



# 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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# Table of Contents

<b>Author/Editor</b> .....	xv
<b>Contributors to Part Three</b> .....	xvii
<b>Introduction</b> .....	xxi

## Part One: Theory

<b>Chapter 1: The Tail Wheel Airplane</b> .....	3
Airplane Design Features .....	4
Low-Inertia Aircraft .....	4
Wing Loading .....	4
Gust Response .....	4
Airplane Structure .....	4
Fuselage .....	4
Wings .....	6
Empennage .....	7
Landing Gear .....	8
Main Gear Assemblies .....	8
Main Wheel Tires .....	8
Brakes .....	9
Care Of Brakes .....	9
Parking Brakes .....	9
Tail Wheel Assemblies .....	10
Tail Wheel Tire .....	10
Tail Skid .....	10
<b>Chapter 2: Ground and Flight Dynamics</b> .....	11
Ground Dynamics .....	11
Geometry (CG Position in Relation to the Main Wheels) .....	11
Ground Loop on Takeoff .....	14
Dynamic and Aerodynamic Effects of Propellers .....	14
Slipstream Effect .....	14
Torque Reaction .....	15
Gyroscopic Effect (Precession) .....	16
Asymmetric (Non-Symmetrical) Blade Effect .....	18
Summary .....	19
Flight Dynamics on Takeoff .....	20
Moment Change on Takeoff .....	20

Dynamics and Aerodynamics in Flight	21
Adverse Aileron Yaw	21
Increased Rudder and Elevator Power	21
Wing Drop at Stall	21
Flaps	21
Flare and Touchdown	22
Final Approach	22
Initiation of the Flare	22
Flare Problems	23
Bounce (Under-Rotation)	23
Balloon (Over-Rotation)	23
Recovery From a Bounce, Balloon or Hang-Up	24
Solution to Landing Flare Problems	24
Types of Touchdown	24
Three-Point Landing	24
Wheeler	25
Tail-Down Wheeler	26
Dynamics on Landing	26
Friction on Contact	26
Bounce	26
Tail Moment Arm	27
Yaw/Swing/Ground Loop	27
Aerodynamics on Landing	28
Ground Effect	28
Span, Aspect Ratio and Sweep	28
Adverse Aileron Yaw	28

## Part Two: Flight Techniques

<b>Chapter 3: Ground Operations</b>	31
Preflight and Prestart	31
Airframe Inspection	31
Engine Start	33
Taxiing	33
Moving Forward	33
Taxiing Speed	34
Braking and Steering Technique	34
Brake Failure	35
Ground Surface Condition	35
Wind Effect	36
Head Wind	36
Tail Wind	36
Crosswind	37
Checks	38
Run-Up Checks and Pretakeoff Vital Actions	38

Postflight and Security Actions . . . . .	39
Engine Shutdown . . . . .	39
Postflight Inspection . . . . .	39
Securing the Airplane . . . . .	40
Tie-Down . . . . .	40
<b>Chapter 4: Normal Takeoff . . . . .</b>	<b>41</b>
Takeoff Performance . . . . .	41
Factors Affecting Takeoff Performance . . . . .	41
Takeoff Direction . . . . .	41
Effects of Wind . . . . .	42
Constant Wind Velocity . . . . .	42
Wind Gradients . . . . .	43
Wind Shear . . . . .	43
Wind Gusts . . . . .	44
Thermals . . . . .	44
Turbulence . . . . .	44
Runway Considerations . . . . .	44
Length . . . . .	44
Surface . . . . .	44
Slope . . . . .	44
Aircraft Condition and Configuration . . . . .	44
Flaps . . . . .	44
Takeoff Weight and CG Position . . . . .	45
Aircraft Condition . . . . .	45
Density Altitude . . . . .	46
Pilot Technique . . . . .	46
Takeoff Flight Technique . . . . .	46
Lineup . . . . .	46
Takeoff Roll . . . . .	46
Keep Straight with Rudder . . . . .	48
Liftoff . . . . .	50
Initial Climb and Turn . . . . .	51
Energy, Momentum, Wind . . . . .	51
Low-Inertia Airplanes . . . . .	51
A Takeoff in Practice . . . . .	52
<b>Chapter 5: Approach and Landing . . . . .</b>	<b>53</b>
Airplane Control on Approach . . . . .	53
Decision to Land . . . . .	54
Approach Path . . . . .	55
Runway Length . . . . .	55
Runway Slope . . . . .	55
Runway Surface . . . . .	55

Density Altitude . . . . .	55
Wind Effects . . . . .	55
Aircraft Weight and CG Position . . . . .	55
Aircraft Configuration. . . . .	56
Aircraft Age and Condition . . . . .	56
Pilot Qualities and Familiarity . . . . .	56
Escape Routes. . . . .	56
Atmospheric Effects. . . . .	57
Wind Gradient. . . . .	57
Wind Shear . . . . .	60
Wind Gusts . . . . .	60
Turbulence. . . . .	60
Air Density. . . . .	60
Flight Technique . . . . .	62
Entry into the Pattern . . . . .	62
Base Turn . . . . .	62
Establishing the Approach Path. . . . .	62
Establishing Centerline and Turning Onto Final Approach . . . . .	62
Final Approach . . . . .	63
Slipping . . . . .	64
Forward Slip. . . . .	64
Sideslip. . . . .	64
Slipping Turn . . . . .	64
Short Finals. . . . .	65
Landing Technique . . . . .	65
Pilot's Viewpoint . . . . .	65
Sitting Height. . . . .	65
Side-By-Side Seating. . . . .	65
Landing Maneuver . . . . .	65
Taildragger in the Flare . . . . .	66
Types of Landing . . . . .	66
Three-Point Landing . . . . .	66
Wheeler Landing . . . . .	66
Tail-Down Wheeler. . . . .	67
Technique . . . . .	67
1. Flare . . . . .	68
2. Hold-Off . . . . .	69
3. Touchdown . . . . .	69
4. Ground Roll . . . . .	70
Common Faults in the Landing. . . . .	70
Balloon . . . . .	70
Bounced Landing . . . . .	71
Hang-Up . . . . .	72
Flaring and Holding Off Too High . . . . .	72
Full Stop, Stop-and-Go or Touch-and-Go? . . . . .	72



<b>Chapter 6: Advanced Takeoffs and Landings</b> . . . . .	73
Crosswind . . . . .	73
Crosswind Component . . . . .	73
Crosswind Flight Technique . . . . .	74
Crosswind Takeoff . . . . .	74
Weathercocking and Wing Lifting . . . . .	74
Lifting of the Upwind Wing . . . . .	74
Diagonal Takeoff Run . . . . .	74
Drift After Liftoff . . . . .	75
Crosswind Pattern . . . . .	76
Base Leg . . . . .	77
Final Approach . . . . .	78
Centerline . . . . .	78
General Considerations . . . . .	79
Landing Techniques . . . . .	79
Crab Method . . . . .	80
Wing-Down Method . . . . .	81
Drift Control . . . . .	82
Touchdown . . . . .	83
Combination Method . . . . .	83
If The Wing Lifts In The Flare . . . . .	84
Diagonal Landing . . . . .	84
Short-Field Operations . . . . .	85
Performance Charts (P-charts) . . . . .	85
Eyeballing the Slope . . . . .	85
Short-Field Takeoff . . . . .	85
Short-Field Landing . . . . .	86
Soft-Field Operations . . . . .	87
Soft-Field Takeoff . . . . .	88
Soft-Field Landing . . . . .	88
<b>Chapter 7: Low Flying</b> . . . . .	89
Why Fly at a Low Level? . . . . .	89
Ground-Referenced Flight . . . . .	89
Speed . . . . .	89
Apparent Drift . . . . .	89
Inertia and Momentum . . . . .	90
Momentum and the Wing . . . . .	92
What is Low Inertia? . . . . .	92
Pilot Responsibilities . . . . .	92
Planning . . . . .	93
Obstacle Clearance . . . . .	93
Ground Features . . . . .	94
Effects of Atmospheric Disturbances . . . . .	95
Wind . . . . .	95



Low Altitude . . . . .	96
Misleading Visual Effects . . . . .	99
Turbulence. . . . .	100
Mechanical . . . . .	100
Thermals . . . . .	100
Technique . . . . .	100
Low-Flying Checks . . . . .	100
Aircraft Configuration. . . . .	101
Technique . . . . .	101
Lookout. . . . .	102
Allow for Airplane Momentum. . . . .	102
Trim. . . . .	102
Bird Strike. . . . .	102

### Part 3: Some Different Taildraggers

<b>Introduction</b> . . . . .	105
Why? . . . . .	105

<b>Chapter 8: Austers By Peter Whellum</b> . . . . .	107
General Description . . . . .	107
Flight Operations . . . . .	108
Preflight . . . . .	108
Starting . . . . .	108
Hand Swinging . . . . .	108
Taxiing . . . . .	109
Takeoff . . . . .	109
Crosswind Takeoff . . . . .	109
General Handling . . . . .	110
Descent . . . . .	110
Approach and Landing (Three-Point Landing). . . . .	110
Landing Roll. . . . .	111
Stirring the Pudding . . . . .	112
Summary . . . . .	112
An Auster Anecdote by John Freeman . . . . .	112

<b>Chapter 9: Avions Mudry CAP 10B By David Robson</b> . . . . .	113
General Description . . . . .	113
Flight Operations . . . . .	114
Starting . . . . .	114
Taxiing . . . . .	115

	Takeoff . . . . .	115
	General Handling . . . . .	116
	Approach and Landing . . . . .	116
	Summary . . . . .	116
<b>Chapter 10:</b>	<b>Austflight Drifter By David Robson . . . . .</b>	<b>117</b>
	General Description . . . . .	117
	Flight Operations . . . . .	119
	Starting . . . . .	119
	Taxiing . . . . .	119
	Takeoff . . . . .	119
	Engine Failure . . . . .	119
	General Handling . . . . .	120
	Stalling . . . . .	120
	Approach and Landing . . . . .	120
	Summary . . . . .	120
<b>Chapter 11:</b>	<b>Bellanca Citabria/Decathlon By John Freeman and David Robson . . . . .</b>	<b>121</b>
	General Description . . . . .	121
	Citabria . . . . .	121
	Decathlon/Super Decathlon . . . . .	122
	Flight Operations . . . . .	123
	General Description . . . . .	123
	Starting . . . . .	123
	Taxiing . . . . .	123
	Takeoff . . . . .	124
	Cruise . . . . .	124
	Approach and Landing . . . . .	124
<b>Chapter 12:</b>	<b>Cessna 185 Skywagon By John Freeman . . . . .</b>	<b>125</b>
	General Description . . . . .	125
	Flight Operations . . . . .	126
	Starting . . . . .	126
	Taxiing . . . . .	126
	Takeoff . . . . .	126
	General Handling . . . . .	127
	Approach and Landing . . . . .	127
	Crosswinds . . . . .	127
	Summary . . . . .	128
<b>Chapter 13:</b>	<b>CAC CA-25 Winjeel (Little Eagle) By David Robson . . . . .</b>	<b>129</b>
	General Description . . . . .	129
	Landing Gear . . . . .	130
	Tail Wheel . . . . .	130

Flight Operations . . . . .	131
Starting . . . . .	131
Taxiing . . . . .	131
Takeoff . . . . .	131
General Handling . . . . .	132
Approach and Landing . . . . .	132
Crosswind Landing . . . . .	132
<b>Chapter 14: De Havilland Canada DHC-1 Chipmunk By David Robson . . . . .</b>	<b>133</b>
General Description . . . . .	133
Flight Operations . . . . .	135
Starting . . . . .	135
Taxiing . . . . .	135
Takeoff . . . . .	135
General Handling and Aerobatics . . . . .	135
Approach and Landing . . . . .	135
Summary . . . . .	136
<b>Chapter 15: De Havilland DHA-3 Drover By David Robson . . . . .</b>	<b>137</b>
<b>General Description . . . . .</b>	<b>137</b>
Flight Operations . . . . .	139
Engine Start/Priming . . . . .	139
Taxiing . . . . .	139
Takeoff . . . . .	139
General Handling . . . . .	140
Approach and Landing . . . . .	140
Crosswind . . . . .	140
Summary . . . . .	140
<b>Chapter 16: De Havilland D.H.82 Tiger Moth By John Freeman . . . . .</b>	<b>141</b>
General Description . . . . .	141
Flight Operations . . . . .	143
Starting . . . . .	143
Technique for Hand-Swinging the Propeller . . . . .	144
Taxiing . . . . .	145
Takeoff . . . . .	146
Engine Failure . . . . .	146
Crosswind Takeoff . . . . .	147
General Handling . . . . .	147
Approach and Landing . . . . .	148
Crosswind Landings . . . . .	148
Summary . . . . .	148
Some Life Lessons For the Tiger Moth Pilot . . . . .	149
Taxiing . . . . .	149
Starting When No Help Is Available . . . . .	149

	Crosswinds . . . . .	150
	Aerobatics . . . . .	150
	Securing the Aircraft. . . . .	150
	Crosswind (Again) . . . . .	150
<b>Chapter 17:</b>	<b>Douglas DC-3 (Dakota) By Captain Don Hutchison . . . . .</b>	<b>151</b>
	General Description . . . . .	151
	Flight Operations . . . . .	152
	Taxiing . . . . .	153
	Takeoff . . . . .	153
	Airborne . . . . .	154
	Approach and Landing. . . . .	154
	Afterword . . . . .	156
<b>Chapter 18:</b>	<b>GAF Avro Lincoln (Long-Nose) By John Laming. . . . .</b>	<b>157</b>
	General Description . . . . .	157
	Flight Operations . . . . .	158
	Starting the Merlins . . . . .	160
	Takeoff . . . . .	161
	General Handling . . . . .	162
	Flyby . . . . .	162
	Approach and Landing. . . . .	163
	Afterword . . . . .	164
<b>Chapter 19:</b>	<b>Hawker Sea Fury By John Laming . . . . .</b>	<b>165</b>
	General Description . . . . .	165
	Flight Operations . . . . .	166
	Preflight . . . . .	167
	Starting . . . . .	169
	Taxiing . . . . .	169
	Takeoff . . . . .	170
	Airborne . . . . .	170
	Approach and Landing. . . . .	171
	In Retrospect . . . . .	172
<b>Chapter 20:</b>	<b>Piper Pawnee By John Freeman . . . . .</b>	<b>173</b>
	General Description . . . . .	173
	Piper Pawnee PA-25-235. . . . .	173
	Flight Operations . . . . .	174
	Starting . . . . .	174
	Taxiing . . . . .	175
	Takeoff . . . . .	175
	General Handling . . . . .	175
	Approach and Landing. . . . .	175
	Crosswinds . . . . .	175

Summary . . . . .	175
Anecdotes . . . . .	176
An Easy Life . . . . .	176
Time Slows Down . . . . .	176
<b>Chapter 21: Pitts Special By David Pilkington . . . . .</b>	<b>177</b>
General Description . . . . .	177
Flight Operations . . . . .	178
Starting . . . . .	178
Takeoff . . . . .	179
Aerobatics . . . . .	179
Spinning . . . . .	180
Approach and Landing . . . . .	180
Landing Roll . . . . .	181
Further Comment . . . . .	182
<b>Chapter 22: Slepcev Storch By David Robson . . . . .</b>	<b>183</b>
General Description . . . . .	183
Cockpit Ergonomics . . . . .	184
Flight Operations . . . . .	184
Preflight . . . . .	184
Starting . . . . .	184
Taxiing . . . . .	184
Takeoff . . . . .	184
General Handling . . . . .	185
Approach and Landing . . . . .	185
Crosswind . . . . .	186
Conclusion . . . . .	186
<b>Chapter 23: Southern Cross Replica By Captain Tom Russel . . . . .</b>	<b>187</b>
General Description . . . . .	187
Flight Operations . . . . .	188
Introduction . . . . .	188
Preflight . . . . .	188
Starting . . . . .	189
Taxiing . . . . .	189
Takeoff . . . . .	189
Cruise . . . . .	190
The Open Cockpit . . . . .	190
General Handling . . . . .	191
Approach and Landing . . . . .	191
Conclusion . . . . .	192
<b>Index . . . . .</b>	<b>193</b>

## 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.



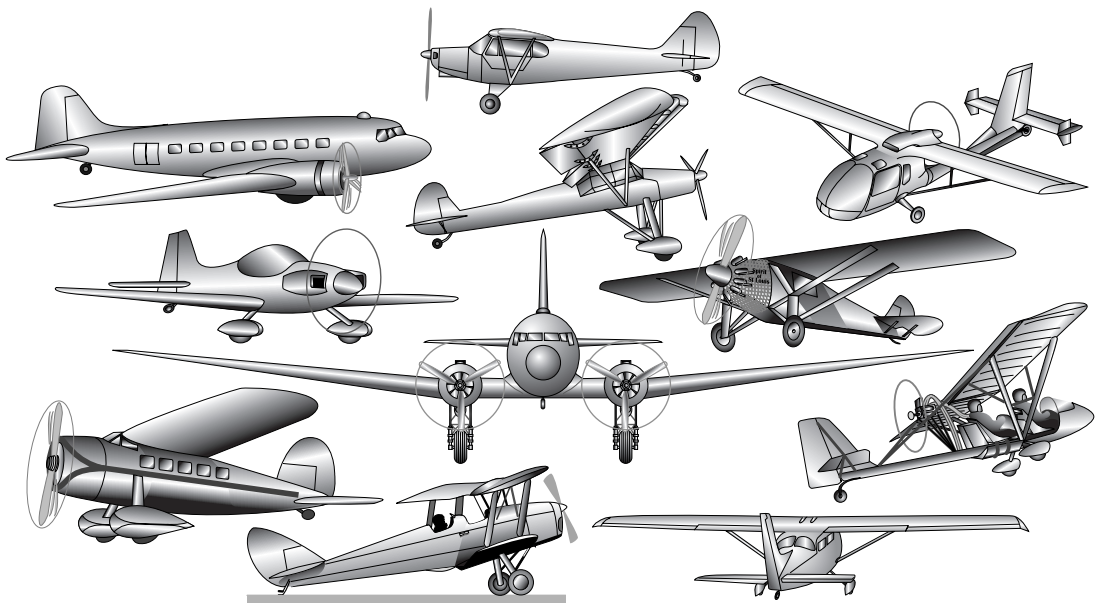
## Chapter 1

# 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**

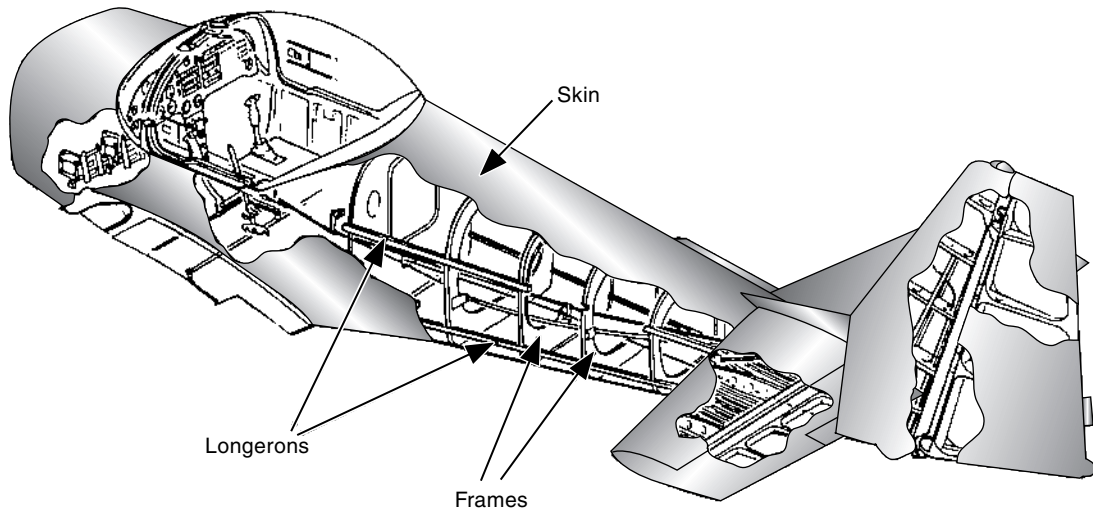
An airplane will respond to vertical wind gusts and thermals depending on its wing loading and the shape of the airfoil (its change of lift coefficient with angle of attack). A light airplane with a high-lift airfoil will respond quickly and positively to a vertical gust whereas a heavy, high-speed warbird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

## **Airplane Structure**

### **Fuselage**

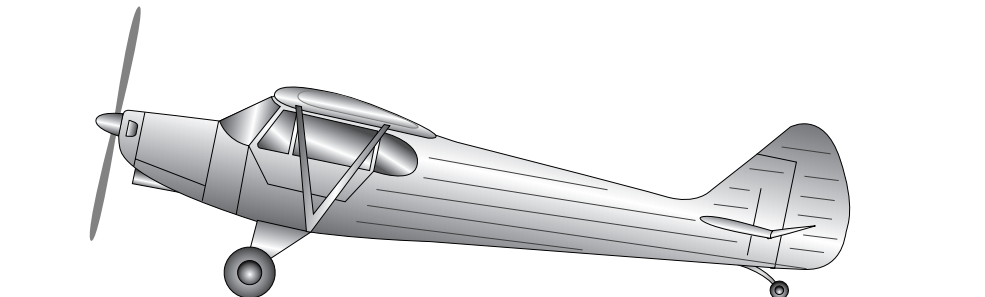
The fuselage forms the protective cabin and the connecting structure of the airplane to which the wings, empennage, engine and landing gear are attached. It contains seats for the pilot and passengers, plus the cockpit controls and instruments.

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.

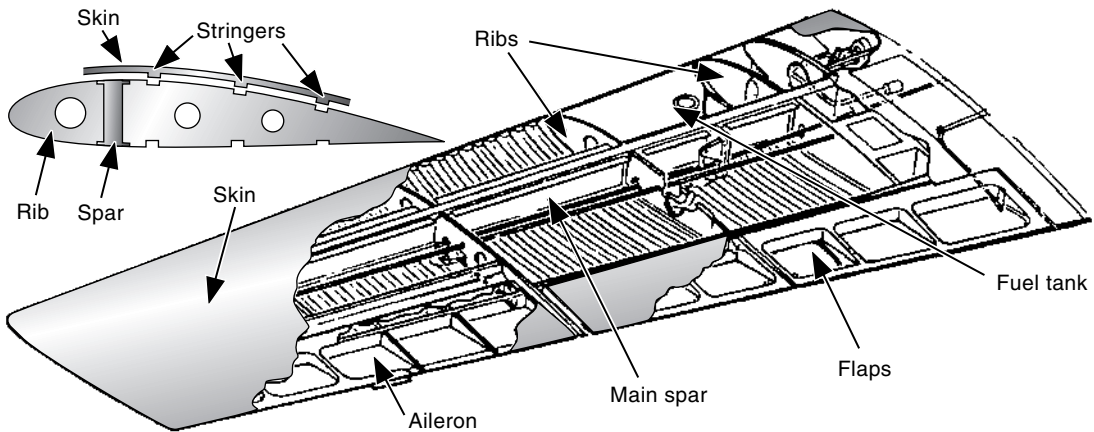


**Figure 1-3.** Typical taildragger structure.

## 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).

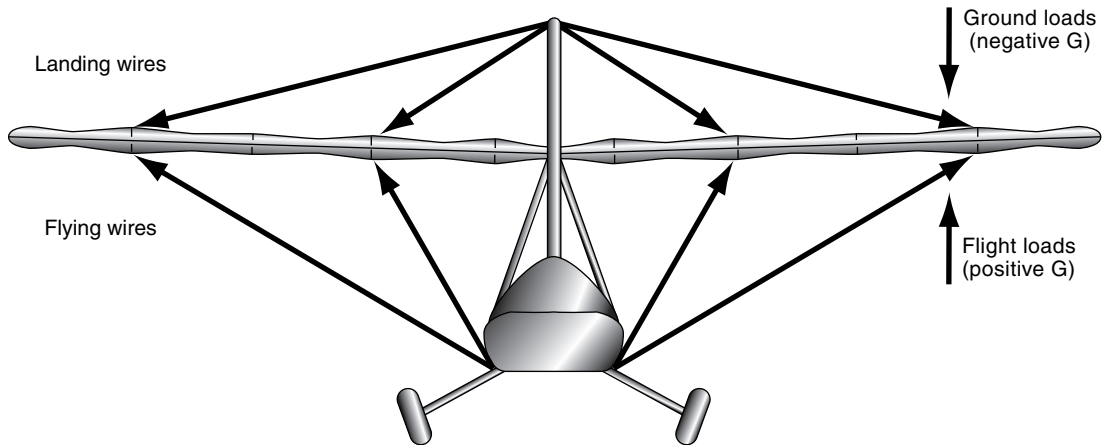


**Figure 1-4.** Spars, ribs and stringers in the wing.

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.