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A Few Experiences of a Young Lieutenant(N) Naval Architect

By Commodore (Ret'd) W.J. Broughton

A-bracket corrosion:

In 1962, I was tasked with visiting Davie Shipbuilding in Lauzon, QC to investigate a *St. Laurent*-class destroyer that was exhibiting severe corrosion pockmarks on the A-brackets that support the propulsion shafts just forward of the propellers. Both arms of the port and starboard brackets were pockmarked on one side only, in mirror image to one another, indicating that the ship's wake must be striking the bracket arms at an angle such that the water flow was smooth on one side, and turbulent with cavitation on the other.

Back in Ottawa, I looked up the ship-class towing tank report from the National Research Council, and noted that the recommended fore and aft angles for the A-brackets were based on the wake flow at the ship's top speed of about 28 knots. What was happening was that, with the ship travelling at a speed of just 12-15 knots most of the time, the brackets were misaligned with the flow of the wake, causing the one-sided turbulent flow and cavitation. In other words, the ship's waterflow noise would be worst at the speed it would be conducting most of its anti-submarine operations. Ten years later when I was working on the DDH-280 Tribal Class project, I made sure that the A-bracket orientation was optimized for speeds of 12-15 knots.

HMCS *Provider* inclining experiment:

When the replenishment oiler HMCS *Provider* (AOR-508) was inclined at Davie Shipbuilding, Lauzon, QC in 1963 to calculate the tanker's stability and safe load capacity, Lt(N) Peter Bergen and I had to first inspect every space to estimate and record the weight of extraneous gear and any liquids remaining in all tanks. Then, as Davie used a crane to move large blocks of known mass from one side of the upper deck to the other, we took careful note of the angle of heel, the draught fore and aft, and other factors including water density. Since the tides affect the water level and currents in the St. Lawrence River at Lauzon, we consulted the tide tables to ensure the experiment would be conducted at slack water.

As the experiment got underway, and the weights were shifted in stages, we plotted the increasing heel of the ship on a graph. If I remember correctly, the first three moves plotted a nice straight line, but the fourth was a bit low, and the fifth came in even lower. By then it was late in the day, so we stopped the operation and told our Davie contact that we would check with HQ to see if we would have to redo anything. After calculating the metacentric height based on the first three readings, we were quite relieved when Capt(N) Keith Farrell, Director of Ship Design and Construction, said that the experiment was sufficient, and the result was acceptable. The consensus was that the river current had started to run before we had finished, thus skewing the numbers.

(Continues next page...)

HMCS *Provider*

Bow shape design study for hull-mounted sonars:

Also in 1963, I was tasked to visit both the Royal Navy (RN) and the United States Navy (USN) to learn their thoughts on where they intended to locate the hull-mounted sonars on their ships. The two options being considered by the RCN for our General Purpose (GP) Frigate project were a retractable keel-mounted fit, and a bulbous bow arrangement.

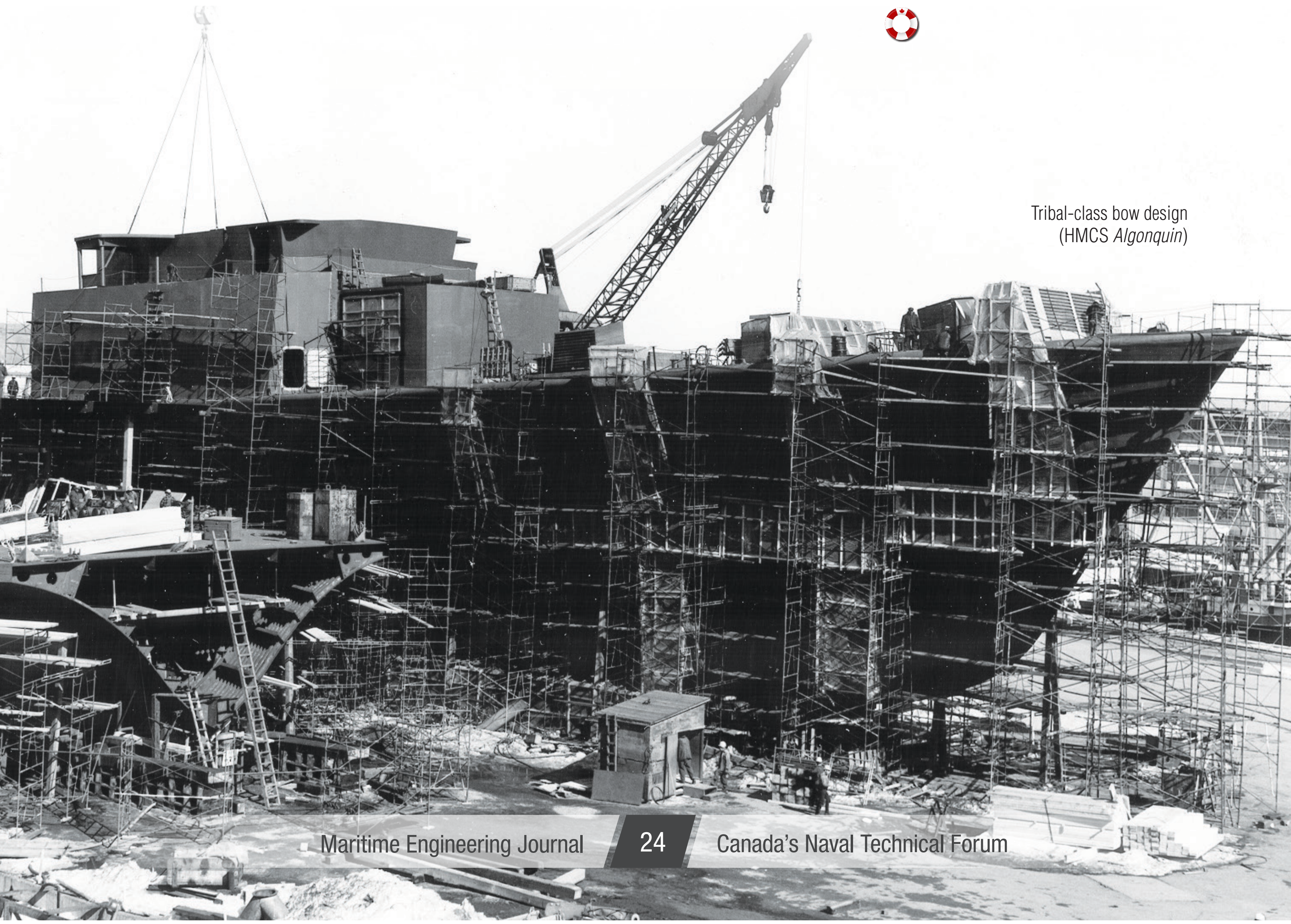
I began by visiting the UK National Physical Laboratory southwest of London to learn the results of a water flow study conducted with the test ship HMS *Penelope* (F127). The study, which considered the effect of different underwater bow shapes in delivering the smoothest (i.e. quietest) waterflow past a retractable sonar mounted abaft the start of the keel, showed that a parabolic shape for the bow's stem would be best for the sonar and for seakeeping, and more cost-effective than going to a bulbous bow.

I then visited the David Taylor Model Basin near Washington, DC to see what the USN was leaning toward, and was surprised to learn that they preferred the bulbous bow option based on low noise, better seakeeping, and reduced resistance for propulsion—almost the same three factors looked at by the RN, but with the opposite conclusion! The GP Frigate was eventually cancelled, but two iterations later, the parabolic stem for the bow was used on the Canadian navy's four DDH-280 Tribal-class destroyers.

Simulated atomic blast:

In 1964, while still a junior lieutenant, I was understandably surprised and nervous when I was summoned to Engineering Commodore Sam Davis's office. I needn't have worried, as it was only to discuss a planned, simulated atomic air blast against the destroyer escort HMCS *Fraser* (DDE-233) off Hawaii as part of Operation Sailor Hat. Earlier, a similar test had been conducted with USN participation at a site near Suffield, AB, where various equipment and structures, including a Canadian mast, had been exposed to a 500-ton TNT blast. The commodore simply wanted me to calculate how close *Fraser* could be anchored to the blast so as to sustain no more than $20,000 in repair costs. I was to report back to him.

Fraser had been chosen for the trial because it was scheduled to go into refit at Vickers Ltd in Montreal. After calculating the possible above-deck structural damage, I estimated that the ship could lie as close as about 500 yards to the explosion, with the deckhead of the captain's cabin being the weakest structure and most likely to suffer permanent deflection. This amused the commodore greatly. I only learned of the results of the trial the following year, after my posting to HMC Dockyard Halifax. *Fraser*, it seems, had been anchored twice as far from the blast as I had estimated, which was a good thing considering the amount of damage inflicted on various bits of topside equipment. As I had predicted, however, the deckhead of the CO's cabin did suffer a permanent deflection.



Tribal-class bow design
(HMCS *Algonquin*)