THE WRIGHT FLYER AND ITS POSSIBLE USES IN WAR

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Flying consists in sustaining a body in the air against the force of gravity by means of the dynamic action of the air against some movement of the body. Men have attempted to fly in three different types of machine, the ornithopter, which flaps its wings in imitation of the flight of birds; the helicopter, which lifts itself by the use of vertical propellers, and the so-called aeroplane, which is sustained by the reaction of the air on inclined surfaces.

Neither the ornithopter nor the helicopter has given practical results. The aeroplane is the one which has made all the flights worth mentioning and is at all practical.

The word "aeroplane" is decidedly a wrong name to apply to the present day machine, as the surfaces used are not planes but curved surfaces. The Wright brothers and several New York papers have introduced the use of the word "flyer," which is much more appropriate.

The Wright flyer which has been purchased by the Army for instruction and experimentation consists of two main surfaces, a forward elevating plane, a steadying plane in rear and two vertical rudders for steering.

The main surfaces do the actual supporting of the flyer. They are about 36 feet long, 5.2 feet deep, superposed with 5.2 feet between the surfaces. These, like the main surfaces in other successful machines, are concaved downward, as can be seen in the illustrations.

The forward plane is used for elevating and depressing the flyer. It is about 15 feet long and 3 feet wide, arranged so that it is concaved on whichever surface is bearing. This is seen in Figs. 1 and 2, in one of which it is in position for elevating and the other for depressing.

The steadying plane is of the same form as the front elevating plane, but is rigidly attached and has no motion. This plane was at first used superimposed on the front plane and having the same motion, but was changed to the rear to give greater steadiness. Fig. 3 shows the old arrangement, and Fig. 4 the new.

The vertical rudders are two planes, each about 1½ by 6 feet, placed 1½ feet apart and 8 feet behind the main surfaces. They
guide the flyer in the air in the same manner that a rudder guides a ship in the water.

To secure lateral stability the tips of the main surfaces can be warped. This idea was first used by the Wrights and is one of their patents, but it is now used by several foreign aviators, notably Bleriot and the Antoinette Company. The lawsuit of the Wrights against the Sydney Bowman Automobile Company when they imported a Bleriot machine to sell in this country was over this point.

The main surfaces are in three parts, a main central section and two wing tips. The central section is 13 feet long and each tip 11½ feet long. There are between these sections joints movable in a vertical direction. The entire front of the main surfaces is trussed by wooden struts and steel wires and is immovable. The middle section is similarly trussed in rear and also cross-trussed from front to rear. The end sections, however, are trussed in rear, as shown in the diagram (Fig. 5).

From this it is seen that if the lower wire is pulled toward the left the right tip will be pulled down and the left up, and vice versa. Then, as the front of the surfaces is immovable, a movement of the wire in any direction will warp the tips and cause them to present a greater angle on one side and a lesser on the other side.
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thus giving an increased lift on the side of the greater angle and a diminished lift on the other side. (See Figs. 6 and 7.)

(For small angles the greater the angle the greater the lift. The exact law of this lift, like all other aero-dynamic data, is in dispute, as all the data comes from men who have not built successful machines, and the men who have built successful machines either say nothing or imply that the existing law tables are not correct.)

The flyer is given motion by two propellers about 9 feet in diameter and 11-foot pitch, which revolve in opposite directions at about

Fig. 2. Forward plane in position for depressing.

350 revolutions per minute. They are driven by chains from the engine.

The engine is gasoline, four cylinder, water cooled, running at about 1,200 revolutions per minute and giving about 36 horsepower at that speed. It weighs 165 pounds, exclusive of radiator and magneto.

The flyer altogether when leaving the rail with water, gasoline and two men weighs about 1,100 pounds; it goes at a rate of about 40 miles per hour and carries enough fuel for a flight of three and a half hours.

There are several questions which are almost invariably asked by people looking over the machine. One of them is: "What happens when your motor stops? Do you have to come down?"
A flyer is only sustained in the air by the reaction due to its speed, and whenever this is lost the flyer will drop. However, this is never totally lost, as the same force that causes the descent can be used as a motive power to keep up the speed. In other words, if the motor stops, the machine is pointed down at an angle until the component of gravity in the direction it is going is equal to the push required. This keeps up the speed necessary for control, but, of course, makes the flyer gradually descend.
The present flyer can glide down without motor at an angle of from 1 in 5 to 1 in 7.

The next question is: "What use are these things going to be?"

From a military standpoint, the first and probably the greatest use will be found in reconnaissance. A flyer carrying two men can rise in the air out of range of the enemy, and, passing over his head out of effective range, can make a complete reconnaissance and return, bringing more valuable information than could possibly be secured by a reconnaissance in force. This method would endanger the lives of but two men; the other would detach several thousand men for a length of time and endanger the lives of all.

The next use will probably be in carrying messages. A flyer will average a speed of 40 miles an hour in a straight line. Excepting the telephone and the telegraph, there is no other method of communication as rapid as flying. Automobiles, motor cycles, etc., usually do not average this speed, and very often have to go around two or three sides of a square to get to where they are going. This would be particularly valuable for carrying messages between bodies which have been more or less separated, as between the main attack and a flank attack, and between the main body and independent cavalry, or cavalry on a raid.
Another time where advantage might be taken of the speed of these machines is when officers of high rank might desire to give personal supervision at a distant point of the line or to go from one point to another for a council of war. This is particularly the case in modern armies of large size where the front is 70 or 80 miles long. Take an army on a 70-mile front, the army consisting of three parts, the center and the flanks. The commanding officer desires a council of war. The two flank commanders are then about 20 to 25 miles from main headquarters. These men could be brought to the council in three-fourths of an hour by a flyer and returned in about the same time. If they tried to come in an automobile, or on horseback, they might find no good roads, and what there were would probably not be straight and would be certain to be congested. Their progress then would almost certainly be slow, and they would probably be kept from their commands for hours.

As the United States was the only first-class power which signed the Hague agreement as to dropping projectiles from balloons, it is not probable that this agreement will be in force in future wars. Probably a large amount of damage could be done to the personnel of the enemy when in mass, or in a raid to the storehouses and depot, by projectiles dropped from a flyer. That any could be done to fortifications or ships is doubtful.

Flyers might also be used to give warning to war vessels and fleets of an impending attack by submarines. A person looking at water can see down into it only when the angle of the line of sight with the vertical is less than about 50 degrees. In other words, a man at a masthead 100 feet high could not see a submarine until it was about 125 feet away; a man in a flyer 3,000 feet directly over a ship could see a submarine approaching within a radius of 4,000 feet of the vessel and by circling around could greatly extend the zone of protection.

Another remark frequently made is: "Well, I don't see what use these things are if you can't fly except in a large open plain and in a calm or almost a calm."
This is quite reasonable, judging from the flights at Fort Myer and College Park. However, conditions at both places were quite different from those of actual warfare.

At Fort Myer, Orville Wright had a new machine 4 feet less in width and 9 inches less in breadth than usual. He, naturally, did not want to try this machine in anything except a calm, and he waited until the weather conditions were favorable for trying it. When used to the machine, he went up in winds up to 15 miles per hour, but never more than this. His object was to go through the tests and sell his machine to the Government, and he did not care to run any risk of smashing the machine beforehand.

At College Park the object of Wilbur Wright was to instruct two officers in handling the machine. These men had to receive their instruction in a calm and gradually advance to higher wind. To have taken the machine out in high winds would not have been any instruction to the officers and would have risked smashing the machine and having it out of commission during weather favorable for instruction.

In the hands of experts these machines ought to be able to work in winds up to 35 miles per hour and would be able to work in fields much smaller than College Park.
Of course, accidents of one kind or another are bound to occur, and in open country the damage resulting from any cause, such as the engine stopping or a wire breaking, is greatly decreased. In flying over rough country any accident is liable to cause serious consequences, especially if the flyer is low down, as it may not be able to avoid trees, houses, trolley wires, telegraph poles, etc. At a great height this risk lessens, as there is then a much larger radius from which to select a landing place.

Of course, in time of war flyers would cross any kind of country.

Fig. 7. Wing tip warped to diminish its lifting effort. The far tip is simultaneously warped in the opposite direction.

but in their present state of development there is no more reason for risking the lives of aviators by sending them over rough ground unnecessarily than for risking those of soldiers by firing real projectiles at maneuvers.

In addition, it must be remembered that if because of a storm the flyers can not be used the Army is no worse off than if it had none, and the cost and number of men used is insignificant. One officer, ten men and two wagons are a full equipment for a flyer.

Figures 3 and 8 are from photographs borrowed from the office of the Chief Signal Officer, U. S. Army. The remaining photographs are by Sergeant-Major Lefever, Engineer School Detachment.
Fig. 8 Showing the arrangement of motor and propellers.