Why and how use a model flight simulator?

This is a collection of knowledge and hints in a question-and-answer style. It’s intended for those who want to learn model flying and wonder what a simulator would help. Most questions asked over and over again in the Web forums are answered and some not asked as well. You have to read sequentially at least for the first time.

Simulator?

Q: Does one really need a simulator?
A: No, but you will want one. It really helps you learning faster, avoiding frustration, and saving money – assumed you want to learn model flying. And it really helps you gathering lots of stick time for practice or just for fun – assumed you just like model flying.

Q: Isn’t a simulator a computer game?
A: You might see it that way. But maybe you’d find a good simulator a too expensive game for 100 or even 200 bucks. And why should more than three top simulators worldwide compete for realistic flight behavior if it were just for a game?

Q: So why use a simulator?
A: The short answer is because we can do things in a simulator we can’t do in reality. The long answer is a list of these things:

- Fly in an environment perfectly suited to learning.
  Think of a nice landscape, fine weather, no wind, sunshine from your back, a huge area of mowed lawn or a big tarmac runway, and no other people bothering you.

- Fly a perfectly set-up model.
  Is your real model built symmetrical, is the center of gravity in it’s centerline and the right amount behind the wing’s leading edge? Are all controls linked without slop and deflecting the right amount?

- Crash a model without cost.
  You’ll lose no money for spare parts and repair and no time for going back home and repairing. You press a key or just wait for the virtual model coming back intact. Learn from your mistakes.

Or the other way around:

- Fly in an adverse environment.
  Learn to land in gusty crosswinds. Find out how easy it’s to lose a model in bad visibility, backlight, or distance. Trees can be so
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attractive for your model, like a magnet! Why is the runway so short and narrow, and wasn't there a centerline? Why should you avoid to fly over your buddies’ heads in the pits, and why should you stay in the aerobatics box? Try it out!

- Fly an unruly model.
  Did you fill the tank or charge the battery before flight? Good, but be aware of engine failure, especially with multi-engine models. Do you know what flight behavior you get from sloppy control linkages? What does a rear center of gravity mean? How about a C/G slightly left or right of the centerline? How to fly a heavy and/or poorly powered model, or an overpowered one?

- Avoid any crash.
  Not flying is absolutely safe, flying is risky – more or less. Practice risky situations you would never try in reality. Practice until you’re safe also in reality.

Yet another aspect:

- Fly virtually when you can’t really.
  Rain, snow? Cold or dark? How long is the summer, and how often the weather is fine? No gym to fly in?

- Fly more.
  No refueling or battery charging, no driving to the field and back, no model assembly and disassembly. No building, covering, cleaning repairing, engine break-in. Just installing the simulator on your PC, starting the program, and flying. Even if you are short of time.

- Fly expensive.
  How many different models can you afford? Ever owned a jet powered model, or could borrow one? Where’s the nearest really good airfield?

Very likely, you’ll have most of your flight time in the simulator. Just that’s why the small rest in reality will be more (or most) satisfactory. This rest isn’t smaller than without a simulator, virtual flight time is in addition. (OK, only if you don’t get a simulator addict.)

Q: But why not simply get by with some fun flying in reality?

A: Good point. But maybe there is fun only if you are a proficient flier, and what do you think how many hundreds of hours stick time you will need to become one? A simulator will get you to the fun phase soon.

Q: What are you talking about?

A: Model flying. A simulator won’t tell you what it is. Read about it (see next section), ask people who know how to do it, search for help. Then come back and try simulators.
Q: Do you really think a simulator is realistic?
A: Simply yes. From the outset, simulators have been realistic enough for learning. Even the really primitive simulators of the 1980s could replace the dangerous (and costly) first 80% of learning in reality. Today they are good enough for any practical purposes. With modern VR headsets for better visual impression, realism even approaches the 100% mark.

Q: But isn’t a simulator too easy to be prepared for reality?
A: It even has to be easier than reality in the first place, that’s how it makes it easier to learn the basics. After that, a good simulator lets you add many troubles (gusty wind, vicious model – just re-read my third answer above), even more than you will likely experience in reality. That’s how it makes you ready for reality, or rather you have to use it sensibly for that. Only a moron would fly in reality after learning the basics only.

Q: What about the adrenaline factor I heard of?
A: Yes, it does exist. It means you are more nervous in reality so you will make more mistakes. It does not mean, though, that the simulator is useless – just the contrary: What do you think how high your adrenaline level would be without practicing in the simulator? Same point as in the previous answer (and same advice – just re-read my third answer above): The simulator makes you ready for flying in reality, it’s actually meant to lower your adrenaline level.
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Make up your mind!

Q: How should I learn to fly a helicopter?
A: By visiting a helicopter flying school. Seriously! Though the following information in general is valid also for helis, all special information applies to airplanes only. I strongly recommended John Vugts' RC Helicopter Web, but unfortunately it has been abandoned. Michael Pfenning's Heli School isn’t bad either, though. And there is John Salt's Flight School. But I just described my helicopter experiences at the end of this document.

Q: So where should I look for learning to fly airplanes?
A: Instead of reading books to learn the basics of model flying, you may visit the AMA Flight School website or the R/C Airplane World website. You may as well visit Ed Moorman's RC University. After that, let Ed Moorman teach you how to fly aerobatics. Years ago, he was running a very good website where he offered a wealth of information in a pragmatic manner. Thanks to the Way Back Machine, we can still read his articles. He’s an experienced teacher, so read carefully and obey him!

Q: Should I really learn aerobatics as a beginner?
A: Sure. That doesn’t mean the so-called 3D aerobatics, which have little in common with normal flying. Old-school aerobatics are just a high skill level of normal flying, including landings. You’ll get to know the limits of your model and your own limits as well. You’ll acquire reflexes which might help you out of trouble. And you might even become a really good pilot if you master low power aerobatics.

Q: Do I need an expensive simulator?
A: It depends. If you’re a rank beginner, a cheap or even free simulator (R/C Desk Pilot, PicaSim) will suffice, even though you might appreciate a better and more expensive one. But before you go to reality you’ll just need one because you won’t really learn landings without one.

Especially for slope soaring and thermaling, there are very good free simulators (sss, PicaSim, and crcsim). But if you want to fly also powered models and fly realistically and precisely or to the limits, you’ll need one of the more expensive ones (Reflex XTR², aeroflyRC7, RealFlight, Phoenix, FS One, and others). This may change some time, though.

Q: So which one do you recommend?
A: Reflex XTR². This is no ad, I’m not paid by Reflex. It’s just that I’m expert in Reflex XTR² and able to guarantee that it’s very well suited to learning and practicing. (And it's easily available in a web shop.)
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Q: Is Reflex XTR\(^2\) the best simulator?
A: I just don’t know. As much as I’m expert in Reflex XTR\(^2\) as little I know about the other simulators. But that’s not the point. Reflex XTR\(^2\) is very well suited – no doubt at all. You might take one of the other simulators as well, but in that case I couldn’t help you anymore.

Q: But why not use an even better simulator?
A: Because nobody knows what the best simulator is. No simulator is completely true to reality, it’s only similar, hence the name. All great simulators have their strengths and weaknesses, but you would notice these only as an experienced pilot, if at all. On the other hand, Reflex is very concerned in making the simulator a tool for learning and practicing. There are no gimmicks just for fun, but the learning environment is nearly perfect.

Q: What makes for a good learning environment?
A: It must make you believe it’s real. That actually says it all but still has to be explained. Of course, the flight physics must render all aspects of a model’s flight behavior. You would wonder how much you are influenced also by a model’s appearance, which therefore should be rendered nearly photo-realistic. Even the model’s sound is important for your experience. Last but not least, the scenery should show all objects on the ground and in the sky with realistic lighting and other physical properties. All that does not have to be perfect, just good enough to make you feel like in reality and concentrate on your flying skills.

Q: What about people complaining of bad flight behavior?
A: They might be even right. There are quite a few bad models for Reflex XTR\(^2\), but that doesn’t mean the simulator is bad. It’s just very hard to render a model’s flight behavior correctly, and most people don’t want to do such hard. Even some models coming with Reflex XTR\(^2\) are not perfect. Actually, the really hard part is to avoid the self-delusion adjusting a flight behavior you wish to be real. This, in general, will need measurements, aerodynamic calculations and/or the real model for comparison – and a clear and unbiased mind, at least as far as possible.

Q: You mean the simulator is good but only the models are bad?
A: Not quite. On the one hand, no simulator is perfect and should get better with every new version. Reflex XTR\(^2\) is by far good enough for learning and practicing purposes and has the potential for really good models – there are just not that many. On the other hand, there are several models by far good enough for learning and practicing purposes – you just have to find them.
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Q: And where can I find these good models for Reflex XTR²?
A: You just found some – no kidding! What do you think why I wrote this text? Obviously, because I have to offer something you should notice. It’s the chance to learn and practice flying model airplanes in a simulator – even if it’s just Reflex XTR² and not another one. Look at my download page for beginner and trainer models as well as for more advanced models.

Q: Why should I believe that?
A: You don’t have to believe – just try! It’s only an offer to use my models. If you still wonder if you should buy Reflex XTR², you have the opportunity to try it before in a free trial period. It may help you knowing that even though I’m not a professional, I professionally built and adjusted my models. (In fact, I’m a full-scale pilot and flight instructor and an engineer and very critical.) And there are even more good models.

Q: But you don’t have my model for the simulator, or do you?
A: Most likely not, but that doesn’t matter at all. If you have one of the common trainer models, you will find a close match for the simulator. If you even have a more advanced model that you won’t be able to fly yet, you shouldn’t think the simulator is just right to learn flying that model without further ado. You have to generally learn flying in the first place, and you will be glad to find very typical models for each learning step in the simulator. It will help you immensely to master just different models step by step, one after the other. In the end, flying your model in reality will be a piece of cake for you. Only if you are a professional practicing for contests you may need an exact copy of your real model in the simulator.

Q: There is even my model for the simulator, but why is it not realistic?
A: You mean it doesn’t fly like your real model? Wait a minute! There are several possible reasons: (1) It’s a bad simulator model. (2) It's good but set up differently, most likely intentionally. You might wonder at how different the same model can behave. (3) You only think it’s not realistic because the impression of a model’s flight behavior is different in the simulator. (4) You expect the model to behave in a certain way, but you are plain wrong. You are a beginner and just not yet able to criticize that. Find out why models behave differently, and why their owners might even want that, then you can. Learn flying!
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Be prepared!

Q: What’s needed?
A: You need the Simulator and an R/C transmitter (TX). Of course, you must have a PC with good 3D video (this does not mean stereo view) and a fast display. Any PC suited for computer games is good. Avoid the very simple TXs and buy a reasonably priced “computer” TX with expo and simple mixers. It will do nearly all tricks you’ll ever want to do. Simulator is Reflex XTR², just with a game-controller compatible interface connecting the TX to the PC (maybe wireless).

Q: Anything more needed?
A: Indeed, additionally you’ll need some basic computer skills. Installing Reflex XTR² is easy. You have to check the prerequisites before and select a suitable graphics mode after. Selecting one of the pre-installed models and sceneries is easy, too. To select one of my models, though, you have to download and install it before. My models come in an installer that you just have to run after download. Learn these skills before trying the simulator.

Q: How should I begin?
A: Hook up the TX to the PC using the USB interface. Start the simulator and switch on your transmitter. Follow the instructions to calibrate and assign controls. It should work, but otherwise you have to read the Reflex XTR² help and your TX’s manual. Maybe you also have to adjust your TX’s mode.

Q: What the heck is MODE?
A: It’s the way the airplane's controls are assigned to the TX's two sticks. There are standard modes numbered 1 to 4 (or even more). Basically, it’s about ailerons, elevator, rudder and throttle (power) of the model and the two sticks of the TX. You may look here in the Web for basic information.

Q: What mode should I choose?
A: Many people are happy with mode 2, which means the “primary” controls (aileron and elevator) on the right stick and the “secondary” controls (rudder and throttle) on the left one. That will allow flying with one hand only. Presumably you’ll like that because it's easier to coordinate the two primary controls with only one hand and that should be your dominant hand. Left-handers please read Ed Moorman's hints, but they are very interesting for right-handers, too.
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Q: Isn’t mode 1 better?
A: Some people claim so. It means rudder and aileron exchanged. It’s intended that the main controls are separated from each other so they aren’t influenced by each other. This should make for more precise flying and could pay if you’re an experienced and skilled pilot, maybe flying jet models requiring precise control inputs. But I think in most cases these are not required and it’s harder to learn in mode 1. You might nevertheless try it; it’s all up to you.

Q: How to hold the transmitter?
A: Good question, but how to hold the sticks? Some aficionados have a TX with a big desk case. They rest their hands on it and hold the sticks between thumb and index finger. Some do that even without a desk case suspending their transmitter from a neckstrap. They are striving for precision, sometimes even using elongated sticks. I think that’s overkill at least for a beginner. You should have a lightweight handheld TX with short thumb sticks. Hold it relaxed and let your thumb tips rest easily on the stick tops (which are toothed to this end).

Q: Do these decisions fix me forever?
A: No, they are only likely to stay unchanged. You won’t depend much on these things with time and practice. You might switch to a different mode later, and even though it may feel hard to re-learn, it will be easier than the initial learning. You might switch to a long-stick desk-case TX without any effort. But even world champions are using handheld thumb-stick TXs in mode 2. World-known glider champion Joe Wurts is able to steer with his big toe, and there’s a guy who is able to fly helicopter aerobatics while riding a monocycle. There are many aims to strive for.

Q: What’s going on now?
A: Keep it simple (if you’re not stupid)! Forget all these complicated things and, above all, try to stay relaxed. Watch yourself! If you are making mistakes you are most likely not relaxed. If your hands are clenched and your thumb tips become white, something is wrong. Of course, in reality you just can’t stay cool because there is some real risk. One nice thing about a simulator is that there is just no risk and you really can stay cool. Relax and notice you’re flying better and making fewer mistakes. Now you’re ready to fly.
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Let’s go flying!

Q: Which model to begin?
A: You should know the basics, what the upper and lower side of an airplane is, what side is front and what side is rear. Take for granted that there’s a propeller up front and avoid planes being different. There are still plenty of nice models you could be tempted to try. Do yourself a favor, control yourself, take the cheapest, simplest, and ugliest model we have for Reflex XTR², as you should do in reality. Take the GWS Slow Stick!

Q: Ready now?
A: No! You forgot the environment. Familiarize yourself with the simulator’s scenery and simulation settings. Select a scenery you like, but pay attention to the lighting and the surroundings. Imagine what backlight or fences and trees could do? Set wind and thermals to zero, what means absolutely calm weather. Set camera zoom to zero and camera field-of-view to 90 degrees. Set full-screen mode and your display’s native resolution. Select a model position you like. Set the most easy conditions for your first steps – ah, flights.

Q: But now?
A: Yes! The Slow Stick in front of you in your favorite scenery, nice and calm weather – but wait!
First, pull the throttle stick back, then switch the TX on and hit F4 or double-click in the window to start the simulation.
Slow Stick is not only an electric model but also a so-called rudder-and-elevator (R/E) one. It has no ailerons but is flown with rudder instead. We want to have the main controls assigned to the right stick of the TX. Your “computer” TX has a switch called “combi” or similarly. Now you have to set it “on” so any aileron movement with the right stick will automagically move the rudder. You may have to set this behavior in the TX before.

Q: Anything else?
A: You’re so patient! Now simply set full power with the left stick and let the model gain some height. Then take the power stick back to less than 50% and wait a few seconds. The model will establish on a straight and level flight path. Let the left stick alone and use only the right stick. Any control input will disturb the model, but you’ll want to fly some turns.

Q: So how can I do it?
A: Try with rudder, but very carefully – that means start with very small stick deflections and watch what will happen. The model will make only
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big turns, but with bigger deflections it will go out of control. At least it will drop its nose and get faster. Now you know what the elevator is for. Pull it really carefully to hold the model’s nose up. If you’ve overdone just release the elevator and wait for the model calming down. Even if not flying turns you’ll need the elevator to maintain level flight. Practice!

Q: Is it really so easy?
A: So far, but remember landing. There’s enough flight time to prepare for this highlight of each flight, but you should prepare. Try to line up the model with the “runway”. Even if there’s no runway at all you should imagine one in the scenery. In the simulator, it’s harder to keep orientation than in reality. If you don’t manage to line up the model, go around and try again, as often as you need.

Q: And now?
A: The model is flying in the direction of your runway at some moderate altitude and at some distance from the intended touch-down point. You didn’t intend to touch down on a certain point? You’d better do, but for now just cut power and watch what will happen. The model should commence a glide and eventually settle on the ground on it’s own.

Q: Didn’t you say landing is hard?
A: Yes, that’s right, but didn’t you notice that Slow Stick did it for you? Actually, it plopped down. You have to help it making a smoother, which is a better landing. Anyway, it’s your task now to practice what is called traffic patterns – take-off, climb, departure leg, downwind, base leg, approach, landing. And landing is the highlight of each flight because it will turn out well only if the preceding steps succeed. So practice landings as much as you can – and be demanding!

Q: Any hints?
A: Of course. Remember you’re the only reason for the model to behave strangely. So try to curb your movements on the sticks, the model is still better than you. On the other hand, many beginners only pull the elevator. You might also use down elevator to correct a strange attitude of the model. Whatever, pay attention to the model’s attitude, which means it’s inclination, and it’s effects. You should notice that the elevator controls the model’s attitude and thus altitude in level flight (with cruise power) but speed in glide (idle) and climb (full power). Learn to only direct the model’s movements by its attitude, not to move it directly yourself.

Q: Slow Stick is boring, what next?
A: If you feel perfect try walking over water! Are you really able to fly a precise traffic pattern and land smoothly? Every time without any error?
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OK, you don’t have to be perfect, but be demanding and self-critical! You may step forward and try another model, but be prepared to step back if you couldn’t handle it. You want to learn model flying, but I can’t really help you. You must help yourself and should not overstretch your abilities. Find out your talent and behave accordingly. Have fun!

More flying!

Q: Couldn’t I fly in reality now?
A: If you have a Slow Stick and the weather is really calm, why not? But for now you only learned to fly a Slow Stick and not to fly generally. You don’t know what even the lightest wind would do to your model, and you are used only to your virtual flying field. You need to generalize your skills.

Q: What do you mean?
A: Vary virtually every parameter of your flying situation. Take different models, fly on different fields, even some with adverse lighting conditions and obstacles, set wind and gusts, try crosswind of different strength, try landing in thermals, try wrong center of gravity and sloppy control linkages of the model. By varying only one parameter at the same time, you’ll soon master it’s effects. By combining two or more parameters you’ll come closer to real situations.

Q: So should I be perfect before going to reality after all?
A: Remember a fact of life known as the Pareto law. In my words: You’d need only 20% of the time required to become perfect to reach yet 80% of perfection. You’d have to practice the other 80% of time to become a perfect pilot and maybe world champion. But 80% of perfection will be enough for most of all practical purposes. You might still wonder how long the 20% of time really are.

Q: How do I recognize these 80%?
A: Just answer yourself some simple questions: Is my real model less demanding than the models mastered in the simulator? Is the real flying field better than the ones used in the simulator? Is the real weather better than the simulated you tried successfully? Better should be really better and not only equally good because you have to allow for the “adrenaline factor”. You just can’t hit a “Del” key and have a new model after a crash in reality. But if you are really able to answer these questions (not only guessing) and all answers are “yes”, then go out flying! There’s nothing better and more satisfactory. Learn to answer these questions and avoid sitting in front of your PC when real flying conditions are good.
Q: What next model do you recommend?

A: Good question. Next step could be the Miss 2 parkflyer. It’s not as lightweight and slow as a slowflyer but it will take some wind. Rudder and elevator are so small that you may panic and the model will still stay calm despite of full control deflection. The power-to-weight ratio is low for the same reason. The same is true for Graupner Taxi, which is a glow-powered model but which is even faster due to its weight. If you can fly and land these two, try Brummi parkflyer, which is essentially the same as Miss 2 but has bigger control areas. You might appreciate the better controlability when exploring thermals.

Q: What next, come on!

A: Did you practice all the new things mentioned in the previous paragraph? OK, now it’s time to try ailerons. It’s not about one more stick function. Actually, rudder is now replaced by aileron, and you’ll feel how real flying is at all. Steering with rudder was facilitation as far as the model was sluggish. Steering, or more correctly controlling, with ailerons makes the model twitchier. Compare the Super Miss to Miss 2 and even Brummi and compare Calmato 40 Trainer to Taxi. You don’t have to apply rudder because it could be actuated automatically by combi mixer (Super Miss) or is replaced by aileron differential (Calmato 40 Trainer).

Q: What next models do you recommend?

A: The most well balanced model might be Taxi with ailerons and flaps. It’s rock-steady and will teach you flap landings and basic aerobatics. Calmato 40 Trainer is a good and common trainer but a bit twitchier. Super Miss is a very capable but twitchy enhancement of Brummi. Now or as your first aileron model you should try Das Ugly Stik in the mild version. You’ll learn to fly a somewhat heavy and sluggish model and low-power aerobatics including inverted maneuvers. The wild and especially the hot rod version will show you complete classic aerobatics including spins and snap rolls but still land like a trainer. Only after mastering this you should try a low-wing model. Kwik-Fli Mark III and Mark IV will teach you not only just aerobatics but also a decent flying style. It’s a long way to a classic aerobatic sports model!

Q: Why do you recommend so many different models?

A: Well, if you like a change it’s always good to practice with different models. You will learn the essence of flying by seeing what is specific to a model and what is flying in general. If you like constancy you might as well use one single model to learn all aspects of normal flying. I made the WingMaster in a basic and acro version for this purpose. You will learn with ailerons from the beginning and won’t have to get used to new conditions. WingMaster shows the essence of flying because it behaves so typical. After mastering basic aerobatics, you may change directly to the
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Ugly Stik and after that to the Kwik-Fli. That would be a classical way, the WingMaster being your first model, Ugly Stik the second, and Kwik-Fli the third and the first low-winger.

More model airplanes!

Here we stop the question-and-answer ploy and start looking at some airplanes and what they can teach us. You might additionally go to the AMA Flight School website and to the R/C Airplane World website for more information and help.
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Slow Stick

Miss 2
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Brummi

Super Miss
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Taxi

This was a very well known beginner model by market-leading company Graupner (at least in Germany) till the 1980s. As usual back then, it has no ailerons. It’s very solid and sturdy and rock-stable in flight. It may be over-loaded and will still fly well. This excellent REFLEX XTR² model was made by Bo (Jörgen) Strömberg.

![Taxi model](image)

The model glides well and will teach you a decent speed management on approach for landing. It floats on landing and gives you time to observe what’s going on and to practice a correct flare without ballooning. These abilities are basic for all further flying.

Just for entertainment, you may come back later and try some crude aerobatics. In the old days when R/C equipment was expensive, many modelers had only rudder-and-elevator planes. Nevertheless they did rolls and stall turns with them.

Bo Strömberg even made a small-dihedral version with ailerons and flaps. It’s nice for learning to handle these things and even for real basic aerobatics.
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Calmato 40 Trainer
WingMaster

Actually, this is not a real model but only a virtual one. Originally a mere rudder-and-throttle model built after a design sketch in the 1960s, the full-fledged electric version is now an even excellent beginner model in the simulator (and might be even in reality).

It may be the very first model to be used in the simulator and will teach real flying with ailerons from the beginning. All aspects of normal flying can be practiced like take-off and landing, climb and descent, level flight and turns. Standard maneuvers like traffic patterns, holding patterns, landing approaches, and touch-and-goes are easy to learn with this calm and steady flying plane.

There are no bad habits at all. No rudder is needed against adverse yaw, no top aileron in turns, though both still won’t hurt. There will be no tip stall and even no stall at all. But the flaps may be deployed to make the model fly as slow and land (nearly) as short as a parkflyer.

And the model is able to fly basic aerobatics, namely loops, rolls, and stall turns, and even to fly inverted. Of course, spins and snap rolls are not possible though some other stunts like sideslip or tailslide. And the model will stay unswerving even in gusty wind. Therefore it’s easier to handle than a slowflyer or parkflyer.

So this plane might be a dependable companion from the very beginning to the point where you mastered all aspects of normal flying also in adverse conditions. The model makes this as easy as possible. Now you would look for a model capable to do real aerobatics but just as well behaved. But be prepared there are also vicious models which would take you by surprise with their behavior.
Telemaster

The well-known German designer Karl-Heinz Denzin designed this model in the late 1960s. It was produced in three sizes of which the biggest, Senior Telemaster, became popular especially due to its size. Whereas most models had about 60” wingspan this one has even 95”. Still it’s quite lightweight so its wing loading and flight speed are rather low. Besides, it’s well balanced and its flight behavior is just amazing. You may try this model as a pleasant and interesting excursion from your learning career.

The model is well suited to beginners even if not to rank beginners. See it as a WingMaster complement, not a replacement. The Telemaster has high-lift airfoils even for the horizontal stabilizer. Weight and thus wing loading are very low. So the model flies slowly, and besides very smooth and steady. It glides quite well so you’ll appreciate flaps which produce some drag to make the glide path steeper. But you’ll have to cope with substantial adverse yaw, either by using the transmitter’s combi mixer or, even better, by flying coordinated turns (aileron – rudder coordination).

Select the “Senior .45 glow flaps” (two-stroke engine) or the “Senior RCV 58-CD flaps” (four-stroke engine) for trying. The quite small engines are well sufficient for just vivid flying. You’ll experience the slow-motion flying the Senior Telemaster is known for, and its smooth flight behavior. With flaps down (30 degrees) the model is still completely under control and even climbs at full power.

Even though you might think this is a perfect beginners plane it is not. Yes, it’s slow, stable, steady, smooth, honest, but it’s well balanced and neutral as well. The former makes it suited to beginners, but the latter means not to rank beginners.
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Such a plane is easy to handle for the seasoned pilot because it’s a utility plane. The pilot wants to concentrate on the real task, which may be glider or banner tow, dropping candies, or aerial photography and video. He appreciates the slow and smooth flight and the fact that the model maintains a certain flight path, may it be a turn or straight and level.

The rank beginner needs a model that flies on its own. Even when he has upset the plane it should return to normal flight after leaving the transmitter sticks alone. As an advanced beginner, you are flying your plane, not the plane is flying you. So you might well explore the flight behavior of a utility airplane.

Select the “Giant electric flaps”, the “Giant 26ccm gas flaps”, or the “Giant FA 125A flaps” version to do this. The Giant has 12 ft wingspan whereas the Senior has only 8 ft, but the Giant has still the same wing loading as the Senior. So flight speed and landing distance are the same, but the Giant seems to be even much slower.

In fact, it’s a real STOL airplane (Short Take-Off and Landing). The big flaps make for much drag and a steep descent and approach. Add to this a moderately powerful engine that makes for fast climb. Now you know how to accomplish short turnaround times in airwork.

But you will as well notice that the plane doesn’t accomplish that on it’s own. You have to fly it, and especially the Giant Telemaster is an excellent plane to learn and practice STOL and airwork – and coordinated turns.
Das Ugly Stik

Designed 1964/1966 by the world-famous Phil Kraft, Das Ugly Stik soon became world-famous as well. It may be ugly but it flies very well. It’s a simple but effective design needing no special things like flaps or retracts. Still it will teach you all main aspects of flying including classic aerobatics. It will do that in at least two steps: basic and advanced. There’s a “mild” and therefore safe version, and there’s a “wild” and therefore capable version.

Here it’s liveried as a mild and safe basic trainer. It will stall but very well behaved. It won’t spin or snap because it lacks the control authority and power needed for that. Even if you pull full elevator, the model will never drop the nose or a wing. So you can push it to its limits, especially on landings, without being afraid of bad consequences. This way you may really learn landings and aerobatics.
Why and how use a model flight simulator?

Doing so, you may later even prefer the “wild” version. The higher engine power may cause trouble if you are not used to fast flying. But if you are you will instead find the power helpful to get out of trouble, for instance to pull out of a maneuver started too low.

Here Das Ugly Stik is aptly liveried as a (sort of) wild and aggressive advanced trainer. It simply has more power and control throws. Main advantage is more powerful aerobatics, but still no stall maneuvers.
Why and how use a model flight simulator?

For that, there’s a “hot rod” version featuring an even more powerful engine and a nearly “neutral” setup for all sorts of pattern. But this setup makes it unsuitable for a beginner.

Spinning and snapping is achieved by a trick. The rectangular wing plan-form and the special wingtips make for the tame stall behavior. Stall starts in the middle of the wing and proceeds to the wingtips. But if full rudder is applied shortly before stall, one wingtip is slowed down and will stall first. A spin is initiated by applying full rudder when approaching stall, a snap roll is initiated by applying full rudder and elevator at the same time, with the rudder slightly leading the elevator. You can still be unconcerned on landings as long as you avoid abrupt rudder.
Kwik-Fli

Phil Kraft designed the Kwik-Fli as his own competition model and won the 1967 aerobatic world championship with the Mark III version. But that doesn’t mean it is out of question for you. The name doesn’t imply a fast flying airplane but a model that is quickly built and thus flying soon. As a matter of fact, Kwik-Fli is a slow flying plane with its thick airfoil, boxy shape, and low weight. The simple design actually contributes to good and honest flight characteristics.

After all, 1967 pattern competition wasn’t that spectacular. There were no flick maneuvers, and the thick-airfoil square-planform wing makes them hard to fly. But such a wing and a low weight make a good first low-wing model. Additionally, Kwik-Fli is a remarkably smooth-flying airplane. While the “hot-rod” Ugly Stik flies all maneuvers simply by brute force, Kwik-Fli may teach you a decent and graceful flying style.

This is the original world championship model, but you are allowed and even encouraged to fly it in the simulator. It is very forgiving of flying mistakes and easy to land. But as all these tricycle-landing-gear models, it likes to fly from paved runways, so select an appropriate scenery.

There are two different setups of this model. The “Mark III original” setup has the center-of-gravity and the wing incidence angle as recommended in the plan, but like most plans and kits it’s over-stabilized. On the other hand, the “Mark III crisp” version is set up like a world-champion model, so just use this one to practice aerobatics. And there’s another choice...
Phil Kraft designed and tried a tapered-wing version, the Mark IV, though he never used it in competition. But others appreciated the flick ability and maybe the slightly lower drag. I couldn’t resist making it a modern electric sport model.

This "Mark IV electric" version flicks easily at nearly any flight speed using only elevator and rudder (the old-school method), especially because it has the suitable balance. It even flicks with elevator only, but one has to really snap it to full deflection to accomplish that. And a stall immediately stops when elevator is slightly released. Thus the model is still not vicious and is actually the better version.

Weight is only a bit higher with the strong electric drive, but speed and aerobatic performance are very good. Landings are still quite easy. You will like this model once you’ve mastered the Mark III.
Brushfire

Ken Bonnema designed the Brushfire as an aerobatic competition model in 1978. This was the era of the "ballistic" pattern style and the models were called "rocket" ships. They flew big patterns at high speed like full-scale military jet aircraft, and the models looked a bit like those.

The engines had a tuned pipe (instead of a simple muffler) for more power and a high-pitch propeller for more speed. The landing gear was retracted in flight for less drag and smoother flying. The weight was more than 9 lb compared to less than 6 lb of the Kwik-Fli. Sometimes air brakes or flaps were used to enhance the landing behavior of the fast and heavy models.
Why and how use a model flight simulator?

Now why a ballistic pattern model and especially the Brushfire in a flight training course? You are quite far in your flight training now and have to experience just what a "rocket ship" does best: flying fast! Brushfire does it perfectly but is yet able to do slow landings, all without any bad habits. Brushfire is a typical example with its jet-like shape and its swept wing and empennage. The latter is not that typical because many rocket ships had unswept wings for some reason, while the swept-wing models aimed for good roll characteristics. You will notice that with Brushfire, but maybe you won't notice that it's harder to keep track in looping maneuvers. The differences are subtle even for the expert and shouldn't bother you.

Really typical is a very "neutral" flight behavior with very few and little "couplings". Take the Kwik-Fli and apply full rudder and you'll get not only yaw but also much roll and pitch – yaw-roll coupling and yaw-pitch coupling. Brushfire has very little coupling, if any. Like Kwik-Fli or even more, it will fly where you point it and fly smooth, just at low and high speed.

Aided by the flaps, but also without them, Brushfire may slow down to a surprisingly low speed. Besides landing slowly, it may even fly low-speed patterns. In any case, you can be unconcerned of unintentional stalls or other bad habits – Brushfire is easy to fly. That's why it's suited to a kind of flight training.

Let's assume you are able to fly consistently precise patterns, not only aerobatic but also traffic patterns and landings. When you switch from Kwik-Fli to Brushfire, likely the airplane will be ahead of you, just too fast for you. At full throttle, it will accelerate to high speed and you won't get worked out a traffic pattern. You have to throttle back and establish on a deliberate flight path and speed.

You have to learn not only thinking faster – ahead of the airplane. You have to learn also deliberately setting and maintaining flight modes. The main means is power setting, and the main difficulty is to cope with different pitch attitude and control response. You can make good use of the flaps for approaches and landings, even though it's another complication in addition to the retractable landing gear. Such a rocket ship is a handful, even if it's well mannered and not vicious.

On the other hand, flying a fast model is a learned skill like others. After a bit practice you may find it very satisfying to put it through its paces, the model faithfully following your control inputs. It may scream in fast and big patterns, purr in slow and close-by patterns, do an amazingly slow traffic pattern and landing approach, and a quite slow and short landing.

By the way, a paved runway is absolutely needed.
Sundries

Landing gear

Do you wonder why vintage models have this “tricycle” landing gear? Not quite true, the Calmato 40 Trainer has it as well. But aren’t modern models “taildraggers”? Again not quite true, the WingMaster is one, too. So what is the reason?

In the old times, a “full-house ship” with all controls was quite heavy because the R/C equipment was heavy. It needed a powerful engine, which not nearly gave a thrust/weight ratio of 1 though. Therefore the models were fast (three to four times as fast as a parkflyer) and aerobatics had to be flown with an impetus instead of power.

At high landing speed, a taildragger tends to swerve out of line because the center-of-gravity is behind the main wheels. Small obstacles on the runway can make the model go nose-over. A tricycle landing gear is steady after touch-down and prevents the model from going nose-over.

That’s why the old pattern models had one; after all landing was rated in competition as part of the maneuver schedule. And that’s why old beginner models had one, after all a beginner is tempted to simply push a too fast model on the runway to force the touchdown (but a forced landing is still something different). Really old or small beginner models from the 1960s were even lacking an elevator.

A taildragger has also advantages. The landing gear weighs less, has less drag and is more robust. The propeller clearance on the ground is better. And if the pilot is able to touch-down the model in a nose-high attitude, there’s no swerve-out-of-line problem. If he is not able, it helps if the model flies slowly anyway. WingMaster is a taildragger because it is slow, but Calmato has a tricycle landing gear because it is faster.

Brushfire typically had a tricycle landing gear, but sometimes it was modified to a taildragger to have the nose landing gear out of the way of the tuned pipe running inside the fuselage under the wing. There’s no problem because the model can do slow landings, anyway. So the choice between tricycle or taildragger may be a matter of convenience or even taste.

Flaps

Do you know what the wing flaps really do? Many model fliers dismiss them as unnecessary, and in some way they are even right. In fact you may well do without flaps, but they may come in very handy and convenient. Let’s take Telemaster and Brushfire for typical examples.

Both models have big wings and don’t really need more lift. On the contrary, they both glide well and you may find it hard to get them down and on the ground. That’s why some fast models have air brakes to slow down and others even deflect their ailerons a bit up to reduce lift. So the most desired effect of flaps is their drag, but obviously in conjunction with other desirable effects.
Think of flaps as a means to increase the wing’s airfoil camber and angle-of-incidence at the same time, in effect giving more drag, lift, and decalage (the angle between wing and stabilizer). Deflections of up to 25 degrees will mainly give more lift and decalage but not much drag, while more than 30 degrees will give nearly only more drag. So even a rather small deflection of flaps will make for a new balance of the model.

That's why both Telemaster and Brushfire manage on rather small flaps. Their additional lift may be just big enough to compensate the down force of the horizontal stabilizer. They are just big enough to give the desired "more stable" and "slower" balance and some drag. And that's why both models behave similar even though they are very different, Telemaster being a stable high-wing floater and Brushfire a neutral mid-wing rocket.

Flap deflection shifts the lift rearward making the airplane nose-heavy, but the wing downwash hitting the horizontal stabilizer makes it tail-heavy. The thrust line above the flaps with their drag makes nose-heavy, thrust line below flaps makes tail-heavy. Which effect prevails? It depends to some extent on airplane configuration, but there is more:

Just consider the big decalage, making the airplane very stable in the pitch axis, that is very sensitive to flight speed. So with flaps deployed it is balanced for much less speed than normal, which is why it will pitch up if flaps are deployed at high speed. After speed is dissipated, the airplane will lower its nose and settle on a low, stable speed. Full throttle will let it pitch up and climb, idle power will let it pitch down and settle on a steep glide path. A certain low power setting will give slow level flight. All is conveniently stable and dampened due to the big drag.

Flaps make Telemaster a real STOL airplane, even needing a short stroke of throttle/power to touch-down in three-point attitude. Brushfire benefits from flaps because it can pitch up only about 5 degrees before the protective tail skid hits the ground, and because the flight behavior is more stable and dampened at low speed.

Right and down thrust

Down thrust is easy. Remember the effect of decalage? If the airplane pitching up and climbing at full power is not desired, or not that much, simply tilt the engine's thrust line down a few degrees.

Right thrust is a bit obscure, however. It's said to counteract the effects of the engine's or propeller's torque, respectively. But how at all can a yaw effect relate to a roll effect? This mystery is usually unraveled by introducing the "corkscrew effect". It means that the slipstream of a propeller turning clockwise is rotating clockwise as well. It hits the vertical tail on the left side, pushing it to the right side, and that's what turns the airplane left. Even though this effect undoubtedly exists, it's not the only one.
Why and how use a model flight simulator?

The "corkscrew" explanation even fails for a twin-engine airplane with a single vertical tail. Even though it's not hit by any slipstream, there is still a very noticeable yawing effect of the slipstreams or propeller torques. One explanation is P-factor, that is the propeller’s thrust shifted to the right side if the airplane is pitched up and the propeller is inclined. But there is yawing even if the airplane is level.

A good explanation for this case is obtained by considering the rotating slipstream to be a gyro. When it streams across the wing, it is deflected downward like any air flow that is streaming across the wing. After all, the wing produces lift by pushing the air downward. But deflecting a gyro has a side effect. If a slipstream turning clockwise, seen from behind, is bent downward, some gyroscopic forces will bend it clockwise also seen from top. Like pushing air downward (action) produces lift (re-action), turning the slipstream clockwise (action) makes for turning the airplane counterclockwise (re-action).

That might explain why some pattern models don't have any right thrust. In fast level flight, the slipstream isn't blowing and turning that fast, and the wing is deflecting the air only a small amount (small angle-of-attack AOA). When the airplane enters a loop, however, the prop has to pull hard and the AOA has to be big. The resulting left-turning tendency has to be canceled by substantial right rudder. On top of a big loop, though, the airplane may fly inverted and in that case may even need substantial left rudder to keep on track. So if you have to apply alternating rudder, anyway, why bother with a fixed right thrust.

But why all stable non-pattern airplanes do have substantial right thrust, as well as down thrust? Their weaker drive has to pull harder, producing more slipstream twist, and they fly slow so the wing has a bigger AOA. Their power and speed range is not that big so a fixed right thrust may well cure any left-yawing tendency.

Besides, there is a propeller torque to be canceled on any airplane. On the Telemaster, for instance, the right thrust makes for some yaw to the right, giving a roll tendency to the right, which cancels the left-turning propeller torque. That's a desired effect of yaw-roll coupling, also called proverse roll, and that's why "normal" airplanes have that coupling by means of wing dihedral.

Pattern airplanes, on the other hand, should not have any coupling and have next to no dihedral. Right thrust would be useless for counteracting the torque and the pilot has to apply varying aileron deflection, anyway.
Why and how use a model flight simulator?

Several pattern competition models yet have right thrust, but the reason why is a secret of their owners (read: not known to me).
Why and how use a model flight simulator?

Enjoy!

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http://time.hs-augsburg.de/~erd/Modellflug/textReflex.html

My REFLEX XTR² models in the latest versions are on my web page
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