full-scale testing to provide much enhanced escort towing and

seakeeping performance. These tugs will typically be high-powered, and are intended for operations in weather and exposed operating areas such as many new LNG terminals where a high standard of seakeeping is required.

The RAsstar Class tugs are classified according to their approximate length, eg RAsstar 3400 (34m length), and a range of powers can be accommodated within each hull size according to the specific operational needs.

Below: ASD 34/70 (Svitzer Sakhalin)



RAmpage 5000



Presently, the following RAstar Class tug designs are available:

- RAstar 2800 55-75 tonnes BP
- RAstar 3200 65-80 tonnes BP
- RAstar 3400 70-85 tonnes BP
- RAstar 3600 70-95 tonnes BP
- RAstar 3800 75-100 tonnes BP
- RAstar 3900 100-120 tonnes BP

and further designs up to 45m and 125 tonnes BP are under development.

RAmpage Class offshore support tugs

The RAmpage Class of offshore support tug (OST) designs were developed to address a perceived gap in the market for a truly high-performance towing, anchor-handling tug for critical offshore terminal and oil-field support duties. Filling a gap between a full offshore supply vessel and harbour/coastal tug, in the size range from 45m to 65m maximum, the RAmpage Class tugs are designed to be rugged, hard-working and reliable, able to maintain station in extreme ocean conditions, with enhanced manoeuvring and sea-keeping capabilities. With compact dimensions and high power, they are capable of performing the types of duties expected of tugs at both extremes of the spectrum used in this service, namely everything from ship-handling to ocean towing and bulk cargo supply, but with an emphasis on anchor-handling and terminal support/towing duties. Typically they are replacing large OSVs engaged in offshore mooring buoy operations, but at much lower cost.

The RAmpage Class tugs are classified initially according to their length, by the type of propeller system; either Z-drive (-Z) for those situations where manoeuvring and positioning control is of paramount importance as in DP operations, or twin-screw, nozzled propellers, (-T) with lateral thrusters, offered for more conventional applications, especially where maximum bollard pull (BP) is required, and long-distance towing is more likely, and finally

by the type of powering system, either diesel-mechanical (-M) or diesel-electric propulsion (-E). Hence a typical designation would be RAmpage 5000 Z-M.

The following RAmpage Class designs are currently available as fully developed designs, while others are still under design development:

- RAmpage 5000 Z-M
- RAmpage 5000 T-M
- RAmpage 6000 T-M

VT Class tugs

The VT designation is used for custom-designed, Voith-propelled tugs with relatively standard VWT type hull forms. Each type is designated according to length (in metres) and bollard pull.

Examples of this class of tug which have been developed in recent years include:

- VT 27/70
- VT 35/70

AVT Class Voith tugs

The AVT (advanced Voith tractor) designation

applies to Voith-propelled tugs designed by Robert Allan Ltd for harbour or offshore terminal/escort operations that feature the unique sponsored hull forms similar to those used in the RAstar Class ASD tugs. The hull form was first introduced in the high performance tugs *Ajax* and *Velox* built for Ostensjo Rederi AS of Norway. These tugs are classed according to length, and accommodate a wide range of powers according to operational needs.

This class of tug has been the subject of extensive model-testing and full-scale performance verification. The AVT Class tugs currently in operation are noted for their exceptional sea-keeping capability:

- AVT 3600
- AVT 3900

Designs are available, capable of adaptation to any unique set of operational needs.

AZT Class tugs

The AZT (Advanced Z-drive Tractor) designation applies to Z-drive-propelled tractor tugs (drives forward of amidships) designed for harbour or offshore terminal operations. These tugs are classed according to length, and accommodate a wide range of powers according to operational needs.

AZT designs, such as the very recent completions for Fratelli Neri of Italy designated the AZT 2400, are capable of adaptation to any unique set of operational needs.

Z-Tech Class tugs

The Z-TECH™ Class tugs were initially developed uniquely for PSA Marine of Singapore. The design incorporates the best

Velox



Z-Tech 6000



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handling and operational characteristics of both Z-drive tractor tugs and azimuthing stern-drive (ASD) or 'pusher' tugs.

These tugs are designed primarily for operation in major ports and marine terminals where maximum crew safety and the efficiency of tug operations is extremely critical. The design of the Z-Tech tug emphasises the safe and capable operation of ship-handling operations with large ships, particularly those with extreme flares.

It also offers almost uniform omnidirectional performance – speed and bollard pull astern are almost equal to that going ahead. The most unique feature of the Z-Tech tug however is the relationship of sheer distribution to the working deck areas, and the location of the deckhouse and wheelhouse in relation to the 'working end'.

Emphasising the need to work in either a push or pull mode under the flared ends of large container ships and car carriers, the Z-Tech has a flat forward sheer, and a wide, heavily fendered bow.

The wheelhouse is set well aft and inboard, offering excellent visibility over the entire working deck and to the sides of the tug, ensuring that there is almost zero risk of contact with a ship when working. With the low bow, the tug is then expected to make transit or open water voyages stern-first in the 'tractor mode'. In this configuration, the Z-Tech tug then can also function efficiently with only one winch, located for maximum efficiency for both ship-handling and towing operations.

To ensure good sea-keeping capability, the stern has a strong vertical sheer, and is much more rounded than in a typical tug, presenting a 'sea-going' stern. However, the underwater hull is essentially identical to that of other ASD tugs designed by the company.

The Z-Techs are classified according to their bollard pull, but are adaptable to a range of powers and engine types in each size and, as exemplified in the recent series of 10 tugs for the Panama Canal Authority, can be customised to suit each client's unique needs. The current range of Z-Tech designs comprises:

- Z-Tech 6000 – 60 tonnes BP
- Z-Tech 7500 – 75 tonnes BP

Further developments, keeping pace with the demand for ever-increasing powers, are under development, as are some units with lower power demands.

Z-Tech 6000



RAven Class



PATROL CRAFT

Over a period of many years, the firm has established a reputation for the design of a diverse nature of a large number of high-performance, successful high-speed patrol craft. These include many small patrol craft in both aluminium and GRP, typically intended for local police, coastguard and harbour patrol functions. The following describes many of these vessels.

RApier Class fast patrol craft

The RApier designation is used for a range of fast monohull patrol craft. Numerous successful designs exist, and have become the prototypes for more standard design series. Arrangements and powering can be adapted to suit any specific application. An example of one of the most recent vessels of this type is the new RApier 1200 Class boats for the New York City Police.

The following RApier Class designs, designated according to their length, (eg RApier 850 – 8.50m length) are available:

- RApier 850
- RApier 1000
- RApier 1100
- RApier 1200
- RApier 1500
- RApier 2000
- RApier 2500

RAven Class catamaran patrol craft

The RAven Class patrol craft had their origins with a series of successful 17m patrol planing catamarans developed for the Royal Canadian Mounted Police. These high-speed, spacious vessels were very successful, and became the prototypes for another series of larger and more robust patrol craft for the same client. The catamaran platform is ideally suited to a wide range of patrol boat functions, providing much more stability and usable space for crew and operational functions than a monohull of equal speed.

The following RAven class designs are currently available:

- RAven 1500
- RAven 1800
- RAven 2000
- RAven 2100

Emergency response vessels and fireboats

In recent years, Robert Allan Ltd has designed a significant number of emergency response vessels for major port cities around the world. Primarily configured as fireboats, these platforms also frequently serve as Command and Control centres or indeed as primary response vessels for local emergency actions, such as pollution response and search and rescue.

Custom fireboat designs

A number of unique fireboats have been designed in response to the specific operational and performance requirements of particular clients. These vessels have a diverse array of configurations and fire-fighting performance. These include:

- Port of Vancouver fireboats
- Philadelphia fireboat (nearing completion)
- Tampa fireboat
- Portland fireboat
- Baltimore fireboat (nearing completion)
- Hong Kong fireboat

Los Angeles fireboat



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- Shen Zhen fireboat
- Dongguan fireboat (recent delivery)
- Los Angeles fireboat
- New York City fireboats (tendered)

Ranger Class fireboats

As with the tug design portfolio, with a stable of existing successful fireboat designs, it made sense to 'package' some of that experience into a standard design series to offer to customers looking for the proverbial 'proven design'. Accordingly, the company has invested design effort into a new generation of a standard class of fireboats which will at least serve as the basis of defining a new vessel for new clients. That series, designated as the Ranger Class, includes the following designs:

- RAnger 3000
- RAnger 3200
- RAnger 3500
- RAnger 3800
- RAnger 4000

Rally Class crewboats

Capitalising on its experience with patrol craft and other semi-displacement vessels, the firm has also developed a range of successful crewboat designs including vessels of both aluminium and steel-hulled construction. Designated as the Rally class, these crewboats designs are proving very successful and have recently been built for operations in both the Middle East and in North America.

The following existing designs are available, and variations on this theme are under development:

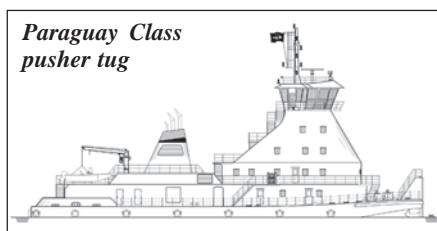
- Rally 2500
- Rally 3000
- Rally 3200
- Rally 3500

Shallow draft tug and barge transportation systems

For many years, Robert Allan Ltd has been active in the design of shallow draft tug and barge transportation systems. This experience stems principally from a long-term involvement with the operations of the Northern Transportation Company Ltd, (NTCL), which is the principal operator on



Beaufort Class ice-breaking OSV



Paraguay Class pusher tug

Canada's northern Mackenzie River system and Arctic Coast. From the late 1960s until the present day, Robert Allan Ltd, has been involved with the development and refinement of designs for tugs and barges operating in what are generally considered extremely shallow-draft waterways, some with draft limitations as low as one metre.

This expertise has lived through a number of cycles as the demand for this type of craft has ebbed and flowed over the years. Currently, however, there is an increased requirement for vessels of this type, particularly for river transportation systems in South America. Projects in progress include several major tug and barge systems for bulk commodity transportation.

Ice-capable vessel designs

As may be expected of a company solidly invested in the Canadian milieu, a significant expertise has been accumulated in the design of ice-capable ships of many types. This experience can largely be traced to the development of oil exploration in the Beaufort

Sea in the mid to late 1970s. Vessels from this period include the Arctic Ice-Class 4 Offshore AHTS vessels *Ikaluk* and *Miscaroo*, designed for Gulf Canada Resources Ltd and now owned and operated by SMIT in the waters off Sakhalin, under the names *SMIT Sakhalin* and *SMIT Sibiu*. With the recent expansion of offshore exploration in ice-bound areas such as the Caspian Sea and Sakhalin, this earlier experience has been brought up-to-date with recent designs of ice-breaking escort/terminal tugs for Svitzer at Sakhalin, and with the Beaufort Ice Class OSVs recently built at Keppel Singmarine for Lukoil, for Caspian Sea operations.

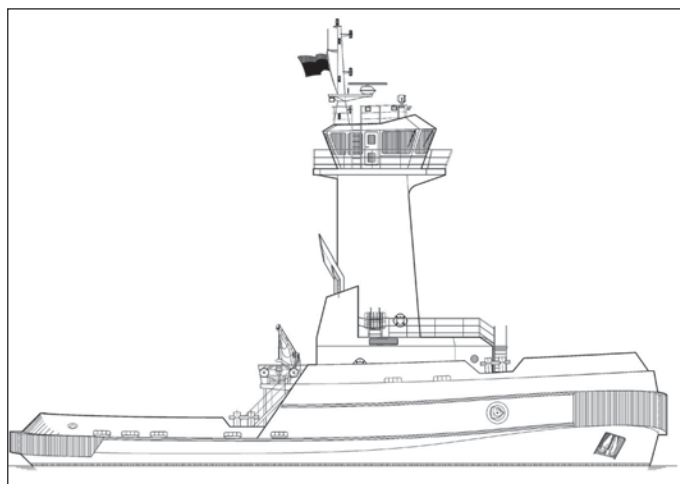
Special service craft projects

Although Robert Allan Ltd's business has been dominated lately by tugboat design activities, at heart the company remains designers of customised 'solutions' to the specific requirements of its clients. When unusual projects arise for which there are no 'proven designs' available, the 'proven design team' is always excited to put its collective talents to the test, and develop new vessel designs for these individual challenges.

These types of project are always considered by the team as the most fun, and represent the true test of a naval architect – especially those that pride themselves on a history of innovation and diversity in ship design.

Recent examples of such unique projects include the following:

- Maintenance/launching barge for an underwater tidal energy system in Canada;
- Icebreaking emergency evacuation vessels for the Caspian Sea;
- Ice-capable Lifeboat System.



Below left: ATB pusher tug.

Below right: Maintenance/Launching barge for underwater tidal energy system.



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In the forefront through R&D

For many years, Robert Allan Ltd has been dedicated to maintaining a position in the forefront of modern workboat design, and in particular in the field of high performance and escort tugs. For the past six to seven years in particular, the company has committed to an on-going programme of internally-funded model testing and research.

"This has led," says Rob, "to a better understanding of the behaviour and motions of a wide range of vessel types, and ultimately to a new generation of tugs for new and demanding mission profiles. Paralleling the firm's typical workload, this R&D effort has recently had a distinct bias towards tug design."

Recent testing and studies performed include:

■ Tug motions in waves, in conjunction with large ships

This independent research to a large degree parallels the work being performed under the international SAFETUG project. However, Robert Allan Ltd had committed to doing some of this work more than two years before the start of SAFETUG, and has had the opportunity to continue this 'interactive motions' research on several occasions since.

Its research has focussed on the sea-keeping behaviour of the RAsstar Class Offshore tug designs, and has clearly demonstrated the superior motion characteristics of this sponsoned, chine hull form in comparison to a more conventional wall-sided, round bilge shape. Model testing of this new tug series has included the following:

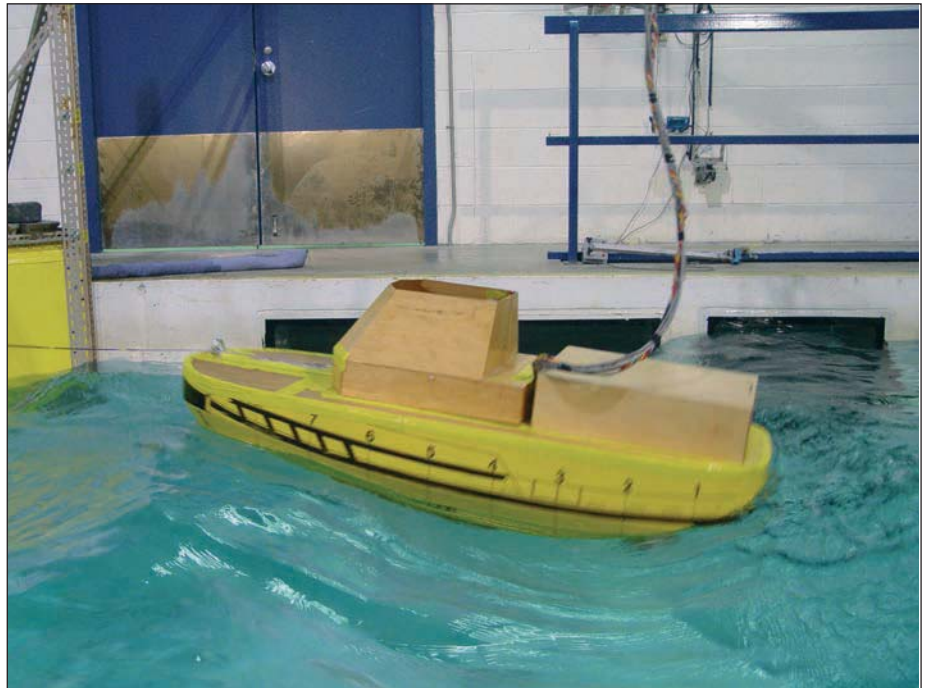
- Resistance and propulsion – calm water;
- Resistance and propulsion – in waves;
- Indirect towing performance – Fs and Fb characteristics;
- Motions when tethered to a ship in close proximity;
- Behaviour in a seaway when tethered;
- Manoeuvring characteristics.

■ Tug manoeuvrability

It is becoming increasingly common to see bow thrusters specified for larger offshore tugs, and there is almost no published data to establish whether in fact these devices are necessary for a given set of position-keeping criteria or not.

Particularly for tugs with ASD or VSP propulsion, the vectoring capabilities of these drives, in most instances, should be able to enable a tug to hold position.

But, says Rob: "Currently available software for station-keeping analysis does not adequately reflect the hull characteristics of the new generation (or indeed any generation) of tugs."



A systematic series of tests on its RAsstar Class hulls has just been completed to measure the manoeuvring and station-keeping characteristics of this class of tug and thus enable much more accurate assessment of thruster needs for any set of environmental conditions. This test programme involved a systematic evaluation of the resistance characteristics of the tugs in a full range of current and wave directions. "It was illuminating to see the influence that the drive systems themselves have on the position of the centre of rotation of the tug in the ensuing manoeuvring simulations."

■ Escort towing dynamics

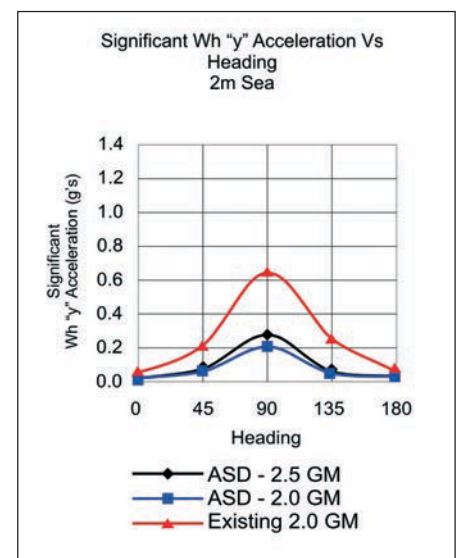
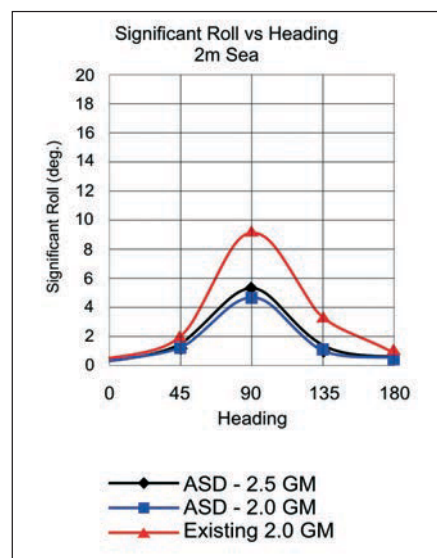
The company has been participating in an on-going R&D programme to measure the comparative benefits of different hull forms

and propulsion systems in performing indirect escort towing. A degree of this work has been in-house private research, and some has been done in collaboration with the Institute of Marine Dynamics in Newfoundland.

This research has included a detailed evaluation of the comparative performance of the three major types and configurations of tug propulsion, namely Voith cycloidal propellers in tractor position, azimuthing stern drive (ASD), and Z-drive tractor. This study has indicated clearly that a well-designed tug with any of the above systems can achieve almost identical Fs and Fb characteristics.

Above: Tank testing.

Below: Performance comparisons of the RAsstar Class hull (ASD) with existing standard hulls.





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The research shows that the achievement of high indirect steering and braking forces are clearly more linked to the hull form, skeg design, tow-point position and vessel stability rather than to the precise nature of the propulsion system.

"Clearly though," says Rob, "when one looks at the entire escort towing operation, the application of power in a seamless manner throughout the exercise is also a critical performance criteria."

RAmpage Class offshore tugs

The undoubted success of the RAmpage Class tugs has generated a large number of enquiries and requests for designs of various sizes of this tug type, distinct from the original 50m long prototype.

Thus, in order to predict the overall performance of this range of designs with the highest degree of confidence, a complete set of model tests involving extensions to the hull up to 60m in length has just been concluded. This enables the accurate prediction of powering and performance for the full range of these rugged new offshore tugs.

RAnger Class semi-displacement hull forms

In addition to the plethora of tug designs being developed at present, a steady stream



of fire-boats and patrol craft designs are being produced. In particular, the company has created many new fire-boat designs in the past couple of years, with diverse performance requirements, but the majority fall into the category known as semi-displacement craft.

In order to provide assured performance in this often very awkward area for vessel

performance prediction, several model tests have been commissioned to verify the powering and sea-keeping characteristics of the range of semi-displacement hulls now designated as the RAnger Class.

The results of this work are being applied to the new 40m long fire-boats currently under development for the Fire Department of New York.

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The development of a new Rotor tug

Robert Allan Ltd was tasked in late 2005 with the development of a new generation of high-performance Rotor tug for Kooren Shipbuilding and Trading BV. The vessel was to have a 100-tonne bollard pull and all the favourable performance features of the previous generation of Rotor tugs, but with enhancements for improved escort and offshore operations. This presented design challenges and an extensive model-testing programme was undertaken to verify the general performance and escort towing capabilities of the design.

A unique hull form was developed for the new escort Rotor tug, incorporating some of the features developed and refined by the company in previous successful escort tugs. The need for a hull to operate in both escort and towing modes demands a form that is capable of working equally well in both directions. Higher steering forces will be developed with the stern forward and the proposed hull has similar speeds when sailing bow first and stern first.

This sponsored hull form, which has been used in several of the firm's successful escort tug designs to date, was also proposed for the new Rotor tug. This shape increases stability when transverse forces are applied from towing or escorting. This feature also creates a narrower



waterline and increases L/B ratio, important to achieving high speed. The sponsons significantly reduce roll motions and accelerations in a seaway.

The high speed requirement on a limited overall length limit demanded a special approach to the hull design. The objective was to create a longer submerged hull, with sharper waterline entry and reduced wake generation characteristics; hence a bow with a bulbous

shape was proposed.

Due to the numerous challenges presented by the design and the combination of unique performance objectives, it was decided at an early stage in the design process to perform a comprehensive series of tests of the new design on a one-twelfth scale model.

The goal of the programme was both to test new proposed technical solutions for various features of the tug, and to verify that the overall

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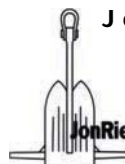
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RESEARCH & DEVELOPMENT

performance objectives could be satisfied. The tests were conducted by FORCE Technology in Copenhagen during June and July 2006. The test programme was directed by Kim Henriksen, senior project manager, FORCE Technology and Alan Reynolds, president, Offshore Research Ltd, acting on behalf of Robert Allan Ltd.

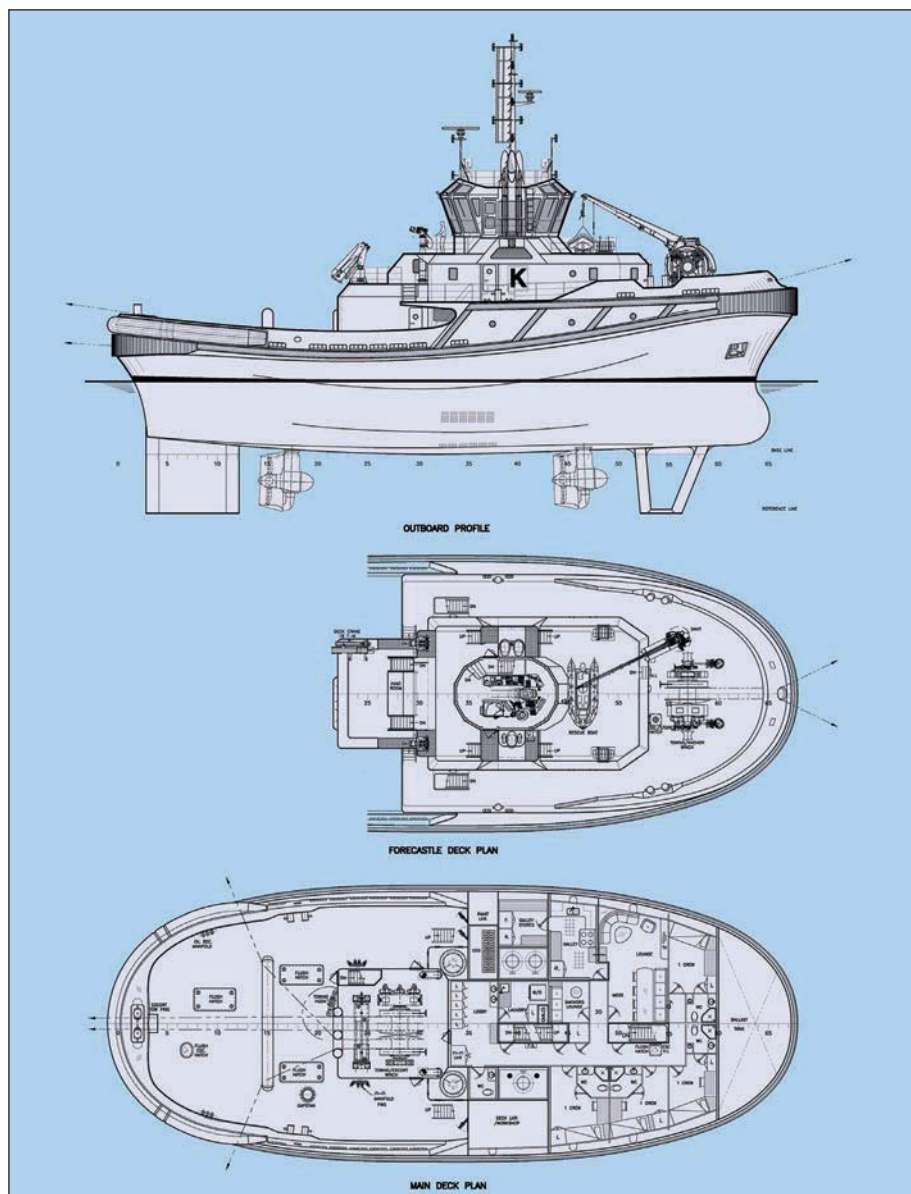
- Calm water tests for determining the speed-power characteristics of the hull for bow first, stern first and sidestepping operations;
- Bollard pull performance;
- Added resistance of bow strut and skeg appendages;
- Indirect escort towing tests (stern first, bow first);
- Rotoring tests to define maximum steering forces at low speed with bow first;
- Sea-keeping tests to define speed loss, accelerations and green water effects in three sea states.

All the tests were conducted in FORCE Technology's 240m x 12m x 5.4m towing tank, equipped with a double flap wave-maker at one end and a metallic beach at the other to absorb wave energy.

The new Escort Rotor Tug design incorporates all the best characteristics of the previous generation of Rotor tugs, and includes new capabilities as an extreme offshore escort and long-range ocean towing tug. This tug is capable of fulfilling all five main operations requested by the owner, with a high degree of efficiency in each mode. The general arrangement of the Escort Rotor Tug, as finally defined, is shown on the right.

The final design has, amongst a host of unique features and capabilities, a speed in excess of 14 knots in both directions, a sidestepping speed in excess of six knots, the capability of generating escort steering forces up to 165 tonnes in accordance with the DNV escort stability criteria, and a retractable skeg that makes it possible to combine the contradictory qualities required for rotoring with exceptional escort performance.

At the beginning of this project, it was not at all clear that it would be possible to create the desired 'universal tug' with good balanced



performance for ship assistance, escort and ocean towing because of some of the contradictory requirements. However, the combined experience of the designers and the owners, coupled with the results of the extensive

and enlightening model test programme have resulted in a new, unique design that has proved that the Rotor tug concept can be applied to a very high-performance escort tug, with performance that exceeds all expectations.



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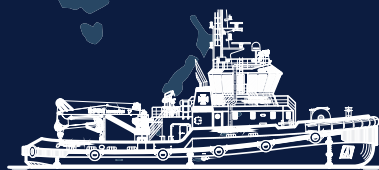
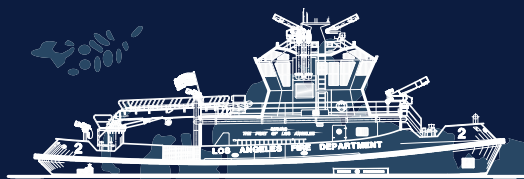


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