STEEL TUBE FUSELAGES IN GLIDERS and SOARING PLANES

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Summary

THE VIRTUAL absence of welded steel tube fuselages in German, and their preferred use in American gliders and soaring planes are due to the differences in the historic development of gliding and soaring, the general level of mechanical skill, and the average income of the individual in the two countries. Perhaps the greatest advantage of the welded steel tube fuselage is its excellent behavior in crash landings. It is definitely inferior to the plywood monocoque as regards streamlining and surface smoothness. Better streamlining can be had with a welded steel tube structure if it is constructed according to the pseudo-framework principle. The pseudo-framework fuselage consists of longitudinals, transverse ringframes, and surface bracing elements.

The Development of Glider and Soaring Plane Fuselage Construction

Although the art of gliding itself is older than that of powered flying, modern gliding and soaring began only around 1920. As is well known, flying enthusiasts in Germany took up gliding at that time because the Treaty of Versaille prohibited powered flying and the construction of powered planes. The first glider pilots were college students, former Army pilots, and generally young men lacking in means, equipment, and experience in airplane construction. They simply had to adopt wood construction as the only one possible without a shop and specialized equipment.

However, the builders of the early gliders were willing to spend lots of time in construction. In the great majority of cases the planes were not intended to be sold but were constructed by the pilot or pilots themselves, and they did not consider the expenditure of many man-hours an obstacle. By the end of the twenties the plywood monocoque fuselage had been developed to a high degree of perfection. The unexpectedly outstanding performance of the plywood soaring plane was reason enough not to abandon this type of construction even when soaring became a subsidized sport in Germany.

The use of metals in powered airplane construction is much older than is generally realized. In 1903 Langley's "aerodrome"—this was Langley's name for an airplane—was built of steel. The wing of Brekuet's 1910 model had a large-diameter steel tube as its single spar. In 1912 Morane-Saulnier constructed a steel monocoque fuselage. The successful development and large-scale use of the present-day type of welded steel tube framework fuselage dates back to the First World War and was in no small measure due to the efforts of Anthony Fokker.

The construction of the welded steel tube fuselage is definitely cheap and simple as compared to that of the modern aluminum alloy monocoque. Nevertheless it is not feasible without some metal manufacturing equipment which represents a considerably higher capital investment than the simple tools required to build a wooden glider at home. Moreover, welding is unreliable and consequently dangerous for the pilot unless done by a well qualified welder. The widespread adoption of welded steel construction in American gliding in the thirties was largely due to the undeniably higher mechanical skill of the average American than that of the average European. In the United States there is a higher proportion of men with access to some mechanical shop than in any country of the Old World.

The situation in Germany until large scale government support made flying possible to everyone is illustrated by a quotation in translation from a book* published in 1925: "The principal material of construction in gliders and soaring planes is wood although today it is possible to produce just as light structures in metal. The reasons for the preference for wood can be found in the difficulties of shaping metals and in the fact that at the present time soaring planes are built largely by soaring clubs and private persons who only in the rarest cases have access to the special tools and machinery necessary for metal airplane construction."

Advantages and Disadvantages of the Framework Fuselage

Safety

In the case of gliders and soaring planes employed in training, undoubtedly the most important argument for the use of welded steel tube fuselage is the increased safety it affords. Plywood shell elements, and even comparatively heavy wood members, break into small pieces and splinter badly in a crash. On the other hand low carbon and chromium molybdenum steel tubes can absorb a great amount of kinetic energy by bending. The writer once saw a sports plane which went into a flat spin at an altitude of 4,000 feet and reached the ground at sea level after hitting a tree. The joint of the welded steel tube space framework fuselage to which the landing gear was attached was pushed inward a distance of about 3 inches. All the tubes were bent at this joint, some of them through an angle of about 60°. Nevertheless there was not a single crack in the structural elements of the fuselage and the pilot miraculously escaped without the slightest injury.

It is obviously of advantage to have such a shock absorbing construction in training planes with which minor crashes must be expected.

* Der Gleit und Segelflugzeugbau, by Alfried Gymnich, Carl Schmidt and Co., Berlin, 1925, p. 121.