

the

Ampeer

May		The EFO Officers		2006	
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Ampeer subscriptions are \$10 a year US & Canada and \$17 a year worldwide		The Next Meeting: Date: Saturday, May 13 Time: 10:00 a.m. Place: Midwest RC 5 Mi. Rd. Flying Field, Northville Twp. MI			

What's In This Issue:
Thoughts on Motor Testing with Props – More Bantam SRE info – Upcoming RAMS Meet - Upcoming E-FLI-OWA - Adjustable Width Hot Wire Bow - March EFO Meeting - Upcoming Cedar Rapids, Iowa E-Meet - Possible Future Projects for the Ampeer Readers - Upcoming MISS Glider and Electric Flying Demo at Lyon Oaks Park - A Correction for the April Ampeer - Two Brushless Motors on One ESC – Upcoming Events

Thoughts on Motor Testing with Props

The April 2006 issue of *Fly RC* contains a review of the Astro Flight 19 direct brushless motor, p.46. The review contains some statements about the motor, some motor data and some performance data collected using various diameter APC thin electric props with a Kokam 3S1P Li-Po pack and a Castle Creations Phoenix-35 controller.

I have recently been corresponding with Christian Persson on his Drive Calculator 3.0 application. The program, much like *ElectriCalc* and *MotoCalc*, is designed to predict motor performance with a specific power source and propeller.

Just for kicks, I put the data from the review into Drive Calculator and was very surprised with the results. I knew that something just had to be wrong!

According to the statement by Jonathan Pope and Thayer Syme, authors of the *Fly RC* article, “A sealed case demands high efficiency from a motor capable of continuous operation at 300 Watts to avoid over heating. This

shows up when you look at the performance of this motor, so let’s look at the numbers.”

That is exactly what I did.

The first thing that I noticed was that, according to the performance table in the article, AF recommends a maximum amp draw of 25 amps. The authors tested eight props. Of the eight APC thin electric props, only one registered under 25 amps during static testing. I found that “interesting”, but not too disconcerting, since the amps will drop some in the air due to some unloading of the prop in flight.

The authors didn’t appear to weigh the motor. The AF site and the authors state 4.2 oz., while the ad on p.51 of same issue of *Fly RC* gives the weight as 4.6 oz.

I went to the Astro Flight site to compare the numbers that AF publishes to the numbers presented by the authors. This is when the “problems” began.

Maximum Amps	25 Amps
Maximum Power	400 watts

The authors, in the SPECS box say 300 watts, the AF site 400 watts. How can this be? I opened the .pdf document

for the 19 on the AF Web site and found this:

Maximum Amps	25 Amps
Maximum Power	300 watts

Interesting.

Next, I looked at the prop data. One example will be used here to demonstrate the problem, but it pretty much applied to all similar props.

Fly RC data:

Prop	Volts	Amps	Watts	RPM
8x6	11.42	22.5	258	10,500

AF Web site:

Expected performance on 3 Lithium cells

Prop	Amps	Volts	Watts	Rpm	Thrust
8x4 APCE	18.2 A	11 V	201 W	11,800	31 oz.
8x6 APCE	23.4 A	11 V	255 W	10,400	28 oz.

AF .pdf documentation file:

Expected performance on 3 Lithium cells

Prop	Amps	Volts	Watts	Rpm
8x4 APCE	17.3A	11V	191W	11,800
8x6 APCE	25.2 A	11V	280W	10,000

Neither the *Fly RC* authors nor Astro Flight noted

which APC 8x6E prop they were using. As previously noted in the *Ampeer*, APC changed their props a couple of years ago. The older APC E props have a thinner hub, weigh less, turn at a higher RPM and have different characteristics from the current production versions. This may or may not account for the variations in the above data for the 8x6 props.

Neither the *Fly RC* review nor the AF site noted elevation, temperature and air pressure. All three of these factors will affect the results.

I put the data from the AF site and *Fly RC* review into Drive Calculator 3 and was surprised at what I saw. I had to revise the data over and over, since NONE of it was worked. I finally came up with the screen capture at the bottom left of this page. I cannot say with certainty that this screen capture actually reflects this motor, but if it does, it can be seen that using the APC 8x6E or larger prop is pushing this motor way past its most efficient operating range of 4 amps to 8 amps.

Now I had more questions than answers!

There were some things that I found “interesting” in the data presented in *Fly RC*. As expected, the 8x6

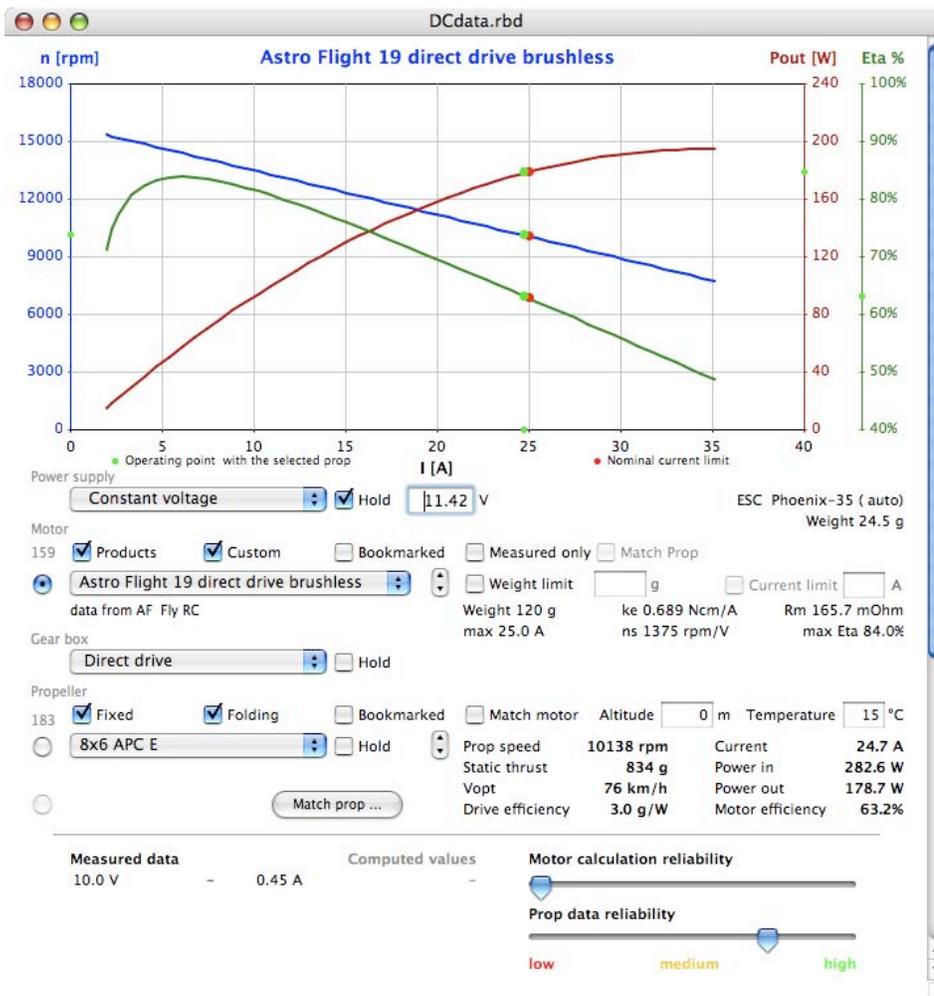
had the highest volts, lowest amps and highest RPM, but the 9x6 didn't seem to fit into the rest of the data:

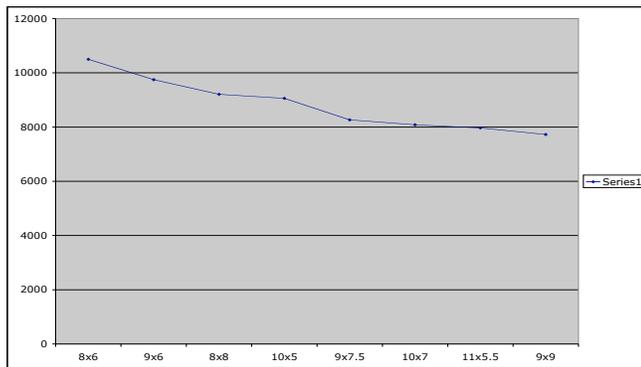
Prop	Volts	Amps	Watts	RPM
9x6	11.40	25.3	288	9,750

The volts appeared to be too high for the amp draw when compared to the rest of the voltage readings in the Performance Testing data on p. 46.

I put the *Fly RC* data into an Excel spreadsheet to see what it would show me about the data. Graph 1 on the next page was arranged by the reported amp draw. It wasn't exactly what I expected to see. I thought that it might be a bit straighter.

I couldn't believe the efficiency numbers that I was getting, so I decided to start back figuring numbers. I did this for all of the *Fly RC* data, but will illustrate with the APC 9x6E, as that is a prop that someone might expect to fly on a glow 19 and on this motor. (Of course it would be a glow 9x6.)





Graph 1

With the reported RPM 9,750, I computed the output watts three different ways after seeing the Drive Calculator 3 output.

Hyperion Emeter: $9.75^{3.2} * 0.129 = 188.5$ watts out

Using Torque via the [Electric Motor Handbook](#) by Bob Boucher.

Generator constant (Kv) = 1375

$K_t = 1355 / 1375$ (Kv) = 0.9854545 (oz.-in./amp)

No Load Current: 0.45 amps

Amps out: $25.3 - 0.45 = 24.85$ amps

Torque: $0.9854545 * 24.85 = 24.49$

Watts out: $(24.49 * 2 * \text{Pi} * 9750) / 8496.7154 = 176.6$ watts out

$\text{RPM} / K_v = 9750 / 1375 = 7.09\text{v} * 24.85$ amps = 176.2 watts out

Using the above figures the drive efficiency (efficiency of the motor, ESC, connectors and wiring from the ESC to the motor) ranges from a high of 65.4% using the 188.5 watts out to a low of 61.1% using 176.2 watts out.

That didn't look very efficient to me. I continued to explore what might be going on with the numbers.

AF states the $R_m = 90\text{mOhms}$. $0.09 * 25.3$ amps = 2.277v + 7.09 volts out = 9.367 volts.

When I checked for the resistance of the Castle Creations Phoenix-35, I ran into the next problem.

SPECS	
Part #	PHX-35
Price	\$99.95
Cells w/BEC	5-12
Cells w/o BEC	5-16
Continuous	35 amps
Switching Rate	Programmable (11, 22, or 41 khz)
Resistance	0.0045 ohms

Web site

1.0 Features of the *Phoenix-35™*:

- Extremely Low Resistance (.0035 ohms)
- High rate *adjustable* switching (PWM)

.pdf documentation

(Enough to drive you crazy isn't it!)

Voltage drop through controller: $0.0045 * 25.3 = 0.114\text{v}$

$9.367 + 0.114 = 9.48$ v into the ESC. *Fly RC* recorded 11.4v on the Emeter. That is way off!

I back figured the R_m using the *Fly RC* data and came up with an average R_m of about 0.165 ohms, almost twice the AF published number.

$0.165 * 25.3$ amps = 4.2v + 7.09 volts out = 11.29 volts + 0.114 = 11.4v into the Emeter.

There are several points that I'm trying to illustrate with this example.

First, once again, I am *pleading* with ALL manufacturers to post usable, correct, non-conflicting data on your Web sites!

When a reviewer makes a statement like the authors of the *Fly RC* review about efficiency, there should be some "proof" of this in the article.

Anyone doing "motor testing" using props should provide the following:

The procedure used

The equipment used

The temperature, altitude, and barometric pressure at the time of the testing

The specific prop, and if an APC E or SF, the prop hub thickness and weight.

Data to be reported should include:

Two no load measurements including volts, amps and RPM readings using different voltages and only after the motor has been "warmed up".

There should be repeatable data for volts, amps and RPM from three different prop "loads".

The data should be carefully analyzed and spurious data checked again for accuracy and repeatability.

While it is best if motor testing is done via a dyno, as Mr. Steve Neu does, it can be done with some reasonable accuracy using the parameters and procedures outlined above.

Lastly, I want to make it perfectly clear that the Astro Flight 19 Direct Drive motor will certainly do the job it was designed for. Even though, in all the examples, it is operating near its recommended maximum current, with its samarium cobalt magnets,

it is much more “rugged” than others in its class, and there is no reason to believe it won’t prove to be a long lasting, useful motor! Put it in a House of Balsa P-51, use an APC 8x6E prop and a good 3S Li-Po pack and have a ball!



More Info on Keith Shaw’s Bantam SRE

The January 2006 issue of the Ampeer had a photo of Keith Shaw with his Bantam SRE, a kind of stand off version of a WACO SRE kit-bashed from the SR Batteries (srbatteries.com) Bantam biplane kit.

Here are the details that Keith gave me:

New tail surfaces
 34” span, clipped from the original, with elliptical tips
 Radial Cowl
 PJS 300 SF motor
 APC 9x4.7SF prop
 2S1P Kokam 700mAh battery
 Castle Creations Phoenix-10 ESC
 Weight: 9.2 oz.

Upcoming RAMS Meet

The Radio Aeromodelers of Seattle is hosting the RAMS/PSEMF Electric Fly-In on June 24 and 25. The contest will be held at the RAMS field in Sumner, WA. Take Hwy 167 to 24th St. exit, to West Valley Hwy. It is about 1/4 mile to the RAMS field. The event begins each day at 8:00 a.m. The contact person is Randy Smithhisler at 253.927.4672 or rsmithhisler@paccar.com.

The following events are scheduled:

Mostly Open Flying
 Class A Battery Allotment AMA #609 – 1 round daily

Most Impressive – Contestants vote
 Best Multi-motor – CD’s choice
 Best Scale – CD’s choice
 Best Aerobatic – CD’s choice
 Best Thermal – CD’s choice
 Best Trainer – CD’s choice

This is the longest running electric event in the country. You are invited to come and watch these incredible aircraft in action in the hands of some of the best radio control pilots in the Pacific Northwest.

For updated information and a map to the event, check the contest schedule at <http://www.seattlerams.com>.

Upcoming E-FLI-OWA

September 9 & 10
 AMA Required

\$15.00 landing fee covers both days and includes a raffle ticket for prizes donated by our vendors.

You must be present to win.

Flying commences at 08:30 AM both days
 Ends at 7:00 PM on Sat. - 4:00 P.M. on Sunday.

This will be a fun-fly only.

NO competitive events. Buy, sell or trade is welcome.

Great Eats!

Lunch will be available both days catered by Hy-Vee Deli. There will be Grilled sandwiches, Chips and the like available.

Davenport Radio Control Society will have drinks available both days.

For more information contact:

Jon "Wrong Way" McVay

319-895-6527 Togflier@AOL.com

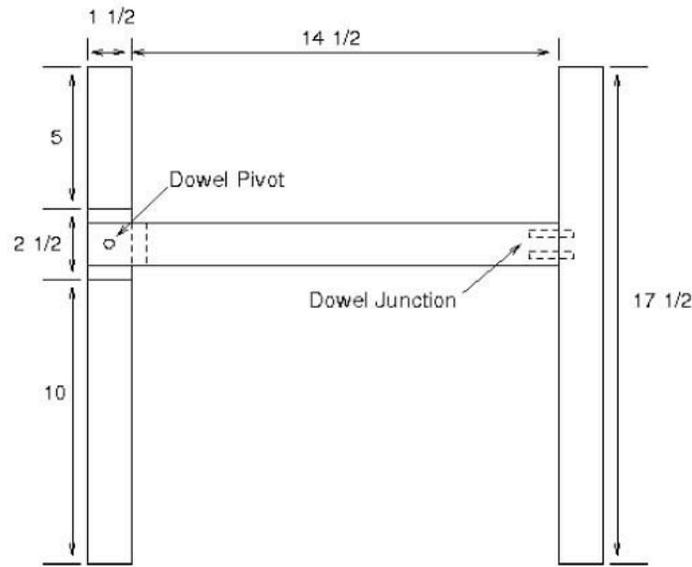
or visit: <http://www.rc-dymond.com/efliowa/>

An Adjustable Width Hot Wire Bow -- Design Notes:

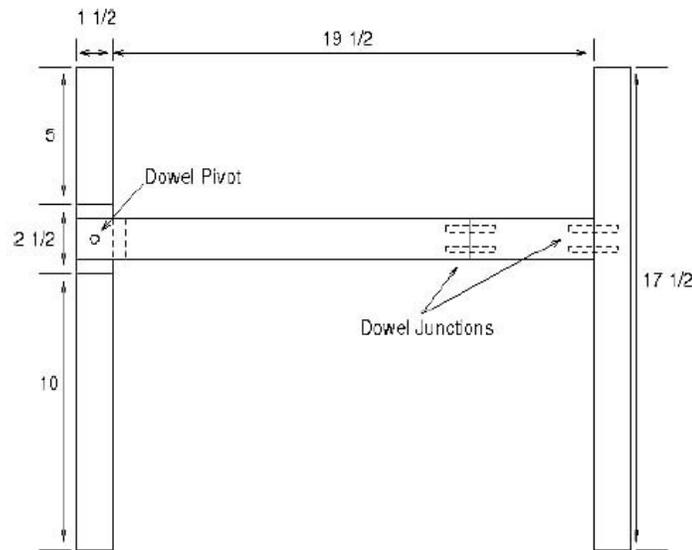
From Jim Yuzwalk jjy@pop4.net

To build a hot wire foam-cutting bow I used a scrap 2 x 6 that I cut into 1 x 1 1/2 strips. You could use a 2 x 4 to do the same thing. I wanted a bow that could be used to cut various size parts for aeromodeling, so I designed its cutting width to be adjustable. The adjustable part of the design came

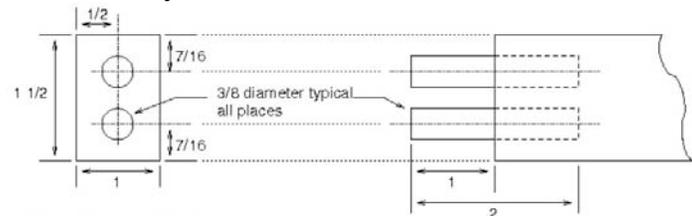
about because I didn't have the room to store multiple bows.



I used 3/8-inch diameter dowel to connect the various parts. Even the bow's pivot uses a dowel. The dowels, used to connect the various sections, are all 2 inches in length. They provide a strong, stable, and removable junction. It is relatively easy to adjust the bow's width by adding or removing an extension.



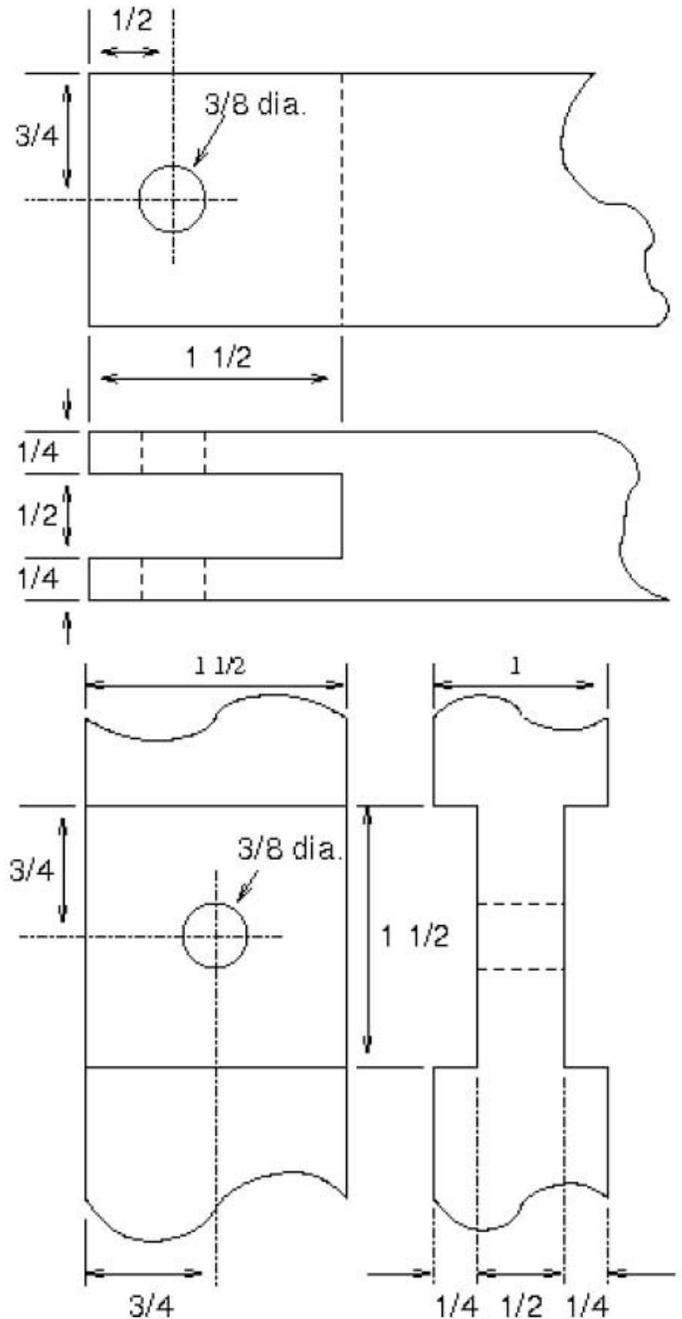
The next figure shows a detailed graphic of a dowel junction. These can be combined to give a bow of almost any desired width.



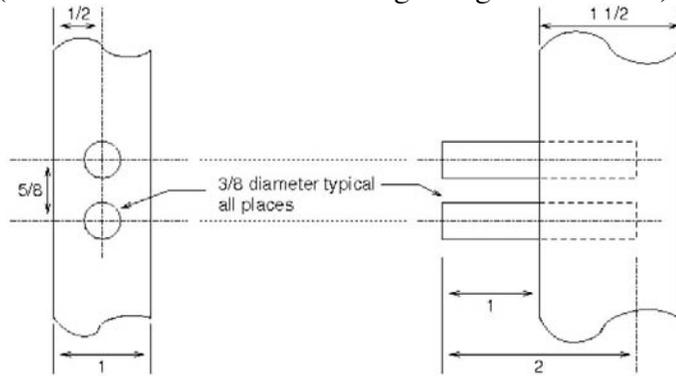
All wood is 1 x 1 1/2 inches ripped from 2 x 4 or 2 x 6 stock

The most critical fabrication step is in drilling accurate 3/8-inch holes. The holes must all be parallel with the major axis of the beam. I used a drilling jig to ensure all holes were true. Furthermore, I started with a 1/16 inch bit and walked my way up to 3/8 inch using four bits. Otherwise you will lose accuracy and have poor alignment between beams.

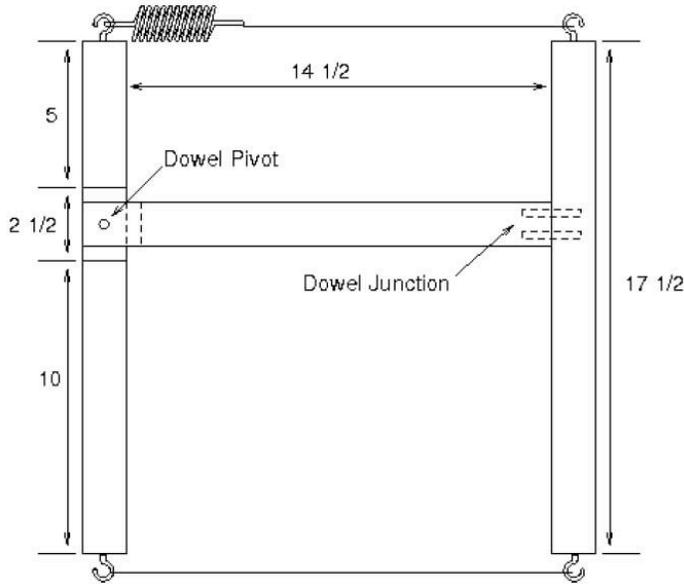
The next two figures show detailed views of the bow's pivot area – located on the left hand side of the bow. These pieces were fabricated by using a table saw with a fence. The saw blade was used as a poor man's dado cutter to cut out the slots – a router table would do the job much more easily.



The right hand bow handle is detailed below at the dowel junction. It is relatively simple by comparison (see the full bow view at the beginning of the article).



Here's a figure showing the bow with the rest of the hardware (hooks, spring, and stainless steel wire). As can be seen, I used hooks to attach the spring and the wires. This allows for easy replacement, and the bow's width can be adjusted by changing the lengths of the wires.

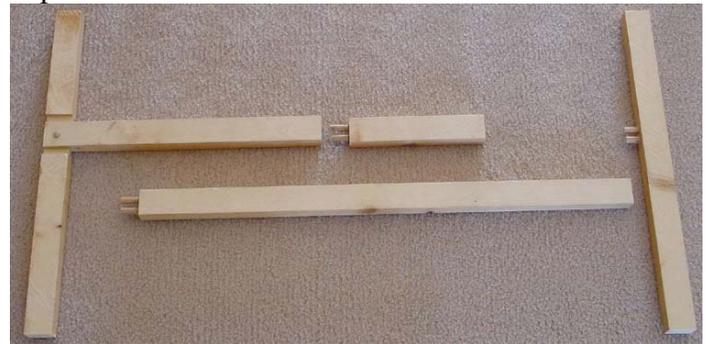


I cut the wire to give a reasonable spring tension and then made a loop at each end of the wire and soldered the loops closed.



The photo shows the completed bow in its narrowest width configuration. You can see the spring being held under tension by the wire with soldered loops. The "extended version" looks the same, just wider.

Here's a view showing the wooden parts in an exploded view.



The bow works as expected. In my tests, using a high current DC power supply, I found that thicker stainless wire is needed to cut dense foam. Thicker wire, i.e., smaller gauge, can handle higher currents and is mechanically stronger.

I had no issue cutting low-density foam with the wire I originally used. However the current had to be held to not much more than five amperes. Anything beyond six amperes and the wire would snap. With



To attach the spring to its neighboring eyehook I used some old copper wire I had lying around -- this is just a piece of scrap romex safety wire.

higher density foam you need a bit more heat and strength, so a larger diameter cutting wire is called for.

By the way, the hooks for the cutting wire worked out nicely as attachment points for the power leads. You can easily clip an alligator clip to the shafts of these hooks, and the hooks stay cool even though the cutting wire is quite hot.

For a more permanent electrical connection you could solder the power leads to the shafts of the hooks and dress the wires away from the hot wire. Anderson Power Poles would work nicely to provide adjustable lengths.

Here's the bow in its storage configuration. I used one of the bow's hooks to hold the cutting wires, and I used the spring's hook to hold the tensioning wires with loops.



Jim Yuzwalk
March 20, 2006

March EFO Meeting

The March 2006 EFO meeting was held at Rick Sawicki's house in Commerce Township and was a great night of sharing. **Dave Stacer** had prepared a really great video of us flying in Rick's basement at the February meeting. Many of you saw a little clip from this video if you checked out the March Ampeer. Thanks Dave, really great and lots of fun.

Roger Wilfong shared his Astro Flight 035 powered Clancy Lazy Bee. He chose the colors because he likes them, and he also had them on hand. Very nice.



It turned out to be boat night at the flying club meeting.

Rick Sawicki shared his Splash 3D Hydro-Plane flying boat. As you can see from the photo, this version is much larger than the more common Miss Hangar One. It is designed by a man named Ben in Jacksonville, FL. The kit contains; CNC cut 6mm Depron construction/3mm cockpit, 4mm carbon spars, .060 carbon control and support rods, 3mm flat carbon bar, Carbon control horns and a CD-rom instruction manual.

Rick is using most of the recommended power system components listed here, except for the ESC; Hacker A30-28S, Hacker X30 esc, TP 2100 Pro-Lite 3S1P, 3- HS-55 servos 4-6 channel rx and APC 9x6E prop.

For more info or to order for \$90 the email contact is benrod65@hotmail.com.



Richard Utkan shared a blue foam version of a flying hydro that he had picked up at swap shop. The plans were printed on the foam. He got a lot of advice as to how to finish it up.



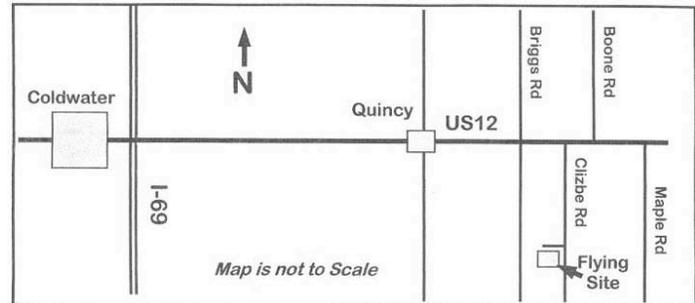
There was a lot of sharing of ideas by all of the members in attendance. That is the greatest thing about our EFO meetings; they are about model airplanes or related activities!

Ken Myers demoed the Drive Calculator application beta and showed and shared some of its features, via Rick's TV. (Rick's TV behind Richard – above - is showing stills from the Feb. EFO meeting) Several EFO members are now trying out the application betas as well.

All of us would like to thank Rick for being a wonderful host all winter long for our meetings, thank you sir!

The Keith Shaw's Birthday Electric Fly June 3 – 4

Quincey, MI near Coldwater, MI, see map.
Dave Grife CD, 517-279-8445.



Upcoming Cedar Rapids, Iowa E-Meet

August 12-13, Electric Fun Fly Hosted by the Cedar Rapids Skyhawks of Cedar Rapids, Iowa.

Our flying site is located at 3125 "C" Ave. extension NE, Cedar Rapids, Iowa.

For driving instructions, please see the field map at: <http://216.15.238.56/skyhawks/funfly/fieldMap.html>

Pilot's Fee \$5.00 each day, with good catered food at the field.

Proof of AMA Membership is required for pilots. Pilots briefing 9:00 a.m., Tx impound w/controlled flying until sunset. Spectators are welcome and entry to the field is free, Modern Porta-Potti is available but no running water, Cold soft drinks and water will be available.

Contact Event Chair Kerry Lawrence at 319-390-3570, or email at kerrylawrence@mcleodusa.net.

Complete info can be found at:
<http://www.foxcoins.com/skyhawks/funfly/index2006.html>

Possible Future Projects for the Ampeer Readers

By Bob Kopski
25 W. End Dr.
Lansdale, PA 19446

Given the recent reader reaction to the LCDC article, I began to wonder what interest there may be in other items - for the future. The attachment shows some home brew accessories I'm using with the popular CBA battery test device from West Mountain Radio.

Bob



PHOTO INFO

The tower-like item to the left of the CBA is a Power Amplifier. The battery under test plugs into it as do the normal CBA battery test leads. The Power Amplifier is electrically transparent, i.e., as far as the CBA is concerned; the battery is connected as usual to it.

In operation, the Power Amplifier automatically multiplies the test current to 10 times what the CBA software is set for. This PA is capable of over 30 amps and 400 watts. A simple mental-multiplication of the CBA reported ampere-hours reveals the true new value at the higher current drain. West Mountain Radio is aware of this design and is presently developing an "industrial strength" Amplifier as a product to be used this way as well.

The device to the right of the CBA is a "CBA Li-Poly Cells Discharge Monitor". This device connects to the battery balancing connector and to the CBA temperature sensor port (although there is no "temperature" involved).

The Monitor watches cell-by-cell voltage during discharge for a voltage reaching a settable level. The Monitor signals the CBA to stop discharge upon some cell falling to the selected value. This is much like the normal CBA stopping at the software selected pack voltage level. The idea of course is to not allow a test discharge to damage some cell. This is much like what the LCDC does in flight.

Neither accessory shown here requires any modifications to the CBA.

Okay folks, are you interested? Let Bob know or let me know. We are here to give you what you want.
KM

Upcoming MISS Glider and Electric Flying Demo at Lyon Oaks Park

Once again the Michigan International Soaring Society (MISS) has invited the EFO and local area electric fliers, to join them for their (MISS) flight demo on May 6, 2006 at the Lyon Oaks Park near the big Wixom auto plant and us. You MUST have your AMA card to fly. This was very successful last year. Tom Blazsak is once again organizing the event and has asked me to contact you about participating with your electric planes.

The park is best suited for smaller types but Tom flew several of his really fast EDF's there last year. Bring several different types and allow good judgment determine which ones you will demonstrate.

The park is located on Pontiac Trail west of Wixom Road. It is just a few miles west of the City of Wixom. Hope to see you there about 9:30 a.m. on Saturday.

A Correction for the April Ampeer

In the April *Ampeer* I wrote, "He told me that his nephew learned to fly the EasyStar very easily and that he has now recommended the Hitec Space Scooter for his nephew's second plane. This is an absolutely excellent way for anyone to get into this great hobby. KM"

Tor (t_skauli@hotmail.com) wrote, "Hi from Norway. The Space Scooter is a Multiplex product, not Hitec on my side."

Well it is on this side of the pond as well. Got a little confused there, sorry, Ken.

Two Brushless Motors on One ESC

Jim Houfek (houfekj@oclc.org) sent along the following:

As to Tony Ives question on multi-engine ESC questions, take a look at the second article "Joe's Jobs: Brushless Multi-motor Power Systems" in the Castle Creations newsletter for March 2006.

http://www.castlecreations.com/media/castle_scribe_archives/Castle%20Scribe%20CE-03-Mar2006.pdf

Here's to spring!!

**Upcoming E-events
2006**

May

4 – 7, Southeast Electric Flight Festival Hosted by the Fayette Flyers of Georgia, Andersonville, GA, info at www.hodgeshobbies.com

5-7 Silent Electric Flyers of San Diego Midwinter Electric Fly-in, info at <http://sefsd.org/>

20 All Electric Fly, Midland R/C Modelers Club, MRCMC Field, 200 Patterson Rd., Midland, MI Paved & Grass runway, no landing fee, Free camping w/electrical outlets, TX impound, AMA Members Only, Lunch Available, 10 a.m. Pilot meeting, John R. Hoovener, SR. CD, 989-832-2785 or Jerry Hanfeld 989-631-1168, www.midlandrc.org

21 Kishwaukee RC Flyers of DeKalb, Illinois 3rd Annual Electric Fly-in on May 21, 2006. Information at <http://www.kishwaukeeerflyers.org/>
Spectators are always welcome at our event. Lunch will be available on-site, and is free for registered pilots. While at our website, check out the photo gallery and

downloads section for coverage of last year's events at our field, as well as video and photos of events from around northern Illinois.

28 Radio Control Club of Detroit Electric Fly-In, info at rccd.org

June

3 - 4 The Keith Shaw's Birthday Electric Fly, Quincey, MI near Coldwater, MI, see map. Dave Grife CD, 517-279-8445.

17 Skymasters RC Small Fry & Electric Fly-in, info at skymasters.org

24 - 25 The Radio Aeromodelers of Seattle is hosting the RAMS/PSEMF Electric Fly-In. The contest will be held at the RAMS field in Sumner, WA. Take Hwy 167 to 24th St. exit, to West Valley Hwy. It is about 1/4 mile to the RAMS field. The event begins each day at 8:00 a.m. The contact person is Randy Smithhisler at 253.927.4672 or rsmithhisler@pacar.com.

Please get event info to Ken Myers ASAP for the 2006 E-events



The Ampeer/Ken Myers

5256 Wildcat

Croswell, MI 48422

<http://members.aol.com/kmyersefo>

The Next Flying Meeting:

Date: Saturday, May 13 **Time:** 10:00 p.m.

Place: Flying Meeting at the Midwest RC Society Flying Field, 5 Mile Rd., Northville Twp. MI, just west of Plymouth. MI