

example, the horizontal tail surfaces may be attached near the lower part of the vertical stabilizer, at the midpoint, or at the high point, as in the T-tail design.

T-Tail

In a T-tail configuration, the elevator is above most of the effects of downwash from the propeller, as well as airflow around the fuselage and/or wings during normal flight conditions. Operation of the elevators in this undisturbed air allows control movements that are consistent throughout most flight regimes. T-tail designs have become popular on many light and large aircraft, especially those with aft fuselage-mounted engines because the T-tail configuration removes the tail from the exhaust blast of the engines. Seaplanes and amphibians often have T-tails in order to keep the horizontal surfaces as far from the water as possible. An additional benefit is reduced noise and vibration inside the aircraft.

In comparison with conventional-tail aircraft, the elevator on a T-tail aircraft must be moved a greater distance to raise the nose a given amount when traveling at slow speeds. This is because the conventional-tail aircraft has the downwash from the propeller pushing down on the tail to assist in raising the nose.

Aircraft controls are rigged so that an increase in control force is required to increase control travel. The forces required to raise the nose of a T-tail aircraft are greater than the forces required to raise the nose of a conventional-tail aircraft. Longitudinal stability of a trimmed aircraft is the same for both types of configuration, but the pilot must be aware that the required control forces are greater at slow speeds during takeoffs, landings, or stalls than for similar size aircraft equipped with conventional tails.

T-tail aircraft also require additional design considerations to counter the problem of flutter. Since the weight of the horizontal surfaces is at the top of the vertical stabilizer, the moment arm created causes high loads on the vertical stabilizer that can result in flutter. Engineers must compensate for this by increasing the design stiffness of the vertical stabilizer, usually resulting in a weight penalty over conventional tail designs.

When flying at a very high AOA with a low airspeed and an aft CG, the T-tail aircraft may be more susceptible to a deep stall. In this condition, the wake of the wing impinges on the tail surface and renders it almost ineffective. The wing, if fully stalled, allows its airflow to separate right after the leading edge. The wide wake of decelerated, turbulent air blankets the horizontal tail and hence its effectiveness diminished significantly. In these circumstances, elevator or stabilator control is reduced (or perhaps eliminated) making it difficult to recover from the stall. It should be noted that an aft CG is often a contributing factor in these incidents, since

similar recovery problems are also found with conventional tail aircraft with an aft CG. [Figure 6-11] Deep stalls can occur on any aircraft but are more likely to occur on aircraft with “T” tails as a high AOA may be more likely to place the wings separated airflow into the path of the horizontal surface of the tail. Additionally, the distance between the wings and the tail, the position of the engines (such as being mounted on the tail) may increase the susceptibility of deep stall events. Therefore a deep stall may be more prevalent on transport versus general aviation aircraft.

Since flight at a high AOA with a low airspeed and an aft CG position can be dangerous, many aircraft have systems to compensate for this situation. The systems range from control stops to elevator down springs. On transport category jets, stick pushers are commonly used. An