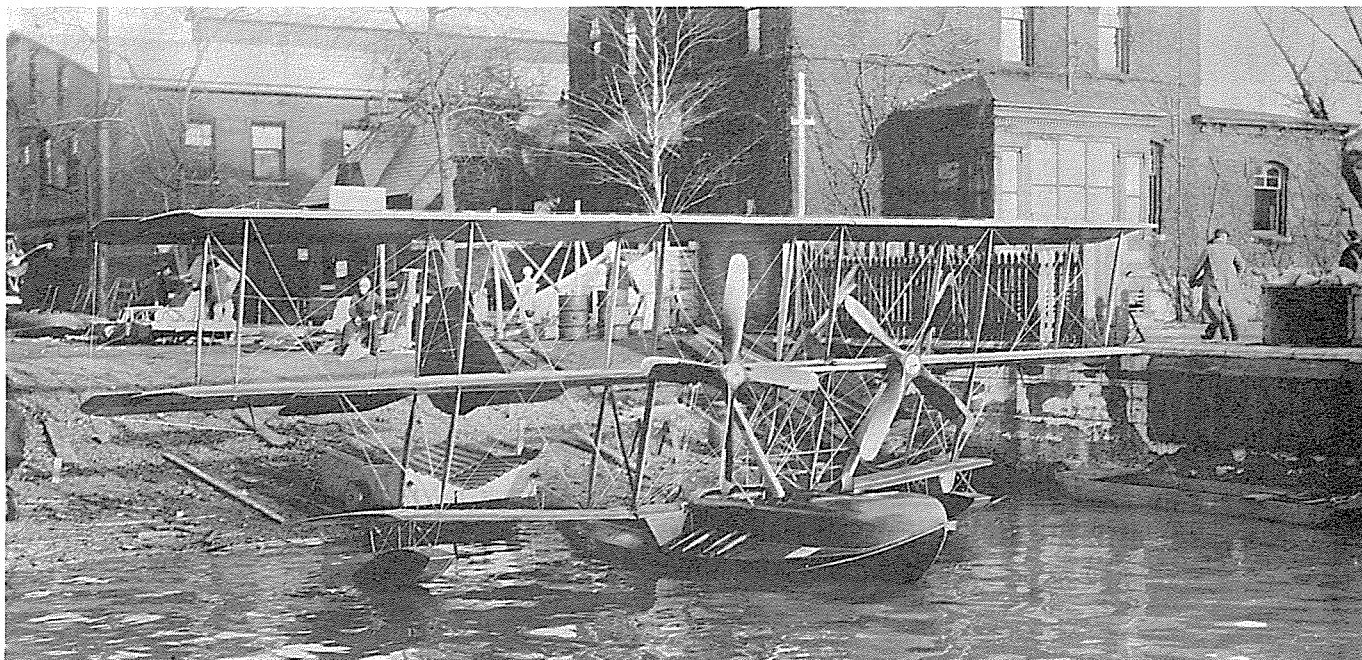




The Curtiss BT-1 at Buffalo, New York prior to first flight. (Photo - Smithsonian Institution, National Air Museum)

Curtiss Flying Lifeboat

By LOUIS S. CASEY

It is soon apparent to anyone who is a student of the evolution of aircraft design during the early twentieth century that Curtiss Aircraft attained a record both in numbers and variations of designs. The development of Curtiss designs never lacked originality whether they were those of Glenn H. Curtiss himself, or from his talented engineers. In fitting together the pieces of the puzzle--and puzzle it is--one cannot fail to be impressed by the many unusual designs. Some led up blind avenues, never to be repeated; some, on the other hand, although unsuccessful, contained major or minor details which showed up again later in successful designs.

Of the latter group, one little known design was the BT-1. The meaning of this designation can only be guessed: Boat Tractor no. 1, or Boat Triplane no. 1 (because it had 3 wings). An earlier tractor flyingboat design might have borne this designation had it proven successful, but this 1911 dud was hardly recorded. Neither are there many details available about the fate of the BT-1, also known as the "Flying Lifeboat."

The design concept for the BT-1 originated during a luncheon aboard the Coast Guard cutter Onondaga. At the invitation of Captain Chiswell, the luncheon was attended by Glenn H. Curtiss and Assistant Secretary of the Treasury, Byron R. Newton. In the ensuing discussions, the problems and dangers of launching Coast Guard surf boats were explored. It was during this discussion that Curtiss was asked to suggest and answer through the medium of aeronautics. (1)

The proposal was for a means of airlifting a standard seaworthy lifeboat over the surf and intervening distance thereby reducing time and danger, and placing the boat near a distressed ship. It was realized that the wing would probably be damaged by a rough-water landing. On alighting, the wings and tail group were to be jettisoned, and the boat was to proceed as a waterborne craft.

Patent no. 1,294,415 gives the mechanical sequence of shedding the aeronautical components. Unlike many such complicated designs, this one actually did fly. It is not known whether the divestment operation was ever tried in actual test or that this linkage system was actually incorporated in the test specimen.

Early in the project, it was determined that the standard surf boat offered little hope of success as a flyingboat hull due to its configuration below the water line. An earlier failure by Curtiss and his fellow members of the Aerial Experiment Association with the smooth-surfaced floats of the "Loon" in 1908 was an argument against a repetition of the same mistake. Also, there were the successes with the D hydro of 1911 and the flyingboats of 1912 to draw upon.

At the time the BT-1 was built, World War I was advancing and the Coast Guard was part of the Navy. The Flying Lifeboat, therefore, was developed further as a Navy project. The resulting design called for a broad-beamed, double-stepped hull, with the engine (a Curtiss V2-3, 8-cylinder, 200 hp) mounted low in the hull, driving, through a shaft and gear train, a double four-bladed propeller assembly which included a complicated transmission. There was an intention to add a water propeller, driven by an auxiliary engine, but this was never installed.

Built at the Curtiss plant on Austin Street in Buffalo, New York, the BT-1 was flown by Roland Rohlfs in 1917, taking off from the Niagara River. As Rohlfs relates it, "The test flight was made to settle a bet between Curtiss and the designer, William L. Gilmore. Curtiss bet that the propeller transmission would not survive until the craft became airborne." Rohlfs had nicknamed that complicated combination of gearing and housing "wobbling eggs," because the rounded housings galloped about like a pair of eggs being hardboiled in a bubbling



Rear view of the BT-1 on the water at Buffalo showing pilot's position. (Photo - The Smithsonian Institution AI96)

pot. As it happened, Gilmore won the bet but only by a matter of minutes. The transmission flew apart soon after the craft had risen from the water.

Shortly thereafter the propulsion was altered by lifting the engine out of the hull and mounting it in the middle bay of the triplane above the center wing. The "wobbling eggs" were replaced by a direct drive to a two-bladed propeller.

Further details of the early flights have not come to light but apparently the aircraft was of sufficient promise to be entered under procurement contract no. 33945 and assigned on December 15, 1917, to the Naval Operating Base, Hampton Roads, Virginia, where it bore the number, 2277.

Further tests were conducted and evaluated by Roland Rohlfs and Lt D. H. McCulloch. The evaluation was not very flattering, as seen by the following extract from the report: (2)

"The tests consisted of air and water work in general, without obtaining definite data in accordance with instructions. The conditions under which all tests were conducted were very good, the water being smooth with scarcely any wind, and the atmospheric conditions being good. No speed or climbing tests were made, but the estimated rate of climb was 2000 feet in ten minutes and the estimated speed was 72 mph. Turns were made on the water at both high and low speed. The boat seemed to handle well in every respect, except that at certain speeds water washed over the stern and into the pilot's cockpit. It appears that the pilot's position would be unusually wet when operating on the water in a cross wind and choppy water. The boat porpoises slightly four or five times before finally leaving the water. Very little spray strikes the propeller when operating on the water. The pilot preferred to use power in gliding, but it was demonstrated that this seaplane could glide without power to a landing. Power was also used at times to prevent the following wave from entering the pilot's cockpit. Mr. Rohlfs stated that he did not care to bank the seaplane very much when turning because of its tendency to sideslip.

"The seaplane is well balanced fore and aft and laterally in normal flight, but on the whole appears to be unstable but controllable under ordinary conditions. There is excessive vibration of the motor while in flight. The seaplane porpoises badly when landed forward of the step, but if landed on or abaft the step, there is no appreciable porpoising. It is the opinion that this seaplane would porpoise considerably when

making a getaway or landing in a slightly rolling sea. The proximity of the observer's cockpit to the propeller is considered dangerous. It is necessary to crank the motor with the propeller by hand, which is difficult and dangerous.

"This seaplane cannot be used to any advantage at this Station for instruction purposes, but if it is to be further used it is recommended that keel planes of greater area be placed on the planes to eliminate the tendency to sideslip; that the motor mountings be re-strengthened in order to decrease vibration; that washboards be constructed around the pilot's cockpit to prevent the entrance of water; that the pilot be more protected from wind and spray, and more protection be made for pilot in case of mishap; that mechanical starter be installed and that control wires to rudder be doubled or increased in size.

"The assemblage in general of this seaplane appears to be worthy of mature consideration and more elaborate tests should be conducted, but when an experimental seaplane is to be tested, it is urgently recommended that the seating and housing arrangement for the pilot be so designed and fitted that if necessary the seaplane could be tested to destruction without unnecessary risk to the pilot. This seaplane in its present condition is not so fitted.

"Information is requested as to the disposition of this seaplane."

P.N.L. Bellinger

A second evaluation of the BT-1 was made by Naval Constructor Holden C. Richardson and was as follows:

From: Construction Officer

To: Bureau of construction and repair

1. The following comments and recommendations are submitted, it being understood that these comments apply to Flying Boat A-2277 as I last saw her at Buffalo, except that I understand that the motor has been removed from the hull and placed in the intermediate plane.

a. As to wetness, it is not considered that this can be satisfactorily improved without relocating the cockpit in the intermediate plane, but it is not believed that the present position is any worse than that in the old F type boats.

b. A stern should be built up to a height of at least 18 inches surrounding the pilot seat. The connection of this shelter to the present hull should be water tight.

c. As to the porpoising feature, it is probable

that this is not any worse than at present exists in the R-6 type, with this difference. When porpoising of the R-6 type starts it is possible to damp by pulling back until the stern comes in contact with the surface. After a short interval in this position, the R-6 may then be eased forward on the step without further porpoising. With the turned up tail, however, on the flying boat, it is probable that this remedy cannot be used, but with the deep bottom lines it is believed that this porpoising, while annoying, should last for only a short interval, and not involve any serious punishment. It is probable that this porpoising is initiated by the oscillation produced on the stern portion when suction is broken, and that it might be reduced or eliminated by rebuilding the after step.

d. With regard to tendency to sideslip, it is considered that a proper distribution of skid fins under the top plane would compensate for this.

e. The proximity of the Observer's cockpit to the propeller is undesirable, but the danger might be greatly reduced by the fitting of netting or chicken wire just to the rear of the cockpit.

f. The cranking of any motor of more than 100 hp by hand on watercraft should be eliminated.

g. Relative to paragraph 5 of letter of Commanding Officer of Naval Operating Base, all recommendations are concurred in, as amplified above, with reference to the engine mountings and additional protection to the pilot in case of mishap. This latter feature can probably best be provided by providing a more simple type of control than existed in this boat when I last saw her, and by providing a hood in the front of the cockpit of sufficient strength and properly padded to provide a shelter for the pilot in case of a smash. This hood, if not already provided, should afford additional protection against the spray complained of.

2. The above recommendations are made should the Bureau consider it desirable to continue the tests of this craft. I am of the opinion, however, that sufficient information has already been obtained and do not believe that the further information to be obtained by carrying the trials into rough water and into rough air is of sufficient interest to warrant the additional expense or the additional work involved particularly with the facilities existing at Hampton Roads. The principal matter of interest has been the determination of the action of the sharp V bottom

lines, the ability to plane readily and to work without serious shock, in landing or getaway. The lines, except the sharp V bottom, differ materially from those proposed for the NC-1, and in particular, at the bow, also curvature of the second and third steps, which does not apply to the proposed lines for the NC-1. Also, if I remember clearly, the step on this flying boat is somewhat different relative to the center of gravity than that proposed for the NC-1, which may have some influence on the porpoising action.

3. From tests in the model basin, it appears that porpoising action is accumulative and depends largely upon the duration of the stage of action and upon the inertia of the seaplane about the athwartship axis, both of which features will, undoubtedly, be different in the NC-1 from those in this flying boat.

4. I recommend that no further trials be required, and that the disposition of this flying boat be left to determination by the Commanding Officer of the Naval Operating Base.

/s/ H. C. Richardson

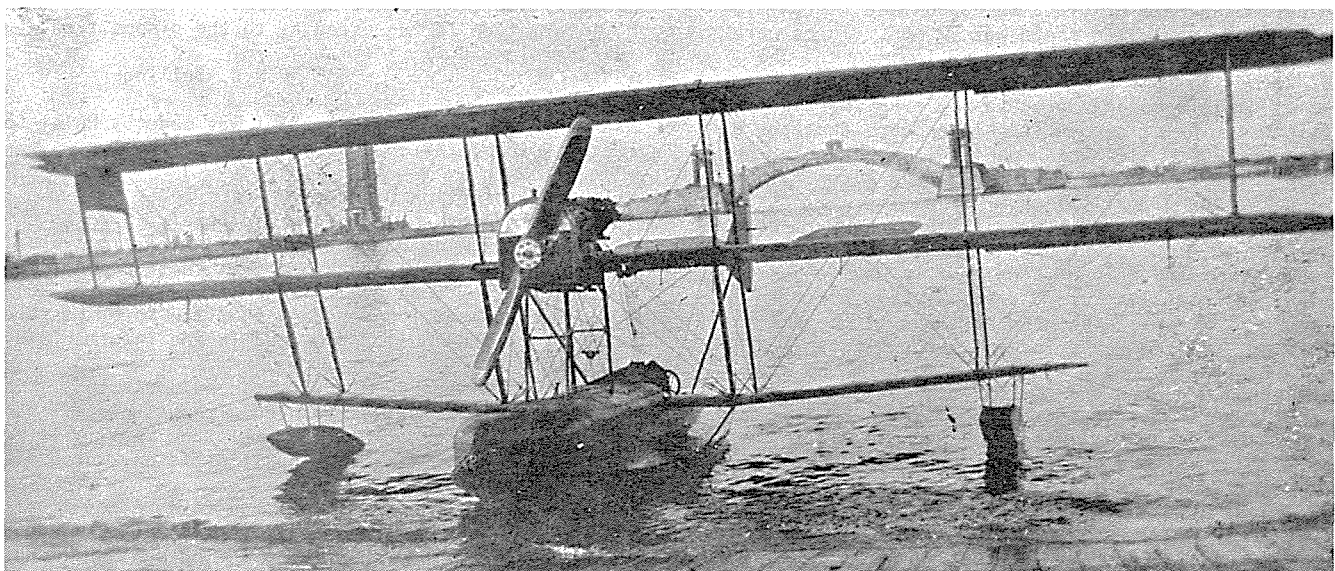
From the foregoing, it becomes apparent that the configuration of the "Flying Lifeboat" with its bobtailed hull, the mounting of the engine, and the geometry and attachment of the empennage, together with the intention of producing a design suitable for use in the open sea and rough water, may well have suggested the general form of the NC flying boats. This is borne out by H. C. Richardson's reference to the first of the NCs.

The BT-1 "Flying Lifeboat" was transferred to the Naval Aircraft Storehouse on October 14, 1918. Reported to be in poor condition, it was stricken from the active list and presumably destroyed on June 9, 1919.

It is interesting to note, however, that while the plane itself was relegated to the bone yard, nine days previously, May 31, 1919, the NC-4 had completed the first of all flights across any ocean. It had safely accomplished what the BT-1 set out to do: alightings and takeoffs on the open sea. And a sister-plane, the NC-3, in which H. C. Richardson was one of the pilots, had survived a wing-wrecking forced landing on the rough ocean and had remained waterborne for 60 hours in 30-ft waves, to sail and taxi over 200 miles to the Azores.

FOOTNOTES: (1) The Engineers Digest No. 106, Sept - Oct. 1957. P. 33.

(2) Evaluation Report 0146-63. P.N.L. Bellinger. Contract File C 33945, National Archives.



The BT-1, with engine relocated, at Naval Air Station Norfolk, Virginia in April 1917. (Photo - NAM 45885-K)