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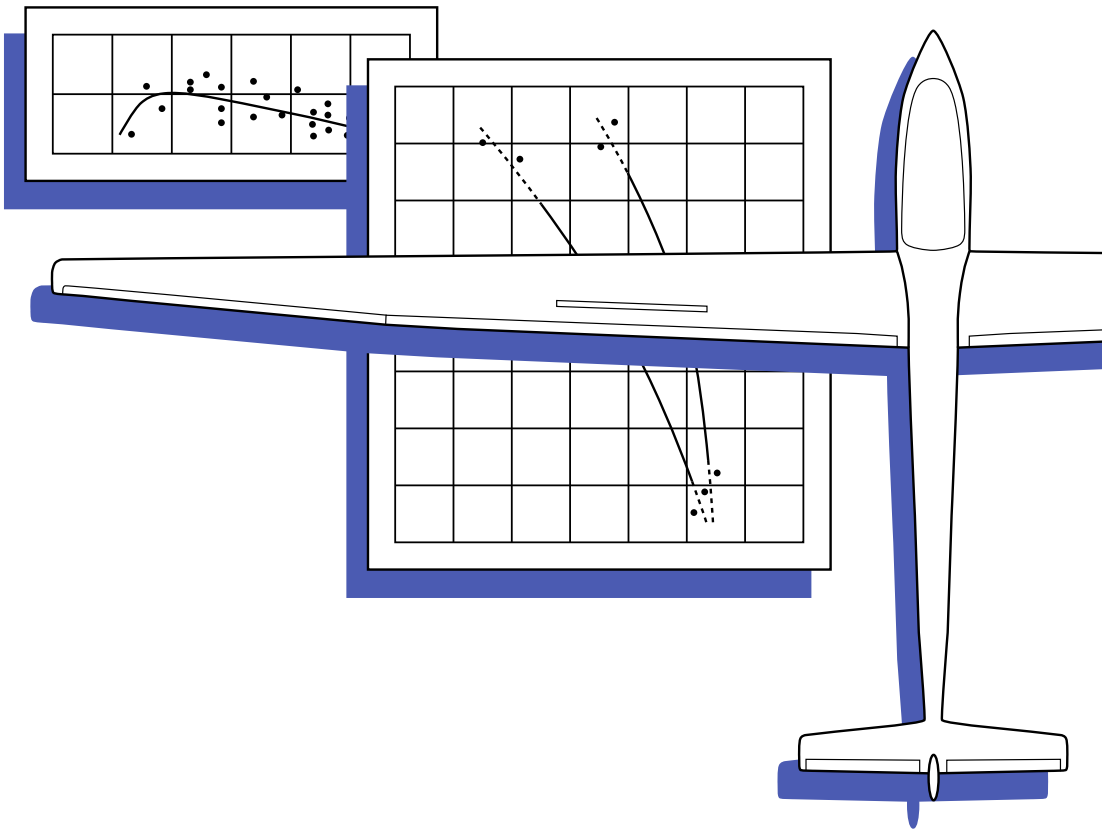

- **Tracing Aerotowing History to 1922**

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From the Editor

Publication Date

This issue is the second of Volume 46 of *TS*, corresponding to April-June 2022. For the record, the issue was published in March 2024.

About this issue

While the mission of *Technical Soaring* is to be an instrument of innovation, documenting 'recent advances in the science, technology and operation of motorless aviation', it is also worthwhile to look back every now and then. The article in this issue explores the early history of aerotowing, providing a detailed account based on original sources of Glenn H. Curtiss's flight experiments in 1922. Authored by Simine Short, a distinguished aviation researcher and historian, this article adds to her extensive portfolio of works on the history of motorless flight. Her latest book, 'Flight Not Improbable' (Springer, 2023), sheds light on the significant contributions of another pioneer, American engineer Octave Chanute. Chanute was instrumental in the late 19th and early 20th centuries, connecting aviation experimenters and promoting the free exchange of ideas and knowledge. For a preview of the book's themes, readers are encouraged to refer to Short's earlier article, 'Flight is Not Improbable: Octave Chanute Combines Civil Engineering With Aeronautics', published in *TS* Vol. 39, No. 4.

Very Respectfully,

Kurt Sermeus
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In the Wake of the Albatross and the Seagull - Tracing Aerotowing History to 1922

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Abstract

In today's world, towing behind an airplane is possibly the most widely used method of launching a sailplane into the air, so that the pilot can search for the right atmospheric conditions to gain altitude and achieve soaring flight. But who thought of this type of launching first? And who was first to succeed? The answer lies in the early 20th century's aviation advancements, prominently led by Glenn H. Curtiss, a pioneer in American aviation. Being interested in hydroplanes, he and his team designed a hydro glider, that could take off and land on water like the albatross and the seagull. This innovative step achieved in 1922 marked the genesis of aerotowing techniques in gliding. Curtiss' experiments demonstrated the feasibility of aerotowing but it took a few more years to be adopted and accepted by the gliding community world-wide.

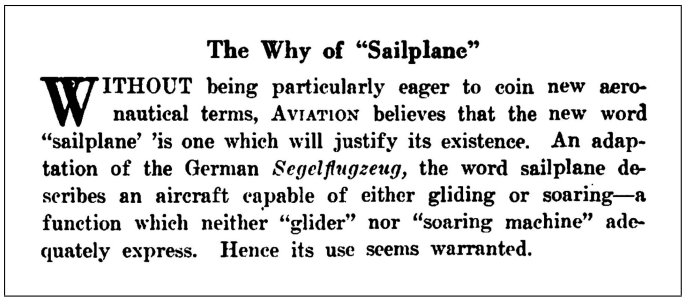
Introduction

At the beginning of the twentieth century, inventors around the world were building and experimenting with gliders, as this was the practical preface to powered flight. Soon, however, the application of the internal combustion engine to aircraft turned the attention of the world's aeronautical engineers to powered aircraft and speed, and this interest was, by necessity, accelerated by World War One. When the war ended, speed lost none of its attraction. Under the terms of the Treaty of Versailles, German aeronautical designers had to work on the less spectacular, but still significant, development of low-speed, high-lift aircraft, typically unpowered gliders. German pilots called their motorless craft "sailplanes" (in German: Segelflugzeuge), because "for all practical purposes, gliding or soaring is simply aerial sail boating in three dimensions" [1]; see also Fig. 1. Their success started a gliding craze that soon presented a challenge to the rest of the aviation world.

Glenn Curtiss

Glenn H. Curtiss, then chairman of the Curtiss Aeroplane & Motor Corporation of Garden City, Long Island, NY, reported in late August 1922, "we can learn how to build lighter, more efficient airplanes, and, having built them, to utilize natural air currents to the consequent saving of artificial motive power. By lessening our speed and increasing our load we not only cheapen air transportation, but also minimize the cost of the planes to popularize aviation in general. The wind tunnel, in which full scale airplanes are tested, performs admirable service, but nothing can equal practical, full-size trials" [3].

This article has been reviewed according to the *TS* Fast Track Scheme.



The Why of "Sailplane"

WITHOUT being particularly eager to coin new aeronautical terms, AVIATION believes that the new word "sailplane' 'is one which will justify its existence. An adaptation of the German *Segelflugzeug,* the word sailplane describes an aircraft capable of either gliding or soaring—a function which neither "glider" nor "soaring machine" adequately express. Hence its use seems warranted.

Fig. 1: Ladislas d'Orcy, Editor of *Aviation* in 1922, explains why the word 'sailplane' needed to be introduced into the American (or English) language [2]. 4 September 1922.

Curtiss (pictured in Fig. 2), whose company always found time and manpower to be active in other directions beside filling orders for the Navy and doing commercial work, now wondered if his "company could develop a plane, light and manageable, for any one to work it, and so cheap that almost anyone can buy one. To do so, manufacturers must find a way to take advantage of the lifting powers of air currents, so that less power would be required from the motor" [4].

Up to this time gliders were usually launched from hills using an elastic bungee cord and manpower, but Curtiss who had always been interested in water-borne aircraft (or seaplanes), wanted to explore soaring over the water. "The albatross takes off with little effort from the crest of a wave and rides the winds for hours. If pilots could learn the secret of the albatross instinct we, too, can soar at will over the surface of the sea" [3].

Fig. 2: Glenn Curtiss standing beside the almost completed water glider in the experimental shops at his Garden City plant. Author Collection.

The Curtiss Flying-Boat Glider

Coinciding with the publication of the sensational results of the three recent European national glider meets in 1922, the 44-year old Curtiss announced via the Aeronautical Chamber of Commerce in late August that his company had developed a new type of biplane flying-boat glider.

Except for its blunt nose, the resulting glider (see Figs. 3 and 4), constructed of wood (spruce) and duralumin with silk fabric covered wings, looked like a miniature copy of his famous NC flying boats. The dimensions of the biplane water glider were as shown in Table 1 [5]. The glider was designed to fly at 20 miles per hour, with an estimated glide angle of 13:1 [6]. To keep the overall weight low, the 49-pound hull was made of duralumin, the "feather-light alloy" used by the Germans for the frames of their Zeppelins.

Table 1: Main dimensions of the Curtiss biplane water glider [5].

Weight (empty)	150 pounds
Loaded (one man)	310 pounds
Wing span	28 feet
Chord	60 inches
Gap	54 inches
Length (overall)	22 feet 11 inches
Wing area	280 square feet
Hull length	13 feet 2.5 inches
Hull width (beam)	30 inches

It had taken two months to build at his experimental shops at Garden City and construction cost was about $5,000, but according to Curtiss, quantity production was expected to reduce

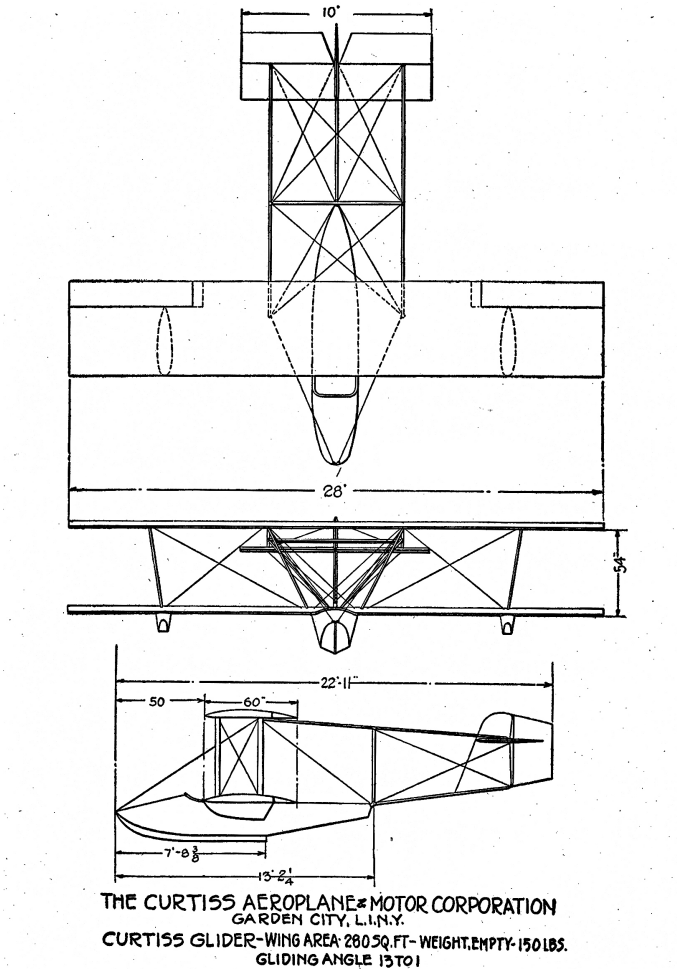


Fig. 3: Three-view drawing of the Curtiss biplane flying-boat glider; from Aircraft Yearbook (1923) [6].

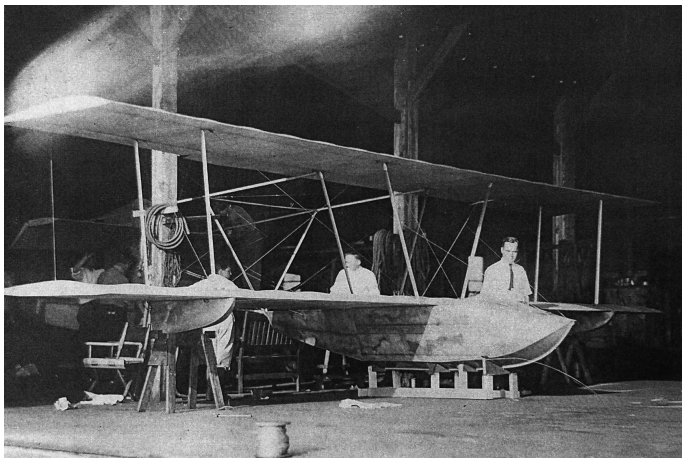


Fig. 4: The water glider at the final assembly on 25 August 1922. Library of Congress, George Grantham Bain Collection - no LCCN.

the price to as low as $500 [7]. The *Brooklyn Eagle* reported that Curtiss' ultimate goal was to develop a glider, which could take off from the surface of the sea, just like an albatross, and then soar over the ocean without flapping its wings.

Take-off Trials

Being mostly involved with the manufacturing business, Curtiss had not flown since 1915, but the latest news about glider flying in Europe, as well as the American efforts by members of the Massachusetts Institute of Technology (MIT), rekindled his interest. He was ready to pilot his "sea-going sailplane" on its first public test flight just outside the Port Washington harbor, at Manhasset Bay, Long Island, on 5 September 1922.

Dressed in his golfing tweeds, Curtiss was barely able to squeeze himself into the tight glider cockpit [4]. The first few attempts to take off into the almost non-existing wind failed, as the towing wire between the speedboat and the glider snagged in the water, snapping several times. The "flying sailboat" (see Fig. 5) did not leave the surface of the sea as expected; they had to increase the towing speed and decrease the skin friction of the hull in the water. Curtiss also hoped to have some wind to assist the take off and to remain airborne.

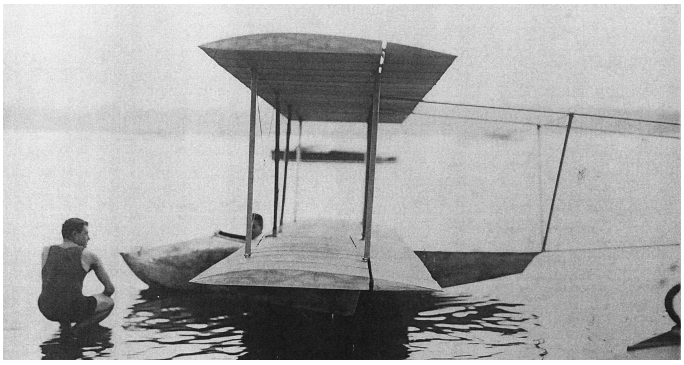


Fig. 5: The water glider floating on 3 September 1922. Library of Congress, George Grantham Bain Collection - no LCCN.

First Flights

A reporter of the *New York Tribune* [8] described in a half-page illustrated article the flying activities of 6 September. The company-owned speedboat with its Curtiss engine could only achieve 25 miles per hour, which was simply not enough speed. Caleb S. Bragg, chairman of the contest committee, Aero Club of America, and Director of Flying, McCook Field in Dayton, OH, attended the flight-testing. His 55-mile per hour, mahogany hull, Liberty motored Casey Jones speedboat, was docked nearby, so he decided to help out; he got his boat and "scooted up to the experimenters, backing it up to the nose of the glider. Put your line on here," invited Bragg. After several additional rope breaks, the sailplane finally rose from the water almost as easily as leaving the ground. For 37 seconds, the glider flew like a kite behind the speedboat over nearly a quarter of a mile. Curtiss was satisfied and considered that enough for

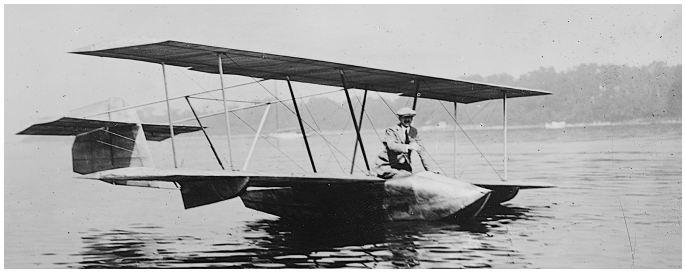


Fig. 6: Glenn Curtiss after his successful first flights. Library of Congress, LC-DIG-ggbain-34904.

one day. Bragg, who liked speed just like Curtiss, had different ideas; he knew where to obtain a stouter wire towline in Port Washington to replace the heavy fishing line. It was a four-mile journey, but "the boat traveled like a streak of light and was back in no time."

Not wanting to wait and sit in the middle of the bay, Curtiss paddled the glider closer to shore (see Fig. 6). As soon as Bragg returned from Port Washington, they attached the new towline to the glider to pull it back to the hangar. Watching the weather, Curtiss detected a slight breeze and "signaled to those on board the Casey Jones to give him more line and pick-up speed. In a flash he was in the air again. For about half a minute he sailed along like a kite on a string. When Curtiss was 30 feet up, he released the line and for nine history making seconds glided unassisted over the water. The smacks of the duralumin hull taking to the water again were like applause in his ears" [8]. Curtiss did not achieve soaring flight, but his glider successfully took off from the water, glided successfully behind the speedboat and then landed back on the water (see Fig. 7).

The two longest towed flights on 6 September lasted about 49 seconds each. Reaching the shore, an enthusiastic crowd greeted him; Curtiss smiled sheepishly, admitting to the on-looking engineers that he used the old time shoulder yoke control system, dating back to his earliest flying days; here a lever on either side of the pilot controls the plane's bank [9].

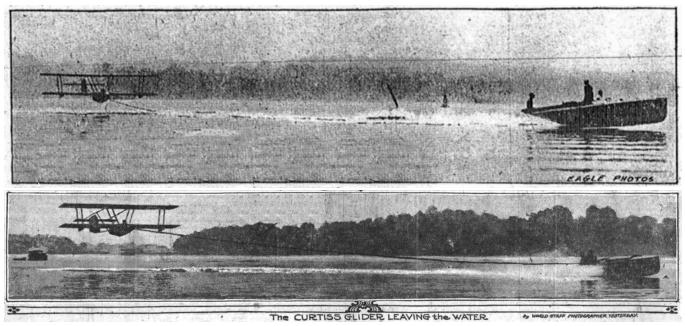


Fig. 7: Sailplane on first trial without having snagged the cable. Note the relatively short towline dragging in the water behind the speedboat. The Brooklyn Daily Eagle, 7 September 1922.

On the last flight one of the lower wing tips was damaged landing in the water near the hangar of the Curtiss Aeroplane & Motor Corporation. The team quickly repaired the wing tip area overnight and installed larger floats to steady the glider when taking off from or landing in the water.

The press, usually not very knowledgeable about motorless flight, continued to headline Curtiss and his glider flying experiments. An editorial in the *Philadelphia Inquirer* questioned, "To what practical use these German gliders can be put is not readily conceivable. If they cannot go anywhere in particular; cannot make regular trips; cannot ascend with a definite plan of reaching an objective point, of what particular use are they except toys? Mr. Curtiss has no ambition to enter the toy business. He is, of course, looking to commercial possibilities in the experiments he is undertaking ... There may be a future for his contrivance, but we are not yet convinced that there is." [10]

The next day, 7 September, was another full day of excitement. The first flight behind the speedboat with the Curtiss engine lasted only ten seconds, it was to oblige a group of motion picture reporters aboard two motorboats [11]. But it would have been good to have more speed to launch the glider.

Kiting Experiments

The Curtiss Aeroplane & Motor Corporation had recently opened its flying school at nearby Port Washington. Flying operations were under the supervision of David McCullough, who had flown the NC-3 across the Atlantic in 1919. He suggested giving his big hydroplane boat a try. Now the glider, being "attached to a skimming mahogany speedboat that only needed wings itself to fly" [12], allowed Curtiss to make a new record by gliding through the air for 17 seconds after releasing from the 500-foot towline. When Curtiss landed back in the water, the hydroplane came back and reattached the towline to the glider. The two-mile return tow from Plum Point back to the hangars was made in 3 minutes 6 seconds.

The experiments of kiting and flying the glider, towed by various speedboats, continued, and several members of the team enjoyed the flying and new experiences; see also Figs. 8 and 9.

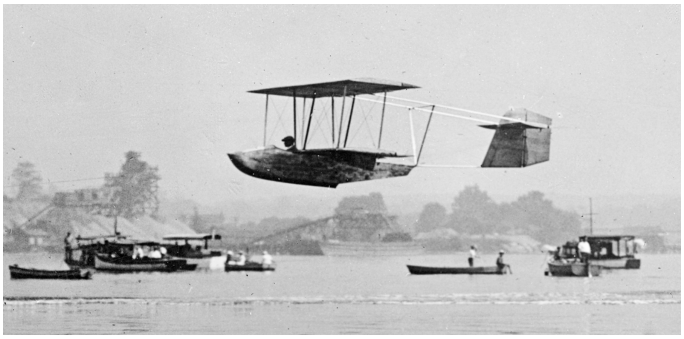


Fig. 8: Glenn Curtiss in flight over Manhasset Bay, Long Island, 11 September 1922. Library of Congress, LC-DIG-ggbain-34903.

Fig. 9: An unidentified member of the Curtiss team flies the glider on 13 September 1922. Reprinted with permission from Glenn Curtiss Museum.

Commercial Prospects

Yes, it was a fun and exciting sport, but being a businessman, Curtiss thought of two possible commercial uses. One could design a small airplane with a comparatively small engine that would utilize the glider's aerodynamics to increase its performance. Such a craft would be similar to today's self-launching motorglider. The other development could be an "air train", where a flying boat or airplane would pull one or more "sailplanes" as "trailers" [13]. This theory had been bouncing around in the aviation community for several years.

To tow a flying machine or a small airship with a larger lighter-than-air airship had been envisioned in the early 1890s; however the editor of *The Safety Valve* [14] ridiculed the inventor of this airship train scheme as being too imaginary. To tow a glider with a speedboat had been tried more or less successfully in various parts of the world since 1905. A few pioneers had envisioned towing a glider with a powered airplane, but no one had done so successfully. Antonius Raab wrote in his autobiography [15] that the Dutchman Anthony Fokker, who resided in Berlin, Germany, in 1912, thought of towing a Lilienthal glider behind an airplane and had submitted his idea for patent. So far no patent has been found to substantiate this claim. Five years later the Caproni brothers from Italy declared: "There will be aerial trains, luxuriously fitted up, capable of transporting upwards of a hundred passengers and of travelling from 120 to 190 miles an hour." [16]. As the war ended a couple years later, Fokker announced that he would develop an aerial train for freight and passengers, where one plane pulls a motorless glider [17]. In November 1921, Fokker exhibited a glider at the Paris Air Show that "could be trailered behind an aeroplane ... and that at any time the occupant can cut adrift and glide down." A reporter for *Flight* [18] dryly remarked, why "anyone should wish to do so is not quite obvious ... It seems that the only advantage of the glider, for this particular purpose, is that

it can be guided to a particular landing ground once it has been cut adrift." This time, Fokker submitted his towing arrangement idea for patent in the United States [19], as shown in Fig. 10, but did not actually experiment with it.

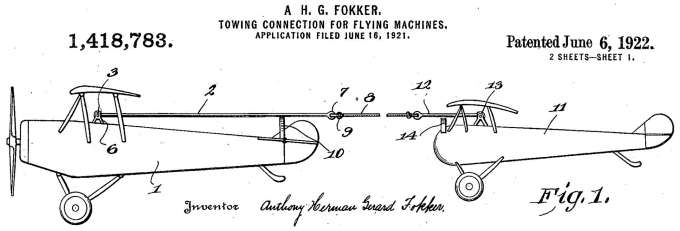


Fig. 10: Drawing of Anthony Fokker's patented aerotow arrangement, US Patent 1,418,783.

First Aerotowing

Curtiss proposed that towing the motorless glider with a powered airplane at higher speeds than any of the speedboats could achieve might be a logical next step. He decided to give aerotowing a try, yet another unheard-of aerial feat. Earlier in the spring of 1922, the Curtiss team had reconstructed their "Seagull" scout plane with an updated, lower weight CD-12 385 hp engine; see Fig. 11. It could now easily fly at 60+ miles per hour. So why not use this sleek and speedy seaplane to tow the glider into the air?

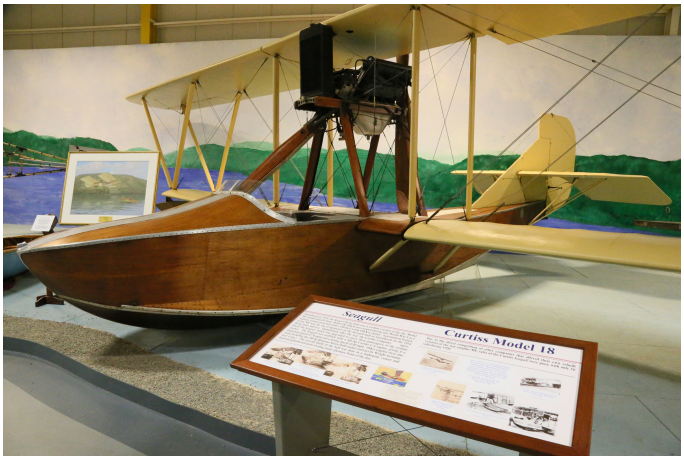


Fig. 11: The "Seagull" as displayed at the Glenn Curtiss Museum, Hammondsport, NY. Peter Selinger photo.

With this in mind, the glider was put back into the shop for various improvements. Among others, the release mechanism, which at first consisted of only one catch (as the German gliders used), consisted now of two catches, one on either side of the nose of the glider. Two lines, forming a yoke, allowed the pull of the towing line to act near the center of gravity [20]. The release mechanism and yoke arrangement of the aerotow lines are shown in Fig. 12.

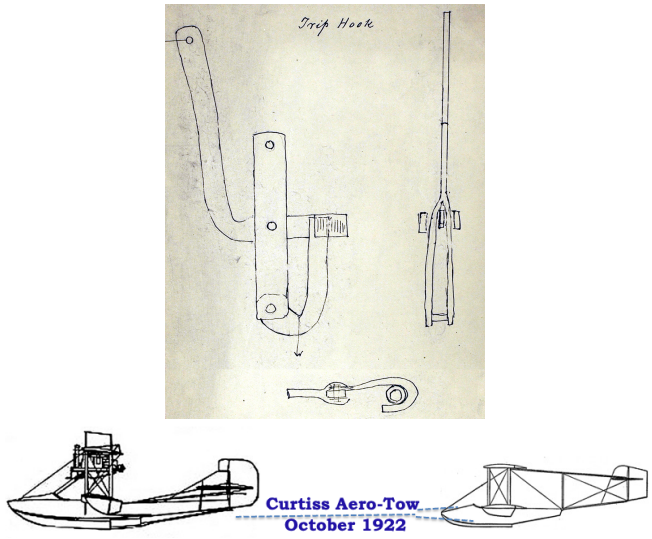


Fig. 12: Curtiss 1922 aerotow arrangement. Top: release mechanism; bottom: yoke arrangement of tow lines. Author collection.

Everything was ready on 1 October 1922. The powerful Curtiss "Seagull" piloted by Harry Rogers, towed the glider, piloted by McCullough, using a 400-foot long steel piano wire. But the wire dragged in the water, snapped twice and the glider failed to get airborne [21]. The experiments were more successful the next day using a heavier and longer wire. Again, McCullough flew the glider and Rogers the "Seagull". This time, using an 800-foot towline, both aircraft succeeded to take off from the water. After a short run, the glider lifted off the water surface first and the towplane rose next. Figure 13 shows both aircraft shortly after lift-off of the towplane. Both aircraft gained altitude quickly and flew over the whole length of Manhasset Bay, the towplane about 175 feet and the sailplane 200 feet in the air. Reaching the opposite side of the shore, the glider released and glided easily down to the surface of the water, landing with a small splash, which did not even spray the pilot [22].

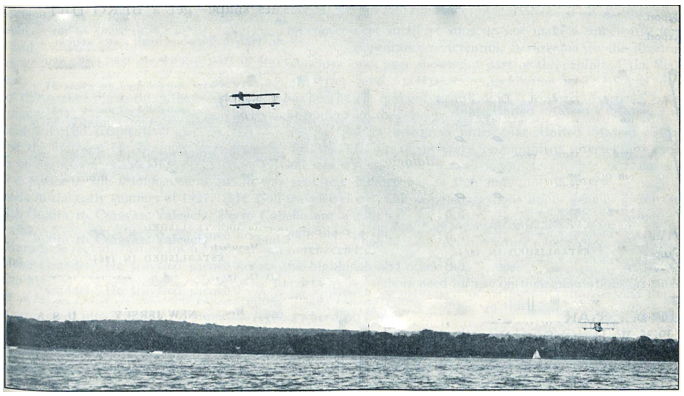


Fig. 13: Aerotow with the Curtiss 'Seagull' as towplane over Manhasset Bay on 2 October, 1922 [23].

Military Applications

The excited crowd in attendance on 1 October 1922 included locals, camera and motion picture reporters, and several aviation personalities, including Stanley Yale Beach (Secretary, Aero Science Club of America and former editor of *Scientific American*), Maj. Lester D. Gardner (Publisher of *Aviation*), Augustus Post (Secretary, Aero Club of America), Edward Schildhauer (American Investigating Corporation) and Samuel S. Bradley (Manufacturers Aircraft Association). General Patrick and Rear Admiral Moffett, representing the army and navy, watched the flights with a view to a military application. They agreed that the glider could be developed as a moving, unmanned aerial target long sought by aviation officers. Interestingly, in late 1922 and early 1923 the staff of the Engineering Division of the Army Air Forces, at McCook Field developed target gliders as part of the American system of anti-aircraft defense. But their glider designs differed significantly from Curtiss' sailplane. Curtiss, the sportsman, however, had different thoughts. He hoped that a thrilling new sport of aerial yachting would develop in America. "Taking off with the help of a powered airplane," he stated, "makes the glider independent of car towing or any other method of launching, offering some very interesting possibilities to the sport of flying."

Watching the glider come down after its last flight (see Fig. 14), Curtiss reportedly turned with a boyish smile to Augustus Post and remarked that the evolution of flight apparently had come to full circle, "from the dreams of birdlike soaring through powered flight back to soaring again" [24].

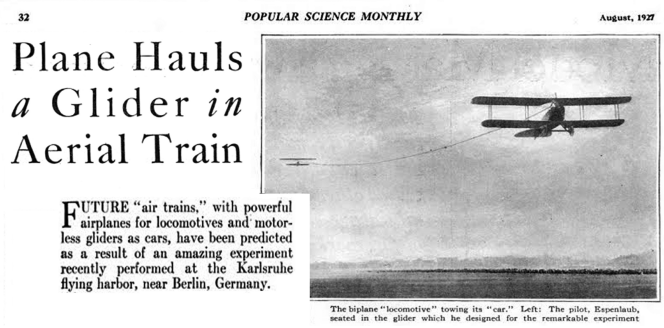
A Critical Look Back on the Experiments

While the high-speed Curtiss Racers were being developed, Glenn Curtiss continued his interest in other exciting aspects of aviation. An interesting editorial was published in late September 1922 in the magazine *Judge*, with which *Leslie's Weekly* was combined. It is entitled "Curtissy" and gives a charming view of Curtiss and his glider flying experiments. "He (Curtiss) was not a firm believer in the contribution of glider flying to the science of aviation, but to conduct novel experiments with an aquatic glider as a means of soaring into the limelight he had canvassed all the possibilities of the sailplane. He demonstrated its value in his recent experiments and was very successful doing so. In fact, with nothing but wind and gravity to help him, he broke all records for sustained self-advertising… Curtiss had put together a motorless plane, hitched it first to a motor boat and then to an airplane and without previous effort rose right up to the top of the front pages of the daily papers and stayed there for twenty-four hours, or was it one week?" [25].

Fig. 14: David McCullough back at the shore after a successful aerotowed flight. Reprinted with permission from Glenn Curtiss Museum.

For Curtiss and his team of innovators at the research facility at his Garden City plant, the glider development and flying most likely was a fun diversion at the conclusion of a pleasant summer on Long Island. No commercial benefit came to the Curtiss Corporation at that time, but the experiments had a lasting effect.

Five years later, in 1927, several groups in Germany experimented with aerotowing gliders, further proving the feasibility of this launching method (see Fig. 15).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Plane Hauls *a* Glider *in* Aerial Train

FUTURE "air trains," with powerful airplanes for locomotives and motorless gliders as cars, have been predicted as a result of an amazing experiment recently performed at the Karlsruhe flying harbor, near Berlin, Germany.

The biplane "locomotive" towing its "car." Left: The pilot, Espenlaub, seated in the glider which he designed for the remarkable experiment

Fig. 15: Gottlieb Espenlaub being aerotowed. Reprinted with permission from Popular Science.

Foreseeing the military potential of gliders, Frank Hawks visited the Peel Glider Corporation in Manhasset on 15 March 1930 to flight test their latest design, the Peel Z-1 Glider Boat, in tow behind a speedboat [26]. The Peel, also a biplane with a Duralumin hull and wooden wings, looked surprisingly like a two-place version of Curtiss' 1922 glider. Two weeks later, on 30 March, Hawks was aerotowed across the United States, from San Diego to New York City, in a Franklin PS-2 glider "Eaglet," as a promotion for the Texaco Company [27]. Starting in 1934, commercial sky train experiments were conducted around the globe, including in the Soviet Union, the United States and Australia [28]. This concept of hauling freight in gliders was further developed during World War II when specially designed cargo gliders delivered troops, mail and supplies to remote war zones in various parts of the world where no powered airplane could land.

Conclusion

Today, 100 years after the first aeroplane tow experiments by Curtiss and his team, sky trains are no longer used, but aerotowing is the predominant method of launching gliders and sailplanes to start their soaring flights.

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