

GETTING STARTED IN RC AIRCRAFT MODELING – HARDWARE (PICKING THE RIGHT AIRCRAFT AND FIELD SUPPLIES)



The first part of this article, “Software” dealt with how to find a local RC model club and instructors, information sources, Simulators, Flight Schools and the questions never to ask. Now we can look at some of the fun parts: Picking the right model aircraft is important and is covered in this installment. In the last installment of this series, we’ll review radio and engine choices plus basic or luxury field equipment used to get you flying.

There are so many great trainers available that choosing one can be difficult. So lets look at the selection of trainer aircraft. First, you should understand that only certain model aircraft are suitable for a beginning model pilot. I know that you really want to fly a P-51 Mustang fighter, (F-16, F-15, Extra 300, Spitfire, B-17, Pitts Special, insert dream airplane of choice). But that is really, really not a good idea.



Photo 1 Photo 2

Scale models (model replicas of full size aircraft) like the Spitfire shown in photo 2 or highly aerobatic scale models like the Dave Patrick Extra 330L in Photo 1 make poor choices as trainers. First, they fly too fast and require that the pilot be far ahead of them. Second, these models have no self-righting ability; they stay exactly where they are put even if that is the wrong place to be. Takeoff and landing speeds are high because [wing loadings](#) are high. So are roll rates and elevator response. Stall characteristics can be fierce with fast wing drops and [snap rolls developing](#) into [spins](#). While great for an experienced pilot, these types of models are best deferred to next season’s flying.



Photo 3

What about scale models of light aircraft? Shouldn't they be good trainers? Not really. Even the venerable Piper Cub shown in photo 3 is not the best trainer. While it may takeoff, fly and land slowly it has other flight characteristics that limit its use as a basic trainer. First, it is too "short-coupled" meaning that the distance from the wing's trailing edge to the front of the elevators is much too short when compared to the airplane's wingspan. This makes the model airplane, as it does the full-size, less stable around the **yaw** axis. There is a lot of **adverse yaw** in a full-size or in a model cub. Being short-coupled also makes the elevator too sensitive for a basic trainer and the ailerons somewhat fast.

The cub is also difficult to handle during the ground roll part of the takeoff. No student pilot needs these hassles while trying to learn to fly RC. The cub pictured is a great *second* aircraft however if you like scale airplanes (who doesn't?), Most other scale kits of light aircraft have high **wing loadings** in addition to most of the Cub's problems. Their takeoff and landing speeds are too high while their **stall** characteristics are too drastic.



Photo 4 Photo 5

Now that we have eliminated all the models you really wanted, what's left? A tremendous amount is left actually. So we have to rule out most of them. Low-wing sport aircraft like the one in photo 4 make great *second* airplanes. Many of them, like the Goldberg Tiger II pictured, were designed just for this purpose. While possessing more gentle flying characteristics than scale or aerobatic models, these aircraft have fast control responses and less gentle stall characteristics.

Mid-wing sport aircraft like the Top Flite RC Nobler shown in photo 5 should be deferred until next year, as they are great *third* models. Control response is even faster than most low-wing airplanes, stall responses even worse, landing speeds higher and there are no self-righting abilities. Many of the newer "3-D" capable models also employ a mid-wing. While their stall characteristics are gentler than other mid-wing airplanes, their control response is even faster. My opinion is that they remain good third aircraft.

Since an aircraft can only be a low-wing, mid-wing or high wing, guess which design is best as a basic trainer. Exactly right, the high-wing design. There are several reasons for this. A high-wing aircraft with generous **dihedral**, usually 3 in. or more over a six-foot wingspan, has the ability to regain straight, level

flight even if the pilot places the aircraft in a 10-15 degree bank. RC pilots say the airplane is self-righting or self-leveling. This is often referred to as being “very stable”.

Without getting into great technical detail, this is a misnomer. Actually trainers are very unstable aircraft. Stability in an airframe means that the aircraft remains exactly where the pilot places it. RC Aerobatic Aircraft are among the most stable of all model airplanes. They stay exactly where they are aimed, even if left in a one-degree bank; they do not regain straight level flight on their own.

Good RC Basic Trainers do not stay put. They tend to regain wings-level flight if given half the chance. In addition, a Basic Trainer with a flat-bottom wing usually tries to regain level flight after elevator controls are released. Both characteristics make for a good Basic RC Trainer. But an airframe designer would say they have “roll and pitch instabilities.” This last part was mentioned just so you know the truth. But it is not really worth the effort to try to reinvent modeling terms that have been in use for sixty years so it is best to keep this knowledge to yourself.



Photo 6



Photo 7

As we discussed with the Piper Cub, a wing located on the top is not a guarantee that the aircraft is a good Basic Trainer. The [Hobbico AviStar](#) in photo 6 is a phenomenal Aerobatic Trainer and, like the [Hangar 9 Arrow](#) and Midwest Aerobat, provides the newer pilot with the easiest transition to a second airplane. While it is possible to become an RC pilot using any of these three fine aircraft, the learning curve is steeper and requires more flight time to achieve.



Photo 8



Photo 9

But these aircraft look so much like a basic trainer, such as the [Midwest Aero Star](#) in photo 7, that you could be wondering what the differences would be. These four aircraft, and other basic trainers like the [Hangar 9 Alpha 40](#) in photo and the [Hobbico NexSTAR](#) in photo 9, all have wings on the top and lots of dihedral. All of them look the same. They should all fly alike too.

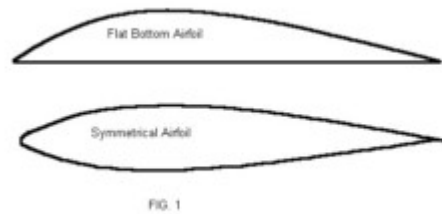


Figure 1

Not really. The three aerobatic trainers have one major difference. Their wings possess a nearly symmetrical airfoil shape. The airfoil is the curving shape of the wing when viewed from the side. See Fig. 1 for more detail. This makes all the difference in the world. To understand why, we need a very brief course on what makes an aircraft fly. Promise, it will be a very brief course. We all learned in school that an airplane wing develops lift because air flows faster over the curved top of the wing than it does over the wing's straight bottom. This happens because the air on the top must cover a greater distance in the same time frame than does the air on the bottom.

Good ole' Uncle Bernoulli discovered that the faster a given amount of gas moves, the lower becomes its pressure. We call it Bernoulli's Theorem. Since the air on the bottom of a flat-bottom wing is moving more slowly, it must have a greater pressure than the air on the top and tends to push the wing upwards against the lower top pressure. Viola' the wing develops lift. Great story. It is even somewhat true.

But most all full-size and model aircraft have wings that are nearly symmetrical (called semi-symmetrical) or truly symmetrical. The wing shapes are the same top and bottom. How then do these aircraft fly? Good question that. There is a good answer as well. These wings develop lift because they, like most things in the Universe, must follow Newton's Third Law of Motion.



Figure 2

You know this one. It is the one that says push on something and that something pushes back at you with the same force: Something about equal and opposite reactions. If you look at Fig.2, you will see how this works. A symmetrical airfoil *must* have a positive [angle of attack](#) to the oncoming air to fly. Because of Newton's Third Law, the air deflected downwards pushes the wing upwards with equal force. Again, we have the wonder of lift and the airplane flies. The greater the attack angle, up to a point of about 17-20 degrees for most models, the more lift the wing produces.



Photo 10

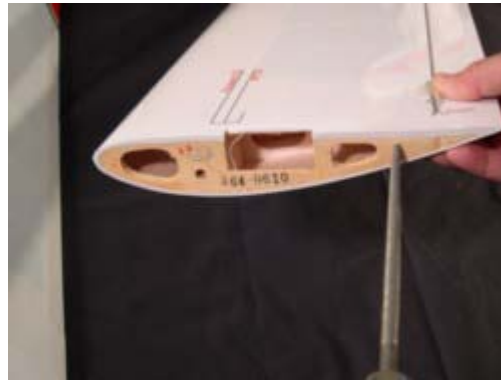


Photo 11

A symmetrical airfoil like the Avistar's pictured in photo 10, develops lift using *only* Newton's Third Law. But a flat-bottom wing like the NexSTAR's in photo 11 obtains lift using *both* Newton's Third Law *and* Bernoulli's Theorem. Therefore, for a given wing area, a flat-bottom wing produces more lift at a given airspeed and angle of attack than would a symmetrical wing with the same conditions. This is why all basic trainers utilize a flat-bottom wing. Aerobatic trainers use more symmetrical wings because these airfoils develop the same amount of lift whether inverted or upright. This is good for aerobatic flight, but not usually required in a basic trainer.

Semi-symmetrical airfoils have some airfoil shape on the bottom but a lot less than on the top. They use a little Bernoulli and a lot of Newton to develop lift. These airfoils develop more lift than symmetrical ones but a lot less than flat-bottomed airfoils. They also sacrifice some aerobatic performance.

The extra lift produced by these wings allows the basic RC trainer to takeoff, fly and land more slowly, Modern RC basic trainers are nearly impossible to accidentally stall because of the excess wing lift. The extra lift can often rescue a student pilot from bad situations such very slow airspeeds in steep bank angles at low altitude. An aerobatic aircraft, even most aerobatic trainers, will stall and snap roll in such situations. When stalled in a steeply banked turn, a basic trainer just kind of levels it wings shakes its fuselage straight and starts flying again.

Since it flies slowly with lots of excess lift, the basic trainer allows the student pilot time to think and react. This extra time is really appreciated during landing practice. The slow landing speed also limits nose gear damage during those first hard landings.

That brings up the subject of landing gear configuration. Almost all basic trainers use a nose wheel. Very few are "tail draggers." The nose wheel provides easier ground steering and more stability during the takeoff ground roll than does a tail wheel. We will *not* discuss the Center of Gravity relationships to control vector application point details as to why. Trust me, rather than delve into that subject, you will want to just take my word for it.



Photo 12



Photo 13

So now we know the best basic trainer configuration has a high-wing with a flat-bottomed airfoil and uses a nose wheel on the ground. What about size and 3 versus 4-channel control system? Size first as it is the easiest. The [Hangar 9 Alpha 40](#) in photo 12 is the exact same aircraft as the [Alpha 60](#) in photo 13. The only difference is size. The Alpha 60 is 54 in. long, has a 72 in. wingspan, weighs 7.25 lb and is powered by an Evolution .60 cu. In. engine. The Alpha 40 is 52 in. long with a 63 in. wingspan, weighs 5.5 lb. And is powered by an Evolution .40 cu. In. engine.

Both are great basic trainers. The Alpha 60 is easier to see since it is larger. But it is heavier and therefore has more momentum than the Alpha 40. The Alpha 40 uses less fuel and costs about \$75 less than the Alpha 60. Otherwise, both aircraft fly and handle about the same. So which do you pick?

This is a pilot's choice thing. If you don't have the best eyes or you really prefer larger airplanes, get the 60-size. If you think most of your next few models will be in the 40-size range and want to save some money and enjoy lower operating costs, the 40-size airplane is for you. Most manufacturers offer trainers in both sizes. Hobbico for instance, has the Hobbistar 60 trainer plus the 40-size [NexSTAR](#) and 40-size [Superstar](#) trainers.



Photo 14 Photo 15

Three versus four-channel operation is more difficult. There are strong opinions about this and many factual misunderstandings. Both the 3-channel [Hobbico Superstar-EP](#) in photo 14 and the 4-channel [Hobby Lobby's Bonnie 40](#) in photo 15 are great electric-powered trainers and can teach anyone to fly RC. The Superstar-EP flies a bit more slowly since it is lighter than the Bonnie. It is also far less expensive and much easier to assemble.

But the three-channel control arrangement does impose a few limits. Rolls are more difficult since rudder affect reverses when the aircraft is inverted. The only way to complete a roll is to either release or never apply down elevator during the inverted part of the roll. As the nose drops, the airplane can complete the roll. Many other maneuvers such as loops, inverted flight and snap rolls are possible however, using just three channels.

Aerobatic ability is not a real criterion when evaluating trainers. But three-channel aircraft have one performance characteristic that does affect training. In order to keep the aircraft in a banked turn, the pilot must continue to hold the rudder control (positioned on the right, or aileron, stick) throughout the turn. If this is not done, most three-channel aircraft will roll out of the turn. This is exactly what the pilot *must not do* with an aileron-equipped aircraft. Continuing to apply ailerons after the aircraft has reached the desired bank angle causes the aircraft to continue the roll and then fall off into a steep, descending spiral.

When transitioning to an aileron-equipped aircraft, the new pilot will have to re-learn how to make proper turns. This is not a major problem but one you should be aware of before selecting a trainer.



Photo 16



Photo 17

Finally, there is the matter of whether your trainer should be an Almost Ready to Fly (ARF) or a Ready-To-Fly (RTF) model. The [Hangar 9 Arrow](#) kit pictured in photo 16 is a RTF. The engine, fuel system, nose gear and radio are factory installed. The wing, main landing gear and tail parts bolt together. No adhesive is used. Total assembly time can be as little as 30 minutes and requires no special tools.

The [Midwest Aero Star](#) ARF in photo 17 requires engine and radio purchase and installation plus fuel system and nose gear installation. The wings and tail parts use adhesive for assembly. No special tools are needed but some alignment work must be performed. Total assembly time is usually around 20 hours.

Both aircraft are excellent and each has its strong points. The RTF requires very little work and saves a lot of time. It is also the least expensive as the low purchase price (usually \$250 to \$380) includes radio and engine. But with only one exception, the Hangar 9 Extra Easy 40 Trainer that includes a JR 421 computer transmitter, the radio systems supplied use basic, 4-channel, non-computer transmitters and non-ball bearing servos. These radio systems do not allow for much growth. Your next airplane cannot have flaps or retractable landing gear for example. You also must use the .40 cu. in. engines supplied with "forty-size" trainers. Again, future growth potential is limited as high performance "forty-size" aircraft do better with additional power.

With an ARF kit, you choose the radio and engine. Five, six and even seven channel radio systems with computer radios and ball-bearing servos are available from every manufacturer for less than \$300. There is plenty of growth room with these systems. 45 cu. in. high performance engines are also offered by every engine manufacture for around \$80 to \$120. These engines are more powerful than the .40 engines and again allow future growth as the pilot develops additional skills. Most ARF trainer kits sell for about \$100.

Buying an ARF trainer system will cost between \$450 and \$550. In addition, some basic modeling building skills are necessary. RTF's cost about \$150 less and require no building skills. The choice is up to you.

The next installment will discuss radio systems and engines as well as field equipment to get it all working.

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