



Glenn
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Diagram of the New Curtiss War Biplane

CURTISS BUILDS BIG WAR BIPLANE

Giant Air Fighter Will Be Capable of Dropping a Ton of High Explosives at One Spot

THE day of the big fighting aeroplane is at hand. With a ton of explosives it is to be hurled by the Allies at the strategic line of the Rhine, to be met by the aviators of Germany in similar giant craft, armed with light artillery and machine guns, and using a bursting projectile.

Practically all the great powers of Europe are at work on the construction of such big aeroplanes. In America, where aviation has long been neglected by the Government, Glenn H. Curtiss is leading the way for the rest of the world in the service of England and her allies.

It has taken a year of modern warfare to develop the fighting aeroplane from the experiences of light-armed scouts who flew in small craft under great limitations. Their small flying machines lifted little more than those seen in exhibitions in American cities. Though of the highest importance for observation, they may be rated as fighters with the smallest torpedo boats. They depend for success largely on the elements of surprise and swiftness, and are limited in operation by their low fuel capacity. The radius of action of the small military aeroplanes now in use in the European conflict is little more than 200 miles.

Four hours' gasoline supply was the usual military requirement before the war. It soon expanded to six hours, and before long may exceed twenty. The big Curtiss craft at Toronto might meet such a demand if need be. There are, however, other needs that are considered more important than endurance of flight, chiefly that of lifting a great load of high explosives and carrying it to the enemy's base or to other strategic points within easy striking distance.

The big Curtiss war machine, though assembled at Toronto, is largely a product of the Curtiss factories at Hammondsport, N. Y., where the motors were built, and at Buffalo. In weight it will reach nearly two tons without load. The two engines alone will weigh 1,200 pounds, and deliver a total of 320 horse power. This is nearly double the power of the America, built by Mr. Curtiss last year for the Rodman Wanamaker transatlantic expedition, though the power plant's weight is only 50 per cent. greater. With a ton and a half load

aboard the total weight to be lifted will be about three and a half tons.

Mr. Curtiss and his advisers are confident that the big craft, which spans 100 feet from tip to tip of her wings, will do what is required of her, insuring orders for a large squadron of similar aeroplanes for the British Army's use, besides others for Russia. He is developing another class of equal power, but slightly smaller, a flying boat of high speed, for the Russian Navy, at his Buffalo works.

With her load of a ton and a half in men, fuel and explosives, the new Curtiss biplane will be able to start from the British base at Dunkirk and strike at any of the German military centres along the Rhine. She may drop almost a ton of dynamite in one spot; for instance, on the big bridge that spans the Rhine at Düsseldorf, or on that near Cologne by which the railway arteries that day and night pour men and munitions into the German trenches cross the stream. Consider the effect of an attack of a squadron of such aeroplanes on a base of supplies and ammunition! Each of the lines of communication will become a target for the aerial assailant at the vulnerable river crossings, which are few in number and congested with traffic. Scouts have reported trains passing at ten-minute intervals for the front across the Rhine bridges day and night.

To meet the threatened attack Germany's air fleet is receiving strong additions in the form of high-power biplanes and triplanes known as "Kolossals." Several of these already have been seen in the field, according to official reports. They are driven by double engines and carry light pieces of artillery.

In Italy a 250 horse power flying "destroyer" has been constructed in Government shops, with three engines. In Russia, Igor Sykorsky is endeavoring to give more speed and lift to his big Ilya Mourametz biplane of 400 horse power, which carried sixteen persons aloft at one time in a brief flight. Other constructors in England and France are reported at work on the problem of the big aeroplane.

With engine power known, and speed and lift approximately determined, it is easy to see the possibilities of the big Curtiss biplane. Mr. Curtiss recently

said that the aeroplane he had designed would carry, if required, enough fuel to cross the Atlantic from Newfoundland to Ireland—about 1,900 miles. For military purposes, of course, this would not be required, as to carry fuel alone would deprive the craft of offensive power. But the estimate served to show the size of the big load to be carried.

At seventy-five miles an hour, the approximate speed of the biplane, the duration of a 1,900 miles' flight would be nearly twenty-five hours. Tests have shown that her motors consume less than half a pint of fuel an hour for each horse power, weighing thirty-eight one-hundredths of a pound. For twenty-five hours at this rate, 320 horse power would require 3,040 pounds of gasoline. In the distance estimate of 1,900 miles, allowance was made for the weight of at least two men with lubricant and instruments, amounting in all to about 700 pounds more. This would bring the total load up to 3,740 pounds. As an effort has been made to increase the speed of the big biplane, possibly at the expense of lift, it is conservative to place the load limit at 3,000 pounds, including men, fuel, oil, and explosives or guns. Probably it is considerably higher.

Raids in which British and French aeroplanes have dropped 300 to 400 pounds of explosives each on vital points in the German defense system have caused a great stir. There was a bitter outcry in Baden over such an attack on Karlsruhe recently. Destruction was wrought by an air fleet of the Zeppelin works at Friedrichshaven, the submarine base at Zeebrugge, and at Düsseldorf, Cologne and Cuxhaven. Every one of these places is open to attack from the big biplane, possessing five times the destructive power of the small aeroplanes, operating from the Allied bases at Dunkirk on the north and Belfort at the southern extremity of the fighting line in the West.

The Krupp works at Essen and Düsseldorf are about equally distant from the British base at Dunkirk—about 185 miles, or five hours there and back for the aviator, at seventy-five miles an hour. Expanding about one and six-tenths pounds of fuel for each mile flown at the seventy-five-mile pace, he must take with him about 590 pounds of fuel and about sixty pounds of oil for the two

160 horse power motors. At least two men, weighing, say, 300 pounds, must make the journey, one to steer, the other to attend to the motors. Both must be ready to fight. In an emergency the control may be set to maintain a given course with the aid of the gyroscopic stabilizer invented by Elmer A. Sperry of this city, which is being installed. This instrument also automatically balances the aircraft at all times, leaving the pilot's hands comparatively free for a clash of arms. Deducting the weights above given leaves a lifting power of 2,050 pounds, or more than a ton, which can be used entirely for enormous bombs to destroy the enemy's works. The weight carried would be divided as follows:

	Pounds.
Gasoline	500
Oil	60
Two men	300
Explosives	2,050
Total.....	3,000

For encounters with other aircraft it would be possible to carry machine guns and ammunition, or light cannon, the weight of which would be deducted from the allowance for bombs.

By carrying more gasoline—752 pounds—the raiding craft could reach Coblenz, 235 miles from Dunkirk, where another of the big German trunk lines crosses the Rhine. She would have available lifting power on this incursion for 1,870 pounds of dynamite, and fuel enough to return to her base at Dunkirk.

Cologne is 200 miles from Dunkirk, the British base, and almost 2,000 pounds of explosives could be used against its railway buildings. Twenty miles south of the city another of the trunk rail lines from Berlin into Belgium and Luxemburg crosses the Rhine on a bridge, a fair mark for the airman.

The fortress and railway bridge at Mainz are 270 miles from the British base. This city can easily be reached by burning 864 pounds of gasoline. This permits carrying 1,750 pounds of high explosives.

Cuxhaven and the German fleet hiding there and guarding the Kiel Canal are 335 miles from Dunkirk—about four and a half hours of flying in calm weather. Fuel and oil for this raid would weigh 1,180 pounds, leaving 1,520 pounds for explosives. Bremen, the big

seaport near the mouth of the Weser, lies about the same distance away.

Hamburg, the principal seaport of Germany, is 360 miles from Dunkirk. After taking aboard the necessary fuel, it would still be possible for the biplane to carry 1,330 pounds of explosives to wreck the shipping there.

From Belfort, the air base at the southern end of the allied line, Ulm, the big railway centre in Württemberg, is but 155 miles. Baden-Baden is 130 miles away, Karlsruhe and Friedrichshaven, the Zeppelin-building city, are each 120 miles away. Consequently, only a small load of fuel is needed, giving room for more than a ton of bombs, to work destruction at these places.

Darmstadt, residence of the Duke of Hesse, is little more than two hours' flight from Belfort. Munich, the Bavarian metropolis, is 220 miles away. About 1,900 pounds of dynamite could be taken there besides fuel and oil. Dresden, the Saxon capital, or Prague, in Bohemia, can be struck after flying 385 miles, little more than five hours, with 1,350 pounds of explosives.

Most interesting, perhaps, is the possibility of taking the war in the air to the two Kaisers at Berlin and Vienna. The Prussian capital is 455 miles from Belfort. One of the big new fliers could cover the distance in little more than six hours, in fair weather. About 1,600 pounds of fuel would be needed for the daring enterprise, but this would still leave room in the bomb compartment for eleven missiles, each weighing 100 pounds, enough to disturb the poise of Potsdam. Vienna is slightly nearer, and might be agitated a trifle more by the new aeroplane.

From the 27 horse power motor that the Wright brothers first used, to twin motors of 160 horse power each, is a long step. Most of it has been taken by Mr. Curtiss in the last eighteen months under the stimulus of the Rodman Wanamaker transatlantic flight effort. Indeed, America's lead in the development of the big aeroplane is directly due to the encouragement given by Mr. Wanamaker to the constructor and his staff at Hammondsport, N. Y., at a time when

aviation was languishing. In one short season, on the order for a transatlantic flier, Mr. Curtiss produced what had previously been found impracticable—a double-engined aeroplane, and one of larger size than any other flying boat.

It proved capable of lifting heavy loads and of traveling through the air at a rate of more than sixty miles an hour. Trouble in rising from the water, which appeared in the first tests, was overcome, soon after the war began in August of last year, by a simple alteration of the tail from a cylindrical to a flat form. The America, as she was known, flew with one motor stopped, the other sustaining her.

In England, where she was sold to the Admiralty on the recommendation of Commander John C. Porte, the Curtiss craft seemed to point a way ahead in aeronautics, and orders were given for thirty-two of her type.

Though the America proved useful in North Sea raids, she is a flying boat, unable to alight on or rise from dry land. In addition, there appeared the need of aircraft with still greater capacity than hers, said to be about 1,800 pounds.

It was found that the ordinary biplanes used by the British and French armies, sent to raid the line of Rhine defenses, supply stations and communications, arrived at their destination with a comparatively small amount of explosives, even after the pilot discarded his companion, the observer, and flew alone to save lifting power. This proceeding, while successful in a measure at times, failed at others. The strain on the pilot was tremendous. He was trying to aim at the enemy, while keeping a hand on the control and an ear to the engine's beats. Often he missed fire and expended his few bombs in vain. The gyroscope stabilizer was added to the America class to relieve these overworked aviators.

Then came the demand for more speed, more lift and more power. It found the American builder already prepared with a big motor, developed for the next transatlantic effort, and another flying boat of larger size than the

America, designed for the same purpose. The latter is the big biplane at Toronto, with modifications in the plans to give greater speed and load-lifting, and others to add to its offensive qualities, and to make it a landing machine instead of a seaplane.

Without exception this biplane is believed to be the largest ever constructed for military use. It is slightly exceeded by the Russian Sykorsky, built for passenger-carrying, with four motors of 100-horse power each. The Curtiss giant spreads its wings 100 feet, as against 72 feet, the stretch of the America's top plane. There is about one-third more sustaining surface in the new wings than in those of the Wanamaker boat. The stout main spars of these planes look more like a bridge span than a flying machine.

There is indeed the power of a miniature storm in the two engines and propellers of the big "pusher," as this type of aeroplane is termed in distinguishing it from the tractor type, which is drawn through the air by a screw at the bow. Each of the 160-horse power motors exerts a thrust on the air of 1,000 pounds through the grip of its nine-and-a-half-foot propeller.

The engines are of the water-cooled stationary pattern, each with eight cylinders, set V-shape, four on a side. The use of two of them gives the advantage that descent in a hostile country is not made necessary if one motor stops, the other being able to sustain the biplane in slow flight.

The engines are near a line midway between the upper and lower planes and on either side of a long torpedo-like body or fuselage, and are about ten feet apart. In the body are sheltered the pilot and engineer, control wheels in duplicate, fuel and explosives. The engineer finds the motors more conveniently placed than in the America, where he was obliged to stand on the after deck to reach them. They were placed almost as high as his head.

To gain speed, Mr. Curtiss has cut down head resistance wherever possible to do so without weakening the craft.

In this work he has had the assistance of Dr. Albert F. Zahm of the Smithsonian Institution, a noted authority on aeronautics. The constructors' staff at Toronto also includes as manager J. A. D. MacCurdy, a noted aviator long resident in this city, and Anthony Jannus, constructor and pilot, recently of Baltimore. Charles M. Manly of this city, once Samuel P. Langley's aid, is watching the work for England.

Compared with the America, there is an increase of nearly a third in length, giving about forty-five feet over all. The expensive silk covering of the America's wings gives way to Irish linen over frames of spruce and ash. The fabric is coated with a waterproof and airproof preparation.

Balancing is obtained by flaps hanging from the rear edge of the upper planes, each about sixteen by four and a half. If the craft tilts to the right, the flap on that side is pulled down and the pressure of the air stream against it gives more lift to the falling side, correcting the tilt.

Elevating planes are placed on either side of the tail, which is terminated by the vertical rudder. This sheet of steel armor will shield the under side of the pilot's and engineer's places and the motors from bullets fired from the ground.

The propellers are an interesting feature. Each swings through a circle of nine and a half feet diameter, a foot and a half greater than those of the America. At 1,200 revolutions the tips of these members are moving through 35,810 feet, or nearly seven miles a minute. Because of the great centrifugal force, a severe strain is imposed on the tips. The propellers are built up of layers of wood, and the tips are sheathed with copper.

Those working on the new biplane are enthusiastic in the belief that she is only the first of a big fleet of aeroplanes of even greater size that will be built by American ingenuity, encouraged by Europe's appreciation and money. Already nearly \$4,000,000 is being sent here this year from across the ocean for aeroplanes and aeroplane engines.