FLIGHT CHARACTERISTICS OF THE FLAT TOP TG-4A

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IN a previous paper (*Soaring*, July-August, 1948), the author mentioned some flight characteristics of the Flat Top. Since that time the author as well as his associates and many other visiting pilots have flown one or another of the three research Flat Tops constructed at Mississippi State College. In addition, static longitudinal stability tests have been made for the standard TG-4a as well as for the Flat Top. It is the purpose of this paper to report these data in an effort to dispel such fears as may exist in regard to the flight characteristics of the Flat Top.

Most pilots who have flown other ships are aware of the sensitiveness of the elevator control on the TG-4a. High sensitivity means that a small change in stick position makes a large change in airspeed. The sensitivity is really influenced directly by elevator effectiveness and indirectly by longitudinal stability. In other words the high sensitivity of the TG-4a may be due either to a very effective elevator or to poor longitudinal stability or to both causes. It is possible to improve the stability by moving the center of gravity forward. This procedure is limited, however, by the trim tab's ability to trim out the stick loads.

In order to get an idea of the sensitivity of the elevator on various ships, a special stick position indicator was designed and constructed. This instrument was used to measure the stick travel for various trim airspeeds in several different sailplanes, Fig. 1. Since most pilots who have flown the Olympia have expressed such a high regard for its flight characteristics the Olympia was used as a model for study. It will be seen from Fig. 1 that Olympia has a very large stick travel for the normal range of lift coefficients. The TG-4a (two place) with molded canopy shows instability at the lower lift coefficients (high speed). Such a ship would be dangerous to fly blind. Comparison with the standard TG-4a (two-place) shows the latter to be stable. Evidently the molded canopy does some lifting ahead of the G.G., thereby introducing some instability when the C.G. is at the normal TG-4a positions.

The stability of an airplane is determined by the horizontal tail area, the distance from the center of pressure of the wing to the center of pressure of the tail (tail moment arm) and the dynamic pressure of the airflow over the tail as well as some secondary parameters. Perhaps a tabular comparison of the TG-4a and the Olympia will best illustrate the longitudinal

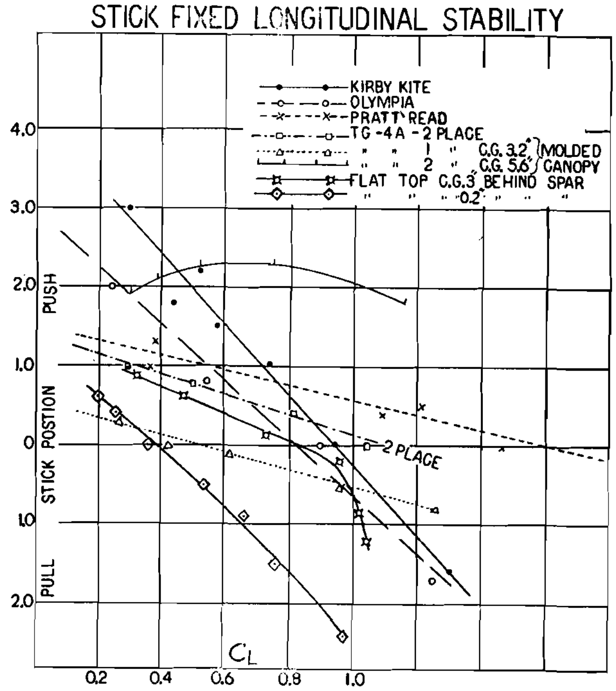

Fig. 1

stability differences of the two ships. (See table I).

TABLE I

	TG-4a	Olympia
Wing area	167 sq. ft.	161.5
Tail moment arm	3.36 mean aero. chords	4.3
Horizontal tail area	20.8 sq. ft.	25.4
Stabilizer area	7.15 sq. ft.	15.1
Elevator area	13.6	10.2
Stability factor	.0418	0.0678
Elevator effectiveness	1.9	.67

(Note: The stability factor is taken as the horizontal tail area divided by the wing area times the tail moment arm. The elevator effectiveness is found by dividing the elevator area by the stablizer area.)

A study of this table immediately reveals the reasons for the TG-4a's elevator sensivity.

a. Its stability factor, 0.0418, is only 63% of that of the Olympia, 0.0678.

b. Its effectiveness assuming similar elevator travel is about 2.8 times that of Olympia.

Because the TG-4a is to be used as a meteorological research sailplane and therefore must be capable of accurately maintaining a constant airspeed, it was felt at the Engineering Research Station of Mississippi State College that the standard model would have to be modi-