winter months under average conditions. Though the heating of the lower air one degree Centigrade will cause only small initial vertical speeds (the acceleration being 3.37 cm per sec. per sec. at 15° C), the great volume of unstable air produced would make possible a continuous thermal difference at considerable altitudes, thus permitting a building up of high vertical speeds (See Lange,[13] pp. 111 and 112). The addition of water vapor to the air being warmed at the sea surface increases the instability of the (already thermally unstable) air. A change in humidity from fifty to one hundred per cent saturation at ten degrees Centigrade produces a change in the density of the air about equal to that caused by an increase in the temperature of the air of eight-tenths of a degree Centigrade.

Concluding Remarks

Cold weather may make flights off the northern states impractical save in the late fall months. However, by moving southwestward along the coast towards Florida, one could find warmer air and at the same time warmer water. Sailplane flights have even been proposed over tropical seas, using a ship as a base for operations. This ship was located at that time in the Atlantic between Cape Verde, Africa, and Cape Sao Roque, South America. Whether these flights were made is not known, but the proposal is mentioned here simply to show that others have thought that sea thermals might prove useful for sailplane flights.

It is hoped that the increasing use of sailplanes will soon bring about a testing of the potentialities of convective flow over the seas.

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A Critique of the Paper "Soaring Over the Open Sea"

By August Raspet

HERE is a report of research displaying the highest order of analytic thought. As such, this paper must be placed in the classic scientific literature pertaining to soaring. Soaring has often been termed an art—more and more we are compelled to believe that soaring is becoming a science. This paper, along with Huffaker's, Langley's and other future contributors, is a stone in the foundation of the soaring science. From these papers it is possible to define *soaring as the science of extracting energy by means of a sailplane from the discontinuities of the air mass flow in the atmosphere.* Mr .Woodcock has carefully observed the flight of gulls and has correlated his observations in such a way as to make it possible for us to more accurately determine under what conditions we may extract energy from the air.

Mr. Woodcock tacitly attacks the bubble theory of Professor Georgii and his school. He, being a scientist, dared not extrapolate his results over the ocean to include thermals over the land. It is not likely though that the hydrodynamic laws should differ according as the flow is over land or sea. As a matter of fact, observations of the soaring flight of buzzards in Maryland lead me to doubt the validity of the bubble theory. There is further proof of continuous flow over land in photographs of pyrocumulus clouds (cf. Humphrey's Physics of the Air, 3rd edition, Figure 90).

Woodcock argues that the birds in a thermal are not dynamic soaring. His argument is not too strong. The best proof that the gulls were not dynamic soaring by circling exists in the fact that the paths of most birds soaring in thermals are not steeply inclined to the horizon. This flight path would be necessary if the birds were flying in two strata of different wind velocities. Further proof of the thermal soaring exists in the fact that the birds climb in thermals. Only the unusual air condition in which the strata were inclined steeply to the horizon would permit such a climb. To eliminate the possibility of the birds' dynamic soaring in circles in horizontal wind discontinuities would require the observation of the relative phases of the birds' changes in direction. My observations of a large group of buzzards showed that the various buzzards turned in perfectly random phases with respect to each other.

Although Woodcock makes the statement that dynamic soaring requires circling flight, linear dynamic soaring cannot be said to be theoretically non-existent. Lanchester in his book "Aerodonetics" demonstrates the possibility of dynamic soaring directly into or away from a wind having velocity fluctuations. A discussion of Lanchester's theory appears in Needham's "Sailplanes." In view of the discrepancies mentioned above, Woodcock's logic, depending as it does upon eliminating all other possible explanations, does not absolutely prove his contention that the bird flight observed by him was thermal soaring. However, his strongest proof of this fact lies in the excellent correlation of his results illustrated in Figure 1.

No better compliment could be paid Mr. Woodcock than to have some one in the post-war period make a long cross-water soaring flight. say from Florida to Cuba. His careful consideration of the preparation for such a flight should be useful to future cross-water sail-planists.