ment then is that $\dot{z}(r)$ be as flat and as small as human engineering ability can make it. These requirements may, however, be somewhat severe, for the relative abundance of very small thermals may be insignificant and the frequency of the larger thermals may be quite adequate for practical soaring even at the lower altitudes. The only way we can design for a really practical craft is to map the atmosphere's thermal population.

First we must further develop and perfect the theory of buoyant convections in variable density atmospheres, both stable and unstable. The theory must be experimentally verified. Then the unknowns necessary to allow theoretical calculation of the thermal diagrams must be obtained experimentally, that is V', R, a, Γ, etc. This data gathering will take some time for it must be determined for each specific geographical locality and terrain type just what the frequency per unit land area is for each thermal size and intensity and how this frequency varies with time of day, day of the year, and the nature of the general weather at the time. This is a statistical problem, obviously, and the required amount of experimental data for accurate statistical predictions is always great. But the problem really is not so formidable. If we begin with present sailplanes much can be learned immediately. On the basis of this data more efficient craft can be designed which can serve to gather even more valuable data on the smaller thermals. The process of data gathering and craft improvement can be continued indefinitely until either the atmospheric offerings or our engineering capabilities are exhausted.

The methods of obtaining the values of the thermal "constants" will be established when the theory has been further developed. The measurements will be simple, however, requiring little more than accurate barographs or accelerometers. Capable and interested soaring pilots will be a must.

In the process the soaring fraternity itself serves as the agency for gathering the data and thus contributes to its own future progress. Needless to say, such a program requires a great deal of coordination and teamwork. The value of the meteorological mapping should enlist the direct interest and aid of meteorological institutions. The value of the future development of sailplanes to meteorological research in the lower atmosphere, again, cannot be overestimated.

The practical aspects of thermal soaring of course involve many important operational problems not covered here. For instance, there is the problem of locating the thermal in the first place. Then it must be entered at the correct level and the radius of turn properly adjusted to attain equilibrium. This must be done correctly and rapidly. With the development of efficient craft, pilot experience can go a long way towards solution of these problems. The development of mechanical aids should, however, receive close attention. Here again the methods of the birds deserve close study.

Finally, one last comment on thermal soaring is in order. This paper has, as stated before, been concerned with the aspect of gaining as much altitude as possible from thermals. It must be realized of course that the more practical considerations of combining straight glides with thermal soaring for covering distances, etc. may require compromise of the craft design, since L/D maximum and L^3/D^2 maximum may be hard to obtain simultaneously. Birds solve the problem with variable geometry; so can we. But the real problem is to gain altitude: this deserves our immediate attention. As far as the sport of soaring is concerned, for the average enthusiast, just being able to remain airborne and to fly with certainty over a reasonable area with reasonable speed is far more important than making one quick *glide* to some distant point and then spending the remainder of the day (and night) hauling the craft back home. If soaring is to be truly popularized, it must be made more certain and reliable.

In conclusion, I would like to emphasize that while thermal soaring appears to offer the most profitable means for immediate progress, dynamic soaring and other possibilities certainly must not be ruled out. It just may be that dynamic possibilities exist but birds do not find them generally suitable. Research on dynamic possibilities should proceed with full speed. Unfortunately, we shall not in this case have such great cooperation from the birds, but at least natural flight information is available. In addition, immediate interest must be awakened in this country in the sadly forgotten subject of man-powered flight. The question is not "can man fly by his own power?" but "how far can he fly?" When we can marry the thermal soaring plane with an efficient man-powered craft, the ultimate capability in practical soaring by man will have been reached.

C.A.P. MANUAL ON SOARING

The Civil Air Patrol has recently published C.A.P. Manual 50-14, titled "Soaring for Civil Air Patrol," and distributed copies to each C.A.P. Flight, Sqd., Group, Wing and Reg. It has six pages containing concise information about soaring under the following headings: Foreword; Introduction; Soaring as a CAP Function; Ground Training; Safety; Instruction; Pilot Certificates; Cost of Soaring Equipment and Insurance. With this sort of official encouragement on the part of C.A.P., there should result a significant increase in the level of U.S. soaring activity.

$150 ELMIRA-PITTSBURGH GOAL PRIZE ESTABLISHED

Mr. A. C. (Gus) Haller has established a $150 goal prize for the first pilot who soars from Elmira, N.Y., to Pittsburgh, Pa., a distance of 210 miles. The Elmira Area Soaring Corp., 224 William St., Elmira, N.Y., is administrator of the prize and can furnish rules for those interested. They will be printed in the July *Soaring* if space permits.