

Column: Condor Corner
Issue: October 2010
Title: Glider Flight Simulation and the Curriculum
Author: Scott Manley - CFIG

In the May installment of Condor Corner, I shared with you how my list of “Instruction Challenges” motivated me to go in search of the best glider flight simulation I could find.

In the August issue, I talked about Condor’s myriad features and how nicely those features address all my instructional challenges.

In this issue, I am going to get specific about how I incorporate simulation into the glider flight instruction curriculum. I will introduce you to more features of Condor and tell you how I use those features to enhance the whole teaching/learning experience.

While this article is targeted primarily at flight instructors, anyone who has ever been on the receiving end of flight instruction will benefit from seeing the teaching process from another perspective.

Note: Items in *italics* are Condor-specific.

The Teaching Process

If you have never studied to be a professional educator, you may not be familiar with the “Fundamentals of Instruction”. This branch of educational psychology is all about how human beings learn and how one goes about teaching another person something new. In my opinion, flight instruction is not as much about knowing how to fly as it is about knowing how to teach. So, to set the stage and provide a context for this article, here is a quick overview of the teaching process.

- **Preparation**
In preparing to teach a lesson, the instructor puts together a written lesson plan that defines the material to be covered and outlines the lesson’s objectives and goals. He or she next decides how best to present the material, acquires or develops the presentation materials, and develops and rehearses the presentation.
- **Presentation**
In the presentation phase, the most common teaching methods used in individual flight instruction are the lecture, and the demonstration component of the demonstration/performance method. In this phase, the student is introduced to the “what”, “why”, “when”, and “how” of the day’s lesson. The primary goal of the presentation phase is to establish understanding.
- **Application**
The application phase provides the student with the time and opportunity to apply what is being taught. This is the hands-on, doing phase. The student “applies” what they have learned and then practices their newly acquired skills.
- **Review and Evaluation**

Finally, at the end of each lesson, the student is evaluated on his or her performance and on the attainment of the stated objectives and goals. Deficiencies and faults are carefully noted and steps taken to remedy them.

Incorporating Flight Simulation

Before getting into the details, here is a quick overview of how I incorporate flight simulation into my teaching process. As the instructor, I

1. use simulation to prepare myself for the lesson, to build presentation materials, and to rehearse my presentation.
2. use simulation to introduce the student to new material.
3. use simulation to demonstrate how to perform flight maneuvers.
4. have the student perform the flight maneuvers on the simulator.
5. use the simulator to record the student's performance and then replay the recording to critique their performance. As needed I repeat steps 3 and 4.
6. have the student practice their new skills on the simulator prior to flying the lesson in a real glider.
7. have the student practice their newfound skills at home after the actual in-flight lesson and prior to their next lesson.

Preparation

Let's suppose the objective of today's lesson is to learn to fly the traffic pattern.

My first tenant of instruction is that you cannot teach something you do not know. In fact, I believe you never understand something better than when you have to teach it to someone else. So for me, preparing to teach a lesson is, in large part, a process of thoroughly re-educating myself with respect the topic at hand.

The first step then, in my preparation, is to sit down at the simulator and personally perform the day's objectives to the required standards. In this case, I need to fly a standard traffic pattern, under a specific set of conditions, within a speed range determined by those conditions, using coordinated control inputs, and a controlled descent to a pre-selected aim point. Sounds easy, doesn't it?

As the instructor, actually having to perform the lesson objectives to the required standards does the following:

- It reminds me of all the things that need to be introduced and explained to the student in the course of the lesson. I add notes to my lesson plan.
- It makes me think about and select the features of the simulator that will best help the student visualize the lesson's objectives; in this case, what a traffic pattern is all about.
- It provides me the opportunity to practice and polish my presentation.

The better prepared I am as an instructor, the more efficient and effective the learning experience is for the student.

Condor specifics:

1. I enter *Free Flight* mode from Condor's main menu. This puts me into the Condor *Flight Planner* where I establish the ideal environment for the lesson, including:
 - The *Task* – airport, terrain, turn-points, time of year, time of day, etc.
 - The *Weather* – wind speed and direction, cloud base, turbulence, etc.
 - The *Aircraft* – ASK-13 for primary training
 - The *NOTAM* – a whole series of related parameters including things like the launch method, altitude recovery option, etc.

I save the complete set of parameters related to this lesson as a *Flight Plan* file (.fpl) and give it a meaningful name like "Traffic Pattern". The next time I need to teach the Traffic Pattern lesson, I simply call up this *Flight Plan* to quickly and easily reestablish the lesson's complete environment.

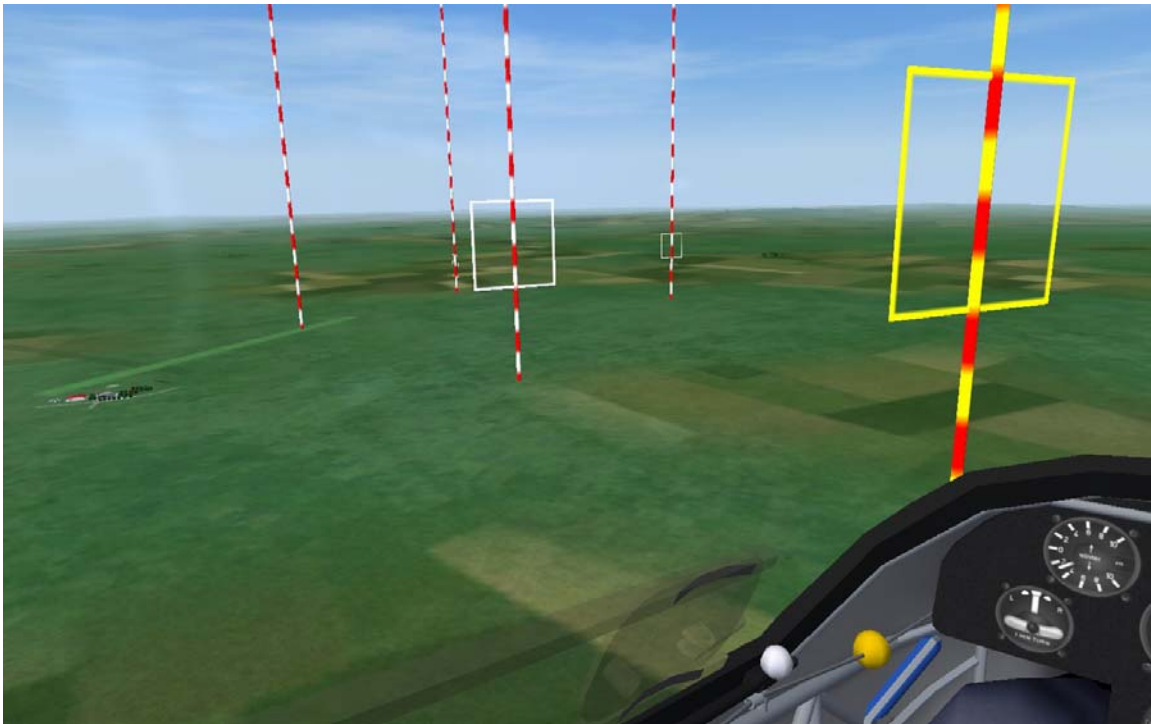
2. I fly the lesson until I have an sample flight which meets the required standards and I feel prepared for the next phase in the process; the presentation.
3. Upon exiting *Free Flight*, I save my best flight as a *Replay* file (.rpy). A *Replay* file is just like a movie of my flight, but it can only be played back in Condor. I name the *Replay* file "Traffic Pattern" so I can associate it with other resources related to this lesson.

By creating these *Replay* files, I have, over time, developed a rather extensive *Replay* Library. I use *Replays* for a variety of purposes that I will relate in this and future issues of Condor Corner. A replay library is an almost invaluable asset.

4. Depending on the nature of the lesson, I may also create and save one or more *Flight Track* (.ftr) files. A Condor *Flight Track* is similar to an IGC file in that it allows you to analyze your flight using Condor's *Flight Analysis* function.

For example, in preparation for a recent lesson on the effects of crosswinds in the traffic pattern, I recorded a series of *Flight Track* files, each showing the ground track resulting from varying degrees of crosswind correction.

If this preparation stuff seems like a lot of work, it is. As a professional educator, it has been my experience that the initial preparation for a lesson often takes 4 to 8 times the number of hours it will take to actually conduct the lesson. That's the bad news. The good news is you only have to do the initial preparation one time. Once you have your collection of lesson plans, and presentation materials (e.g. *Replays*, *Flight Plans*, *Flight Tracks*), it takes a lot less time to prepare the next time you teach a particular lesson.



Visualizing the Traffic Pattern

Presentation

Part I - Developing Understanding

As I mentioned earlier, the objective of the presentation phase of instruction is to establish in the student's mind a firm understanding of the lesson's objectives and goals. Since 75% of what we learn is taken in through our sense of sight, it makes sense (no pun intended) that the most effective presentations are also the most visually stimulating. To the extent audio effects can be added to the mix, the learning experience is that much more effective. Enter the *Condor Replay* capability.

In the preparation phase for this lesson, I conducted a *Free Flight* of the traffic pattern and recorded the flight as a *Replay*, essentially a *Condor* movie of my flight. The primary reason for recording the flight was to create a highly stimulating visual aid to be used in the presentation phase of instruction. If you have ever watched an educational DVD from Sporty's Pilot Shop or King Flight Schools, you understand how effective this method of presentation is.

Condor specifics:

1. I enter *View Replay* mode from *Condor's* main menu and select the "Traffic Pattern" file from the list. *Condor* loads the file and begins playing it back. As the movie plays, I describe to my student the important concepts (what, why, when) of flying a standard traffic pattern. Suddenly "ground school" seems to be a lot more fun than it used to be. It gets better, though.
2. Like any modern video replay device, I have nearly complete control over the *Condor* replay process, including the ability to *Pause* ("P" key) and reposition the recording

using my mouse to move the indicator on the progress bar. I now have the luxury of being able to stop the action and discuss things, or back up and repeat a sequence of events. It gets better yet.

3. The F9 function key toggles Condor's *Replay Camera* On/Off. The default is ON, which causes Condor to use only the originally recorded view settings. That makes perfect sense. By default, the *Replay* behaves just like any recorded video would.

A *Replay* file, however, is not a video file. It is a parameter file capable of generating any of Condor's point-of-view graphics. Turning the *Replay Camera* – OFF, makes all of Condor's view functions (and zoom) available at any point in the playback.

Those views are:

- F1 – Cockpit view (the only view available in real life)
- F2 – External view from any point around the glider
- F3 – Fixed Camera Positions (toggle)
 - 3.1 – Behind the glider
 - 3.2 – In front of the glider
 - 3.3 – On the right wing tip looking back at the fuselage
 - 3.4 – On the vertical stabilizer looking forward
- F4 – On the Airport looking up at the glider
- F5 – External view from any point around the tow plane
- F6 – The glider flying by a fixed point in space

From an instructional standpoint, this is absolute dynamite.

Presentation

Part II - The Demonstration

Now that the student has a clear understanding of what a standard traffic pattern is, and a very good idea of what it looks like to fly one, it is time to show them “how” it is done.

At this point in the real world, I would have no choice but to take the student out to a real glider and go for a real flight. For all the reasons I have mentioned in this and previous Condor Corner articles, I prefer to do my demonstrations in simulation.

Condor specifics:

1. I enter *Free Flight* mode from Condor's main menu. *Free Flight* takes me into the *Flight Planner* where I establish today's flight environment by simply loading in the “Traffic Pattern” *Flight Plan* I created during the preparation phase. This particular *Flight Plan* uses an airborne start 2000 feet above the airport so there is no delay in getting to the meat of the lesson.
2. When I created this *Flight Plan*, I used the *Task* sub-function to create a series of special turn-points called Gates and to place them at all the important places in the traffic pattern; the initial point, the turn onto downwind, the turn to base, the turn to final, and the aim point. These gates provide the student with a much better visualization of the traffic pattern including the descent profile. I emphasize that these

gates are not fixed points, but in fact change position based on conditions. The gates can be turned on/off (i.e. made visible or not). The idea is to gradually wean the student off the gates and onto “that looks about right” (Knauff).

3. As I fly the traffic pattern, I demonstrate to the student the proper procedures and required flight control inputs, just as I would in a real aircraft. Unlike actual flight, however, I again have the option to *Pause*, talk about what I am doing and why, and view the demonstration from any of Condor’s many vantage points.

The demonstration phase can take as long as is required and be repeated until it the student “gets it” and is ready to “take over the controls”.



Demonstrating a Forward Slip

Application

Part I – Procedural Training

Condor is an excellent procedural trainer. In addition to being able to teach all of the required flight maneuvers, I use Condor to reinforce other flight-related procedures including preflight inspection, pre-takeoff and pre-landing checklists, and collision avoidance scanning.

The flight physics engine in Condor is superb, so the glider performs exactly as it would in real life. All the expected flight characteristics are present including adverse yaw, pre-stall tail buffet, over-banking tendency, tow-plane wake turbulence, and crosswind effects (drift, weathervane). The sound effects are accurate, realistic, and provided in stereo.

At this point, the student has a clear mental image of how to fly a traffic pattern and an understanding of the required procedures and control inputs. It is time to get “hands on”; to incorporate the mechanics of flight with the theory; to integrate the physical with the cerebral and visual.

Condor specifics:

1. In addition to a joystick for pitch and roll functions, I insist my students use a set of rudder pedals to control yaw (none of that “twisting the joystick” stuff). The student needs to experience the physical sensations of simultaneously moving their hands and feet in a coordinated effort to control the glider’s flight path. Those physical movements need to become part of their muscle memory. It is, after all, how “real” gliders are controlled.
2. The student takes the simulator flight controls, we restart the *Flight Plan*, and I talk the student through the lesson’s flight maneuvers. Again, we can stop the action at any point and talk about what is happening. This allows me to quickly correct any errors in technique, procedure, or thinking.
3. At any point, I may exit the student’s *Free Flight* session, and save their performance as a *Replay*. I then use *View Replay* mode to review and critique the student’s performance.

As the student gets the hang of things, I talk less and let them do more of the thinking and decision-making. At some point, it becomes clear they not only “get it”, they can “do” it.

The application phase is complete.

Now that I have my student mentally, visually, and physically trained to PTS standards, it is time to practice.

Application Part II – Practice

As I mentioned in the August 2010 article, simulation provides the student with adequate time and opportunity to practice what they have learned. This may be simulation’s greatest contribution to glider flight training.

After using the simulator to prepare for the lesson, to present the lesson, to demonstrate the objectives, to have the student perform the objectives, and to review and evaluate their performance, I assign them practice sessions to be done on their own, preferably at home, on their Condor simulator, over the following week. This is the equivalent of signing them off to solo, at least within the context of this particular lesson. In addition to building additional experience, my students must now achieve the lesson’s objectives on their own. They must do their own thinking, make their own decisions, and deal with consequences of their actions. They are learning to be pilots-in-command.

Condor specifics:

1. I provide the student with a copy of the lesson's *Flight Plan* (environment) to load onto their home Condor installation.
2. The student uses their home simulator to practice; in this case tens or scores of traffic pattern cycles.
3. If the student is having problems or has questions, I ask them to create a *Replay* file of their practice session and send it to me (via email).
4. I load the student's practice session onto my Condor installation and use the *View Replay* function to review the student's performance. Then, via email or telephone, I offer my critique and recommendations.
5. When the student returns to the airport the following week, I may have them use the simulator to "fly" the lesson a few more times to ensure they have mastered the lesson's objectives and have not developed any bad habits. The additional "flights" also serve as a "warm-up" to ready them for their performance in the actual glider.

At this point, we conduct the actual flight training in the glider. As a result of their simulator training, my students already understand what they are being asked to do, they have a good mental image of what the flight will look like, they are familiar with the required procedures, they have been trained to perform the required flight maneuvers to a high standard, and they are well practiced. All they need to do now is apply what they already know to the actual flight environment. The transition happens quickly.

6. Depending on how the actual glider training flights go, I may send the student home for more practice. More often than not, it is time to move on to the next lesson.

Review / Evaluation

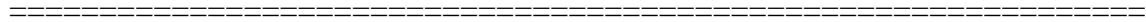
In the sections above, I pretty much covered how I use simulation to perform the review and evaluation phase of the teaching process. Performing this function in simulation, however, has a powerful advantage over its real-life counterpart.

In the real world, the critique normally occurs at the end of what is often a physically and mentally challenging (and sometimes terrifying) flight experience. Because I don't take notes in flight, I often cannot remember everything that went well and everything that didn't. For those things I can remember, the student's tired (or paralyzed) brain will often not recall doing or not doing something I describe about their performance.

In simulation world, however, with the use of the *Replay* function (essentially a video recording) and the *Pause* function in *Free Flight*, there is no doubt about what just happened. I can review the situation as many times as needed and from as many perspectives as required to ensure the student understands what he or she did well and what needs more work, and I can perform the review/evaluation function at multiple points in the teaching process. Deficiencies and misunderstandings get caught and addressed early in the teaching/learning process; stitches in time...

Next Time

In the next instruction-related Condor Corner, I'll let you in on some Condor tips and tricks, and talk about the simulator-specific skills you need to develop to take advantage of Condor's strengths and to compensate for its shortcomings. Until then, keep those cards and letters coming. smanley@wisc.edu



Scott Manley owns, and occasionally actually flies, a DG-303. The back of his pilot's license reads: Commercial pilot: airplane single-engine land & sea; instrument airplane; glider. He lives in Madison, Wisconsin and flies as a commercial pilot, glider flight instructor, and tow pilot for Sylvania Soaring Adventures in Beloit, Wisconsin.