Tuscarora Radio Controlled Air Craft Flying Club	*This student flight training manual was created for the Tuscarora Radio Controlled Aircraft Flying Club, and written by Ed Pollack. It is a great example of a club that has assembled their knowledge to introduce beginners to R/C flight and safe operation.*

Course Title: Introduction to Radio Controlled Flying Utilizing

Tuscarora R/C Club Rules
Category: Fixed-Wing Flight
Tasks: Prepare for Solo Flight

Purpose: RC aircraft modeling is one of today's most exciting hobbies. It involves many interests, disciplines, and skills. Some of these include aerodynamics, electronics, mechanics, drafting and design, composite material, construction, and woodworking. These are in the airplane alone. To reduce the chance of frustration, and before purchasing any equipment, the beginner should become involved with other modelers, visit a flying site, become acquainted with experienced modelers, or join a club.
Any new modeler begins with an investment, and care must be taken in equipment purchase whether new or quality used. The topics that will be covered will relate to a novice and a trainer airplane. The information relating to all aspects of RC-powered flight can be overwhelming, even to the most seasoned pilot. Disciplines relating to the more advanced levels of RC flight will likely be learned as the skill level of the novice improves and the goals become more defined.

Student Flight Instruction Manual

You are about to become part of one of the longest-standing Radio Control flying clubs in Schuylkill County. We acknowledge that our field is the only sanctioned field in the area and that alone brings in many fliers and spectators. The purpose of this instruction is not only for you to "solo," but to become proficient in flying to bring safety and enjoyment to other fliers as well as spectators and neighbors.

Disclaimer

First and foremost, the club, its members, and spectators, are guests of the Pennsylvania Department of Conservation and Natural Resources (e.g. the Tuscarora State Park) and are subject to all rules and regulations established and set forth by the Bureau of Parks and Management.

Removal from the State Park for rules infraction is at the discretion of the Tuscarora State Park and/or the governing body of the Tuscarora R/C Club. Please be mindful of this as you represent the club in all activities either on or off the flying field.

Secondly, by becoming a dues-paying member of the Tuscarora R/C Club, you agree to abide by the club guidelines as set forth by committee. You shall indemnify and save harmless the Tuscarora Radio Controlled Club, Tuscarora State Park and its jurisdiction, members, seller, vendors, affiliates, pilots, spectators, agents, employees, or volunteers from and against all loss or liability, whether based upon any event, act, activity, either by commission or omission or negligence of the Tuscarora Radio Controlled Club or agents in connection with any activities that harbor the use of terms and conditions of the Tuscarora Radio Controlled Club, items, members, sellers, vendors, affiliates, pilots, spectators, agents, employees, volunteers, or services from and or upon any deviation from said rules and regulations as forth by the Tuscarora Radio Controlled Club whether or not caused by the Tuscarora Radio Controlled Club or Tuscarora State Park and its jurisdiction, members, sellers, vendors, affiliates, pilots, spectators, agents, employees, or nomenclature volunteers.

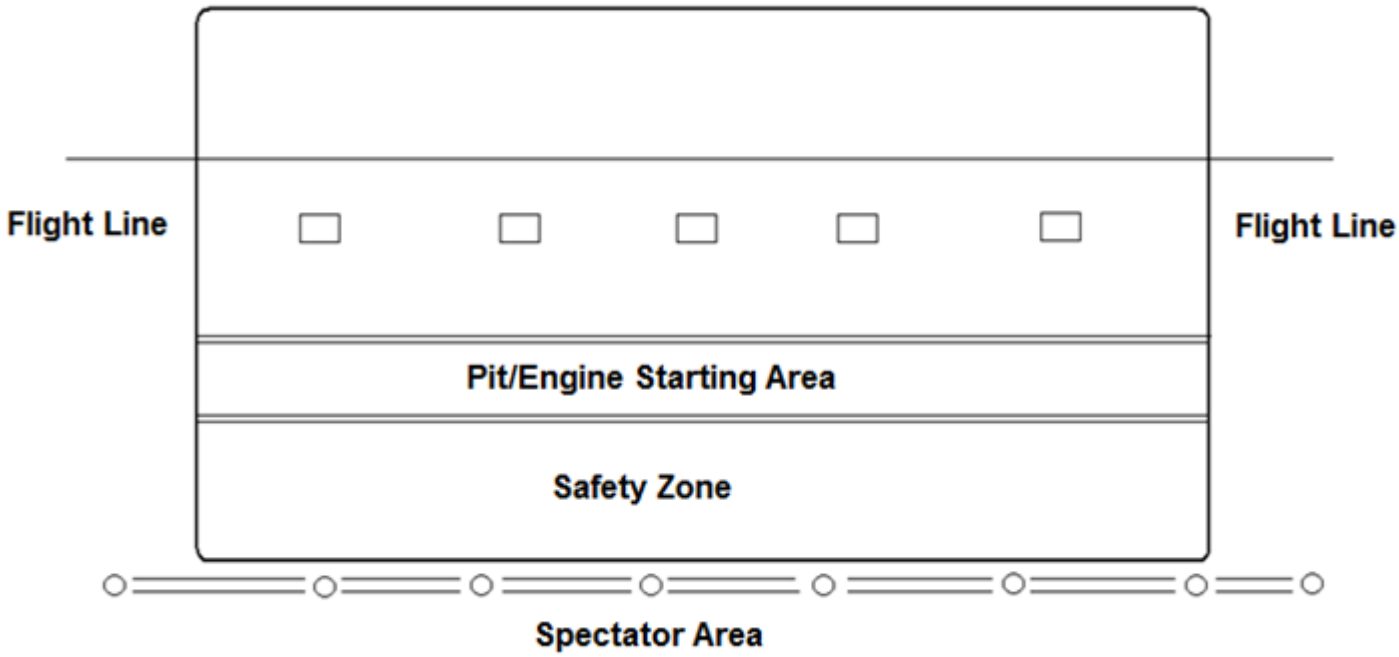
Field Procedures and Safety Guidelines

It is the responsibility of all club members to abide by these simple guidelines. If you observe someone who isn't, please ask him or her to cooperate. They are designed to make our field the best and safest.

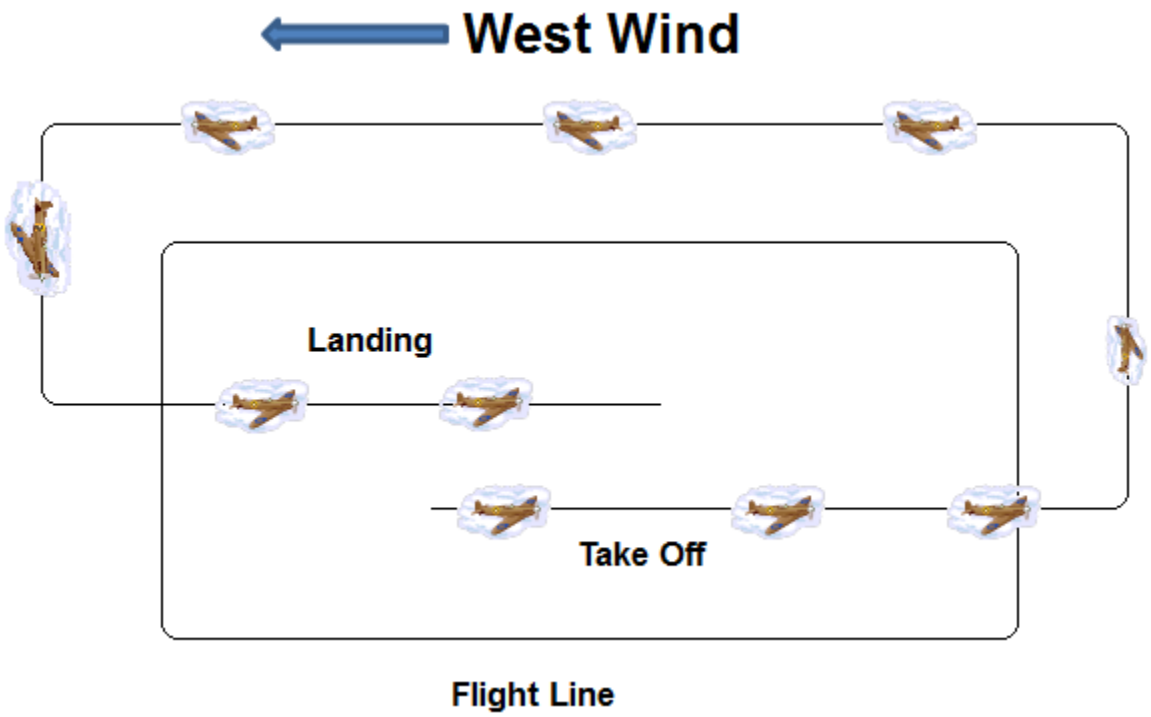
1. To utilize the air field, all AMA and Pennsylvania State Park rules will be obeyed and no person shall be in control of an aircraft without AMA coverage, whether he or she is a student or instructor.

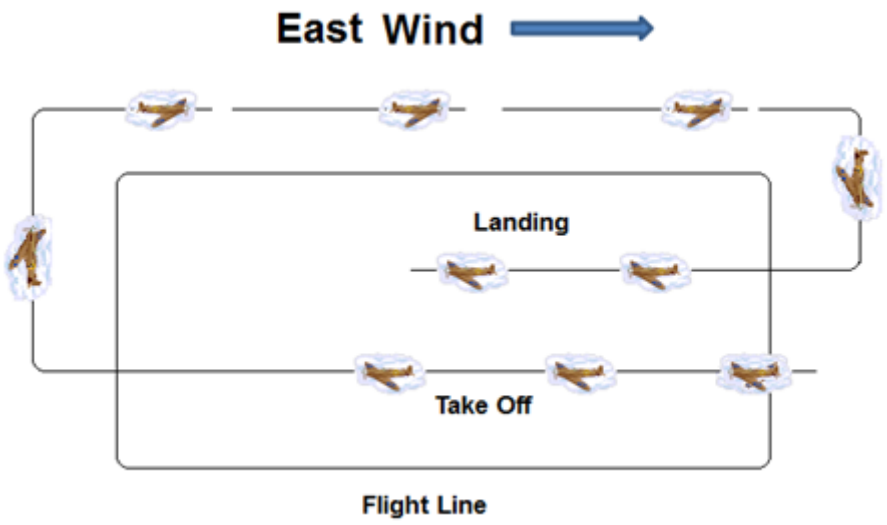
2. *Before* starting your engine or turning on your radio, you must take a channel pin number from the box *and* replace it with your current AMA card. Without this pin, you may not start your engine, turn on your radio, or fly! Return this pin after your flight. Never turn on you transmitter or test your equipment at your vehicle or in the parking lot. If using the 2.4 GHz system, your AMA card or a copy thereof must be in the pin box, however, no pin is required.
* REMEMBER: Without your channel pin, you are financially responsible for the damage you create.

3. All flight gear and airplanes shall be placed in the pit area (25 ft. from fence).



Flight Patterns





4. Models will be started with engines facing the flight line at all times

5. It is recommended when starting engines an assistant must hold model from the rear.

6. Needle valve adjustments are to be made with adjusters body positioned behind the prop.

7. All new models should be inspected before the first flight by someone from the safety committee.

8. Takeoffs must be executed in the most windward direction followed by a procedure to turn away from the flight line /pit area/and spectators..

9. When flying the pilot must always stay on the flight line station and fly in front of the flight line – NEVER over the flight line, pit area or spectators. Also, if possible have a spotter stand with you in case of an emergency

10. Low passes fewer than 30 feet must be made at least 25 feet in front of the flight line.

11. When any problems occur during a flight the pilot shall caution fellow pilots and spectators.

12. To retrieve a model on the field, give a warning to any pilot who is flying. i.e. “On the field”.

13. Flight pattern will be in force when more than one flyer is airborne. Flight pattern will be flown as described in rule 8 and dictated by wind direction.

14. All models shall be starting in the pit area, taxied to flight line, flown, and stopped at the flight line and CARRIED to the pit area.

15. Since noise has been the reason for the loss of other fields, the testing and breaking in of engines will be prohibited at all times!

16. New members shall be trained by certified instructors. Current list is posted inside pin box. Members who wish to instruct new members please contact a safety committee person

17. All new members who have not as yet soloed shall be required to fly the basic flight requirements prior to flying solo and it will be at this time. When flying, the pilot must always stay on the flightline station.

18. All engines .10 and larger are required to have a muffler.

19. Remember, flying without proper credentials such as approved solo, AMA membership, and coverage, will lead to a written reprimand and/or suspension of flying privileges either on a temporary or permanent basis.

20. Any flier who is disabled where a chair and/or devise is required, must have a qualified pilot/spotter with him or her at all times while flying. After completing a flight, the chair or device must be immediately removed from the flightline. *Remember*, members are responsible for the safe operation on this flying field.

21. Stealing or destroying any property belonging to members, club, or state will result in immediate suspension and being barred from the flying site; Prosecution may follow

22. Anyone provoking a disturbance or fight will have flying privileges permanently revoked.

23. Any member receiving a grievance who directs any retaliatory action against the person filing the grievance, will be subject to immediate expulsion from the club and flying site. This is to include threats, intimidation, physical harm, intentional equipment damage, or any action deemed to be retaliatory by the board of directors.

Additional rules that should be followed:
1. Never remove someone else's AMA card from the pin box without his or her permission.

2. When you turn on your transmitter, check to see if any airborne aircraft are affected. Be prepared to turn it off again!

3. Replace your pin and remove your AMA card when you are not using your system.

4. When refueling your aircraft, use a catch container or some sort of material to prevent fuel from contaminating the soil.

5. Never start a loose aircraft; get assistance or use the anchors located at the field. Never start at full throttle; partial is usually sufficient.

6. Do not turn your back to the flight area, especially if you are at a pilot station.

7. Do not taxi your aircraft in the pit area except to prepare for flight.

8. Fly only from pilot stations until you are approved for solo. Always have a proficient spotter accompany you.

9. Before approaching the flightline, do a systems check.

10. All flying will be south of the flightline, which is the northern edge of the runway. Never take off directly from the pilot station line.

11. Announce your intentions loud and clear: "going up," "coming in," "on the field," "dead stick," component or radio failure, etc.

12. Do not fly over the parking lot, highway, or homes.

13. Personnel who are not piloting an aircraft should refrain from disturbing or distracting those who are.

14. No spectators or pets beyond the rail fence.

15. Talk to the spectators and answer their questions. They are the future growth of the sport and our club. Everyone is a potential new member. Politely request that they remain on the spectator side of the fence.

16. Above all else, conduct yourself in a professional and mature manner.

Make club officers aware of those who don't and are detrimental to our image

17. Please clean up your trash such as water bottles, cigarette butts, and coffee cups.

Safe Flying Tips and Hints
1. Roll-test the steering in a driveway or basement. If it doesn't roll straight at home, it won't roll straight on a runway. Set the control to the low rate.

2. Put MonoKote (or otherwise) small marks at the center of gravity (CG) on the wing to indicate balance location. This makes it easy to check at field.

3. Balancing laterally (side to side) will help aircraft track better in maneuvers. Hold at the spinner and tail and add wingtip weight as necessary.

4. Check the receiver battery every two or three flights. Make a chart of how long you have flown vs. voltage drop.

5. Always turn on the transmitter first and the receiver second. Always turn off the receiver first and the transmitter second.

6. Range check your system before the first flight every time out. This should be performed with the engine running at both idle and full throttle.

7. When using a buddy-box system, make sure both boxes are set identically. Never turn buddy-box power on!

8. Remove transmitter neck straps when starting engines.

9. If you don't have a starter, at lease use a "chicken stick." Do not hit it against the propeller. To start your engine, flip the propeller with the stick next to it (touching).

10. Never jamb a running starter onto the spinner. Back up the propeller, and place the starter cone against spinner before turning it on.

11. When you start your engine, look at your watch and keep track of time.

After the flight, check the fuel level to judge maximum available flight time.

12. Do not reach over the propeller to adjust the needle valve. Do it from the rear. Do not position yourself or others to the side of a rotating blade. It could fail on run-up or kick up debris.

13. Taxi while holding up-elevator.

14. Fly with a copilot/spotter.

15. Never practice maneuvers at low altitude. Always practice "three mistakes high."

16. When trimming an aircraft in flight, trim only until it stops the incorrect movement. Trying to correct it entirely will put it out of trim to the opposite direction.

17. Most trainer aircraft will recover from unusual attitudes (mistakes) by killing the power. Wait and pull up-elevator (depending on altitude). Be ready to level out and apply power.

18. Remember, unless you are "dead stick" (without power), you do not have to land. If it's not right, go around. It's much easier, and safer, to do it over rather than try to salvage a bad approach.

19. Do not fly too far away because it is easy to become disorientated. This is especially true when the sun is low on the horizon and the aircraft is silhouetted.

20. If you are using dual rates, return to high rate before entering the landing pattern. Make a couple of turns to adapt to the greater sensitivity again.

21. On flat-bottom-wing trainer airplanes, low-speed handling (banking characteristics) can be improved by raising each aileron 1/8 inch or so. It makes the "up" aileron more effective.

Helpful Hints:
a. Installing larger (2¾- to 3-inch) wheels will make taxiing in grass easier.

b. Improve your visual orientation in the air.

c. Improve your landings because the landing gear won't bend as easily.

- **This section is designed for those who have little or no knowledge of aerodynamics, and/or are new to the hobby. Please read it thoroughly.**

If you are just starting out, selecting an airplane is difficult. A decision has to be made whether you will buy a used aircraft, an ARF (Almost Ready to Fly), or a kit. Generally speaking, by the time you buy a kit, appropriate tools, the hardware, and the covering, you have spent as much as the ARF and it will take it twice as long to put the kit together.

Major differences are if you do destroy an ARF, you won't have the time or investment loss. However the advantage of a kit is you know the mechanics of how it is built and how well it is constructed.

If you are just starting out don't overspend—just get the basics. Get to the field and work with an instructor or fellow pilots, then decide if you need an upgrade. All too often, new hobbyists overspend, don't learn as quickly as they had hoped, and they become discouraged. This is especially true if they tear up their first airplane.

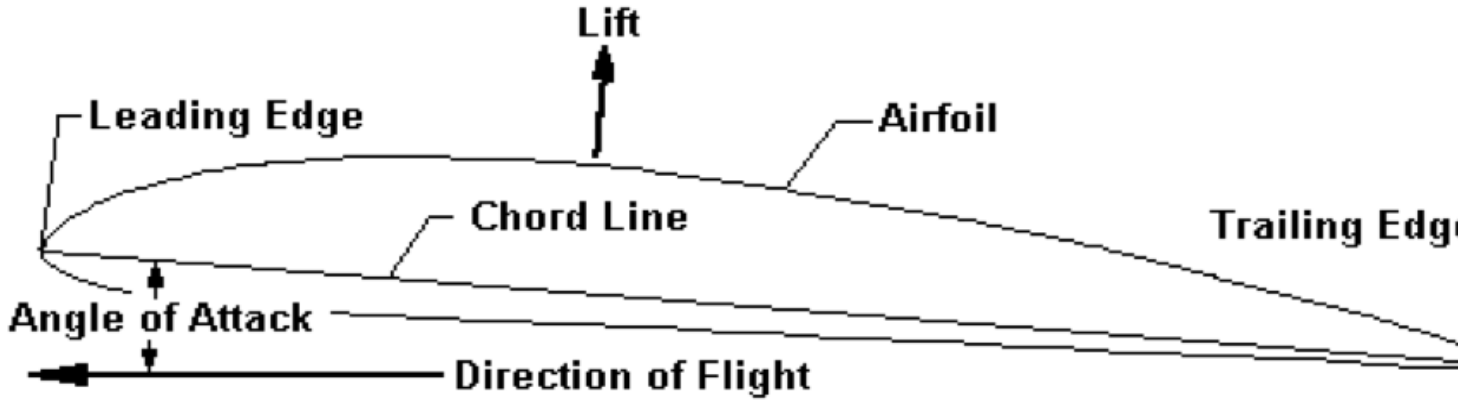
Get some flight time in after you've soloed and you'll have a better idea on your direction and path to take.

The intention of this learning guide is to provide general understanding of basic aerodynamics, which will help a novice to understand why the aircraft does what it does.

The Basics of Flight

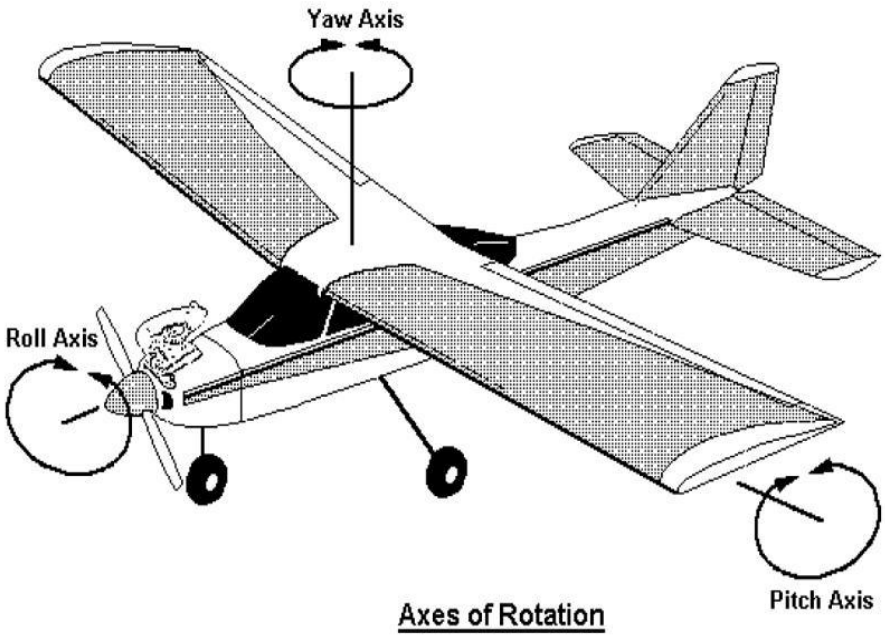
Note: Referring to aircraft as to right or left, is as a pilot would view it from the cockpit.

The concepts of flight should be understood by a beginner. The theories behind the physics of flight are covered in many volumes of books. There are different, and sometimes conflicting, theories and arguments as how airplanes fly, but the one accepted principle is that lift is generated as a result of air pressure on the bottom of the wing being higher than the air pressure on the top of the wing.



Lift increases as the velocity of the air passing over the wing increases, or as the angle of attack increases, as long as the flow of air over the wing remains smooth. Actual flight is attained when the force of the lift equals weight.

An aircraft pivots about three (3) axes: the yaw or vertical axis controlled by the rudder; the pitch or lateral axis controlled by the elevator; and the roll of longitudinal axis controlled by the ailerons. It can pivot about any one of these axes individually or in combination based on the control surfaces that are moved and the direction of the movement.



The Basics of Flight … The Airplane

One significant component of any airplane is the wing. Its design and location determine flight characteristics and each has specific flight attitudes.

Wing: The horizontal surfaces that provide the lifting force.
There are three basic wing profiles.

Flat Bottom: This creates the most lift and is the most stable. Most trainers are flat bottomed. This wing cross-section should have a virtually flat bottom. This type of cross-section has more gentle flight characteristics that are necessary for a beginner
Semisymmetrical:
This is still stable, yet allows more maneuverability and extends aerobatic capability. This is great for "second" airplanes.

Fully Symmetrical:
This is the least stable and most aerobatic. It is for more experienced fliers only. There are three basic wing locations.

Wing position/location:
1. High Wing: A high-wing model is inherently more stable than a low-wing model because of the pendulum effect. Since the weight of the model is below the wing, the fuselage tends to swing downward like a pendulum in order to equalize forces.

2. Mid Wing/Low Wing: The weight of the model divided by the area of the wing should not exceed 19 oz./sq. This reduces the speed required to maintain an acceptable rate that the model descends when the power is reduced resulting in a lower landing speed.

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

The Basic Trainer

A beginning pilot must realize the dedication that is required to gain the ability to fly the type of model that perhaps initially spawned his or her interest. He or she must begin the hobby with a basic trainer and progress through various levels of models until the goal is reached in order to be successful. Too often, new pilots become discouraged at the onset by not making prudent choices with the introductory airplane. These are called trainers. A trainer is called that because it trains.

There are certain criteria that a trainer should have in order to be satisfactory for a beginner.

1. High Wing: A high-wing model is inherently more stable than a low-wing model because of the pendulum effect. Because the weight of the model is below the wing, the fuselage tends to swing downward like a pendulum in order to equalize forces.

2. Flat Bottom: This creates the most lift and is the most stable. Most trainers are flat bottomed. This wing's cross-section should have a virtually flat bottom. This type of cross-section has the more gentle flight characteristics that are necessary for a beginner

3. Dihedral: The wing should have some dihedral. This means that the tips of the wings are higher than the center. The effect of the dihedral is to try to equalize forces and keep the wings level or to return the wings to a level orientation.

4. High-Aspect Ratio: The ratio of the wing length or span should be at least 5½ times the width or chord. This will reduce the rate at which the model responds to command input, allowing more time for a beginner to react.

5. Constant Chord: The width of the wing should be the same from the center or root to the end or tip. This distributes the weight of the airplane evenly over the entire surface of the wing.

6. Moderate Size: Most trainers are for engine sizes between .15 and .60. The smaller ones are more susceptible to the effects of wind and normally the wing loading is higher simply because of the weight of the radio equipment. The larger sizes are easier to fly and easier to see, but are more difficult to transport. Most trainers are for .40-size engines. These trainers have been widely accepted as the optimum size.

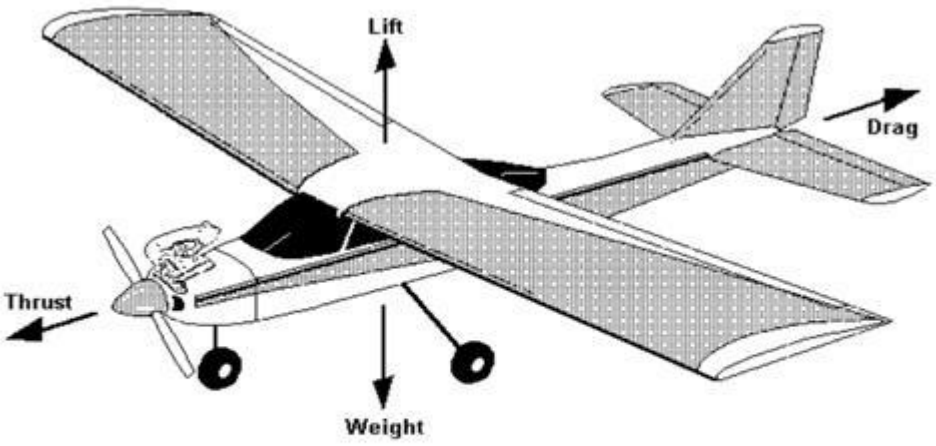
7. Structurally Sound: A trainer must be able to take the abuses imposed by a beginner. This is especially true for hard landings. It must be able to withstand minor crashes with minimal damage. It should be relatively easy to repair.

A trainer is a specific type of model aircraft that is designed to be stable in flight. This means that it has an inherent ability to correct itself and overcome the rotational forces applied so that it regains straight-and-level flight. Most trainers are designed so that they remain stable in slow flight and they are easy to land.

How These Things Fly: The Basic Trainer

A trainer that meets these guidelines will give a beginner excellent service. There are many considerations when choosing a trainer, but the two most basic are time and money.

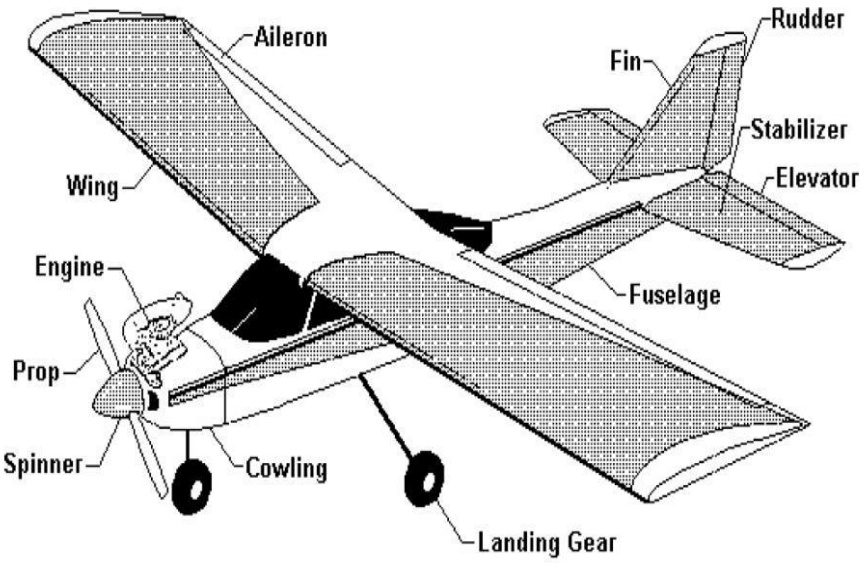
ARF models usually come complete with engine and radio. A trainer built from a kit has the advantage of being less expensive in some cases, and it gives the builder the pleasure of building, the option of color and trim scheme, and the knowledge of the structure to perform repairs. The biggest disadvantage is the time required to construct the model when a beginner would rather be learning to fly.



Flight Forces

When the rudder is moved to the right, the aircraft will rotate to the right about the yaw axis and vice versa. When the elevator is moved up, the aircraft will pitch the nose upward. The ailerons move in opposite directions. When the left aileron is moved up and right one down, the aircraft will rotate to the left and vice versa.

Aircraft Nomenclature



Aileron: The moveable portion of the wing which causes a change about the roll axis.
Cowling: The part of the fuselage which covers the engine.
Engine: A two-cycle reciprocating machine which provides the motivational power.
Elevator: The moveable portion of the horizontal stabilizer which causes a change about the pitch axis.
Fin: Properly know as vertical stabilizer, which provides stabilization about the yaw axis.
Fuselage: The main body of an aircraft.
Landing Gear: The supporting structure of an aircraft, including landing gear struts and wheels.
Propeller: The combination of blades that provide thrust.
Rudder: The moveable portion of the vertical stabilizer that causes change about the yaw axis.
Spinner: Covering over the propeller hub used in starting.

Stabilizer: Properly known as horizontal stabilizer, which provides stabilization about the pitch axis.

Radio Systems

First, a few words about older, narrow-band RC systems…

Traditional narrow-band RC systems on anywhere from 27 MHz to 72 MHz are fairly easy to understand because they work like your regular AM or FM radio—sending out a signal that is picked up by the receiver and then sent to the servos.

Unfortunately, just like regular FM broadcast radio, these RC systems require a frequency all to themselves if they're going to avoid interference with each other. What's more, it doesn't take much to disrupt a regular narrow-band signal. A noisy thermostat or electric drill can often cause massive amounts of electrical interference when listening to an AM broadcast and FM isn't always that much better. But manufacturers of spread spectrum radio systems are claiming that you need never worry about being shot down by other fliers and that all 2.4 GHz systems can get along in harmony, despite apparently using the same frequencies.

How do traditional RC systems work?
Narrowband FM/PCM Radio Control
Since the first radio control systems for models were built more than half a century ago, the technology has been narrow band.

Narrow band refers to the amount of space that signal takes on the spectrum of available frequencies.

Today's FM/PCM radio control systems operate on a tiny sliver of space on relatively low frequencies (27, 35, 36, 40, 41, or 72 Mhz).

This tiny allocation of bandwidth for each RC channel creates a number and can be likened to riding a bicycle down a narrow trail and the same problems apply:

First, you can't ride very quickly simply because it's such a squeeze to get past the bushes and fences on either side of your trail. In radio terms, this means you can't send the control information between transmitter and receiver quickly.

Second, if you run into another cyclist on that narrow track, chances are that you'll both fall off and get hurt. In radio terms, it means that almost any other signal on the narrowband frequency you're using will result in interference (glitches or lockout).

This clearly isn't the best situation for controlling a potentially expensive and sometimes dangerous radio-controlled model but, with careful channel management, it has served us well for decades.

Radio Systems

There are many modern radio systems from which the beginner can choose. There are several common brands including Futaba, Airtronics, JR, Hitec, and Ace. Each of these offers a wide range of options from a simple two-channel system to a computer-assisted eight-channel system. The buyer is limited only by his or her budget. A beginner should discuss his or her choice of systems with his or her intended instructor. There are several reasons for doing this. The primary reason is that the student's systems must be compatible with that instructor's system, especially if a buddy box is being used.

All basic radio systems consist of four (4) basic components.

Transmitter: The unit which takes the input from the user through the gimbals or sticks, encodes it, and sends it to the aircraft.
Receiver: The unit that receives the signal, decodes it, and routes it to the appropriate servo.
Servos: The device that converts the decoded signal to mechanical force to operate a control surface.
Batteries: The device that provides power for the other devices to operate.
There are specific frequencies assigned by the Federal Communications Commission (FCC) for use with airborne RC models. A beginner must ensure that the system that he or she chooses is tuned to one of these frequencies. Most radio system manufacturers place a sticker on the outside of the carton that says, "For airborne use only." There is a frequency reference chart available that lists the purposes of all of the frequencies that are assigned for R/C use.

The radio that is chosen must meet the 1991 specifications for narrow-band receivers. The actual requirements of these specifications need not be known by the beginner because the systems are required to be certified to this standard. The owner's manual for the system will note that the requirements are met and many of the transmitters and receivers will have a gold sticker to signify this.

Radio Systems

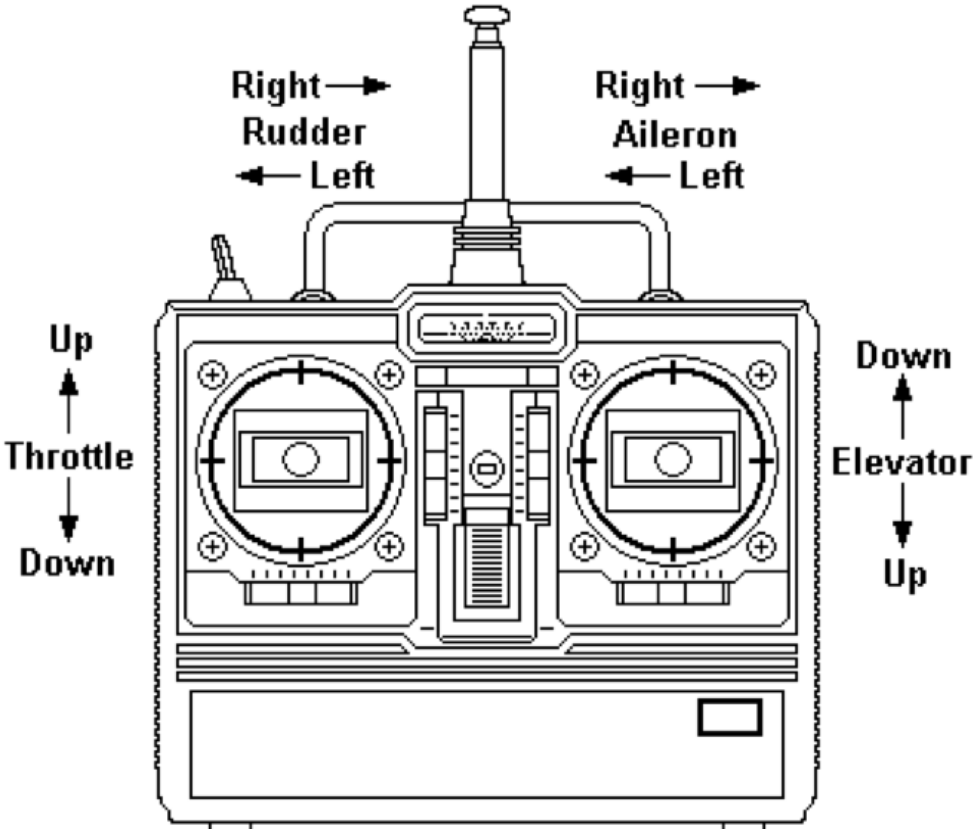
Regardless of the brand of system, the number of channels, or the price, all transmitters have the same basic components. Transmitters might have additional switches, slides, and displays, depending on the functions they perform, but the basic components remain the same.

There have been discussions over the years involving the number of channels with which a beginner should start. Some people say that only three (3) channels should be used: rudder, elevator, and throttle. The argument here is that it is easier for a beginner to only be concerned with using the rudder to make turns and not be concerned with the ailerons. Others contend that four (4) channels should be used for a beginner: rudder, ailerons, elevator, and throttle. The contention in this argument is that by not using ailerons, a beginner must go

through a second phase of beginner training: learning how to use ailerons. A four- (4) channel system offers better control of the model during takeoffs and landings in crosswind conditions. If a beginner chooses to use only three channels, he or she can set up the trainer so that the ailerons are not initially used and then add them later. The four- (4) channel approach to training is more widely accepted.

A beginner might also consider buying a six- (6) channel system to get some of the features that are not available in the basic system, such as dual-rate controls. This feature allows a user to reduce the sensitivity of the sticks, thereby reducing the chance of overcontrolling. If a beginner is relatively sure of future goals that involve the use of a six- (6) channel system, he or she can consider this an investment in his or her future modeling and therefore save money.

A lot must be determined before the initial purchase and should be discussed at length with experienced modelers, especially the intended instructor, before the purchase is made.



This is a typical layout of the transmitter and its functions. Newer radios have an infinite number of changes and settings that can be made

The Basic Powerplant

Electric

Electric motors are adequate for most beginning- to intermediate-level airplane models. They require an onboard battery pack that has to be recharged after each flight. An electric motor can be started remotely and does not require a separate starter. This is considerably safer for fliers whose fingers don't have to get near a spinning propeller during startup.

Glow

A glow engine uses what is called a glow plug to ignite fuel inside the combustion chamber. Glow engines come in two-stroke or more powerful four-stroke varieties. A glow engine requires a battery-operated glow starter to heat the plug, in addition to a propeller starter or hand starting.

Electric Pros: Can be made infinitely faster, easier to maintain, quiet, lower operating costs.
Electric Cons: Expensive startup costs; down time between charges, unless you have multiple batteries.
Glow Pros: Faster out of the box; lower initial cost.

Glow Cons: Higher operating costs. (Nitro fuel is $25 per gallon, and is not renewable. Batteries can be used repeatedly.) Loud, smelly, difficult to maintain.

Comparison

Both types of powerplants have their supporters. A glow engine provides a lot of power in a small package, plus a realistic engine sound that some modelers like. An electric motor is usually less powerful, but it is quiet and can be started with the push of a button. Glow engines can be messy, because they use oily fuel that can soak into the wood of your model airplane, and they require constant refueling. They also often have a cylinder or carburetor that sticks out of the airplane's fuselage to the possible detriment of the model's aerodynamics and appearance. Fans of electric motors enjoy the devices' low maintenance, as opposed to the difficulty of tuning a glow engine. Either type of powerplant is usually suitable for aerobatics.

Costs

The glow engine requires a specialized fuel, which can be expensive. Electric motors just need a recharge from any standard power source. The flight time of a glow-powered airplane depends on the size of the fuel tank, whereas an electric-powered airplane can stay aloft for nearly an hour, depending on battery type and size.

Solo Flight

1. Three takeoffs and landings with adequate control with no damage (other than a broken propeller or nose gear).

2. Power-on and power-off stall with recovery.

3.Controlled pattern at low or idle speed.

4.The ability to control an airplane during an emergency, such as engine failure.

****The certification will be done by two instructors and one soloed pilot. ****

Procedures:

Student Pilot Task Goals

Task #1: Ground support equipment, engine starting, and taxi training.

• Perform aircraft preparation and inspection.

• Perform engine start and radio checks.

• Perform taxi course.

Task #2: Orientation flight.

• Observe orientation flight.

• Note ground and flight safety restrictions.

Task #3: Basic flight skills development.

• Become familiar with speed, yaw, pitch, and roll commands.

• Become familiar with flight trim techniques.

• Execute straight-and-level flight.

• Execute left and right turns.

• Initiate stall or unusual attitude recovery.

Task #4: Takeoff.

• Execute proper upwind takeoff runway alignment.

• Initiate takeoff throttle setting.

• Maintain runway centerline ground steering during takeoff acceleration.

• Execute takeoff rotation at proper speed.

• Execute proper climb speed, pitch, and bank angle.

• Perform a takeoff abort if required.

Task # 5: Turns.

• Perform level shallow turns (left and right) at approximately a 20° bank angle.

• Perform level medium turns (left and right) at approximately a 40° bank angle.

• Perform level steep turns (left and right) at approximately a 60° bank angle.

• Execute shallow, medium, and steep turns (left and right), level flight at low, medium, and full speeds.

• Execute turns in a designated area.

Task #6: Planning maneuvers.
• Perform level rectangular patterns (left and right) as well as Figure Eights over specific ground location(s).

• Apply crosswind technique to maintain proper ground tracking during planning maneuvers.

Task #7: Landing pattern and go-around.
• Execute upwind landing patterns.

• Execute crosswind landing patterns.

• Execute downwind landing patterns.

• Perform go-arounds at a 2-meter height on final approach.

Task #8: Touch-and-go landing.
• Perform traffic pattern(s), final approach, and touchdown, followed by power application and pattern reentry.

• Perform normal and crosswind traffic patterns with touch-and-go maneuvers.

Task #9: Full-stop landing and supervised solo control.
• Execute full-stop landing followed by taxi back and takeoff.

• Execute simulated engine-out landings.

• Perform a supervised solo flight.

Task #10: Supervised solo proficiency/mid-phase review (solo flight).
• Practice tasks 1 through 9 maneuvers.

• Place additional emphasis on instructor-recommended areas of needed improvement.

Task #11: Mid-phase evaluation task (solo flight).
• Perform the sequence of maneuvers required during the mid-phase evaluation.

• Review mid-phase I flight evaluation results and discuss strengths and weaknesses with instructors.

Task #12: Airspeed control maneuvers (solo flight).
• Perform full-, medium-, and slow-speed rectangular patterns (left and right) as well as Figure Eights from level flight.

• Execute a constant-speed climbing rectangular pattern as well as Figure Eights.

• Execute a constant-glide rectangular pattern as well as Figure Eights.

• Perform all maneuvers over designated ground locations.

Task #13: Power-on spot landing (solo flight).
• Perform near-stalled touchdowns on the runway with power on.

• Execute near-stalled touchdowns within 2 meters of the runway centerline.

• Perform touchdowns initially within a 30-meter long touchdown zone, within 2 meters of runway centerline, graduating to a 15-meter long touchdown zone.

• Execute a go-around whenever overshoot landing conditions exist.

Task #14: Power-off (idle) spot landings (solo control).
• Perform a near-stalled touchdown on the runway with power off

(idle).

• Adjust landing pattern to touch down within 2 meters of the runway centerline with power off (idle).

• Adjust landing pattern to touch down within 2 meters of runway centerline and within a 30-meter long touchdown zone