The Flying Electrons Inc.

Ground School

The following section is mainly designed for those who have little or no knowledge of aerodynamics, and/or are totally new to the hobby. Even experienced pilots will benefit from this, as there are some differences between models and full scale. Please read it thoroughly.

First, if you are just starting out: There are benefits to getting an ARF (Almost Ready to Fly) as opposed to kits. Generally speaking, by the time you buy a kit, the hardware and the covering, you have spent as much as the ARF. And it will take you at least twice as long to put the kit together. You will also need the appropriate tools to install the covering. And if you do destroy an ARF, you won't have the time investment loss. The advantage to the kit is you know how well it is constructed, and the covering will probably be better quality material. Keep in mind that covering the aircraft alone is an art in itself, and will probably take 10 to 15 hours. Build kits in the fall and winter; ARFs in the spring and summer.

Second, if you are just staring out: Don't load up your Visa/MasterCard with all kinds of equipment, flight boxes etc. Get some fuel and get to the field. After you've worked with an instructor, and met some fellow pilots, then decide what equipment you want. There is a lot to choose from. And there is a lot of good used equipment available through the club or swap meets. All too often, new hobbyists overspend, don't learn as quickly as they had hoped, and get discouraged. This is especially true if they tear up their first airplane. Keep your investment small until you gain some momentum.

Third, now that you've stared: Unless you're sure of yourself, don't be too quick to buy that "second" plane. Chances are you may be buying a second "first" plane. Take your time. On the other hand, you may surprise yourself and be able to jump directly to a "third" or "fourth" plane. Get some flight time in after you've soled and you'll have a better idea.

We will not get into any discussions of model kit building, or radio systems at this time. Together they could have their own entire manual.

Granted, one doesn't have to know how to fly the space shuttle to fly a model aircraft. However, a general understanding of basic aerodynamics will help to understand why it does what it does. Our objective here is to provide you with the concept of aerodynamics, not the technicalities. For those who wish to go into aerodynamics at greater depth, student or private pilot flight manuals are a good place to start.

Note: Referring to aircraft as to right or left, is as a pilot would view it from the cockpit.

Wings:

There are three basic wing profiles.

Flat Bottom:

Creates the most lift and is the most stable. Most trainers are flat bottom.

Semi-Symmetrical:

Still stable, yet allows more maneuverability and extends aerobatic capability. Great for "second" planes.

Fully Symmetrical:

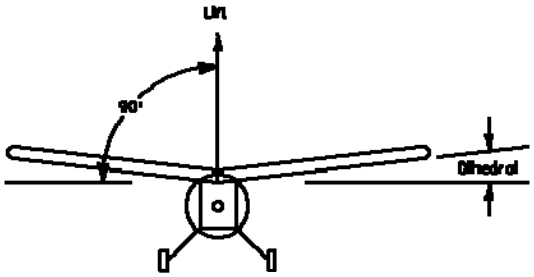
Least stable and most aerobatic. For more experienced flyers only. There are three basic wing locations.

High-Wing, Mid-Wing, Low-Wing:

Stability diminishes as the wing comes down; the high wing being the most stable. Here too, most trainers are high wing. A fully symmetrical, mid-wing with no dihedral is the most aerobatic.

Dihedral:

Dihedral is the angle in the wing when looking at it from front or rear. The more dihedral, the more stable and self recovering. A wing with less dihedral is more aerobatic but less stable. A low-wing aircraft requires more dihedral to be as stable as a high-wing, all other factors being equal.



Washout:

Washout is a twisting of the wing when viewed from the wing tip. The trailing edge is higher at the wing tip than at the fuselage. This increases stability and self-recovery. It allows the outer wing area to still "fly" (maintain control) even if the inner wing area is in a stall condition. Refer to "stalls" later. Wash-in is reverse, and has no practical application.

Ailerons:

Ailerons control the bank of the aircraft which turns the aircraft. Refer to "lift" later. The up aileron decreases "lift", while the down aileron creates more "lift", thereby banking the aircraft. The aircraft always banks or turns toward the up aileron.

Vertical Stabilizer:

The stationary part of the rudder assembly.

Rudder:

The rudder is the movable control surface of the assembly. Its primary function is to coordinate the bank and turn. However, in the case of model aircraft, it can be used to steer or turn the craft.

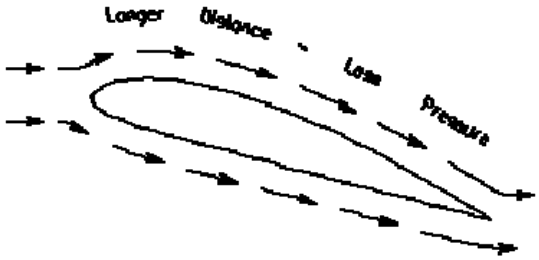
Horizontal Stabilizer:

The stationary part of the elevator assembly.

Elevator

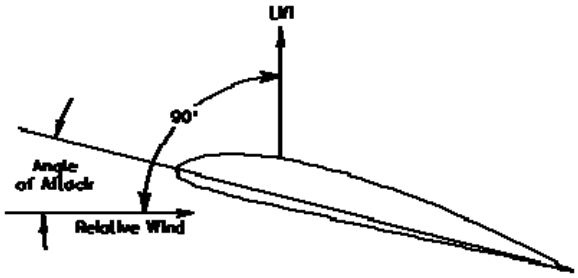
The elevator is the movable control surface of the assembly. Its primary function is to control the angle (nose up, etc) of the aircraft. However, in the case of model aircraft, it is basically used to control altitude. Technically, power controls altitude and elevator controls angle, which in turn controls airspeed. Refer to more advanced flight manuals.

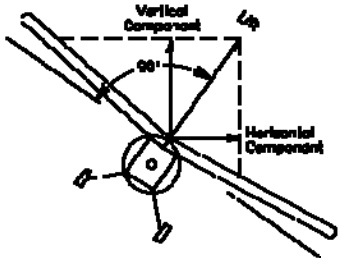
Flaps:
Flaps create more "lift". There are several basic types of flaps, none of which are used on trainer planes. Refer to more technical manuals.



Lift:
Lift is created when the air moving over the top of the wing moves faster that the air underneath. Air over the top must travel a greater distance, therefore it must move faster to get to the rear at the same time. The faster the air moves past a surface, the less pressure it exerts on that surface. The pressure underneath is greater pushing the wing up. This is lift. Lift is always 90 degrees to the relative wind. Lift is always 90 degrees to the span of the wing.

Relative Wind:
RW is the air coming at the aircraft; it is always exactly opposite the direction of travel. Do not confuse this with the wind conditions you are flying in. The angle of the wing as it hits the RW is called the angle of attack. Too high of an angle of attack, without enough airspeed, will cause the wing to stall. Refer to "stalls "later.

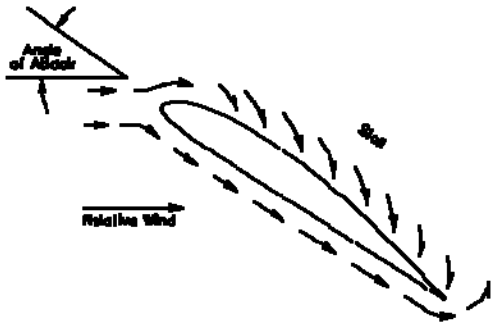




Components of lift:
When the aircraft is banked, the "lift" is banked too. The "vertical component of lift" is no longer as great. This is why you have to add up elevator to maintain altitude. The "horizontal component of lift' causes the aircraft to turn. If you bank too steep, the "vertical component" will lessen even more and the wing will stall and fall. Refer to "stalls" later.

Propellers:
A propeller is nothing more than a rotating airfoil in the horizontal direction. Applying more power creates more horizontal lift (better known as thrust) which pulls the aircraft through the air. Do not think of a propeller as blowing air rearward.

P-Factor:
For the sake of simplicity we will only say that P-factor is the unequal thrust or torque of the propeller. During power on, or climbing conditions, the right side of the propeller produces more thrust. This causes the aircraft to drift left. This is why an aircraft that rolls straight, will run off to the left of the runway on take-off. Correct with a slight right rudder.



Stalls:
A stall is the loss of "lift". This condition occurs when the angle of attack becomes too great for the air to flow smoothly over the top surface. The air then becomes turbulent (much like the spoiler on a race car) and no longer produces lift. When this happens, the nose of the aircraft will drop abruptly resulting in the loss of altitude.

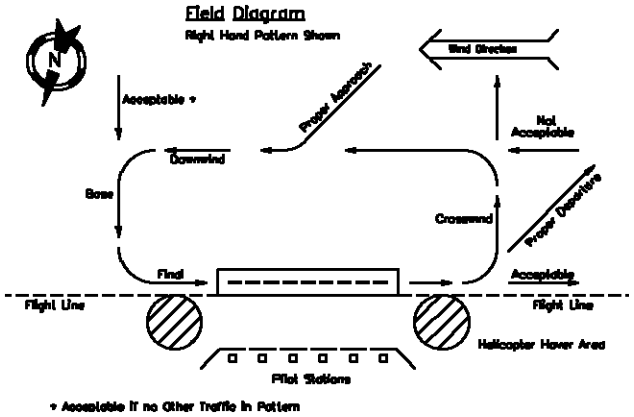
Stalls can occur with power on, or power off, at low speed or high speed, depending on various other conditions. The most common are while climbing too steeply and turning after take-off, or when banking too steeply while turning final to land. All stalls have one thing in common. They all require lowering the nose to recover. Point of interest: A spin is nothing more than a sustained stall with rotation.

Flight Pattern:
The FP, or traffic pattern, is made up of four legs. Starting at the runway, the first 90 degree turn is the crosswind leg. The second 90 degree turn becomes the downwind leg which is parallel to the runway. The third turn is the base leg which is 90 degrees to the runway again. The forth turn becomes the final leg towards the runway.

Henceforth the term: "Turning final". Proper departure for the pattern is to turn only 45 degrees not depart straight out the crosswind leg. Proper approach and entry is to head in on a 45 degree angle towards the downwind leg.

Aim for the end of the runway where you plan to set down. Turn downwind when you are at an appropriate distance away from the runway. Do not enter the pattern straight in on the downwind as you may encounter departing aircraft.

Note: The following diagram is not the Electrons flying filed but is used to show the proper flight pattern.



There are those who believe that flying a model aircraft is more difficult than a full scale. Visualizing yourself from the aircraft view takes some practice. It's like an out of cockpit

experience. Everything is fine so long as you are coming towards yourself, is a whole different story. Think of it as sitting backwards on the dashboard of your car steering wheel between your legs, and driving down the road. Here's a reference list to help you along.

Aircraft Direction	
Control Movement	***Aircraft Reaction***
Aircraft Going Away	
Aileron	Same
Elevator	Same
Rudder	Same
Coming Towards You	
Aileron	Reversed
Elevator	Same
Rudder	Reversed
Inverted Going Away	
Aileron	Same
Elevator	Reversed
Rudder	Reversed
Inverted Coming Towards You	
Aileron	Reversed
Elevator	Reversed
Rudder	Same

08/07 tdb—info based on Palos R/C Flight Training found at http://www.palosrc.com/flight_training.htm