Rod Machado's Instrument Pilot's Handbook

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Starting Your Instrument Training

Without an instrument rating, even relatively small weather hiccups can keep you ground-bound, where you'll miss business appointments, work, and/or fun (and sometimes all three!). It only takes being weathered in by fog for one or two nights at a motel named *The Nine One One* to provide all the motivation you'll need to pursue that rating.

Another and less obvious benefit of an instrument rating is the newfound confidence you will have in your ability to fly the airplane. You will learn to fly more capably, more competently, and more smoothly. You will navigate with more precision, and fly with the confidence that comes from knowing that if the weather is a bit less than perfect, you are not putting yourself and your passengers at risk. And on those weekend trips, you don't have to spend half your time worrying about whether the weather will be good enough to get home again in time for work on Monday morning.

The fact is that instrument training also makes you a better VFR pilot. Perhaps the biggest difference you'll notice is that you will fly with much greater VFR precision. You'll maintain altitude, hold headings and generally maneuver the airplane with much greater proficiency. You'll soon find it routine to be ahead of the airplane with the spinner at your back, instead of being behind it with tail feathers in your face.

Please don't let me (or anyone else) mislead you. The instrument rating will not be your unlimited license to fly fearlessly into raging hurricanes, towering thunderstorms, and not-so-heavenly hail. A big part of getting an IFR rating is learning when to say "No." In fact, having the instrument rating may make the go/no-go decision harder because you have more options from which to

An Instrument Rating? Why Me?

There are a lot of things you really don't need as a pilot. I hate to disappoint you, but a big watch is one of them. Sorry, but someone had to tell you this.

On the other hand, one thing I absolutely know you can use is an instrument rating. It's a combination passport, insurance policy, and bragging-rights card, all rolled into one. It will enable you to leap tall buildings at a single bound, travel almost as fast as a speeding bullet, and do it all in conditions that appear to require X-ray vision. People will ask, "Who was that hooded pilot?" and others will say, "I don't know, but he had an instrument rating." That makes it worth the effort.

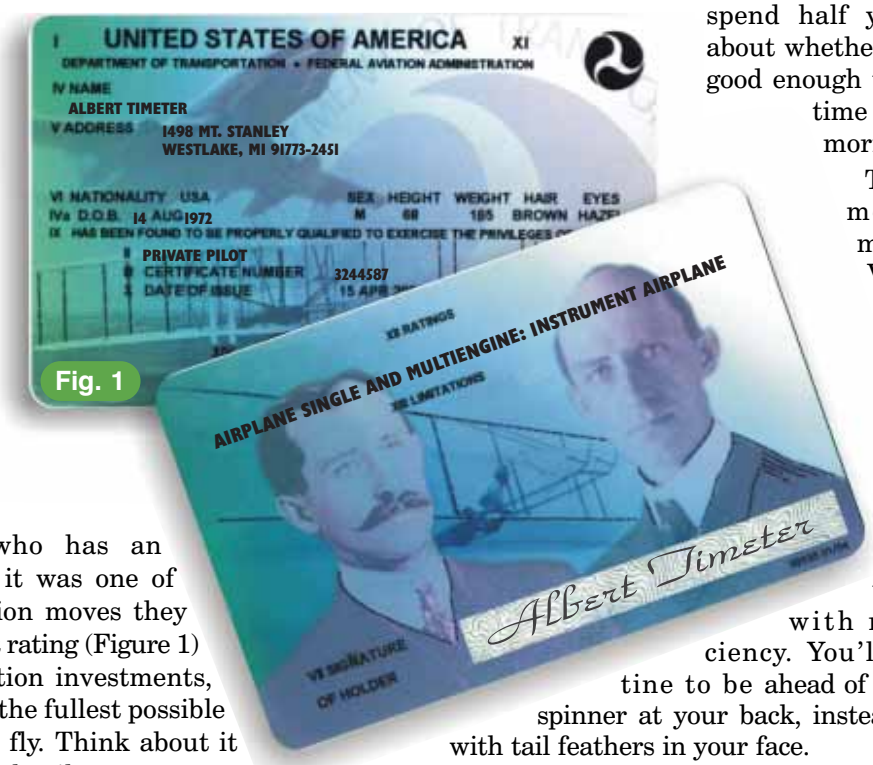
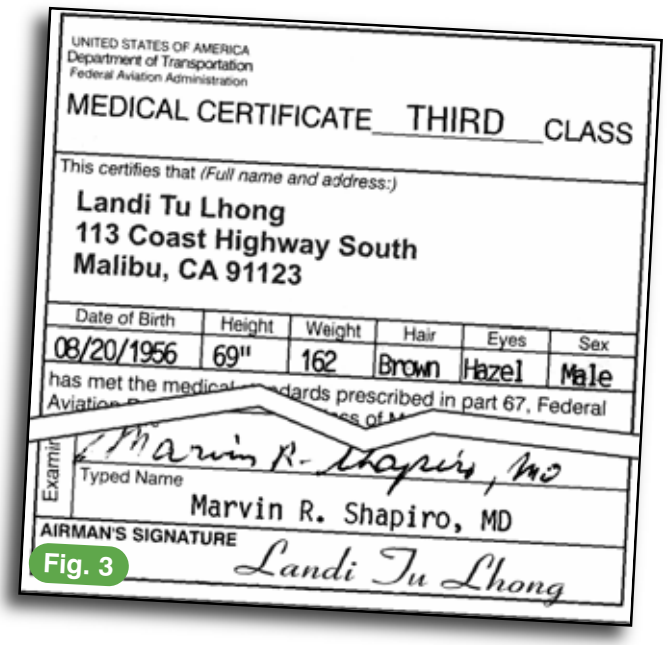


Fig. 1

Everyone I know who has an instrument rating feels it was one of the most valuable aviation moves they ever made. An instrument rating (Figure 1) is one of your best aviation investments, because it lets you make the fullest possible use of your capability to fly. Think about it for a second. As a VFR-only pilot, you are not using the full potential of most airplanes, which are typically IFR capable. You pay the full rent (if a renter) or the full expenses (if an owner), but you can use only part of the possibilities! The only way to be PICE (pilot-in-command of everything) is to get your instrument rating.

Technically advanced aircraft (TAAs) are the newer generation of glass cockpit airplanes that are becoming very popular for instrument training.



choose. Certain weather phenomena like thunderstorms and icing keep even the most experienced instrument rated pilots on the ground. Even big pilots in really BIG airplanes avoid, rather than challenge, the worst of the weather. The instrument rating extends, by a considerable number, your options to fly when the weather won't allow VFR operations. But it is not an unlimited extension. Knowing where to draw the line in the runway is one of the brain skills you will be acquiring.

I'm happy to play a part in helping you better understand what's required to obtain this rating. I know it will make you a better pilot if you are willing to work hard to gain this credential. In short, it makes you an overall better pilot even if you don't wear overalls when you fly.

Let's take a closer look at what you'll be doing to become an instrument rated pilot.

What It Takes to Obtain an Instrument Rating—Part 61

You can start working on your instrument rating as soon as you've earned your private pilot certificate. Yes, five minutes later is fine, and many people jump into formal instrument training immediately after passing the private checkride. There was a time when applicants for the instrument rating needed a certain minimum flight time (125 hours, for example) before they were eligible to take the instrument rating practical (flight) test. Not any more. The FAA, with help from the researchers in the aviation industry, finally concluded that minimum flight time wasn't a strong predictor of a person's readiness to be a good instrument pilot.

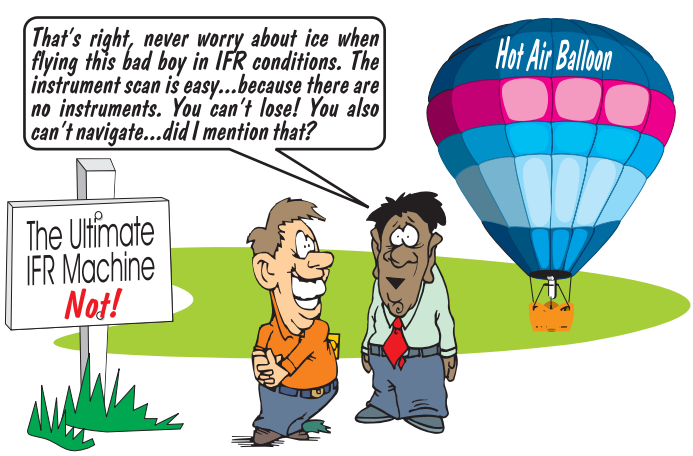
It goes without saying that you'll also need at least a third class medical certificate (Figure 3). Just thought I'd mention this in case you were under the impression that the medical standards, such as eyesight, cardiovascular health, and normal brain function, are suddenly suspended when you enter a cloud and no one can see you.

So, are you qualified to obtain an instrument rating? That depends. Can you read, speak, write, and understand English? You must at least be able to do this. Pig Latin and baby babble don't count. If you've gotten this far, you're probably qualified in the language department.

You'll need to pass a knowledge test for the instrument rating, and that's part of what this book is all about. In addition to providing you with the information necessary to pass the test, I'll also be discussing and dissecting much more material that's useful and practical for the instrument pilot in training. When we're finished, you will thoroughly understand the physical and mental skills involved in instrument flying.

The instrument knowledge exam consists of 60 multiple-choice questions. You're given 2 hours and 30 minutes to answer them, and you must obtain at least a 70% score to pass. Where can you take the test? Denny's? Sorry, but you'll have to visit one of the many FAA-approved test centers around the country. Don't worry. There's almost certainly one nearby. Ask your instructor. He or she will know. If not, you can fly to the nearest center with your instructor and log the time toward your rating!

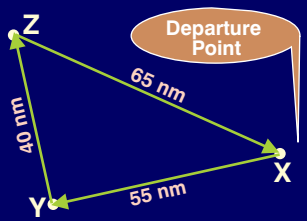
In terms of aeronautical experience, you'll need at least 50 hours of cross-country flight time as pilot in command (PIC). At least 10 hours of this must be in an airplane. Of course, I'm assuming that you're working toward the airplane instrument rating here. Sorry, there is no instrument rating for hot air balloon pilots (but if there were, you certainly wouldn't have to worry about airframe icing, right?).



Meeting The Instrument Cross Country Requirement

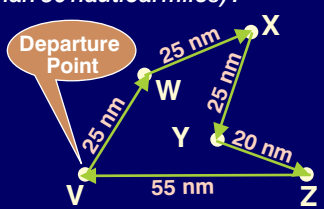
Example A

This cross country flight has 3 stops (the departure airport is considered one of the stops). Two segments (X to Y) and (Z to X) being more than 50 nautical miles from the original point of departure. It meets the XC requirements for the instrument rating.



Example B

This cross country flight has 5 stops and one segment (Z to V, the last segment of the flight) is more than 50 nautical miles from the original point of departure. It meets the XC flight requirements for the instrument rating (the direct distance from V to X is less than 50 nautical miles) .



Example C

This flight has 4 stops but there is no segment with a landing that is more than 50 nautical miles from the original point of departure. The time acquired on this fight can't be used to meet the cross country flight time requirement for the instrument rating.

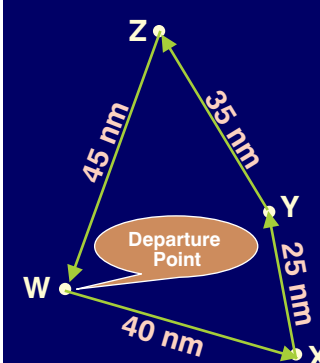


Fig. 4

In certain parts of the country (Southern California, for instance), early morning and late evening stratus clouds make it easy for instrument students to obtain actual instrument experience.

Fig. 5

To count as a cross-country flight, you must make a landing more than 50 nautical miles from the original point of departure as shown in Figure 4. Fortunately, the cross-country flights you made as a student pilot can be used to at least partially meet this requirement. Just to make things clear on the cross country issue, you can land at as many airports as you like on a cross-country flight. To count as a cross-country flight toward the instrument rating, one of the airports you land at must be a straight line distance of more than 50 nautical miles from the original point of departure. Suppose you land at an airport that's 40 miles from the original point of departure, and then proceed to another that's 51 miles from the original point of departure. Does this count toward the instrument rating? You bet it does.

Granted, most applicants working on the instrument rating soon after obtaining their private pilot certificate will have to work hard to acquire the minimum cross-country flight time. Here's an idea that may help you clear this hurdle.

When you and your instructor begin the approach phase of your instrument training, you'll probably make instrument approaches to different airports. If so, elect to make some of these approaches to airports that are more than 50 nautical miles away. If your wheels touch down at those airports (you can do touch-and-goes, that's OK), then the entire flight counts toward the requirement for 50 hours of cross-country time as PIC. The reason you can do this is that it's legal to log PIC time as that time during which you're the sole manipulator of the controls of an aircraft for which you are rated. If you received your private pilot certificate in a single-engine land airplane, then you're rated to fly a single-engine land airplane. If you're taking your instrument training in a Cessna 172, for instance, then you're allowed to log the time as PIC when you are the sole manipulator of the controls, even if your instructor is on board. This doesn't necessarily make you the legal PIC, but it does allow you to log the time as PIC. You were the sole manipulator of the controls during the flight, weren't you?

Regarding the instrument training time, you'll need a minimum of 40 hours of actual or simulated instrument time. Let me explain what *instrument time* is for purposes of meeting this requirement. Whenever you are flying solely by reference to the instruments—in other words, without reference to the horizon outside—you are accumulating loggable instrument flight time.

Now, it would be great if nice, mild, real instrument conditions were always available close to the airport whenever you wanted to train (Figure 5). You'd get all the *actual* instrument conditions you could possibly desire. Very realistic. But not a very realistic possibility in some parts of the country, like Palm Springs, California, unless you want to spend about 40 years getting your 40 hours (but mostly getting a sunburn).

Conveniently, there is an alternative available. *Simulated* instrument time is logged whenever you are flying entirely by reference to the instruments with your

Why Have the IFR Rating? Stuck On Top, Perhaps?

In the aviation equivalent of painting oneself into a corner, this pilot left himself no way out. The decision to stay out of the clouds must be made early, while there are still viable options available.

The FSS said that there was a large band of rain showers and thunderstorms blocking my route. I called back an hour or more later and [FSS] said that the area of rain had passed and that I shouldn't have any trouble going VFR. Initially I was at 5,500 feet, but then I climbed to 7,500 feet to clear the hills and clouds. The farther north I went, the more marginal the weather became. I climbed again trying to maintain VMC. I was talking with several controllers advising them of my problem and requesting higher altitudes to clear the clouds. Eventually I was at 18,300 feet. A controller advised me that I had less than 15 minutes of consciousness at that altitude. I was aware of my bad situation, but I felt that I could not descend into the clouds as I did not have an artificial horizon and I am not instrument rated. I knew that an instrument rating is required at 18,000 feet and above, but I couldn't descend into instrument conditions. The plane got out of control twice and into a spin, but I was able to spot a cloud base for reference and recover.

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view of the outer world blocked by an elongated visor (generically referred to as a *hood)*, glasses that are opaque on the top part (*Foggles* is one popular brand), or a Klingon force field. Devices like these (shown in Figure 6) are designed by people who specialize in evading all provisions of the Geneva Conventions, and you will develop a deep and meaningful love/hate relationship with all forms of view-limiting devices as your training progresses. Using these contraptions will make you wish you had your head in the clouds.

Out of the 40 hours total instrument time required, a minimum of 15 hours must be given by an *instrument flight instructor*. Yes, there are certified flight instructors who only teach others to fly airplanes (called CFI-A, the *A* stands for *airplane*) and certified flight instructors who only teach instrument flying (CFI-I, the *I* stands for *instruments*). Of course, many instructors elect to obtain both ratings. We unofficially represent these ratings by the designation CFI-AI. You'll need to find at least a CFI-I (usually spoken as "C-F-double-I") to give you a minimum of 15 hours of flight training in preparation for the instrument rating. In all likelihood, you'll just train from beginning to end with an instrument flight instructor.

It's also likely that the 40 hours of minimum time will all be spent with the instructor, despite the regulations allowing you to acquire as many as 25 hours of instrument time alone. No, I don't mean flying solo while wearing some type of view limiting device! Anyone who'd even try such a thing should sign up to be the world's first living brain donor, because it's obvious that their brain isn't being used at all.

So how would you acquire instrument time while flying without an instructor? By having someone who is appropriately rated in the airplane sit in the right seat as a safety pilot, while you fly with a view limiting device (Figure 6). This is perfectly legal, and is, in fact, how many instrument-rated pilots meet their instrument currency requirements and keep their skills sharp. The simulated instrument flight time acquired while doing this counts toward the 40-hour minimum for the instrument rating.

If you decide to acquire instrument time with a safety pilot on board, you'll certainly want to discuss this plan with your prospective instrument flight instructor first. Don't, however, count on any instructor being too enthusiastic about your scheme if you intend to try to use it as a way of cutting the amount of time you'll spend with the instructor.

The fact is that most IFR students need *at least* 40 hours of dual instrument instruction to gain the required level of competence, and sometimes much more, particularly in major urban areas where the airspace is complex and congested. One study found that the national average was closer to 55 hours.

Like fine wine, there can be no instrument pilot before its time. Getting it right is a lot more important than getting it quickly. Take the long view, and be patient. An instrument rating will last a lifetime, so a few hours beyond the bare minimum shouldn't be viewed as a burden or imposition, but rather as an opportunity to hone your skills and elevate your confidence as well as your airplane.

In addition to the other requirements, you will need to make a long instrument cross-country flight with your instrument flight instructor. The FAA defines "long" as being a minimum of 250 nautical miles along airways or

Fig. 6 This is a personal view limiting device made from protective eyewear and black electrician's tape. Total cost? About $3.

Full Flight Simulators (FFS) are devices that come as close as it gets to simulating reality for real (Figure 7A). In fact, it's possible to obtain a type rating for some airplanes by using these devices and never once having to fly the real airplane. Frasca's Piper Seminole (Figure 7B) is a Flight Training Device (FTD). Some FTDs have motion while others do not. Aviation Training Devices (ATDs) are often smaller desktop units, such as the one in Figure 7C, which is a sub-category of ATDs known as a *basic ATD* or BATD.

via an ATC-directed routing, with at least one landing at an airport more than 50 nautical miles from the original point of departure. The purpose of this flight is to give you experience flying IFR over long distances. It's also helpful in getting you away from your home area, where you feel most comfortable because you have everything memorized. Part of IFR flying is being capable of coping with sudden changes and unfamiliar circumstances without getting rattled.

You'll be required to make an instrument approach at each airport on your long cross country, and to make at least three different kinds of instrument approaches (either a GPS, VOR, Localizer, LDA, SDF, NDB and/or an ILS approach. Don't worry. You'll learn about these abbreviations later). You aren't required to make approaches to three different airports (although this is certainly a good thing to do for the experience it offers). If you think about it, you must make approaches to a minimum of two airports, one of which may be your home airport. Getting an IFR rating is costly in both time and money, but invaluable in terms of what it gives you for the rest of your piloting life. And there is a way to help reduce the cost of this training and make it more effective in the process. This involves using something known as a simulator or a flight training device.

Aviation Training Devices (ATDs) & Flight Training Devices (FTDs)

Baskin Robins managed to give 31 different meanings to the term "ice cream." In today's aviation world, the FAA has accomplished something similar with the term "flight simulator." It's a generic term that separates devices that simulate flying into one of three broad categories: full flight simulators (FFS), flight training devices (FTD) and aviation training devices (ATD). The latter being further categorized at either a Basic ATD (BATD) or Advanced ATD (AATD). Here's a quick way to make sense of these definitions.

Only a device that moves (i.e., has motion) can use the word "simulator" in its name (just because it moves, however, doesn't automatically allow it the official distinction of being called a FFS or "full flight simulator").

Thus an FFS is the real deal, a big machine with many degrees of motion and classified as Level A through D (Figure 7A). These simulators are so real and life-like that pilots have actually had heart attacks in them during exhaustive training sessions. I guess you could also call them heart attack simulators, too (although I don't think the instructor's objective is to stop an engine and the pilot's heart at the same time).

FTDs fit into seven different levels, the first three of which are no longer used. Levels 4, 5 and 6 all represent different forms of "airplane" simulation, with Levels 5 and 6 requiring FAA approval in situations where time in the device is used to evaluate pilot skills and/or meet pilot qualification times. The Frasca Piper Seminole simulator (Figure 7B) is a flight training device (FTD). Just to be clear, an FTD is not a machine that gives you flowers when you push its buttons (that device is known as a husband).

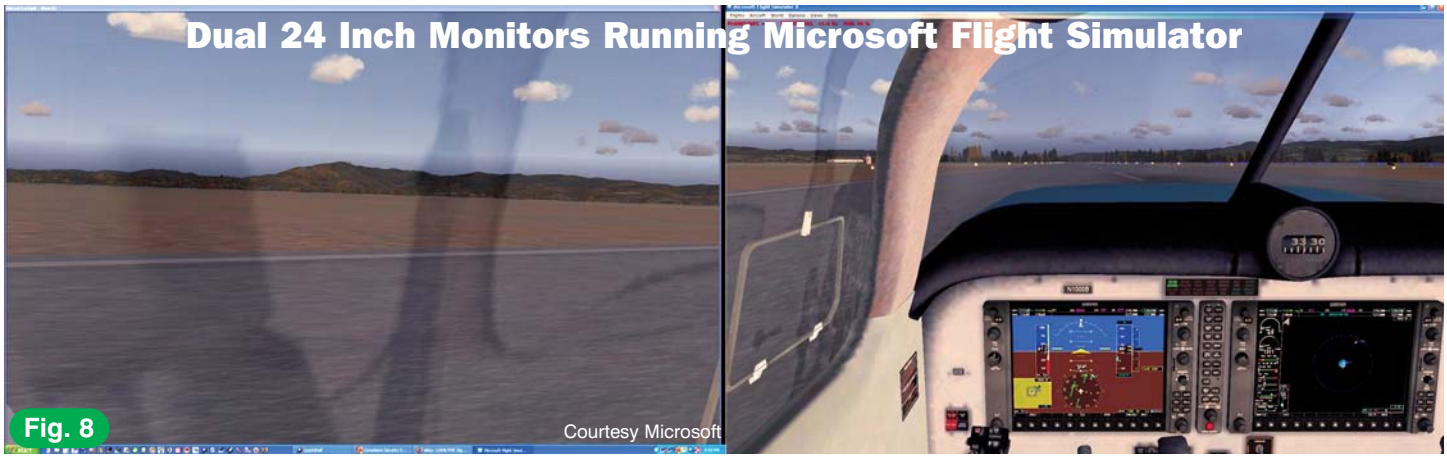
Most of the general aviation training you'll experience will use either ATDs or BATDs (Figure 7C). The regulations allow you to these to obtain a maximum of 10 hours

The FAA's Ruling on the Long "250 Nautical Mile" Instrument Cross Country Flight

QUESTION: Do the approaches required under § 61.65(d)(2)(iii)(C) need to be completed at three different airports?

ANSWER: Ref. § 61.65(d)(2)(iii); No. Under § 61.65(d)(2)(iii), a pilot seeking an instrument-airplane rating must perform three different kinds of approaches with the use of navigation systems, but the approaches may be performed at one or more airports. In addition, in order to meet the aeronautical experience requirements under § 61.65(d)(2)(iii), the pilot also must (1) land at one or more airport(s), other than the airport of original departure, using an instrument approach; (2) return to the airport of original departure using an instrument approach; (3) travel a total distance of 250 nautical miles or greater along airways or ATC-directed routing; and (4) choose an airport for landing that is separated by a minimum straight line distance of more than 50 nautical miles from the airport of original departure (see § 61.1(b)(3)(ii)(B)). Given the requirement that the pilot land at a minimum of one airport other than the airport he or she originated from, it is most efficient if a different approach is used for each landing so the requirements under § 61.65(d)(2)(iii)(C) partially are met.

FAA Question & Answer Response



When it comes to desktop PC flight simulation, it's difficult to find a program as useful as Microsoft Flight Simulator. I know, since I wrote the flight lessons and am the instructor's voice in this program. What makes this simulator so useful is the ability to simulate not only IFR flight, but the VFR transitions that are so necessary for practical training.

(20 hours for an AATD) of the required 40 hour minimum instrument time requirement for the instrument rating. An example of an AATD would be the Redbird FMX or the Elite PI-1000.

The Redbird FMX unit is an amazing machine but it will pinch your pocket at a cost of $65,000. An example of a BATD would be the Redbird TD and TD2 or the Elite PI-135. BATDs can be purchased in the $5,000 to $6,000 price range.

It's possible that your flight school will have an ATD or BATD available for training purposes. What if they don't? You might consider purchasing an inexpensive desktop flight "simulator" to help you train at home. Yes, I used the word "simulator" here as a generic term. After all, your desktop sim shouldn't move (unless you reside in California, where tectonic plate shift makes everything move).

Of course, having inexpensive desktop flight simulator software doesn't mean you can fire up your computer's Captain Galactic space fighter program and start clicking off those instrument hours. Sure, that would be nice, but you wouldn't learn to fly instruments as much as you would learn to make Romulans from Romulat go splat.

Any AATD or BATD must be approved (or have received approval) by the FAA. So, any off-the-shelf computer simulator hardware/software combination most likely isn't an AATD or BATD unless there's an accompanying FAA letter of approval for that device. Generally speaking, the manufacturer of that device will obtain this letter of approval and make it available to you as part of the sales literature. Ultimately, if you don't know whether or not the ATD is approved, then give the manufacturer a call and find out.

It's also important to note that if you are planning on counting any of these "simulated" hours (regardless of whether they are obtained in a FTD or ATD), you must be with an authorized instructor and that instructor must log the time as "dual given" in either a BATD or AATD in your logbook. Sorry to disappoint you but this means that there will be no solo 2 a.m. PC flight sim sessions at home in bed while wearing your bunny slippers and clip-on aviator wings. Besides, if your instructor drops by your place at 2 a.m. while you have your bunny slippers on, I sure hope you are married to this person or that both of you can keep a secret. Keep in mind that the ATD training you receive from an authorized instructor shouldn't be logged as "flight time" in your logbook. Instead, it would be wise for you to create another column in your logbook and label it as "ATD" time to prevent confusion about total times at a later date.

The big question is, if you don't want to spend the money for a BATD or AATD, should you purchase an ordinary computer-based flight simulator instead? The answer is a resounding YES! I am a big fan of these per-

Assault and Battery of the Wind

William Butler Yeats

An air carrier Captain tells a harrowing tale of an encounter with wind shear, and extends thanks to quite a cast of behind-the-scenes actors:

We performed a normal takeoff. At approximately 800 feet AGL, our airspeed dropped rapidly. At the same time, the wind shear warning activated. I put my hand on the First Officer's hand and together we pushed the throttles all the way to the stops. Even with the engines giving us everything they were capable of, our airspeed hung at V2 plus 5 knots. We used our available energy to arrest the descent, and then evidently burst clear of the wind shear. The encounter lasted maybe 20-30 seconds. The remainder of the flight was uneventful.

The Flight Attendant did tell me she heard the wind shear warning from her jumpseat, and she thanked me for getting us out of the wind shear. It was not me that saved us. It was our team working together.

I am pleased with the training we have received on wind shear. I want to thank [everyone] who came up with the wind shear guidance equipment and the procedures to use it. I want to thank our ground instructors for teaching us and simulator instructors for testing us and refining our technique. It works.

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sonal computer assisted training devices as an aid to instrument training. Microsoft Flight Simulator (Figure 8) is a good example. Sure, you can't log flight hours with your CFI using this software, but that's irrelevant here. Many good things result from having access to a regular computer-based flight simulator, even if it's not approved as an ATD.

Fig. 9

Joystick or flight yoke? Which should you choose? At the private pilot level and beyond, it really doesn't matter all that much from a learning perspective.

You can practice your instrument scan, VOR, ADF, GPS, Localizer and ILS navigation skills, flight planning, weather avoidance and a host of other useful things on these realistic devices. You can do things you could never do in a real airplane, such as pausing an approach or instantly returning to where an approach begins. A few of the computer-based flight simulator programs on the market today will even download the current weather from any one of several weather vendors (e.g., DUAT) and simulate it in the form of clouds, reduced visibility, turbulence, etc., in your computer-based flight program (Figure 8). Now that's high tech and real time. You can even simulate flying the approach or approaches to an airport that you plan on going to later in the day. These are just a few of the great things these devices can do for you.

The big question for most pilots contemplating purchase of a PCATD is whether to acquire a joystick or flight yoke (Figure 9). You don't want to operate a simulator by use of a mouse or keyboard alone, since you're not likely to find either as a control device in a real airplane. At this stage of your training, it doesn't matter which of the alternatives you choose. Get what you can afford or what you feel most comfortable with. As an instrument student, you already have acquired well over 90% of all the motor (physical) skills you'll need to fly an airplane. What you're interested in learning are perceptual (sensing) and cognitive (thinking) skills. You can do this unhindered by the means you use to control the simulated airplane, as long as it's not a computer mouse. We don't fly airplanes with a mouse or keyboard, at least not yet. So if you have a mouse on board, make sure it's the type that spins a wheel as an alternate source of vacuum pressure (no, this "rat on a wheel" device isn't commonly found in rental airplanes, either).

What's the Difference Between A Part 141 and a Part 61 Flight School?

Part 141 is a section of the Federal Aviation Regulations (FARs) that describes a more structured and carefully monitored program of flight training compared to Part 61. This doesn't necessarily mean that a Part 141 school provides better training, but it doesn't exclude that possibility, either. After all, Part 141 training includes a structured curriculum, phase checks (Star Trek fans, sorry but this isn't where you check your phaser) with a chief instructor and carefully monitored flight instructors. Training under Part 61 may provide similar high quality training, too. To be frank, the type of training you receive basically depends on the flight instructor and the management of the flight school. If we assume the same instructor and management dedication in either a 141 or 61 flight school, what's the difference? Part 141 allows you to obtain the instrument rating with as little as 35 hours instrument time instead of Part 61's minimum of 40 hours. As I said above, the average is far higher than even the 40 hour minimum, so it's probably unrealistic to think in terms of 35 hours unless you are starting out with a *lot* of aviation time under your seatbelt, and perhaps a lot of informal or prior instrument training. Most all the other requirements for the instrument rating are the same with the exception of the allowable flight time for FTDs and ATDs. In the case of a Part 141 school, you may garner up to 40% or 50% (percentage depends on the type of device) of the total instrument flight training hour requirements in an FAA approved FTD or ATD.

I suggest you make finding a good instructor the most important criterion in your search for the best training available. NOTHING, I repeat, NOTHING else matters more!