

The RMC Submarine

On 15 October 1952 a small, 2 man submarine slid into Navy Bay, the historic water between the Royal Military College of Canada and Fort Henry in Kingston, Ontario. There were a number of remarkable features concerning this launching, not the least of which was that the designer was an Army officer who oversaw its construction in an army establishment. As far as is known this was the first submarine designed and then built in Canada. Submarines had been built at Vickers in Montreal during WW1 but they were of US design.



Figure 1

LCol Peter King and LCdr JC Ruse

Aboard the RMC MkI Submarine

About the Point Frederick naval history

The Royal Military College was established on Point Frederick in 1876, but from 1789 to 1853 it was Naval Dockyard, the only fresh water dockyard in the British Empire. Kingston was in those years a vital military base as it was critical to the maintenance of control of Lake Ontario, and thus the defence of Upper Canada. During the War of 1812 Kingston was the major fortress on the Great Lakes, and its dockyard built the British Lakes fleet. HMS St. Lawrence was the largest warship built in Kingston for the defence of the Lakes, and with its 102 guns it was larger than HMS Victory! Its construction was an

amazing accomplishment given that all of the skilled manpower, rigging, ironmongery, guns and ammunition had to be imported from Britain via Montreal and ferried in barges up the St Lawrence to this wilderness dockyard.

After the War of 1812 naval activity slowly died out and the Dockyard was closed in 1853. There was no further shipbuilding activity at Point Frederick until 30 October, 1951 when LCol Peter King, Head of the Mechanical Engineering department at RMC, submitted his proposal for an Undersea Exploration Craft to the Defence Research Board.

The germ of the idea for a submarine grew from discussions at RMC about locating sunken ships in the waters around Kingston. King saw a need for improving methods for locating objects on the bottom of relatively shallow water. In his words

“The use of divers in various types of diving suits was considered and it appeared that the need for better control of manoeuvring and a reduced expenditure of manual energy to lessen fatigue was required. It appeared that a diver could be suspended from a surface craft and direct his motion over the bottom by telephone, however, this added disadvantages in working around obstructions and left chances for misunderstanding. It appeared feasible to allow the diver to direct his motion by manual control of a propulsion unit. Also, it appeared advisable to have no connection with the surface of a mechanical nature to avoid endangering the safety of the diver. It seems that a device with a two man crew in the nature of a midget submarine or mobile diving bell, if equipped with suitable provisions for good vision, and having proper endurance would permit reasonably rapid search of the bottom without tiring the operators unduly.”

The Proposal

LCol King forwarded his proposal to the Defence Research Board on 30 October 1951. As one might expect when dealing with a headquarters almost one quarter of the main body is devoted to the expected cost! King’s proposed design embodied a number of clever ideas, and somewhat at variance with the norm.

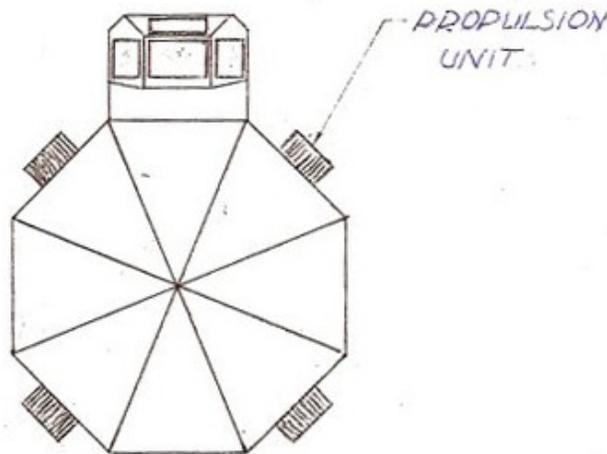


Figure 2

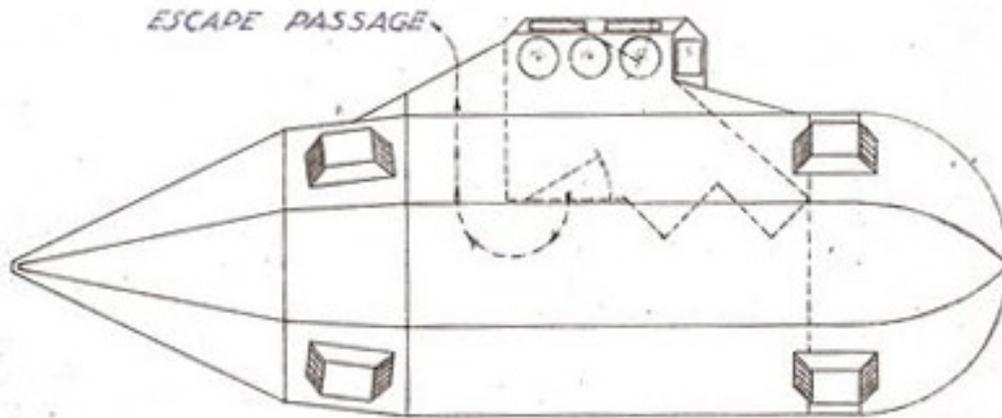


Figure 3

What he envisioned was a two man submersible powered by compressed air, which would operate air motors driving special water jet propulsion units. In order to keep the weight low and the design simple, King proposed a craft where the air exhausted by the engines would be fed into the crew compartment and vented out its bottom. This would result in an internal pressure slightly above hydrostatic pressure, and ensure a continuous supply of fresh air to the crew. It would also result in a hull which could be of relatively light and simple construction since the pressure inside the submarine would be the same as the outside hydrostatic pressure, independent of depth.

The submersible was to have the following operating characteristics:

With a crew of 2, have the ability to operate close to the bottom, to 10 fathoms (60 feet), with good visibility.

Maximum speed of 5 knots, and a duration of 5 hours at 3 knots

Manoeuvrability such that it could turn while stationary, and move vertically or transversely without longitudinal motion.

A simple means of escape through the bottom of the crew compartment.

The controls to be easily operated and so arranged that no appreciable expenditure of manual energy is required for more than a few seconds at a time and then only on a scale comparable with operating a motor truck.

It appears that the proposal was accepted by DRB, but no response from them can be found.

Similarly, no correspondence between RMC and the Diving Unit in Halifax has been found. However, the divers were undoubtedly involved in the design criteria as their strong support for such a project would have been required. As well, two officers of the Fleet Diving Unit (identified as the Explosive Disposal Unit in the report) were directly involved in the trials of the submersible at RMC. (brief biographies of the two divers are included below)

The Design

To save money and time, King intended using standard torpedo air flasks as the source of 2000 psi air, and torpedo engines as the power source of propulsion. Unfortunately his tests of the torpedo engines showed that they would not produce sufficient power, and thus his first unexpected task was to design his own engines.

The project began in October of 1952, with all construction being carried out by the RMC Machine Shop staff. The only exception was the periscope, which was undertaken as a design and build project by the instrument section of the Royal Canadian Electrical and Mechanical Engineers' School in what is now Base Kingston.

The hull consisted of a “cab” (drawing side view here) constructed of 3/8 inch mild steel, and a hull frame of angle iron covered with 1/16 inch steel plate. A number of viewing ports were fitted around the top of the cab. There were two hatches, both of which were hinged in the middle similar to a telephone booth door to permit ease of entry and exit. The lower hatch would be used by a diver to exit and enter, and for emergency escape, and the upper for normal entry.



Figure 4

The Prototype – MkI Submarine

The Propulsion System

The propulsion system consisted of two 6 cylinder radial air engines (insert drawing here) driving a pair of centrifugal water pumps, one assembly forward and one aft. The pump outputs fed 8 propulsion heads – 4 forward and 4 aft. (See Figure 5 – following page)

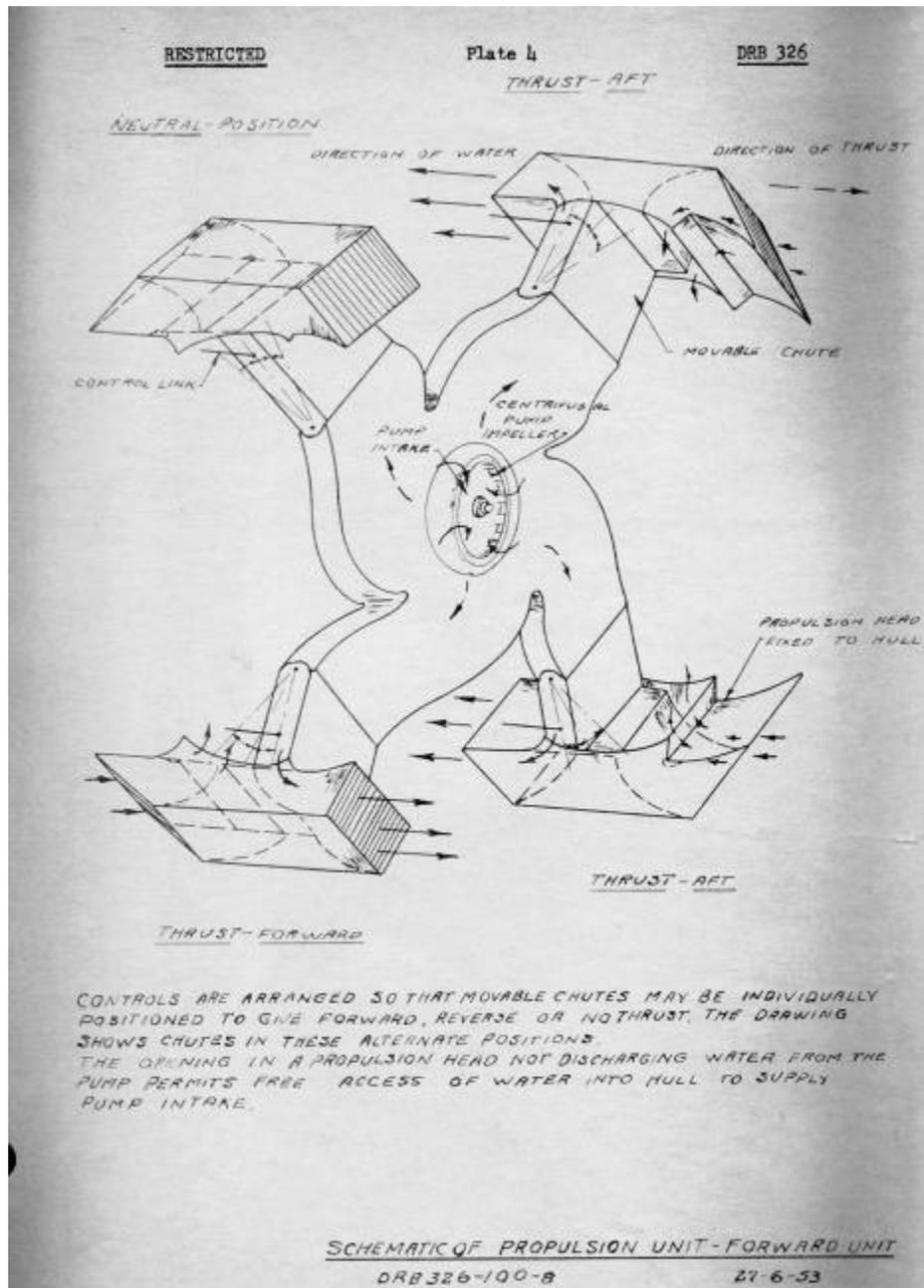


Figure 5

When the propulsion unit was operating water was forced into the chutes. The flow in each chute could be controlled by the operator in the cab by shifting the position of the movable part of the chute forward, aft or to the neutral position. As the water exited the chute propulsion head it produced a force of reaction in the opposite direction. Each propulsion head (Hydro-Jet) was independent so the combination of thrusts could produce accurately controlled movement.

The resulting submersible was 20 feet long with a 6 foot beam, and weighed 7200 pounds. The total cost of construction, including RMC salaries, was just over \$20,000.

TRIALS

The first trial was held on 15 October 1952, less than seven months after the start of construction, with LCol King and LCdr JC Ruse of the Explosive Disposal Unit from Halifax on board. During the first dive, which was done in 20 feet of water, it was learned that buoyancy control was not sufficiently sensitive, making depth keeping difficult. As a result diving and trim tanks were installed over the following winter.



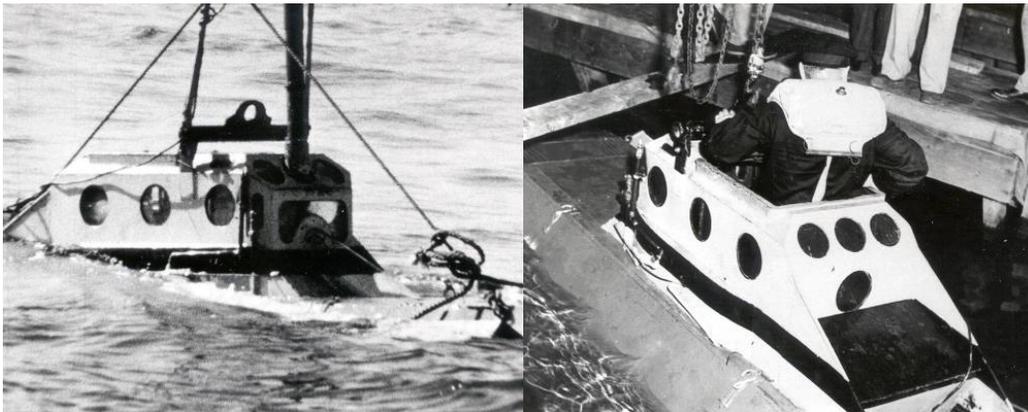
Figure 6

The second trial occurred on 4, 5 and 6 August 1953 with LCol King, and two officers from the EDU in Halifax - LCdr John Ruse and Lt Don Loney. Depth control was much improved from the first trial, LCol King being able to maintain depth variation within 5 feet while traveling at 1 mph close to the bottom. The divers practiced exits and entrances from the crew compartment without any problems. On 6 August the craft was operated for 90 minutes, practicing diving, surfacing and resting on the bottom at 30 feet. "Fuel consumption" was roughly half of the HP air available in the HP air flasks.

Diving planes were fitted in September 1953 which gave improved depth control to only one foot of variation. The final trial proved that the craft could move two people at 2 feet per second over harbour bottoms with good control for up to three hours or more, depending upon the speed. The design could be deemed a success!

The submarine became a popular attraction for visitors, including Field Marshall Montgomery and Canadian naval officer Commodore Horatio Nelson Lay.

Figure 7



The Mark 2 Proposal

The trials proved the design concept, and encouraged LCol King to propose an improved second model incorporating design changes to improve performance. The major change was to be a new, streamlined hull to replace the “lines of a brick” structure of angle iron and steel plate. The new hull would be made of fiberglass to reduce both drag and the magnetic signature, which would increase speed and control, and susceptibility to magnetic mines. The addition of a compass was also recommended. He envisaged a craft of this type being tethered below a “mother ship” which could supply illumination of the bottom, and high pressure compressed gas through a hose. Included would be a communications link between submarine and surface craft. A sketch of the improved hull shape is shown in plate ??.

Since no further work was done it is assumed that DRB turned down the proposal for an “improved” model.

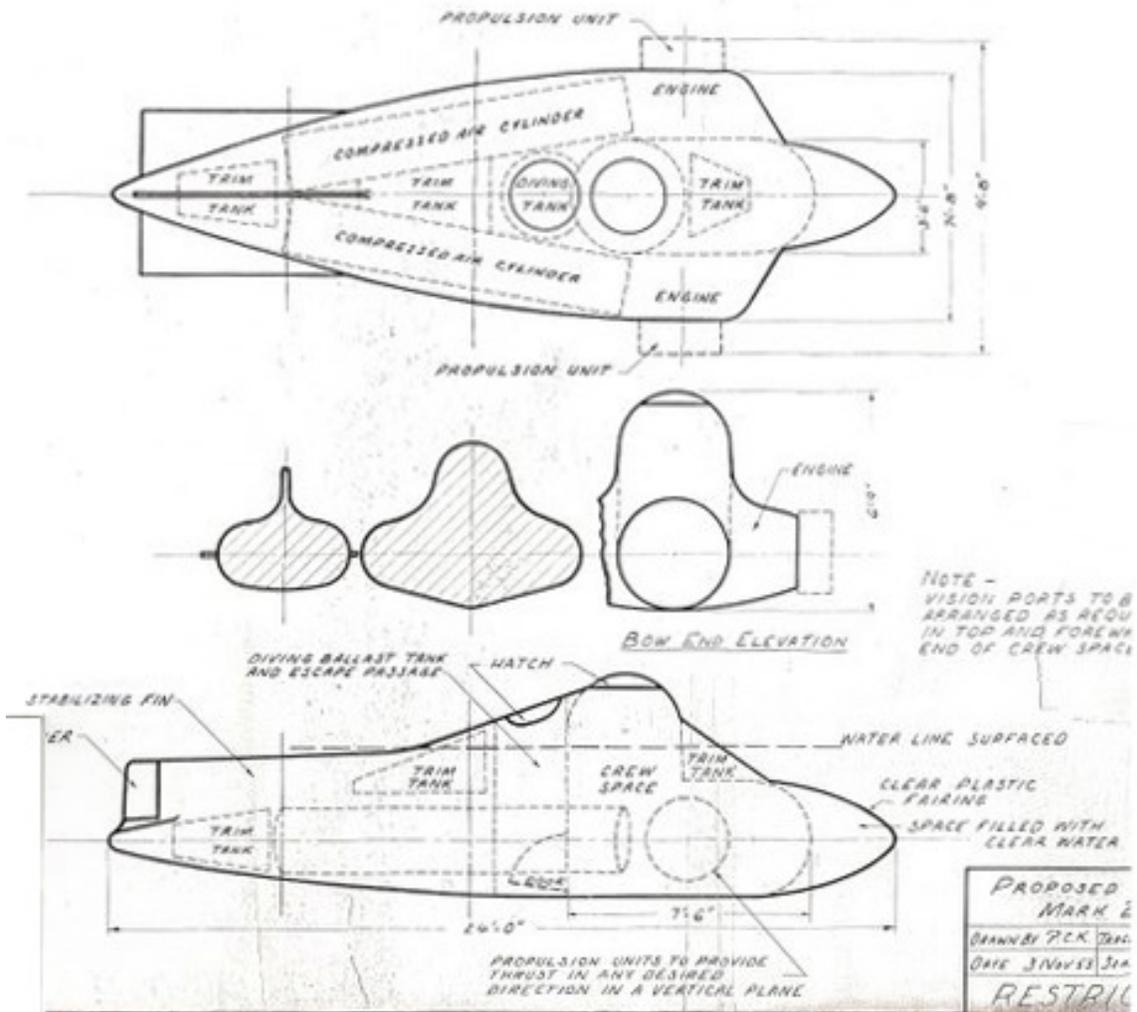


Figure 8

THE DIVERS

The first to arrive at RMC was Lieutenant Commander John Ruse, selected one has to presume because of his wartime submarine experience.



Figure 9

He was the Commanding Officer of the East Coast Diving unit at the time of the RMC submarine trials. After attending Royal Roads in 1940 he served in escorts in the North Atlantic, and then volunteered at age 23 for service in X-craft, the RN's midget subs. It should be noted that the X craft embodied one of the key features of the King submarine - the ability of a diver to exit and reenter the boat while submerged.

A few months after requisite training, Ruse took over as CO of the operational boat X21. As the training soon intensified further, rumours grew that another raid on the German Battleship TIRPITZ in a Norwegian Fjord was imminent, however the planned raid was cancelled, much to the disappointment of all the crews. Ruse then took command of XE8, which was then slated to go to the Far East. However, with the

War drawing to a close, the whole operation was cancelled.

John was demobilized from the Navy in March 1946 upon their return to Canada, but rejoined the RCN in 1950 at HMCS STADACONA as Lt. Commander for the Korean War, taking up the position as Commanding Officer of the East Coast Diving Unit located at HMC DOCKYARD in Halifax.

The second diver to join the project was Lieutenant Don Loney. Many will recognise him as a well known Canadian professional football player, having been on both the Toronto Argonaut and Ottawa Rough Riders teams between 1946 and 1952. He had joined the RCNVR in 1943 and served on the East Coast during the War. He answered the call for candidates for the first self-contained diving course in Halifax in 1950, and served as a Diving Officer until he retired from the Navy in 1957.

Subsequent Events

The submersible was broken up and the parts sunk in Navy Bay. This was confirmed in 2000 when divers involved in NATO exercise found some of the parts and brought them ashore.

One of the larger sections was pressure washed by the RMC boathouse staff, and remained on the jetty for some time. However, the Base Environmental Officer ordered the parts to be put back in Navy Bay as their removal disturbed "fish habitat"! What remains of LCol. King's creation is an 8 minute- long black and white film showing launching and surface operations, more than 90 photos and some construction sketches. NDHQ apparently considered this a Top Secret project as it was not declassified until 1968!



Figure 10

Parts of Submarine MkI

Call For Information

We would appreciate any further information on this project that readers may have. Cadets of that period are known to have helped with the construction. Of particular interest is correspondence related to the involvement of the Diving Unit, and between RMC and DRB.