



# CONVENTIONAL GEAR

*Flying a Taildragger*



DAVID ROBSON



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*Flying A Taildragger*

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by David P. Robson

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## Author/Editor

David Robson is a career aviator, having been nurtured on balsa wood, dope (the legal kind) and tissue paper. He made his first solo flight in a de Havilland Chipmunk shortly after his seventeenth birthday. He had made his first parachute jump at age sixteen. His first job was as a junior draftsman at the Commonwealth Aircraft Corporation in Melbourne, Australia. At the same time, he continued flying lessons with the Royal Victorian Aero Club. He joined the Royal Australian Air Force (RAAF) in 1965, and served for twenty-one years as a fighter pilot and test pilot. He flew over 1,000 hours on Mirages and 500 on Sabres (F-86 with a Rolls-Royce engine). He completed the Empire Test Pilot's course at Boscombe Down in England in 1972, flying everything from gliders to the magnificent Hunter, Canberra and Lightning. He completed a tour in Vietnam with the United States Air Force as a forward air controller, flying the O-2A (*Oscar Deuce*). He was a member of the seven-aircraft formation aerobatic team, the Deltas, which flew his favorite aircraft, the Mirage fighter. This team was specially formed to celebrate the fiftieth anniversary of the RAAF.

David Robson has been flying taildraggers for more than forty years. He first learned to fly in the de Havilland Chipmunk and the Australian Air Force CAC Winjeel. He continued to fly the Winjeel throughout his career as a fighter pilot and FAC. As a test pilot, he flew the Chipmunk, Dakota and Twin Pioneer.

After leaving the air force he became a flight instructor and spent time teaching spinning, aerobatics and landings in the Citabria and Decathlon. He also instructed in the Maule. He has flown some very special antique airplanes including the Auster, Tiger Moth, Aeronca, Beech Staggerwing and the wonderful Drover.

He completed John Freeman's low-level safety course in the Cessna 185. More recently, as development manager of the Australian Aviation College, where he regularly taught aerobatics and tail wheel operations, he introduced the CAP 10B to Australia. In the past two years he has been introduced to ultralights, flying the Drifter and the Storch.

One day he would love to fly what is, for him, the ultimate taildragger: the A-1 Skyraider.



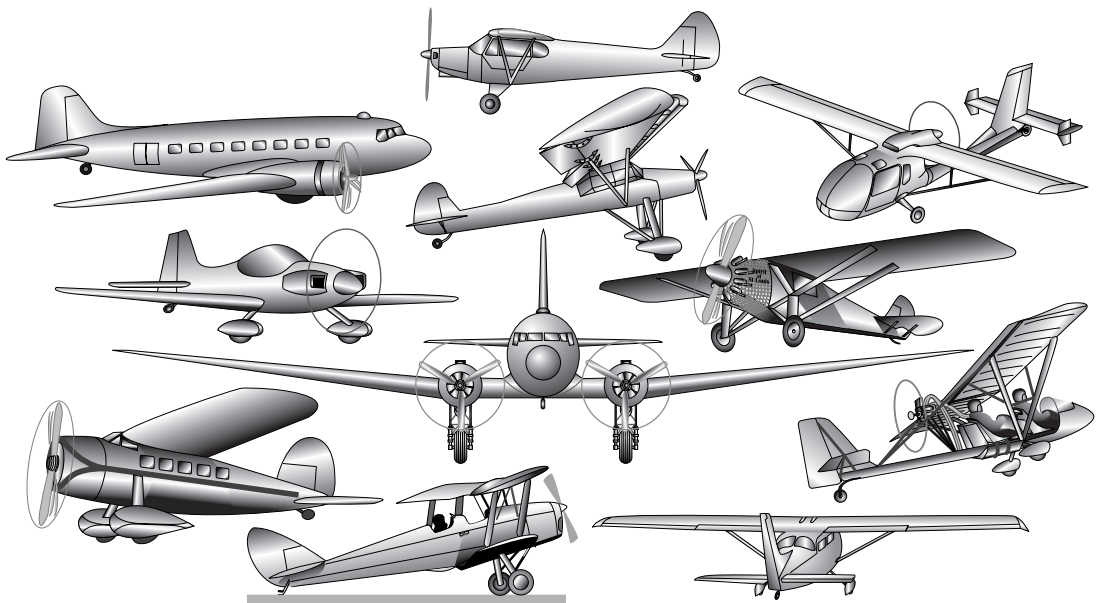
## Chapter 1

# The Tail Wheel Airplane

The standard configuration of the landing gear on airplanes prior to and during World War II was the tail wheel. The tricycle configuration was progressively introduced with sealed runways. To differentiate the two, the tail wheel configuration became known as *conventional gear*. These days, it is commonly called a *tail wheel configuration* or *taildragger*. Tricycle gear is sometimes abbreviated to *trike*.

In terms of general aircraft structure, the taildragger is little different from a tricycle configuration. However, the differences are important as they affect aircraft behavior and pilot control techniques. Further, the control finesse needed for a taildragger, especially in crosswind conditions, is affected by the particular airplane design. While you may have a tail wheel rating, you should also have a specific dual check ride for each taildragger that you fly, as they can vary very much in behavior.

Taildraggers come in many shapes and sizes:



**Figure 1-1.** Various taildraggers

The major assemblies of the airplane are the:

- fuselage;
- wings;
- empennage (tail surfaces);
- flight and ancillary control surfaces;
- landing gear (undercarriage);
- engine and propeller; and
- systems (such as fuel and electrical systems).

## Airplane Design Features

When we consider taildraggers, we must recognize that the characteristics of many taildraggers are the same as any small, light, low-powered, fabric-covered airplane, regardless of their landing gear configuration.

### Low-Inertia Aircraft

You will hear the expression *low-inertia aircraft* to describe lightweight, draggy designs, such as many ultralights and traditional types like Cubs and Tiger Moths. It simply means that, due to low mass and high drag, the airplane has a much less tendency to maintain flight path and airspeed. Therefore, with engine failure, the pilot has little time in which to react, and so must lower the nose positively, severely and immediately to maintain airspeed and control.

### Wing Loading

The wing loading of the airplane is the ratio of its weight to its wing area. The lower the wing loading, the lower the stalling airspeed, and the more it will respond to gusts of wind (it is trickier in a crosswind). The clipped-wing Cub rides better than the standard Cub because it has a reduced wing area for the same weight, but it also stalls at a higher airspeed.

### Gust Response

An airplane will respond to vertical wind gusts and thermals depending on its wing loading and the shape of the airfoil (its change of lift coefficient with angle of attack). A light airplane with a high-lift airfoil will respond quickly and positively to a vertical gust whereas a heavy, high-speed warbird will ride the winds with hardly a tremor.

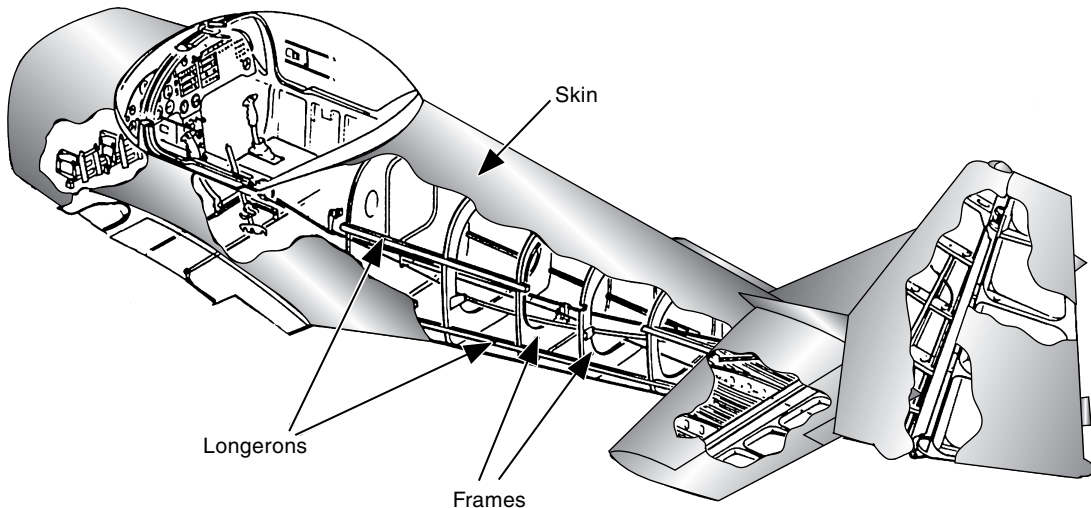
## Airplane Structure

### Fuselage

The fuselage forms the protective cabin and the connecting structure of the airplane to which the wings, empennage, engine and landing gear are attached. It contains seats for the pilot and passengers, plus the cockpit controls and instruments.

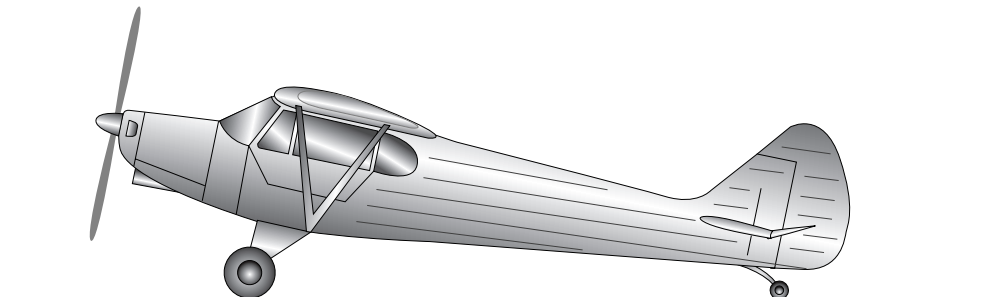


The fuselage of many modern training aircraft is of a semi-monocoque construction, being a light framework covered by a load-bearing skin (usually aluminum). It is a compromise in which the internal framework carries most of the stress, with the remainder being carried by the skin—hence *semi*-monocoque. A monocoque structure is one where the skin carries the total load—like an eggshell. They are light and strong, but very fragile if damaged.



**Figure 1-2.** Semi-monocoque construction.

Alternatively, many tail wheel aircraft and ultralights have a welded steel-tube fuselage structure, with either an uncovered open lattice or a fabric covering. The wings may also be fabric covered, in which case the skins carry no structural loads (neither bending nor torsion), but do transfer the lift and drag pressures to the primary structure within the wing.

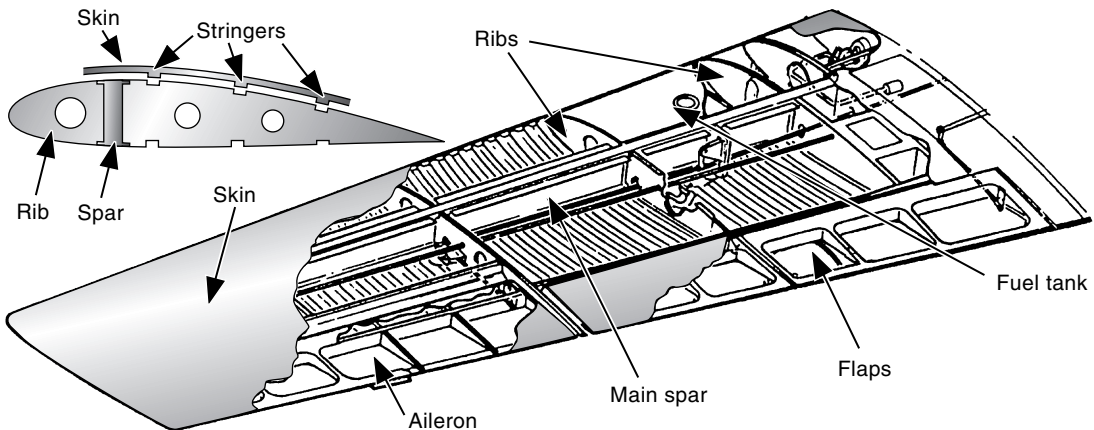


**Figure 1-3.** Typical taildragger structure.

## Wings

The wings generate the lifting force that enables the aircraft to overcome gravity and to maneuver. The wings and their attachments are exposed to heavy loads in maneuvers and turbulence. These loads may be several times the total weight of the airplane. Under FAA regulations (14 CFR Part 23), the airplane structure is designed to accept at least +3.8G (3.8 times its normal, level-flight load) for a normal category airplane.

Wings have one or more internal spars (beams) attached to the fuselage and extending to the wing tips. The spars carry the major loads, both bending (due to turbulence and maneuvering) and twisting (due mainly to control surface deflections).

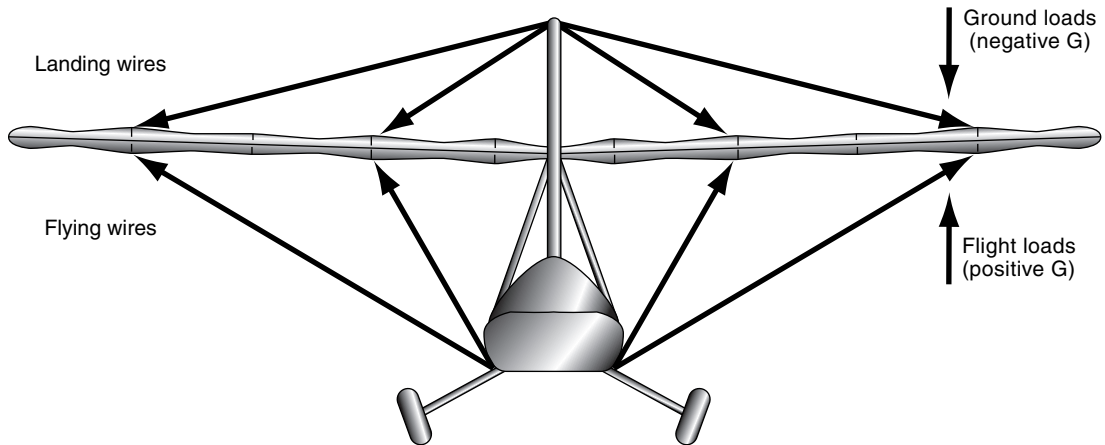


**Figure 1-4.** Spars, ribs and stringers in the wing.

Ribs, perpendicular to the spar(s), assisted by stringers running parallel to the spars, provide the airfoil shape and stiffen the skin. The ribs transmit the air loads from the skin to the spar(s), and thereby the air carries the weight of the total aircraft. The skin may be aluminum, plywood, composite honeycomb or fabric. All are load-carrying in transferring the pressure differential of the passing air, but only the plywood, composite fiber or aluminum skins add to the structural strength and stiffness of the wings.

Some aircraft have external struts (rigid and able to accept tension and compression loads) or bracing wires (tension only) to provide extra strength by carrying some of the wing loads to the fuselage and relieving some of the bending moment on the spars, especially the wing root attachment (figure 1-5).

An underwing strut can carry the flight loads (in tension) and the ground loads (in compression), which flying wires cannot do. The Cessna series of single-engine aircraft uses this underwing strut configuration.



**Figure 1-5.** External bracing wires.

The low-wing airplane can utilize an overwing strut to carry flight loads in compression and ground loads in tension, such as with the Piper Pawnee. This is not such an efficient arrangement (because long slender pieces cope with tension better than compression), but it still reduces the wing-root bending moments.

The strut attachment points, both to the wings and fuselage, are particularly important and should be inspected regularly for damage, loosened bolts and corrosion. There have been in-flight failures of these critical components.

Many modern aircraft are constructed of composites (glass fiber, carbon fiber, plastics, paper and honeycomb), offering very light and strong structures, without the limitations of metal fatigue. Fatigue is the work hardening, or brittleness, that results in the weakening of a metal subject to repeated bending cycles.

## Empennage

The empennage or tail assembly is structurally similar to the wing and consists of a fixed horizontal stabilizer and movable elevators. The horizontal stabilizer may be attached to the side of the fuselage or attached to the top of the vertical stabilizer or fin (called a T-tail). At the rear of the vertical stabilizer is a movable rudder. In some aircraft, the complete horizontal stabilizer and elevator assembly is combined as one movable stabilator.

The rudder and elevators of a taildragger are usually larger than those on a tricycle airplane because the pilot needs more pitch and directional control at low airspeeds and on the ground. Sometimes the space between the movable surface and the fixed stabilator is sealed with a flexible strip to improve effectiveness.