The Seminole Flyer

Charter member of the Academy of Model Aeronautics since 1969

AMA Charter Club 216

50 Years of Responsible Model Aviation and Community Support

March 2020

Photo by Geoff Lawrence

Uncertainty is the New Normal

The news has become like the weather. Just wait a couple of hours, and it'll change! SRCC members weren't letting a few minor things like no shade, no power, no chairs, no assembly tables, no marked flight line, and a rough runway get in the way of flying. When the weather was good, flyers were coming out to the new field, setting up their own chairs and shade, and making things work.

Then, all flying came to a screeching halt when Leon County closed its parks from March 23rd to April 15th. As of this writing, the field is open again, but no more than 9 flyers may be there at a time (see New Field Instructions). Who knows when that may change again? To help us stay sane at home, now is a good time to spend more time on our flight simulators (see Tips for Simulator Flying) or, if you're up for a field trip, trek up for a day of flying in Iron City, GA (see Club News).

Stay well and fly safe!

In this Issue

Next Club Meeting

April 16, 2020
Time and Location TBA – updates to be provided via email

New Field Instructions

DURING "NORMAL" BUSINESS HOURS (M - F, 7AM - 5PM, Saturday 7:30AM - 5PM): The gate that we have the code to will be open. Drive to the right beside building B, but then steer to the left and park in the spaces to the right (East) of the scale house, building A. Get out of the car and go tap on the scale house window and tell the attendant that you are here for the radio control field.

When you are acknowledged, drive back toward the highway as if you are leaving the area, but at the yield sign turn hard right as if you were going to the west side of the scale house. You will come to an automated gate that the attendant will open. Follow the road around to the field.

When you are leaving, stop beside the cones, beside the scale, wave at the attendant, and they will open the gate for you to leave. Please give them a cheery wave and thank you!

Do not go the old way!

OUTSIDE "NORMAL" BUSINESS HOURS: "Our" gate will be closed. Enter your code, 1990*. Proceed but veer to the left, toward the west side of the scale house. The gate that the attendant had been opening for you stays open outside normal business hours. To leave, follow the same route you entered. Stop at "our" gate and it will open automatically.

The field is open for the first 9 people. If you are number 10 you either wait on the roadway outside the field gate for someone to leave, or you are out of luck. This should rarely be a problem and we do know how to share.

Jay Wiggins, President
By email, March 25, 2020

Good Flying and Stay Safe!

SRCC Members Excel at Pattern Flying

On any nice afternoon at the old field, you would have seen SRCC members Jeff Owens or Mike Picou, brow furrowed, mentally rehearsing a set of flight patterns before taking off. Once in the air, their planes can be seen making graceful maneuvers in a large, imaginary box in the sky as they practice for their next contest.

Pattern flying is the competitive sport of precision aerobatics, where flyers execute a sequence of pre-established maneuvers and are judged on each maneuver.

Jeff Owens is current President since 2015 of the Senior Pattern Association (SPA; www.seniorpattern.com), an AMA Special Interest Group. SPA-legal planes are model airplanes designed prior to 12/31/1979 that are powered by engines (electric, gas, or glow) with specific restrictions. Jeff has competed since 1979, progressed through the Novice, Sportsman, and Advanced classes, and is winning awards on a regular basis in the Senior Expert class.

Mike Picou competes in pattern events as a member of the National Society of Radio Controlled Aerobatics (NSRCA; www.nsrca.us/), also an AMA Special Interest Group. He recently took first place in the Intermediate Class at a NSRCA event in Roberta, GA.

The planes eligible to fly in NSRCA events, unlike those in SPA, must have a wingspan and total length no greater than 2 meters (78.74 inches) and, in most classes, weigh no more than 5000 grams gross (fuel excluded), ready for takeoff. With some restrictions, any source of propulsion is allowed. The competition classes include Sportsman, Intermediate, Advanced, and Masters.

Mike came back to RC about 5 years ago after a 20-year hiatus and began flying pattern a couple of years later. What hooked him initially, he says, was watching Jeff Owens practicing for a contest. "He did an outside loop and I was amazed that the plane didn't just fly into the ground, blow up or something."

Attending a contest two years ago and meeting other pattern flyers convinced Mike to jump in. He got his butt kicked in his first contest flying a small plane in the Sportsman class, but that just made him practice harder. Last year he moved up to the Intermediate class and is competing with a full sized 2-meter plane. Mike says what appeals to him about pattern flying is having a goal and the sense of accomplishment that comes with flying new maneuvers and eventually getting the plane to fly something that looks pretty good.

A third option for pattern flying is IMAC (International Miniature Aerobatic Club; www.mini-iac.org), which began as a special interest group under AMA for scale aerobatics but now represents and organizes scale aerobatic competition at a global level. IMAC pilots compete under similar rules to SPA and NSRCA, with classes including Basic, Sportsman, Intermediate, Advanced, and Unlimited.

For more information on pattern flying, see the articles posted by Jeff Owens on the SRCC website under the Pattern Talk menu item.

Club News

There are no minutes to report, as the March meeting was cancelled due to restrictions related to the novel coronavirus.

In other news, President Jay Wiggins is communicating regularly with county officials regarding the field closure and projected construction of our new pavilion. Only a single bid was received for the project, and it substantially exceeded the county's estimate. Hence, county operations will oversee construction and the county will "piggy back" off an existing City of Tallahassee contract for electrical services. Given the current public health crisis, however, it is difficult to predict the time frame for the work. Below is a mockup of the container Jay sent to the membership via email.

Photo by Jay Wiggins

Jay reported that Rusty Trawick, owner of 3-D Farm in Iron City, GA, has extended an invitation for us to fly any time at his facility. Several members made the trek to fly up there (an hour+ drive depending on where you live) and "had a blast!" The facility has shade, chairs, assembly tables, electricity, restroom, and a well-maintained field (long, flat runway and no trees!). If you go, here are a few things to remember.

- No fuel flying before 9 AM, 7 days a week.
- If the corner church is in session, fly over to the right, away from the church.
- Let Jay know if you have a group going. He'll relay that to Rusty, who will make sure the field is mowed.
- Wear your SRCC club badge.
- To use the men's side restroom, plug in the marine-style plug around the back of the building to flush. Make sure it's unplugged when you leave.
- Take your garbage home with you.
- Bring a portable fan and insect repellent for the gnats.
- Thank Rusty when you see him. His generosity is our good fortune.

Tips for Simulator Flying

With the uncertain status of flying at the new field, the flight simulator can be your ticket to keeping your skills sharp and learning new maneuvers. We've surveyed some of the latest research on learning and compiled a list of tips to help you make the most of your time on the simulator.

Learning by simulation is a highly effective way to develop and hone a skill like flying. When you make a mistake that would be catastrophic at the field, the simulator allows a do-over. Press the red button, and poof, a new plane magically appears, ready to fly. Flying on the simulator is not the same as flying at the field, but with some time, patience, and focused effort, you can accomplish a great deal on the simulator.

- First, the bigger the screen (TV or computer) the simulator is installed on, the better you will learn. It's hard to see what you're doing on a small screen, and bad habits are easily overlooked. Go as big as you can afford.

- Keep your flying sessions short, no more than 15-20 minutes at one sitting. Spaced practice is far more effective than spending a long time in any practice session. Remember, your flights at the field are rarely more than 5-10 minutes long (flying sailplanes is the exception, but even then, shorter practice times are more effective for improving your skill).

- Flying every day on the simulator is probably ideal, but if you can't manage 15 minutes a day, do it every other day. The key is consistency.

- Strive for error-free flying while you're practicing. Stop your sessions before you start practicing errors.

- Deliberate practice is critical for improving your skills. This means having a long term goal (e.g., I want to learn pattern, or I want to get good enough to fly a jet), and it means setting specific objectives during each session. That is, during a given session, practice landings, or hovering, or knife-edges, or flying the pylon racing pattern.

- Break complicated maneuvers into parts. Practice each part until you've mastered it, and then put the parts together. With maneuvers like knife-edges, get comfortable with the canopy toward you before practicing the maneuver with the wheels toward you. Work the same maneuver from opposite directions.

- Practice as if you are flying at the field. If your landing isn't quite lined up or you're too high, don't force it; go around. Always practice good habits. How you fly on the simulator will affect how you fly at the field.

Editor's Note: We owe a huge debt of gratitude to our president, Jay Wiggins, for working with the county to allow us to fly during these difficult times and keeping us informed throughout. I would also like to give a shout out to Jay, Jim Bussey, and Bill Ashbaker for sending me pictures to use in the previous issue of the newsletter, and to Leah Evans and Dan Ouellet for their articles. Please keep the content and pictures coming, and let me know what other types of articles you'd like to see in *The Seminole Flyer*. Send story ideas, photos, and tips you'd like to share with your fellow flyers to me at robin.marcy@gmail.com. See you at the field!

3D Printing Basics, Part 5

Dan Ouellet, 3D.DanoSoft.Com

Last time in Part 4, I reviewed basic Cartesian 3D printer calibration and tuning.

In this installment (Part 5), I examine the basic calibration of a Delta 3D printer along with some tuning tips.

Delta 3D Printer Calibration

As stated in Part 4, when making an object, first the digital 3D object file, typically an STL, is processed by slicing software that uses simple geometry to calculate where in space plastic should be extruded to make the part on a specific printer.

In the case of a Delta printer, it reads the instructions generated by the slicing software (gCode) and uses more advanced mathematical functions to calculate how to move the effector (print head) precisely to each point in space to extrude the plastic material.

In other words, Delta printers do not move their print head directly along any one axis. Rather, they move the 3 carriages to specific locations along each of their towers so that the combined effect is that the print head moves where it is needed to extrude plastic material in a precise manner.

The important factors for precise delta printer's head placement include:

- All 3 towers must be exactly 120 degrees apart
- The towers must be parallel to each other
- Each tower must be at right angle in both X and Y directions to the build plate's plane
- All six effector rods must be the same length, measured between bearing centers
- The spacing between a set of rods must be the same – on the carriage and on the effector
- All 3 sets of rods must have the same spacing
- The carriages must not be rotated or twisted around the Z axis
- The frame, towers, and build plate must all be secured rigidly in place
- The 3 end-stops must trigger at the same height above the build plate
- All belts must have proper tension
- All movements must be smooth and fluid

A common method to ensure that the individual towers are perpendicular to the build plate is to use a square to measure the angle of each tower with the build surface in both the X and Z-axis. If they are not perpendicular, then their alignment must be corrected with braces, shims, and spacers until they are.

A simple measurement with a ruler or tape measure between two towers at the top, middle, and bottom is all that is required to ensure that they are parallel to each other. If the measurement is not the same at all 3 locations, and the towers are both perpendicular to the build surface, it is likely that one or both towers are bent. This must be corrected before calibration.

This process must be repeated twice more with the other two towers to ensure that all 3 towers are parallel with each other.

It is important to verify and ensure that the frame and towers are rigid in all directions with no loose parts, and that all movements of the carriages and effector are smooth and precise without any interference throughout the entire build volume.

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On many designs, it is possible to correct small rod spacing errors with washers. In such case, make sure to compensate on both rods evenly.

The 3 end-stops must all trigger at the same height above the build plate. On larger Delta 3D printers, measuring with a tape measure will get them close, but further adjustment is usually necessary. To this end, many designs incorporate small end-stop trigger adjustment screws on top of the carriages. Simply loosen or tighten the screws to fine tune the triggering point of each end-stops.

Delta 3D printer belts are much longer than those used on a typical Cartesian 3D Printer. Therefore, additional care must be exercised when tensioning them. All 3 tower belts must have the same tension and should only be tight enough to prevent any backlash when operating the printer.

As in the case of Cartesian 3D printers, it is important to note that any belt tension springs should be avoided because they introduce oscillations when operating the printer. These oscillations are easily amplified by the printer geometry to the effector, leading to poor surface finish.

Therefore, when printing at normal speed for the printer, if the surface finish of the printed parts suffers from artifacts, a slight increase of the belts' tension, or slight decrease of the printing speed, or both, will usually improve matters.

Build Surface Leveling

The next step is to level the effector with the print surface.

By design, Delta 3D printers differ from Cartesian models in that they should have a fixed build plate that is rigidly attached to the frame.

All bed leveling is usually accomplished through software, either using a probe (automatic), or manually by trial and error (the old fashioned way). The actual means vary from one manufacturer to another, and for each different printer model.

The important item is that the gap between the build surface and the nozzle is calibrated to 30~50 microns (~ 0.002") over the entire build surface, using a standard sheet of paper.

It may take awhile to get a Delta 3D printer properly calibrated, but once the initial calibration is performed, including the bed leveling, it is usually good for a very long time, which in many cases can be the life of the printer.

The only adjustment that remains is fine-tuning the gap between the build plate and the nozzle, which can be done using the live micro-stepping (baby-steps) function in the printer software.

Some low-cost models have manually adjustable build plates. Unfortunately, this practice introduces additional variables, which not only complicates matter when calibrating the printer but also causes changes over time, introducing new errors.

Therefore, any such manual leveling mechanism should be removed from the printer and the build plate should be rigidly attached to the frame.

When performing the initial calibration, consider these additional factors inherent in the design of Delta 3D printers:

- The Z Hight Home end-stops are located at the top of the towers
- The only uncompensated Z Hight distance is in the center of the build surface
- The natural movement of the effector in relation to the build surface is spherical, not parallel; therefore it must be mathematically compensated to be parallel.

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On printers with a built-in automatic calibration routine, it is advisable to let the printer perform it for the initial calibration. If it completes successfully, then you should not run it again unless there is a problem, because all such autocalibration routines normally delete previously stored settings.

For printers without an automatic calibration routine, the initial calibration must be done manually. In such a case, look to the printer manufacturer for their recommendations on how to perform it.

Also, there are many online tutorials describing how to manually calibrate a Delta 3D printer based on the type, electronics, and firmware used in the machine.

Extruder Calibration

As with Cartesian 3D printers, ensure that the extruder is in fact feeding the correct amount of material.

Confirm that the extruder does so by instructing it to extrude a known amount of material, then measure it to see whether it extruded that amount with a ruler, a tape measure, or a caliper. In other words, using control software, instruct the extruder to feed 100 mm of filament, and measure that it in fact extruded 100 mm.

If it did not, then calculate the difference and adjust the printer software to compensate. Re-run the extruder calibration and compensation until there is less than a 1% error. Even better, calibrate to an extrusion error of less than ½ or ¼ percent.

Movement Calibration

Most modern Delta 3D printers arrive from the factory with the proper travel calibration. However, it is important to verify that the effector travels the correct distance along all axes. This is done in a similar fashion as the extruder calibration.

Instruct the printer to move its printing head a known distance along its Z axis, then measure to see if it in fact moved the head that amount with a ruler, a tape measure, or a caliper. In other words, using control software, instruct the printer to move its printing head 100 mm along its Z axis and measure that it in fact moved 100 mm.

Instruct the printer to move its printing head a known distance along its Z axis, then measure to see if it in fact moved the head that amount with a ruler, a tape measure, or a caliper. In other words, using control software, instruct the printer to move its printing head 100 mm along its Z axis and measure that it in fact moved 100 mm.

If it did not, then calculate the difference and adjust the printer software to compensate. Re-run the movement calibration and compensation until the error is less than ¼ of 1 percent.

Note that on a Delta 3D printer, the Z axis is the only axis where the number of steps per mm of travel is uncompensated. The steps per mm of travel along the other axis is calculated real time, depending on the physical location of the move.

Once again, when adjusting the printer software or firmware to compensate, the only precise software adjustment possible usually is the actual number of steps that the motor must turn per mm of travel.

Printing Test Parts

As in the case of Cartesian 3D printers, the final step in calibrating a 3D Delta printer is to print a test part designed for that purpose.

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The same common calibration test prints used for Cartesian 3D printers are applicable to Delta 3D printers:

- XYZ Calibration Cube, typically 20mm X 20mm X 20mm
- 3DBenchy
- Cali-Cat
- Calibration Ruler

Part 6

In the next installment, I will look at some of the items to verify when beginning a new print, and how to compensate any minor discrepancies for optimal results.

Useful links to sites with additional information

- Common Calibration Test Cube 20mm
  - URL: https://www.thingiverse.com/thing:1278865
- 3DBenchy – Jolly 3D Printing Torture Test
  - URL: https://www.thingiverse.com/thing:763622
- Cali-Cat – Calibration and Torture Test
  - URL: https://www.thingiverse.com/thing:1545913
- Calibration Ruler
  - URL: https://www.thingiverse.com/thing:25763
- The online store for the objects that I design
  - URL: https://www.myminifactory.com/users/DanoSoft

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Flight Training

Primary flight training is available by appointment on Saturdays from 10:00 AM until 2:00 PM when the weather is nice and not too breezy. Contact the Training Coordinator or one of the instructors to make an appointment:

Geoff Lawrence 850-591-6879
Jeff Owens 850-545-7482
Bill Ashbaker 850-656-5932

Jim Ogorek 850-766-2477
Mike Atkinson (Tuesday only) 850-251-2694
Troy Emmett (Large Aircraft) 770-546-6199

Field Hours

Electrics/Sailplanes	30 minutes before sunrise until 30 minutes after sunset 7 days/week
Gassers/Nitros	10 AM until 30 minutes after sunset except Sunday Sunday gasser/nitro flying begins at 12:00 PM All gassers and nitros must have a suitable muffler.

The Seminole Flyer is a publication of the Seminole Radio Control Club of Tallahassee, FL. We welcome and encourage items for publishing in The Seminole Flyer. Please submit your suggestions to robin.marcy@gmail.com in Word format. Thank you.

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