GLIDING AND SOARING . . .

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To the uninformed, it is quite a mystery how a human being can go aloft in a motorless aircraft, soar with the birds and return safely to his point of departure. It is even more of a mystery when the soaring pilot goes aloft and flies many miles to a preannounced destination. In order to remove the shroud of mystery for those who are uninformed, this article, in elementary terms, will shed a bit of light on what gliders are and how they operate.

First let us define these motorless craft in their various categories. Gliders generally are classified as primaries, secondaries, and sailplanes (high performance).

The Primary Glider is one of the earliest types using the conventional airplane controls. This glider has the bare essentials of a motorless craft—wing, tail, pilot sea and controls, comprising the simplest type of construction. The gliding ratio of this type of glider is very steep, about 7 to 1, due to the drag of the exposed structure and the pilot. While this type of glider is cheap to build, its low maneuverability and lack of crash protection for the pilot made it obsolete as a training glider in this country at an early date.

The Secondary Glider has essentially the same dimensions as the Primary Glider, except that the fuselage has been enclosed and streamlined to the tail group, the flying and landing wires which brace the wings have been replaced with streamlined struts, and the gliding ratio has been increased to about 12 to 1. A single wheel near the center of gravity makes this type of glider easier to handle on the ground and also lends itself to the "solo" method of flight instruction. The additional fuselage structure provides considerable protection to the pilot as well as providing support for additional controls, instruments, etc.

The term "Utility" is often applied to the Secondary Glider, a very popular type with glider clubs. This term describes a secondary glider which is rugged enough for training purposes, yet which has performance enough for elementary soaring and aerobatics. The term "utility" also implies that the glider can readily be assembled or disassembled by a small crew, and in the disassembled condition packed compactly on a trailer for transporting from place to place.

The sailplane or high performance glider is identified by its sleek streamlined appearance. The pilot compartment (cockpit) is faired into the fuselage and is usually enclosed. The wings are long and slender and sometimes gull shaped like those of soaring birds. These refinements reflect the best application of aerodynamics to give the craft optimum performance. It is the sailplane which holds the most appeal for the soaring pilot since in it he can remain aloft for hours at a time, going from place to place almost at will. The sailplane is man's approach to the soaring birds.

In general, the glider structure is very similar to that of a powered airplane. It consists of the same main parts namely, the fuselage, wings, empennage, and landing gear. It also has the same flight control system as an airplane. It differs from the airplane in that the pilot sits in the nose of the fuselage which is normally the space occupied by the engine. This is for purposes of balance. It further differs in that in most cases the wings and the horizontal tail can be removed and the entire glider loaded on a two-wheeled trailer.

The glider may be thought of in terms of an airplane whose engine has ceased to function or as an "air toboggan." A glider in flight is always "coasting" downward with relation to the air mass within which it is flying. This "gliding down hill" on air is like the toboggan coasting down a snow-covered hill. The distance the toboggan goes depends upon the height of launching and the angle of the slope. Likewise, the distance a glider can go depends on its initial altitude and its angle of glide. This, of course, holds true only in an air mass which has no vertical or horizontal motion relative to the ground.

When a glider is said to "soar," it is gaining altitude with relation to the ground, but is still sliding down through the air mass within which it is flying. By a stretch of the imagination, we can again compare this with the toboggan sliding down hill wherein the hill is being raised upward by some gigantic force. If the hill is being raised faster than the toboggan is descending, then the toboggan will be gaining altitude. The lower earth's atmosphere is full of masses of air to which have been imparted a vertical motion. Some are going up while others are descending. To soar, therefore, the glider pilot must seek out and maneuver his glider within the rising air currents. If wings are substituted for the sliding surface of the toboggan, it can be seen that we have a supporting surface on which to do our gliding.

Glider Aerodynamics may be defined as the study of the forces produced by relative motion between the air and glider. The important parts of the glider that are subject to aerodynamic forces are the wings, fuselage and tail surfaces. The glider wing in cross-section has a certain shape called an airfoil.

An airfoil is a profile designed to be projected through the air in order to produce a useful dynamic reaction. Many airfoil sections of various shapes have been tested in wind tunnels and the effect of the air upon them recorded. Airfoils selected for use on gliders are those which have proved most efficient at slow speeds and give a good lift to drag ratio.

The effect of air moving past an airfoil may be resolved into two forces, one perpendicular to direction of airstream and approximately perpendicular to the surface of airfoil, and the other parallel to the airstream. The perpendicular force is called "lift." The force parallel to the air current is called "drag." Drag is the resistance of the airfoil to movement through air.

As the airstream strikes the leading edge of the airfoil, part of the air is deflected upward above the surface of the airfoil, and creates a lower pressure due to the curved shape of the surface and the resultant increase in air velocity. The air that is forced downward produces a positive pressure on the bottom of the wing. The combination of high pressure below, and a low pressure above, produces the vertical force or lift which supports the glider.

The lift of an airfoil depends upon three factors, the angle of attack, the density of the air and the speed at which it passes through the air.