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Soaring

Lewin B. Barringer

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LEWIN B. BARRINGER†

It gives me real pleasure to talk to you today not only because you are in a better position to help the promotion of gliding and soaring than any other group in America, but also because I am going to have a much easier time telling my story to you. During the past few months I have given many talks before clubs, business groups and professional societies, and when I have explained how gravity is a glider's motor and that soaring flight is possible because the glider is sinking steadily downward through air that is rising more rapidly than its sinking speed, I have realized that all too often this explanation has gone over the heads of my listeners.

When we go back into the history of the development of motorless flight, we become cognizant of the fact that for many centuries man has wanted to fly like the soaring birds and now he can do so. This desire for human flight throughout the ages was brought home to me during the past two years which I spent in Persia flying a Waco cabin for an archeological expedition.

As we excavated the great palace area occupied by the Achaemenian Kings at Persepolis some twenty-five hundred years ago, we came upon abundant evidence of the "air-mindedness" of long ago. In their cuneiform inscriptions as well as their great rock sculptures, the early Persians described and depicted mythical winged creatures which expressed their great interest in and fundamental desire to emulate the birds. And so it was in all so-called "civilized" parts of the world.

Since the history of the early development of gliding is the same as that of all heavier-than-air flying with which you are all familiar, I will mention briefly only the high spots. The first recorded attempt to build a glider was the machine constructed by Leonardo da Vinci in the fifteenth century. If any one man can claim the title "Father of Human Flight" that man was Gustav Lilienthal whose first practical glider was built over three hundred years later. This young German engineer, after spending years in the study of the aerodynamics of bird flight, built himself crude, hang-type gliders and made hundreds of flights with them.

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† General Manager, The Soaring Society of America, Inc.

Establishing his hangar at the top of a conical hill, he built the hill up over his hangar to a peak so that he could take off in any wind direction by running down the slope into the wind. His sole means of control was the shifting of his weight by swinging his legs. On some of these flights Lilienthal glided well out over the valley and stayed up appreciably longer than any others. He did not live long enough to understand why this was, or that he was making an approach to soaring flight, but he did say in one of his books that when man learned the secret of how soaring birds are able to fly great distances and stay aloft many hours with such a minimum of effort he would be well on the way toward making a practical flying machine.

Following Lilienthal came Octave Chanute, a civil engineer of this country. Using his knowledge of bridge engineering he built a biplane glider which was a big step ahead. Then the Wright brothers improved on his glider. After several years of experimentation, they installed an engine in their glider and the first successful power-driven flight carrying a man was made on December 17, 1903. An interesting and little known fact is that eight years later, after the Wright machine had made great progress and had flown in Europe as well as America, the two brothers went back to Kitty Hawk in 1911 to continue their experiments with gliders. There it was that Orville Wright made the first soaring flight of 9 minutes 45 seconds which remained a world record for many years.

With the advent of the World War and the consequent rapid development of the airplane, gliding was almost forgotten. Its revival and the development of soaring can be traced largely to the Germans who, deprived of the use of powered aircraft by the Versailles Treaty, turned their attention to the possibilities of gliding flight. When, in 1921, the first flight of more than an hour was made in slope winds over the Rhoen Mountains, soaring flight was given such an impetus that progress has been steady ever since. In the intervening sixteen years the world records have risen to the astounding figures of 40 hours 45 minutes for duration, over 19,000 feet for altitude, and 405 miles for distance.

The most remarkable of these figures is the distance record made last May by a young Russian, Victor Rastorgoueff. The former record of 313 miles made by the Germans in 1935 was broken by him no less than three times during that one month. Our own national records fall far below the international marks due largely to the slower progress of the movement in this country

where we do not have any government subsidy of the sport such as exists today in all principal European nations. Our endurance record, a type of soaring achievement which we now look on as a sort of glorified flagpole sitting since it has no real scientific significance, is 11 hours 36 minutes made by Lt. Coche in Honolulu six years ago. Our distance and altitude records, both held by Richard duPont, President of the Soaring Society of America, are 158 miles and 6,233 feet respectively.

As we speak of gliding and soaring it is well to pause a moment to define these two terms as well as to explain the different licenses that go with them. When we refer to gliding, we mean descending from a higher altitude to a lower. This is the primary training stage and is usually done from an automobile tow launching on a level airport. When a student has made a flight from a height of a hundred feet or more, lasting thirty seconds and including a slight S turn and normal landing, he receives an "A" license which is represented by a round pin with a single white gull on a dark blue background. The "B" license with two gulls is given after making a 360 degree turn and normal landing near a designated spot after being towed to 400 or 500 feet.

When we speak of soaring we mean gliding flights made in rising air so that altitude is maintained or increased. The "C" license and pin with three gulls is given for a flight during which the pilot maintains an altitude greater than that of point of release of the towline for at least five minutes. These three licenses are issued by the Federation Aeronautique Internationale with headquarters in Paris, or in this country by the National Aeronautic Association, its representative.

A fourth license known as the "Silver C" is represented by a "C" pin surrounded by a silver olive wreath such as I am wearing. This is the highest rating of a soaring pilot and is given by the International Student Commission for Motorless Flight with headquarters in Germany to pilots who have made the three following requirements in two or more flights: duration of 5 hours, distance of 50 kilometers or 31 miles, and altitude of 1000 meters or 3280 feet. There are now nearly four hundred "Silver C" pilots in the world. By far the greater number of these are held in Germany. Poland is second with 56, England third with 26, Austria fourth with 14, and we come fifth with only ten. Seven other nations follow with from one to six each.

The types of gliders used today can be grouped under three headings. The primary glider, a very simple, open-work affair

with wings supported by wires, weighs around 170 lbs. The span is 30 to 36 feet and its stalling speed is about 23 m.p.h. It costs any where from $150 to $350, depending on whether it is built from a kit or bought complete. It is suitable chiefly for primary training up to a few hundred feet altitude.

Then we have the secondary, or as we usually call it in this country, the utility glider. This is a more advanced ship, usually having a welded steel-tube fuselage with cockpit covered except for the pilot's head, semi-cantilever wings braced with streamline struts, and a single airwheel equipped with a brake. This type weighs around 220 lbs. with a span of 36 to 40 feet and sells complete for $500 to $600. Its stalling speed is about 26 m.p.h. It is the ideal type for both primary gliding and preliminary soaring.

The third classification is the sailplane which can be subdivided into the intermediate and the high performance. The former, now available in either all wood or all metal, is distinguished from the utility by a higher wing loading as well as cleaner design. It has a span of 40 to 45 feet and sells for around $800 to $1000. Its stalling speed is 35 m.p.h

The high performance type is probably the most refined of all aircraft. Its streamlining is carried out to such a point that although the plywood joints are plainly visible you cannot feel them when you run your hand over them. The most modern high performance sailplane is a "shoulder wing" design with a full cantilever, high aspect ratio wing with a pronounced gull. Construction is all wood except for wing fittings and control cables and the cockpit is entirely enclosed with Plexiglas. The wing span is from 50 to 55 feet, the sinking speed is 2 feet per second and the gliding angle is more than 25 to 1. Weight empty is from 400 to 500 pounds and the stalling speed is 38 to 45 m.p.h. The cost is anywhere from $1200 to $2500. Due to the extreme cleanness of the design of these ships, they are equipped with spoilers, small metal surfaces 4 inches wide by 2½ feet long on the upper surface of the wings half way out to the gull point. These hinge forward and when pulled upward destroys the lift over that portion of the wing, greatly steepening the angle of glide—the effect of their opening being as if someone had chopped off about ten feet of the wing. They greatly facilitate landings in small fields.

In this matter of landing, the design of a glider has pointed the way to the "tricycle" landing gear which seems to be making such headway with sport airplanes. Landing in a flying position which makes possible a landing anywhere from a stall to more

than twice that speed is one of the things that makes glider flying safe. I have landed my sailplane in a small, rocky field at better than 60 miles an hour and what seems pretty alarming to the average airplane pilot—by pushing the stick forward and pulling hard on the brake—came to a dead stop in 40 feet.

There often arises the question "What good is soaring?." You might just as well ask "What good is skiing?"—or any other worthwhile sport. I feel that soaring excels all other sports as it combines the fine points of so many. I have been flying airplanes for nearly nine years, but when I really want to get a kick out of flying, I go aloft without a motor. Often I have spiralled several thousand feet high in the same thermal with buzzards, hawks, or eagles. Going round and round with these birds, who never showed any fear of my big wooden craft, I almost felt like one of them. When you have flown a ship like my 'Minimoa long enough to feel at home in it, when you are strapped in tightly you begin to feel that these great wooden wings which extend from your shoulders are in reality your own wings. When you have achieved that point you have experienced one of the greatest thrills available to man.

Soaring will always stand on its own as a sport but it also has three practical advantages which it is well to point out. They are: flight training, aircraft design, and meteorological research. Gliding offers the most thorough, practical and by far the most economical way to learn to fly. This fact has been well recognized by the leading European nations who have subsidized the sport as a practical means of building up a reserve of pilots. In Germany alone there is a reputed reserve of over 40,000 C pilots who can be taught to handle military planes after only a few weeks of instruction.

At some of the great German soaring schools such as the Hornberg near Stuttgart where a record of 2,000 hours of motorless flying with no serious accident was made last year, I have seen flight training which takes a student all the way through advanced aeronautics with sailplanes. They now require all commercial airplane pilots to hold soaring licenses. At their national soaring contest this year, several contestants were "million mile" transport pilots.

In my own experience I have found that knowledge of air currents gained through soaring flight has many times stood me in very good stead when flying an airplane. On more than one occasion in Persia I was able not only to use the advantageous upcurrents on the windward side of mountain ranges but also able to

avoid the dangerous downcurrents on the leeward sides of these mountains. When I first went out there I was warned by a pilot who had flown Junkers planes on an airline across Persia for several years, to avoid the mountains near Abadeh in my flights between Teheran and our second base at Persepolis five hundred miles to the south. When I questioned him about the danger he said that his plane had dropped suddenly and nearly crashed. As I flew past this place on my first flight south, I could see nothing unusual about this range except that it was very high—close to 14,000 feet—so crossed it on my return flight north. After thirty-two trips across it during the next year without any trouble, I became convinced that this pilot had been caught in a bad downdraft on a day of high wind and had not understood what had happened to him. Similarly I know of pilots in this country with several thousand hours of experience who simply do not understand the action of air currents in the mountains—something that soon becomes second nature to the soaring pilot.

An experienced pilot of motorless craft is used to having every landing a forced landing and judging his approach so as to be sure to get into the field over the obstructions. He knows that if he undershoots he is just plain out of luck, whereas the power plane pilot is often careless about his approach and depends on his motor to lift him over the obstructions. A pilot of an airplane who has a background of soaring experience is a far safer pilot both because of this fact and because of his thorough understanding of all types of air movement.

The first real soaring flights of over an hour's duration were made in Germany in the early '20's and were all done in slope winds. When launched off a mountain top into the wind, the pilot was able to soar in the inverted waterfall of air being deflected over the ridge. This type of soaring, which is still used for all preliminary soaring instruction, was the only type that was known for nearly ten years.

In 1929, Wolf Hirth, the famous German soaring pilot and sailplane designer, took off from South Mountain in Elmira, New York, after sundown and, although the wind had died completely, was able to stay up for more than an hour. This was the first thermal soaring flight ever made and opened up tremendous possibilities that have now been explored to such an extent that soaring will probably soon be possible anywhere.

What Hirth encountered was what we now call an "evening thermal." During the daytime, the sun's rays warming the earth's

surface are reflected from light colored fields, concrete roads, and beaches. The air directly above them becomes heated and rises in the form of thermal columns or bubbles which are utilized by the soaring pilot in making altitude and cross country flights. At the same time, swamplands, woods, or wet plowed fields absorb the sun's heat and over these we find downcurrents to be avoided in the daytime.

In the evening, after sunset, this condition is reversed and the heat absorbed all day long by the woods starts to rise due to the cooling of the surrounding air. This is the evening thermal which Hirth discovered at Elmira. I well remember my first experience with one. While soaring with the late Warren Eaton over the Skyline Drive in the Shenandoah Park in Virginia a few years ago, I had been up to six thousand feet above the mountain (nearly ten thousand above sea level) when I noticed that it was getting late and I had better start down. Warren and I both flew out away from the slopewinds and were down to about 2,000 feet when we suddenly encountered strong rising air carrying us up at better than five feet per second. Our first reaction was one of elation but soon we were back over 5,000 feet and it began to get really dark.

Now we were in a bad situation—wherever we flew we encountered perfectly smooth air but all of it was going up. Only by diving at 85 miles per hour with the flaps half out and the wings vibrating badly, were we able to make headway and get down. We soon lost each other and when I landed right after him it was in darkness by the light of a fire and a few automobile headlights.

I spoke of the wings vibrating at 85 miles per hour, which was nearly three times the cruising speed of the sailplane. The design of these craft has since progressed to a point where one can no longer speak of them as "frail." My Minimoa sailplane, which has a span of 56 feet and weighs close to 500 pounds has withstood a dive of close to 200 miles an hour. It can be looped and spun and put through various other aerobatics with perfect safety. It seems to me that our light plane manufacturers would do well to study what has already been done with sailplanes. Such extremely efficient designs can show remarkable performance with very low horsepower.

Now we come to the third way that soaring flight can be of practical value to aviation as well as all human endeavor. There is no question that soaring has already helped to make great advances in the science of meteorology. The air mass analysis system of forecasting now used by our airlines was largely brought about

through research by soaring meteorologists. In Berlin, the Germans have a research body of 85 trained meteorologists who do nothing but study soaring weather. They help the soaring pilots who in turn are continually discovering new data about the atmosphere for the meteorologists. The present clear understanding of the structure of a thunderstorm and other meteorological phenomena can be traced to fearless soaring pilots who have risked hail and terrific air turbulence to discover facts that could never be collected by the pilot of an airplane flying at considerably greater speed. Sailplanes have been wrecked in storms on several occasions and that is why we always wear parachutes when flying on instruments in clouds. However, both the technique of cloud flying, as we call it, and the design of sailplanes has made considerable progress and such accidents are now quite rare. In this month's issue of our magazine, SOARING, I am running an article by a young German who, this past summer, entered a large cumulus base at 4,000 feet and spiralled on instruments for an hour and a half until he reached an altitude of over 13,000 feet. He only gave up then because his ship was completely iced and his electric turn indicator had stopped working.

A new and very encouraging development of soaring flight which shows that we have barely scratched the surface of its possibilties is airport soaring. Several successful soaring flights have been made from winch tow over airports in level country. One of these was made here in Miami at the Municipal Airport by Paul duPont, a Stinson owner who had never soared before. Dropping the towline at less than 500 feet, he caught a thermal and spiralled in it to 3,500 feet. He flew over Miami and Miami Beach and stayed up for over three hours before landing back on the airport. From what we know of the new world distance record flight in Russia it was made largely over the plains. Reports have also reached us of a very successful Polish national contest held this year on an airport in level country.

I believe that we have not only the finest soaring conditions in the world but also the safest flying country in our western plain states. To prove my contention by testing these conditions, I am planning a small soaring expedition to the panhandle country of Texas, probably based at Amarillo, next April and May. A study of weather statistics for that region shows prevailing southerly winds carrying moist air from the Gulf of Mexico across those hot dry plains—an ideal condition for thermal production forming cumulus clouds. If I find conditions as I expect, we should be

able before long to bring some of the records back to our side of the Atlantic.

We in the Soaring Society feel that we have a real responsibility not only in encouraging this fine sport, which can be of real benefit to the aviation industry, but also in establishing it on a safe and sound basis. Our recent suggestions for a revision of the regulations for the licensing of glider pilots which will soon go into effect, and our completion of two manuals on glider construction and operation show our serious intent. These manuals, which we expect to have published by the Bureau of Air Commerce, will tell a builder or student pilot just how to go about the safe construction or operation of gliders. The second manual tells in detail about the various methods of launching with a shock cord, automobile, winch or airplane, and specifies not only the exact procedure but also such technical details as the size, length and type of towline to be used.

I appeal to the National Association of State Aviation Officials to do what you can to help encourage the growth of motorless flight in your various states. It is bound to grow anyway but you are in a position to help it to grow along the safe course which we have outlined from our extensive experience. There is no reason why we cannot eventually achieve our goal of leading the world in soaring flight as we now do in every other branch of aviation.