Wing Tips

THE AEROSPACE EDUCATION NEWSLETER OF NEW YORK WING

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1903 WAS THE YEAR

After their success with their 1902 glider, the Wright Brothers were ready to build a larger, stronger version and put an engine on it. They wanted to purchase a gasoline engine that would generate eight horsepower and weigh no more than 180 ponds. They soon learned that no manufacturer had such a motor to offer.

The Wrights' solution to this minor setback was to build their own. They had an employee, in their bicycle shop, named Charlie Taylor who was a superb machinist. Taylor's only prior experience with engines was that he once repaired an automobile engine. The Wright Brothers had built a one-cylinder engine that ran on illuminating gas, not gasoline, to power the machine tools in their shop. Despite this rather limited experience with engines, the three of them designed a suitable engine for the first powered airplane. Charlie Taylor built it in the bike shop while the Wright Brothers worked on the airframe.

The engine had four in-line cylinders and was liquid cooled. It weighed around 200 pounds including accessories and delivered about 16 horsepower at start-up which dropped to 12 after running a few minutes.

The extra horsepower gave the Wrights the opportunity to build a stronger, sturdier plane because a little extra weight wouldn't matter.

All of the knowledge gained in building and flying the 1902 glider was used in designing the 1903, powered, Flyer. There were other improvements in addition to it being larger and stronger. The wing ribs were built up of thin strips of wood with small blocks between. This let the ribs keep their shape under stress. The ribs on the gliders had been steamed and bent to shape and became, un-intentional, "variable-camber" wings under the stress of flight. The gliders had fabric covering only on the top surface of the wings. The 1903 Flyer had fabric covering on both top and bottom. The fabric was used "on-the-bias" both on the gliders and on the Flyer. This enabled the fabric, itself, to provide diagonal bracing for the ribs which were inserted into pockets sewn into the bottom fabric covering.

They used a biplane canard, or front elevator, on the Flyer and a twin, movable tail that was interlinked with the wing warping and operated via the hip cradle.

The Wrights were still faced with a very big problem—the propellers. Their research revealed that there wasn't any real theory about the design of ships' propellers. These were designed by the trial-and-error method; something that the Wrights could

not afford to do. As they, themselves, acknowledged, "With the machine moving forward, the air flying backward, the propeller turning sideways, and nothing standing still, it seemed impossible to find a starting point..."

They did find a starting point, however, by deciding that a propeller was, in reality, a wing traveling in a spiral course. Using this basic premise, they went back to their wind tunnel data that they had collected in late 1901, and made hundreds of calculations. Because of the nature of a propeller, this was a much more difficult task than designing a wing. However, they did it with mathematical calculations, then carved the propellers out of laminated spruce with a hatchet and a drawknife.

They used a chain drive for the contra-rotating propellers and mounted them behind the wing so that the propwash would not interfere with the aerodynamic lift of the wings.

They brought the Flyer to Kitty Hawk, in pieces for final assembly, in late September 1903. Then they had some more problems: the motor kept missing, the propeller shafts broke (twice!), and the sprockets in their chain drive system kept coming loose.

By December 14th all was ready for a flight. A coin was tosses and Wilbur won. He took off, but over-controlled and crashed almost immediately. He was not hurt and the Flyer was repairable. The brothers agreed that this did not count as a flight. They repaired the aircraft and on December 17th, it was Orville's turn. He made the first successful flight of a powered, fully controllable, heavier-than-air aircraft. It was for a distance of 120 feet and a duration of 12 seconds.

Altogether, four flights were made that day. The last, and longest, was made by Wilbur for a distance of 852 feet and a duration of 59 seconds. After the fourth flight, a sudden gust of wind wrecked the aircraft. It was packed up and shipped back to Dayton and never flown again. It has been fully restored and now occupies a place of honor at the National Air & Space Museum in Washington, DC.

AERO ED REPORTS DUE AT WING BY DEC 15

By now, all units should have received blank aerospace education report forms and envelopes in which to mail them back to Wing Hq.