The Seminole Flyer

SEMINOLE RADIO CONTROL CLUB TALLAHASSEE, FL

Charter member of the Academy of Model Aeronautics since 1969

AMA Charter Club 216

AMA SINCE 1936

50 Years of Responsible Model Aviation and Community Support

Thanksgiving 2019 Issue

Christmas Is Coming!!

Members discussing new field facilities at Chuy's in November club meeting

Photo courtesy of Randy

Wow! A lot of things are happening and they're happening fast! We will be moving to our new field soon, our Christmas party is coming up and the next pylon race is imminent.

The revised schedule indicates that we will be moving to our new field in 60 days. At our November meeting, members discussed the design of the new shelter and pilot stations. The new shelter is high ceilinged and contains no internal support posts. This leaves a lot of flexibility for placement of tables and charging stations.

The new pilot stations will be smaller and a little further apart. This will allow better access for the mower and larger aircraft.

Members voted to purchase a new storage container rather than attempt to haul our current, aged storage container to the new field.

Preliminary construction on the new running facility at our current location is due to begin by the end of January. So, we will be moving soon.

See Meeting, Next Page

Meeting

From Previous Page

The second pylon race of our fall/winter series will be held on Saturday, December 14. The series standings after our first race at our Veterans Day event are:

First Place - Ed Budzyna
Second Place - Jim McKinnell
Three-way tie for Third Place - Marcy Driscoll, Jeff Lawrence, Chris Starnes

Since we have only had one race and there is a new scoring system, there is ample opportunity to improve your series standings.

Our annual Christmas party will be held at Chuy's on Thursday, December 19. Food from Chuy's menu and soft drinks will be provided at no cost to members and guests. Alcoholic beverages will be available, but at your own cost. According to tradition, the business portion of the meeting will be very short. The main agenda item is a vote for our 2020 club officers.

Time to Renew Club Membership

It is the time of year to renew annual club membership. Our **2020 club membership dues should be paid before the end of the year.**

All things that keep our field a nice place to fly are paid from membership dues. Dues are our only source of income and provide gas and maintenance for the mower, field repairs and improvements, insurance, electric bills, state and national fees and the list goes on.

Annual dues are: $60.00 for general membership, $75.00 for family membership and $20.00 for junior membership. You may pay the treasurer at the field or at one of our club meetings. Or, you may mail a check to the Seminole RC Club at 2509 Napoleon Bonaparte Drive, Tallahassee, FL 32308.

Or, you may pay with PayPal. From PayPal home page:

1. Click the Send & Request tab at the top of the page.
2. Enter seminoleradiocontrolclub@gmail.com on next page.
3. Enter dues amount and click Change on next page.
4. Click Sending to a friend on next page.
5. Click Send Payment Now on next page. (A small PayPal usage fee is added to your total.)

We hope you will continue your club membership. We have a great hobby filled with fun and brief moments of sheer terror thrown in for excitement.

Serving Our Community

**Jeff Owens participating in a re-
cent outing with cub scouts at
at Wallwood Scout Reservation**

— Photos courtesy of Jeff

**Geoff Lawrence participating in
a recent outing with cub scouts
at Wallwood Scout Reservation**

Club Meeting News

Jeff Owens, Secretary

The meeting was called to order at 7:05 PM on Thursday November 19, 2019 by President Jay Wiggins. This meeting was held at Chuy's Restaurant, our new meeting location. 30 members and guests were present.

Member Recognition – Bill Ashbaker for his work on the Newsletter and Dan Ouellet for contributing an article; Various members for helping the FAMU-FSU College of Engineering team (John McClelland for a flight box, Jim Ogorek for a transmitter, Mike Picou for servos, Dan Ouellet for 3D printing advice, and more I don't know about); Restaurant Selection Committee (Steve McFadden, Robert Tilden, and Al London) for finding a new meeting place; Jim Ogorek for handling a safety violation issue; Rhett Boudreaux for new pylons for the pylon racing course; Marcy for organizing the new pylon racing schedule and running the first event; Jeff Owens for recent updates to the web site; Geoff Lawrence and Jeff Owens for participating in the Cub Scout Family Weekend at the Wallwood Scouting Facility; Jay Wiggins and the Board of Directors for continued work on arrangements for the new field.

Secretary's Report – Jeff Owens – The minutes of the October meeting were posted on the web in the Newsletter. The minutes were approved as posted. Jeff has written a new "Frequently Asked Questions" handout for the Club. It has been posted on the web and 150 copies have been made to hand out at various events. The new slate of officers consists of all the present officers. No nominations were made from the floor. A check for $75 has been received from AMA for our fund raising event in October. Philip Stuart's article in the Democrat was instrumental in showing the publicity for the event and qualified us for $75 instead of $50.

Treasurer's Report – Treasurer Bill Ashbaker gave the Treasurer's report. The report was approved.

Safety Report – Jim Ogorek – one safety violation issue was handled in accordance with our Bylaws. No other safety issues have occurred in the past month. Keep up the good work!

Training Report – Geoff Lawrence – Two trainers are in good shape and ready to go.

Field Report – Gordie Meade – the grass has not needed mowing for the past three weeks. It is in good shape after the October rains.

Facilities Discussion – Jay Wiggins – The grass on the new runway is starting to fill in nicely. Jay reviewed the site plan as presented to the Florida Department of Environmental Protection. The new layout shows the runway, pilot stations, pavilion, parking, heli pad, and container. Our old container is in bad shape. A motion was made, seconded, and approved to appoint a committee to investigate getting a new one using a budget of up to $6500. The schedule for the move is not known, but it is likely to be near the end of January.

Pylon Racing – Marcy reported on the first pylon racing event of the new season**.** A new scheme of using one judge per pilot makes it much easier to count the laps of individual plans. The scheme worked well and was appreciated by all concerned. Seven pilots raced in this event, but sixteen have registered for the season. A new scoring system does not overly penalize members who have to miss an event due to conflicting plans.

Old Business – none

New Business – none

The meeting was adjourned at 8:36 PM.

Around the Field: Veterans Day Event

Ed working the grill

Our club's official food taster hard at work

Planes! Planes! Planes!

Gordie doing his magic

Around the Field: Pylon Races

The audience is ready for the first race

The competitors are almost ready

And they're off!!

Around the pylon

3D Printing Basics

By Dan Ouellet 3D.DanoSoft.Com

Last time in part 1, we took a brief overview of AM (Additive Manufacturing), what it implied and how it differed from traditional building methods. Then we reviewed the two most common AM processes in use today by modelers, FDM and SLA.

For most modelers, FDM will likely be a better place to start with a 3D printer. Therefore, we took a closer look at two types of inexpensive machines in use today, Cartesians and Delta printers, and the benefits of a heated build platform.

In this installment (part 2), we will discuss the different types of extruders and hot-ends used by modern FDM printers, as well as some of the common filaments that are normally used in the hobby.

3D Printing Basics

Part 2

In an FDM machine, the building material normally consists of a spool of filament, which is extruded where it is needed, onto a build plate in thin layers until the part is done.

The Extruder

The extruder in an FDM 3D printer is the electro-mechanical assembly that feeds the filament to the Hot-End in a precise manner. It consists of a stepper motor driving some gears through which the filament is feed.

Extruders come in two styles, direct drive and geared. The latter involves additional reduction of the drive mechanism to increase torque on the filament.

Direct drive extruders are simpler in design but require a stronger stepper motor. On the other hand, geared extruders can get away with a smaller/lighter stepper motor, to produce adequate torque to push the filament through the nozzle in the Hot-End.

As long as the extruder design is well implemented, it should not matter much which type is in use on a particular machine.

Extruders also come in two types depending on the physical location of the extruder assembly:

- Bowden extruders are usually attached to the frame of the printer, and the extrusion path of the filament to the Hot-End in the printing head is constrained with a (Bowden) tube made from low friction flexible material, such as PTFE *(Teflon)*.
- Direct Drive extruders are normally part of the printing head, mounted directly on or very close to the Hot-End.

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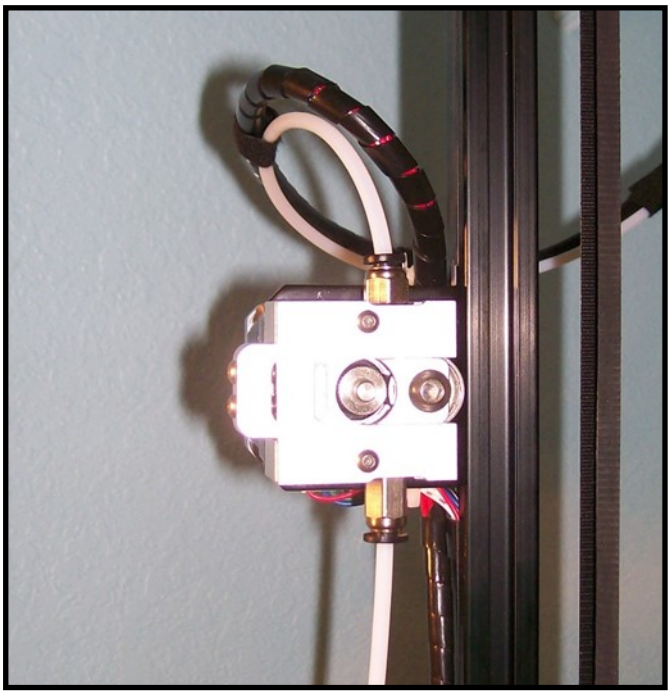
Bowden extruders typically allow for a much lighter print head which may result in faster speeds and less artifacts on the printed part.

However, because all filaments are somewhat flexible and some are almost rubber like, Bowden extruders can be limited in the types of filaments that they can successfully print. They also suffer from much longer retraction movements, when the filament is retracted to release pressure in the nozzle prior to moving the printhead over a non-printed area to prevent oozing and dripping.

To the right is a picture of a typical Bowden extruder. It is an upgrade for my K280 (Kossel) Mega Delta 3D Printer. It uses a standard "Nema-17" stepper motor mounted on the back of the extruder.



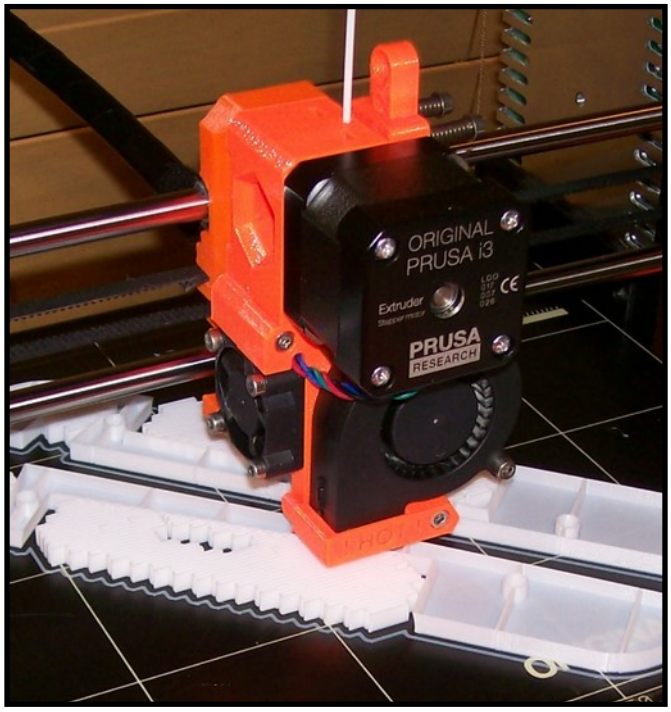
K280 (Kossel) Mega Delta Extruder

Direct Drive extruders provide a more controlled extrusion of the filament in the Hot-End and can retract the filament much faster, because they are so close to the nozzle.

Typical Direct Drive extruder setup requires less than 1mm of retraction to achieve similar results as a Bowden does with 5mm or more.

A good example is that my Prusa MK2s usually only needs .6mm *(~0.024")* retraction movement to release the pressure in the nozzle, whereas my K280 requires at least 7mm *(~0.275").* That is 11 ½ times less retraction movement for the Prusa. Plus, the Prusa usually retracts filament at 60mm per second, whereas the K280 does so at 30mm per second.

It is easy to see that the Direct Drive extruder in the Prusa design performs retractions substantially faster (*~23 times faster*) than the Bowden in the K280. When considering that a typical print may require hundreds, if not thousands of retractions, it really adds up.



Prusa i3 MK25 Extruder & Hot End

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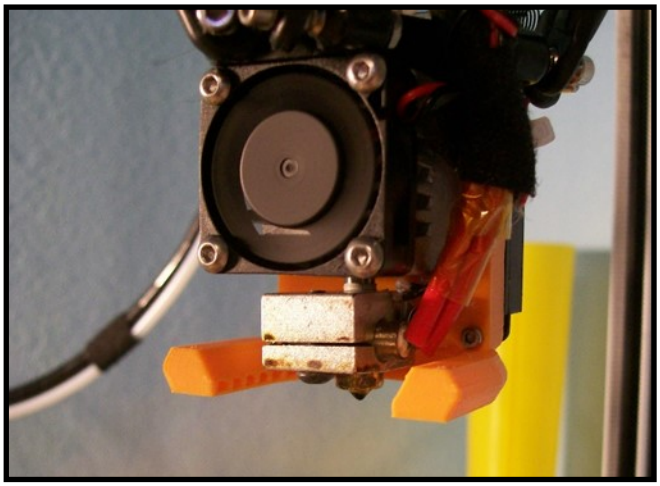
The Direct Drive Prusa Extruder/Hot-End design is very versatile. It can print almost any filament available today, including ABS, ASA, PET, PETG, PLA, PP, Nylon, Flexible, T-Glase and many other exotic materials, with a relatively good finish on the surface of the parts.

The Bowden setup on the K280 Mega Delta does well with PLA and ABS. However, it is not suitable to print any of the flexible or many of the exotic engineered materials.

Interestingly, the Bowden setup on the K280 is capable of providing a better parts finish than the Prusa.

The Hot-End

The hot-end of the 3D printer is the area of the printing head were the plastic filament is heated from room temperature to it molten state and forced through a nozzle to be deposited in precise layer by layer manner where it is needed to make the part.



K280 (Kossell) Mega Delta Hot-End

The filament path in the hot-end is divided into 4 distinct critical areas:

- The cooling block
- The hot-end throat
- The heating block
- The nozzle

The **cooling block** is basically a heat sink and its purpose is to keep the filament at or close to room temperature. Most designs incorporate a small fan to dissipate the heat. It is very important to maintain control of the filament temperature so it can extrude precisely. If the filament gets too soft, it will not retract properly or may even jam.

The hot-end **throat** is the thin pipe or tube between the cooling block and the heating block. Its main function is to provide a sharp temperature transition break between the hot and cold areas of the hot-end.

The **heating block** of the hot-end is the area were the filament is heated precisely to the temperature were the filament changes state from a solid to a molten *(not liquid)* state suitable to be extruded *(pushed through)* the nozzle. It contains the heating element or cartage, the temperature sensor and the threaded path used to join the throat and the nozzle.

The **nozzle** is the part of the hot-end where the filament is extruded to a precise diameter.

The most common nozzle diameter in use today is .4mm *(~0.157").* This diameter offers a good compromise between a good finish of the parts and adequate build speed.

Other popular nozzle sizes for hobby use include, but are not limited to: .25mm, .3mm, .5mm, .6mm.

The smaller sizes can provide better resolution and better-looking parts, but extrude material at a smaller rate which take much longer to complete a part. They are also prone to jamming more often. Anything smaller than .25mm should only be used in a “clean” room, because any speck of dust in the air will most likely be larger than the extrusion diameter and will jam the nozzle.

Larger diameter nozzles provide a faster build speed at a lower resolution because they can extrude substantially more material for a given amount of time. However, it becomes progressively harder to produce smooth good-looking parts. Also, care must be taken to ensure that the heating block is able to provide enough energy to keep up with the additional plastic flowing through.

All Metal Hot-End vs “Improved” Hot-End

Hot-Ends are available either as “All-Metal” or “Improved”, depending on whether or not the PTFE tube is allowed to pass through the throat to the nozzle.

Because it is very difficult to manufacture *(very costly)* a metal cooling block and/or throat with the filament path sufficiently smooth for use in a 3D printer, some inexpensive designs incorporate PTFE tubing extending all the way to the nozzle. This works very well for lower temperature materials that can be 3D printed at or below 240 degrees Celsius (464 F), such as PLA.

This is especially true of many low-cost 3D printers. For this reason, the marketing term “Improved” was introduced to mask the fact that it was done as a cost saving measure.

Unfortunately, PTFE will emit highly toxic fumes when heated above 250 degrees C. Therefore, machines with an “Improved” Hot-End are not really suitable for ABS and have limited usability with PETG.

When considering a 3D Printer, it is important to decide beforehand if an “Improved” Hot-End will meet your 3D printing requirements, or if an All-Metal Hot-End is required.

Common Filaments

For hobby use, the most common filament materials in use today are:

- PLA (Polylactide or polylactic aliphatic polyester)
- ABS (Acrylonitrile butadiene styrene)
- PETG (Polyethylene terephthalate glycol)

PLA is one of the most consumed 3D printable thermoplastic polymer in use today. It is made from renewable resources - fermented plant starch derived from corn, cassava, sugarcane, sugar beet, etc...

It is relatively inexpensive, easy to print and forms rigid stable objects. It is available in many colors from a multitude of vendors.

It does not emit toxic fumes when heated to normal 3D printing temperatures and it is biodegradable.

Overall, it is probably one of the best materials to start with.

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The main shortcoming of PLA is that it's gasification *(state of a material where it behaves like glass - slowly flows)* temperature is relatively low: approximately 60 degrees Celsius (~140 F).

Therefore, if a PLA object is stored or left in a hot environment such as a parked car in the summer, where the temperature can reach or exceeds this temperature, it will likely deform or warp.

ABS is another common 3d printable material that has been around for a while. The first inexpensive 3D printers were almost all dedicated to print ABS.

It is inexpensive and available in many colors from many vendors. Parts made with ABS can easily be machined after they are printed, with common tools such as drills, lathes, mills, grinders, saws, etc., and it has good mechanical properties. It can be chemically affixed to itself and other similar plastics of the same class.

Its gasification temperature is above the boiling point of water at approximately 105 degrees Celsius *(~221 F).*

Unfortunately, ABS emit some toxic fumes and strong odors when 3D printed. Further, the material shrinks noticeably while cooling down to room temperature – sometime up to 4%. Therefore, parts are subject to warping or curling while being made, or while cooling down afterwards.

ABS is not biodegradable, but it can be recycled.

ABS require machines with a heated build platform and hot-ends capable of reaching higher temperature than those limited to printing PLA. Further, enclosed build chambers are typically advantageous when printing with ABS.

Basically, ABS capable 3D printing machines can also print with PLA, but not necessarily vice-versa.

The techniques used to successfully print ABS on a given machine are radically different from those used to print PLA on the same machine.

It takes some practice to get it right, but it is not difficult – just different.

PETG is relatively new to the 3D printing scene. It was first introduced in filament form to provide some of the advantages of ABS while retaining many of the advantages of PLA.

It is relatively inexpensive and available in a wide array of colors with various degrees of translucence from many sources. It provides good temperature resistance with a gasification temperature of approximately 85 degrees Celsius (~185 F).

With a strong layer adhesion, it can provide tough parts capable of some flexibility, that are resistant to chemicals and shocks.

PETG is not biodegradable, but it can be recycled.

PETG require machines with a heated build platform and hot-ends capable of reaching higher temperature than those limited to printing PLA, but not as high as those required to print ABS.

One of the disadvantage of PETG is that it can chemically bound to other materials commonly used on build platforms such as PEI, glass and other popular surface coatings. This is normally overcome with a thin layer of "de-bonding" agent added to the build platform prior to printing.

Another disadvantage of PETG is that it is hydroscopic, which means that it readily absorbs moisture from the air. For this reason, it is important to store it in a cool dry place, and dry the filament if it has been exposed to humid air for too long.

Printing "wet" PETG can lead to hydrolysis which will permanently alter the filament on a molecular level, making it significantly weaker than if it was printed dry.

Just a little moisture in the filament leads to heavy stringing while printing. This is important here in Florida, because of our climate. I observed increased stringing tendencies after just a few hours of printing with a new spool of PETG.

Other 3D Printable Filaments

There are too many other 3D printable materials to list here. However, the following may be of use in the hobby and should be considered when making a purchase decision: Flexible materials such as TPU, tough materials such as Nylon, semi-rigid materials like PP, etc., etc.

Part 3

In the next installment, we will examine the advantages and disadvantages of both open source and closed source machines, as well as the benefits and shortcoming of Kit vs Ready-To-Run 3D Printers.

Useful links to sites with relevant information and tutorials

CNC Kitchen – Stefan Hermann an Aeronautical Engineer who produces videos on YouTube about his research, including the strength of various filament, infill patterns, and much more:
URL: https://www.youtube.com/channel/UCiczXOhGpvoQGhOL16EZiTg/playlists

E3D – Team responsible for many Extruder and Hot-End innovations:
URL: https://e3d-online.com/about
URL: https://e3d-online.com/blog/2019/01/30/60-second-tips-bowden-v-direct-drive/
URL: https://e3d-online.com/blog/2019/01/21/60-second-tips-storing-your-filament/

Matter Hackers – Everything 3D Printing and Fabrication Community Store
URL: https://www.matterhackers.com/about
URL: https://www.matterhackers.com/explore ("How to" articles and tutorials)

Another link

The online store for the objects that I design
URL: https://www.myminifactory.com/users/DanoSoft

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Tallahassee, Florida

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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	10:00 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, Florida.
We welcome and encourage items for publishing in *The Seminole Flyer*. Please submit your suggestions to SeminoleRadioControlClub@gmail.com in Word format. Thank You.

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