• *How It's Done*

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There is longitudinal stability, lateral stability and directional stability. Longitudinal stability is obtained by the use of the horizontal stabilizer and elevators. Lateral stability is dependent upon the vertical stabilizer or fin and rudder. There are other factors entering into stability, such as wing design and dihedral angle of the wing.

There is still an additional type of stability, which is very important in gliders, called "spiral stability." This is obtained by proper combination of wing and tail which tends to hold the glider in any turn in which it is placed. If the glider has proper spiral stability there is little danger of the pilot's getting into a dangerous spiral dive while attempting steep banks or while spiralling on instruments.

One of the primary aerodynamics of gliders is that it can climb only on excess speed. The student must remember this and keep the nose down if he wishes to avoid the troubles incident to an accidental stall.

Soaring is the art of maintaining or gaining altitude in aircraft with no mechanical motive power. Any aircraft can soar under certain meteorological conditions and for limited periods of time. Certain types of motorless aircraft, called sailplanes, are so designed that they may utilize extremely small vertical air currents to maintain flight.

Efficient soaring technique requires efficient allround flying technique. Soaring flight is in many aspects the most highly refined kind of flying, since it most nearly approximates the natural flight of birds. Inasmuch as the "bird brains" acquired in soaring is a commodity useful to pilots of even the most highly powered pursuit aircraft, a cursory technical description of the various facets of the art follows.

While all soaring consists of the utilization of vertical currents in the air, these currents are caused by different forces; or combination of forces. The soaring categories derive their names from the force motivating each; ridge soaring, thermal soaring, frontal soaring, and cloud soaring.

Ridge Soaring is the utilization of rising air which is being mechanically lifted. When wind blows toward any obstruction, it is deflected from its course. If the obstruction is a house, the wind force is directed around the sides and over the top of the house. If the obstruction is a small hill, the same is true. However, if the obstruction is a range of hills or mountains, the wind direction in any given locality along the range will be upward, since the wind finds it simpler to direct its force up and over than to the sides.

The obstructing range will, in addition to deflecting the wind direction to the vertical, act very much like a dam in a waterway. It will build up an area of pressure extending for some distance in front of itself.

Suppose, for reference, we take a sailplane with a sinking speed of three feet per second and fly it toward a ridge such as the above example. If the vertical force of the wind building its pressure against the ridge is greater than three feet per second, the result for the sailplane will be vertical ascent, the velocity of which is the difference between the sinking speed of the ship and the velocity of ascent of the deflected wind. That is, if the wind were rising at five feet per second, the sailplane in question would gain altitude at the rate of two feet per second.

Ridge soaring is the simplest soaring, and it has the distinct advantage of offering a lifting force for as long a time as the wind blows against the ridge with sufficient velocity to neutralize the sailplane's sinking speed.

Thermal soaring is named from the "thermal," which is a rising column of air caused purely by meteorological conditions. The word "thermal" has been coined by the soaring pilots, and it is derived from the fact that differences in temperature and heat are the formulating factors.

When the sun strikes a surface which is a good radiator of heat, this surface will tend to superheat the air directly above it. The superheated air, following physical laws, will become lighter. Being lighter than surrounding air, the surrounding heavier air will tend to displace it toward a position where the weight (pressure) and temperature will be equalized to the surrounding air. The direction of displacement will be upward.

As the column (or bubble) of heated air moves upward, it will expand, since the pressure will diminish with each unit of altitude. As it expands, it will dispel heat, or become cooler. However, on a good soaring day, it will cool less quickly than the surrounding air, and this differential in cooling will continue to furnish vertical motive power. The soaring pilot locates these rising air masses and spirals within them to gain altitude.

Frontal soaring is similar to ridge soaring in that, in the van of a cold front, there is an area of constantly lifting air. This is caused by the fact that a cold air mass, being heavy, will displace a warm, lighter mass upward. While the cold mass is moving steadily across country, the warm air it meets is pushed upward at the line of discontinuity called the Cold Front.

The essential difference between frontal and ridge soaring is that behind the frontal lift lie dangerous flying conditions; the towering masses of thunderheads in which operate vertical currents sufficiently powerful to tear the strongest aircraft to bits. By flying in the rising air before the front, it is possible to perform long cross-country flights.

Cloud soaring is a form of thermal soaring. We know that thermals, with their greater heat and consequently greater potential water content, will condense their water out to form cumulus clouds. We know, therefore, inversely, that the cumulus clouds we see above us have been formed by thermals somewhere. We can usually tell by observation whether the clouds are still building or whether they are already dissipating. If they are building, we know we can find lift under them.

Sometimes we find what are termed "cloud streets." These are long highways of clouds stretching for many miles. Under these formations, it is often possible for the soaring pilot to fly steadily for miles, constantly maintaining his ship in an area of lifting air.

The lift persists and increases in velocity within the cumulus clouds and the proficient instrument pilot takes advantage of this to gain additional altitude.

While this article has but lifted a shroud from the subject of soaring, it is hoped that the reader may more clearly understand the what, why and how of motorless flight.