RAindrops

Robert Allan Ltd. Information & News Issue 13

EMERGENCY RESPONSE

ROBERT ALLAN LTD.
NAVAL ARCHITECTS AND MARINE ENGINEERS

Preface

Port security

Police, fire, ambulance, patrol, spill response, port and event security, terrorism threats... today's modern port needs to be well-prepared to offer high-performance response for any of these marine-based emergencies. These vessels are a necessity that must be available in every major port, but that all hope will never be used in the more extreme types of events.

These sorts of vessels are almost always custom-designed to respond to the very specific needs assessments of each port. While smaller standard type vessels may suit lesser facilities, modern ports require much more specific vessels to ensure proper and adequate coverage of all potential incidents on the water and the adjacent foreshore.

Robert Allan Ltd. has emerged as a leader in developing high-performance response vessels of many types, but particularly fireboats, for many of the world's major ports in both North America and in Asia. Many of these functions can be combined in a single vessel, but one must be cautious that not too many compromises in performance are made in the interests of false economies.

Although there is a focus in this issue on the many fireboats we have designed in recent years, it is important to also note the many other types of vessels which can be described as "emergency response".

The term "patrol boat" encompasses an almost limitless array of applications. Robert Allan Ltd. has designed specialized patrol craft for harbour patrol/inspection duties, fisheries patrol, forestry service, customs and excise and more. These include often quite large vessels for extended coastal patrols or more frequently are small patrol craft in either aluminum or GRP, typically intended for local police, coast guard and harbour patrol functions.

Robert Allan Ltd. has designed a diverse range of successful high-speed boats for police duties in major ports, including Singapore and New York City, among others.

Typically these are aluminum monohulls for high speed and rugged duties, but we have also designed a very successful class of fast patrol catamarans for the Royal Canadian Mounted Police. One of these remarkable boats, the ***Nadon*** in 2000 re-created the historic voyage of the RCMP ***St. Roch*** sailing through the North-west Passage.

Pollution response vessels are a necessity that must be available in every port but which everyone hopes will never have to be called to duty. Robert Allan Ltd. has designed a significant number of these specialized craft, some of which are totally dedicated to spill response/recovery and others, such as many terminal support tugs, which have the response gear aboard as an adjunct to their other primary function.

In this issue of ***RAindrops*** we examine some of the major emergency response vessels designed by Robert Allan Ltd. in very recent years, and the impact they can have on the ports they serve.

Fireboats: a collaboration from start to finish

by: Henry Reeve, P.Eng, P.E.
Project Director/Senior Naval Architect

Every vessel we design at Robert Allan Ltd. is customized to meet the specific needs of the customer, but fireboats are a very special case. Fire departments and port authorities procure fireboats at infrequent intervals, and the requirements as well as available technologies are likely very different from the last time they went through the process.

As a consequence, the design process for fireboats is more collaborative than most projects, but that is part of what makes fireboats so special. I am very lucky to have been a key part of the design process for a pair of new fireboats. We were fortunate to have very enthusiastic and knowledgeable clients working with us on the project.

The initial phases were the most enjoyable where there was a free exchange and discussion of wants and needs and all sorts of vessel configuration ideas were floated. As is often the case when there are many passionate people involved, the conversations were quite lively at times. But those kinds of sessions often lead to the best ideas and give the design team valuable input as to what features and capabilities are most important to the client.

As the design progresses and evolves, it is hugely fulfilling to see the reactions of the firemen as they see their thoughts and ideas take shape on paper, in 3D renderings, and in mock-ups. Once the design is complete and the whole team can see their input on paper, there is a collective sense of pride and accomplishment.

The collaborative effort continues through construction where the Robert Allan Ltd. team provided technical support, working with the port and fire department to ensure that the vessel meets the intent of the design and the needs of the end user.

But the best part of the collaboration is when the vessel is on the water, operating, and all involved are able to experience their ideas in action. The smiles all around are something to behold!

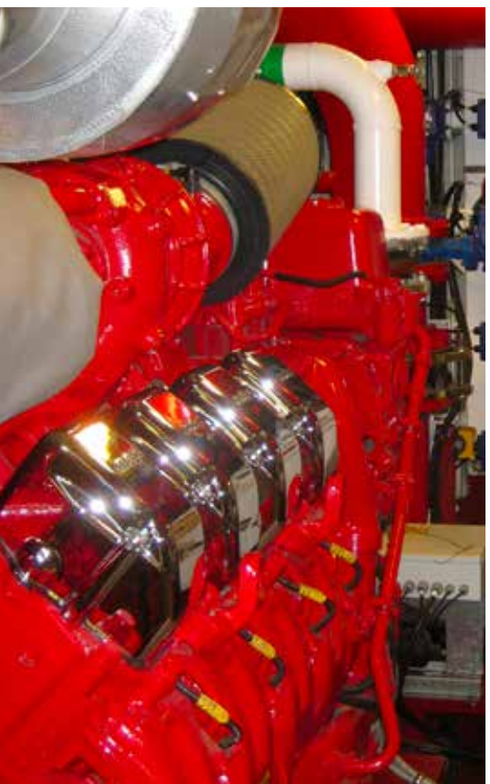
Experiences with emergency response vessels

by: Lawren Best, EIT
Supervisor, Design Development

I grew up on the British Columbia coast spending summers fishing on my family's commercial fishing boats. Our intention was to never have to hail the local Coast Guard, but in the one incident where we ended up near the rocks with a line firmly wrapped around the propeller it was reassuring to know that help was on the way.

Now on the other side of the equation designing vessels for emergency response, I take great pride in placing dependable high performance vessels into the hands of organizations and crews that make a real difference. As part of the experienced Robert Allan Ltd. team we have recently designed the Canadian Coast Guard's new 19 metre, 25 knot aluminum self-righting search and rescue lifeboats which will undertake rescue operations in the harshest and most severe weather conditions. On Canada's East Coast the ***CCGS Vladykov***, one of a series of compact fisheries research vessels designed in 2009, has provided emergency medical services to remote communities when required. Locally, we've recently been assisting an oil spill response organization with the selection and expansion of their fleet of vessels to limit environmental damage should a spill occur in British Columbia's pristine waters. Meanwhile, on the opposite side of the globe the ***Smit Siyanda***, an offshore support vessel in South Africa, responds as an emergency rescue towing/salvage vessel keeping disabled ships and the coast safe, along with its regular role of dive support and SPM maintenance.

Irrespective of location, I am always honoured to be involved in the countless vessels Robert Allan Ltd. designs where the core principle is always customizing the vessels to suit the expected risks so that they can be relied on to respond at a moment's notice if the worst-scenarios do occur.



Fireboat design

by: Derek Noon
Project Performance Manager

When looking at our timeline, it is obvious there are significant differences (size, speed, pumping capacity, etc.) between each of the designs. Why is that?

Each fireboat is custom designed to suit the defined needs for a specific port. The designs need to be as multi-purpose as possible. Fireboats tend to be once in a lifetime purchases so it is important to get it right. It all starts with properly identifying the mission by means of a formal "needs assessment" covering:

- Fire fighting: types of fires (public marina, oil storage, warehouse, piers, container stacks, etc)
- City water supply: ability to pump back into city fire mains
- Foam capacity: oil storage tank sizes, tankers
- High level access: boarding large ships, bridges
- Medical assistance: recovery of persons from water, treatment, patient transfers
- Rescue: pleasure and commercial craft, ferry, downed aircraft
- Diving support: swim grid, ladders, lighting, washdown
- Pollution control: containment booms
- HAZMAT: shore side chemical facilities, container/ship hazardous materials, Terrorist activity
- Emergency command post
- Security duties
- Emergency towing
- Public relations (VIP tours, water displays)

For each applicable mission, a specific strategy needs to be developed considering:

- Size of crew needed, including carriage of land-based firefighters/accommodation/mess and galley facilities
- Equipment needed
- Weather/sea conditions
- Speed/range/endurance

Just to complicate things a little further, one needs to incorporate these overarching considerations:

- Green port initiatives: special fuels, hybrid propulsion
- Wake/wash considerations
- Draft (navigation and air)
- Ice
- Tonnage (crew certifications)
- Cost
- Life expectancy
- Rules and regulations
- Communications (departmental, interagency)
- Redundancy (must be simple and obvious)

The fireboat design needs to take all of the above into account and prioritise each of the missions such that the inevitable compromises are confined to the least important missions. It is quite likely that the missions have not occurred previously so the fireboat should be designed to be as versatile and capable as possible but there is always the possibility that an unforeseen event, or more likely a series of events, creates a unique circumstance. If the phone rings, the boat needs to respond.

One (almost) universal element? Red paint!


FIRE
FDNY
FIRE DEPARTMENT - CITY OF NEW YORK
MARINE DIVISION
FIRE FIGHTER II

Vancouver
Twin-waterjets
12 m
680 m³/h

Hong Kong
Twin-screw
35 m
1800 m³/h

Port of Los Angeles
Twin-VSP
32 m
8620 m³/h

Baltimore
Twin-screw
27 m
1590 m³/h

Portland, MA
Twin-screw
27 m
680 m³/h

New York
Quad-screw
42 m
9600 m³/h

Kuwait Fire Services
Twin-Z-Drive
39 m
8400 m³/h

Chicago
Twin-screw
27 m
3180 m³/h

1977 | 1978 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017

Royal Canadian Navy
Twin-Z-drive
23 m
1130 m³/h

Hong Kong
Twin-screw
30 m
970 m³/h

Shenzhen
Twin-screw
36 m
2730 m³/h

Dongguan
Twin-screw
39 m
4500 m³/h

Philadelphia
Quad-waterjets
20 m
1250 m³/h

Boston (Massport)
Twin-screw
24 m
1360 m³/h

Dongguan
Twin-screw
46 m
10800 m³/h

Port of Long Beach
Twin-VSP
33 m
9300 m³/h

Tugs as first responders

By: Allan Turner, P.Eng.
Project Manager/Mechanical Engineer
and: Erik Johnston, P.Eng.
Project Manager/Mechanical Engineer

Harbour and escort tugs fitted with off-ship firefighting systems have significantly increased in the past 10 years to a point where approximately 80% of the tugboats designed by Robert Allan Ltd. have an off-ship firefighting capability, most typically to full Class 1 requirements, or to some reduced, or in a few cases even greater capability.

Tugs are an excellent platform for harbour firefighting vessels primarily due to their ubiquitous presence in almost every port. In addition their manoeuvrability, power availability, robust construction, relatively small size and typical operating locations make them ideal candidates for first response. Due to the high bollard pull capability of modern Z-drive tugs with relatively small basic dimensions, almost all tugs have sufficient installed power to drive a fire fighting system effectively. There are a number of firefighting pumping configurations to consider:

- Main engine-driven pumps off front PTO, with controllable pitch propellers
- Main engine- driven pumps off front PTO, with full slipping clutch between engine and propellers
- Fixed pitch propellers, with one engine used for pumping and the other for station keeping
- Dedicated pump engine(s)

Workboat fitted off-ship firefighting systems have advanced a lot in the past decade. Previously systems utilized industrial sourced pumps, standard gearboxes, etc. which tend to lead to very large installations. However modern marine/workboat specific equipment is now available, with significantly better packaging,

materials, and remote control options available, resulting in a more compact, user friendly system which limits the influence on a tug's day to day operations.

In recent years more and more LNG terminals require the support tugs to be capable of acting as pumping stations supplying water to terminal or city fire mains via the appropriate shore connections. This can be a critical feature, where the fire is too far inland to be reached by the monitors or where part of the shoreside infrastructure has become damaged due to an incident or natural disaster. The tug can then re-activate those fire main sections, and land-based apparatus can continue to work.

Amongst the plethora of harbour and escort tugs fitted with off-ship firefighting systems there are a few dedicated fireboats which owe a lot to the tug world for their basic design concepts. Some examples of these fireboats are:

- ***Mojaweb*** - Kuwait Fire Services
- ***Warner L. Lawrence*** – Port of Los Angeles
- ***Fireboat 15*** & ***Fireboat 20*** - Port of Long Beach

While these vessels are not particularly *fast* responders, operating at their top speeds of 12-13 knots, they pack a serious punch when they arrive, having firefighting systems delivering in excess of 8500 m^3/hr.

Seakeeping analysis of a fireboat with CFD

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

The seakeeping behaviour of a vessel has traditionally been obtained through model tank testing in waves. While this provides accurate results, it can be quite time consuming and expensive. Various software packages such as Aqua and ShipMo3D are available for carrying out seakeeping calculations and provide good results for more traditional ship forms with larger length to beam ratios. However, for shorter, stubbier hulls such as tugboats and fireboats, these seakeeping software packages tend to be less accurate unless calibration data is available from model testing.

Computational fluid dynamics (CFD) is well accepted for calm water resistance calculations. However, it has not seen much use for seakeeping, mainly because of the long simulation time needed to get good results, particularly for the several hundred conditions that can make up a full seakeeping analysis. These conditions include various wave headings, wave heights, wave periods and ship speeds. The Robert Allan Ltd. high performance computing cluster (HPC) can run one seakeeping condition in 24 hours which means a full seakeeping analysis would take about three months! That said, CFD can be used to demonstrate a vessel's seakeeping behaviour in a few select conditions.

In one recent example, a fireboat which is expected to spend most of its time patrolling inside a protected harbour, was also required to have the ability to make an open water crossing to nearby islands. Though unusual, seas as large as sea state 6 can occur in the Channel, with significant wave heights up to five meters.

Since the fireboats will spend most of their time in harbour, there was no need to do a full seakeeping analysis. However, it was deemed important to see how the vessel behaves in the worst case seas en route to the islands and CFD is well suited for this, as figures 1 through 3 show.

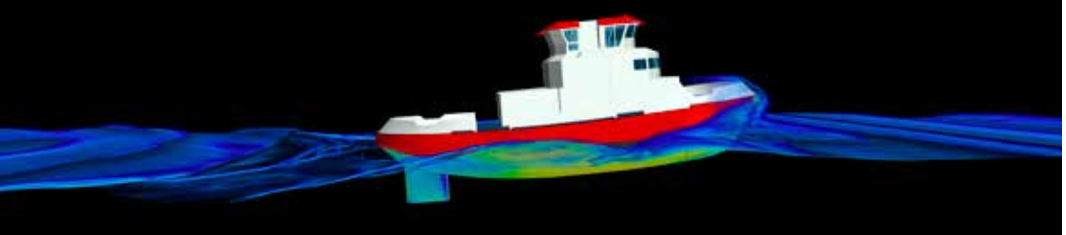
Figure 1 shows the fireboat profile, pitching bow up in head seas with some green water (shown in blue) breaking over the foredeck.

Figure 2 shows the bow quarter view at the same moment in time as the profile in Figure 1. This level of detail, showing the green water over the bulwarks and on deck, can only be obtained with CFD or model testing, but not with seakeeping software.

Figure 3 shows bow quarter images of the fireboat generated from CFD videos. The motion of the vessel climbing over a wave crest and descending into a wave trough can be followed by looking through the sequential images taken in one second intervals. This is one of the main advantages of CFD seakeeping: videos of the ship motion.

By using CFD seakeeping for a limited number of head sea conditions, we were able to determine the expected worst-case motions, including heave and pitch accelerations, that are likely to be encountered during an emergency open water transit. This provides the information needed to determine the maximum speed in sea state 6 and the likelihood of crew motion sickness, both of which affect the vessel's response time to an emergency call.

Figure 1: Profile view in head seas at 12 knots, sea state 6 (Hs = 5.0 m)



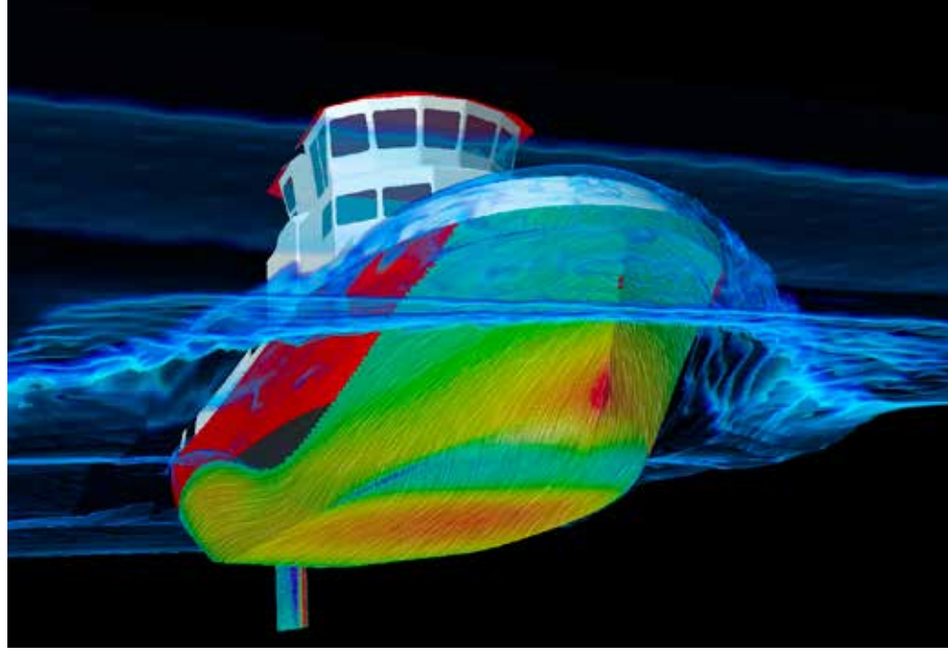


Figure 2: Bow quarter view in head seas at 12 knots, sea state 6 (Hs = 5.0 m)

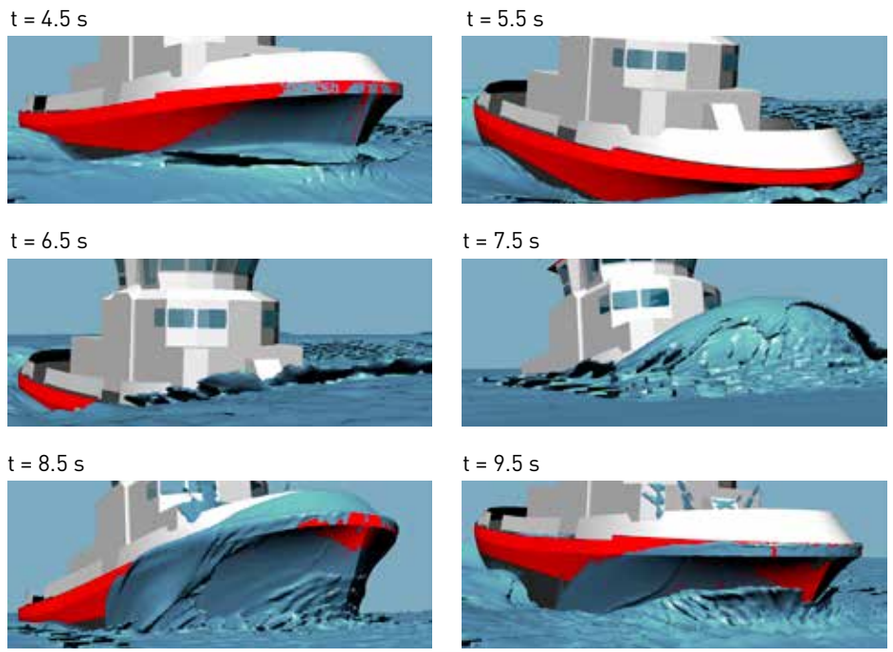


Figure 3: 1 second intervals running ahead at 12 knots, sea state 6 (Hs = 5.0 m)

Old navy fireboats

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

In January 1973 I returned to Canada after studying and working in the UK for almost 5 years. My very first job at Robert Allan Ltd. was to prepare the detailed weight estimate for a new fireboat which the company was designing for the (then) Department of National Defence. My Father handed me a one page series of notes with his shorthand tabulated estimate of the weights; my task was to follow a navy manual defining all the weights broken down according to the military standard weight breakdown methodology (never the ideal format for a quasi-commercial vessel!). After more than a few weeks I had completed this task, with a total weight which was less than 1% different than my Father's off the cuff estimate! I was re-impressed by his skills!

Although of rather modest fire pump capacity by today's standards, those fireboats were quite innovative for their day, as the first application of something called "Z-drives" in a fireboat, (and probably one of the first Z-drive vessels anywhere in North America) using a very early model drive built by Maritime Industries locally (MIL later became part of the Ulstein group).

Today we can look back over the past 10-15 years of major fireboat projects performed by Robert Allan Ltd. and realize how dramatically this technology has changed, and the degree of safety and protection these amazingly complex and powerful craft bring to modern ports.

Incidentally the two navy fireboats built in1973 were both in active service until 2014 when the East Coast boat was de-commissioned.

Port of Long Beach fireboats

In the summer of 2011, Robert Allan Ltd. was awarded a contract to prepare plans and specifications for a pair of fireboats for the Port of Long Beach, California. Due to their operational proximity, the owner's requirements were heavily influenced by the innovative Robert Allan Ltd. designed L.A. Fireboat 2, ***Warner L. Lawrence*** which went into service in 2001.

The new Long Beach fireboats will feature Voith cycloidal drives, in a tractor configuration, giving the vessels exceptional manoeuvrability and the ability to fight fires in any orientation. While top end speed is not a priority for the port or fire department, low wake at patrol speed is important. The hull form is optimized through the use of our in-house CFD capabilities to ensure minimum wake when traveling both ahead and astern at 8 knots. Heavy weather seakeeping ability is also an important criterion, and again, this was investigated using CFD.

The total aggregate pumping capacity of each vessel will be 41,000 gpm, with the single largest monitor capable of delivering 12,000 gpm a distance of almost 600 feet. The vessels will also be capable of providing over 30,000 gpm of water shoreside through 4" hoses, to support land-based firefighting operations.

The new fireboats are to be equipped with CBRN capacities, including a citadel enclosure, protected with specialized HVAC filters, a decontamination shower, and chemical detectors. The vessels will also include a command information center, which will enable them to perform on-scene command duties.

The first vessel is due to go into service in the 2nd quarter of 2016, with the second vessel expected one year later.

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On the cover is one of the FDNY's ***RAnger 4200*** class fireboats.

This issue uses QR Codes to allow quick access to some web links. It does require a QR Code app on your mobile device.

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