An Introduction TO SOARING

by Robert M. Stanley

PART IV

The following is the concluding installment of an article on soaring written by Robert M. Stanley for the National Aeronautics Council. It is reprinted with their permission.—Editor.

Most spectacular of all forms of soaring, and that type calling for the ultimate in piloting skill is that in which the pilot enters the raging interior of the incipient cumulo-nimbus, or thunder cloud. The exquisite beauty of the cloud's external form little suggests the titanic forces upon which its development depends, or the extravagant expenditure of power which can whisk a sailplane to phenomenal heights at a rate undreamed by mere military pursuit planes.

It has long been known that within a well developed thunderhead can be found vertical wind velocities as high as 250 m.p.h. The size of hailstones sometimes accompanying these storms tells us that. However, before the era of successful thunderstorm soaring, the internal structure of a thundercloud remained an enigma to which nobody knew the answer. Hampered by a well founded tradition of fear, few aviators cared to collect those data needed for complete analyses of the thunderstorm's genesis.

Of those equipped to explore the inner workings of a thunderstorm, none enjoys quite the unique advantage of the soaring pilot. His craft is light, climbs literally with the wind, has no internal energy to affect the accuracy of meteorological data, no vibration, noise or heavy metallic masses to adversely affect accurate observation. So it is to the soaring pilot that the meteorologist has looked for a blow-by-blow description of the cloud's structural developments.

It was the author's good fortune to make a number of such flights during our 1939 National Contest, to heights of 19,000 ft. above sea level, and in clouds during various stages of their development. Because thunderclouds present such strongly accented facts applicable to other clouds on a smaller scale, much of value to soaring in general can be obtained by study of the thunderstorm.

Cloud soaring must be done completely within the central core of the cloud. Passing in straight lines through a cloud from side to side avails one little benefit, for the external envelope is composed of air moving downward nearly as rapidly as the central core ascends. Once inside a newly developing cumulus cloud, the pilot will find smooth, steady, but rapid lift so long as he remains centered within the thermal core. He will, in general, be able to make large, lazy circles within the confines of the upward moving area. As the climb continues, it accelerates in speed, and the rate of turn must be increased to stay within the narrowing cone of lift. Flying becomes more difficult due to increased turbulence. Rain, lightly at first, then increasingly more dense, begins to dash against the plane. The rate of climb steadily increases, the turbulence becomes more violent, the bitter cold changes the rain to hail, which roars savagely as it pelts the wings and fuselage of his plane, and the turbulence becomes so vigorous that instrument flying approaches the quality of an aerobatic maneuver. By this time, the rate of climb may be as high as a mile per minute vertically, and ice will have accumulated on the leading edge of the wings. The ice deposit builds up rapidly, despite the scouring action of hail, and the air-speed meter becomes clogged with ice, as does the turn indicator's venturi. Controls must be continually moved to prevent their becoming locked by ice, and airspeed must be controlled by sound of the air rushing past. If the turn indicator still can be made to function, however, the flight can be continued up into the cloud's anvil-shaped summit, where all moisture exists in a cloud of ice crystals, and where the air temperature may fall to 40 degrees below zero. This elevation will be in all cases above 20,000 ft. and for most pilots necessitates the use of oxygen.

Many pilots have lost their planes in the severe turbulence encountered inside the thundercloud. Many more have returned with wings and fuselages riddled by hail, and fabric in shreds. Others have jumped in their parachutes in desperation to avoid being carried beyond the elevation at which oxygen is indispensable. Pilots in parachutes have been carried aloft to such heights as to freeze hands, feet, and ears before the storm expends itself, and permits the parachute to descend. These all represent, however, extreme cases and generally cases associated with excessive enthusiasm and inadequate blind flight experience. Properly handled, thunderstorm soaring within moderate size clouds need not present these hazards.

When entered late in its development, the pilot will find his ascent more smooth, but much slower, and he will go through rain and hail from the start of his climb. He will find it less turbulent all the way up to the ice level, at which point the cloud's energy apparently continues as long as the cloud itself endures. Once expended, the cloud collapses back within itself, creating powerful down drafts as its lofty structure descends back to normal levels.

Sustained rates of climb in excess of 4,000 ft. per min. have enabled pilots to exceed 20,000 ft. altitude gain in five minutes. Turbulence has imposed accelerations in excess of 8g on planes flown by expert pilots. Many times during a particularly turbulent flight will a sailplane be thrown on its back or side. The most severe proving ground in which a pilot can test himself or his plane is the incipient cumulo-nimbus.

Although elsewhere in the world, soaring and gliding have been fostered largely by governmental subsidies, in the United States its development has been purely the result of private enterprise, either through club activity, or private ownership. As a result, our progress has been painfully slow, and the number of persons who have experienced the pleasure and sport of soaring have been all too few. Since a good sailplane will cost as much as a light airplane, private ownership is out of the question for the majority of persons, and the club offers the next best solution to the problem.

The average American soaring club is composed of