the Ampeer

February | The EFO Officers | 2009

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The Next Meeting:
Date: Thursday, February 5 **Time:** 7:30 p.m.
Place: Ken Myers' house (see address above)

Why CWL Gives About the "Same Number" For CWL in Imperial and Metric Units

In the January issue I suggested that maybe a mathematician might be able to answer why the CWL works out to be almost exactly the same in Imperial units (oz./cu.ft.) and Metric units (Kg/M^3). It turns out that our on EFO member, Roger Wilfong, knew the answer. Thanks Roger!

Here is an email that I received from Roger explaining it mathematically. KM

Ken,

Here's the reason the numbers for CWL in metric and imperial units are the same.

In imperial units,
CWL[imperial] = weight [oz] / (wing area)^1.5 [cubic feet].

converting the units to metric
CWL[metric] = oz * (0.0283495231 kg/oz) / (ft * 0.3048 m/ft)^3

Moving the volume conversion factor to the outside of the term and regrouping the numerator, we get

CWL[metric] = (0.0283495231 * (oz * kg/oz)) / (0.028316846592 * (ft * m/ft)^3)

or

CWL[metric] = CWL[imperial] * 1.0011539599896420556912271596488

In other words, the conversion factor for converting cubic ft to cubic meters (0.028316846592) is about 0.1% different from the conversion factor for converting ounces to kilograms (0.0283495231). Since the later is in the numerator and the former is in the denominator, for all intents and purposes, they cancel out.

This is one of the few real world examples where the old adage, "All the planning in the world can't beat dumb luck," actually works. ;)

It sure is, and thanks Roger! KM

I also received this explanation from

Stefan Vorkoetter.

As someone knowledgeable in math, I can answer that.

It's not exactly the same, just very close. There are approximately 35.27 ounces in a kilogram, and coincidentally, approximately 35.31 cubic feet in a cubic metre, so converting from oz/cu.ft to kg/m^3 is a matter of dividing by 35.27 (to get kg/cu.ft) and then multiplying by 35.31 (to get kg/m^3). In other words, converting from the former to the latter requires multiplying by 35.31/35.27, which is about 1.001.

So for all practical purposes, the units are the same, but mathematically, they are not.

Stefan Vorkoetter
Capable Computing, Inc.
http://www.motocalc.com

Handy Nylon Motor Spacer Tip
From Walt Thyng

I'm assembling a BITSA (bits a this and bits a that) Goldberg Cub. I was given a bag full of parts and had a partial kit, also a gift. When I'm building something like that, my Yankee kicks in and I try not to spend any money that I don't have to. I needed some standoffs for my Himax 5030 (itself a half price purchase). I had some 1-inch nylon pieces from ACE, but I needed some 1/2 inchers. As I was plowing around my "Nylon Salvage" bin I came across a bunch of nose-gear mounts. Bingo! I cut off the mounting tabs and had my nylon spacers. Then I realized that the tabs could also be used (they are a little less than 1/4 in.). Since I rarely use nose gear I now have a good supply of spacers.

A Tiger Kitten Under Way
From Nick Bisonni bizboy1@verizon.net

I received an email from Nick with a couple of photos of his Bob Benjamin TigerKitten under construction. Bob Benjamin is an excellent model builder and designer. Bob's original 1989 design of the TigerKitten was published in the September 1991 *Model Aviation* and then kitted by ACE R/C. It was followed by Bob's TigerCat, a larger version, in the January 1993 *Model Aviation*.

I was lucky enough to pick up a new, in the box, ACE kit at the Mid-Am, and I'll be getting mine underway, once my new Fusion 380 design is completed. At this time, I'm planning on using a 4S1P "A123" pack in my TigerKitten.

EFO member, Roger Wilfong, has been flying his for many years now. I had a photo of it flying in the November 2008 *Ampeer*.
http://homepage.mac.com/kmyersefo/ampnov08/ampnov08.pdf

The TigerKitten is still available as an updated CAD drawn plan with the cowl and wheel pants also available.
http://www.rcmodel.com/tiger/tigerk.html

Here is another photo of Nick's under construction to pique your appetite.

CWL Questions
From Bill Mackey

I received an email from Bill with a questions about CWL/WCL. KM

Hi Ken,

Just finished reading your latest *Ampeer*. As always, it was very good.

Questions: I am building my own design from scratch. It is about ready for cover. Therefore I have been able to make some close estimates regarding CG location and RTF weight. I have two motor choices: 1 would be a BP 28-14 motor that would be setup to pull 35A max with a 2200mAh 3S1P LiPo. 350 watts. 2nd choice would be an A20-22L that pulls 15A on the same battery. 150 watts.

With the "bigger" motor the weight will be 30 oz. w/500 sq.in., the smaller motor would be 2 oz. less.

The CWLs are 4.6 and 4.3 respectively. Now, wouldn't the 350W A/C fly quite differently than a 150W setup even though the CWLs are about the same?

Yes and no. The "flyability" will be basically the same, but the performance will be quite different. The CWL is used to describe how difficult the plane will be to fly, compared to other similar types with the same CWL. You plane, whether powered with either motor, will fly at about the same difficulty level when flying on the wing. The thing that is different is the potential performance. The 350 watts in system can either fly faster than the 150 watts in system, have more thrust or even have more of both.

The wing area and weight indicate that you plan to use this plane as a 3D type. That means that you need a minimum of 150 watts in per pound (this is ONE potential performance indicator), and even more is better. 30 oz. is 1.875 lb so you will need a minimum of 281 watts in. 28 oz. is 1.75 lb. and that would require at least 263 watts in. If 3D is your goal, it looks like the 150 watts in system is not really an option. Would the 150 watts in system fly the 28 oz. model? Yes. It would provide about 85 watts in per pound, and be a decent flyer "on the wing." It certainly might not be as fast or have as much vertical punch as the 350 watts in system, but the flight characteristics, while "flying on the wing" during take offs, landing and general flying would be similar. There would just be less "potential performance" from the 150 watts in system. KM

Also, I never see any reference to "Span Loading" or oz./foot of span. I know in full scale aircraft the ability to climb is greater with a longer wingspan. (assuming you could interchange two wings on the same aircraft without changing the weight). For example: A 150 hp Citabria with flaps has about 18" more span than the same aircraft without flaps. I assume the span difference is only to accommodate the flaps. The flapped or longer span aircraft will tow advertising banners much better than a non-flapped aircraft. This is based on about 3000 hours experience in Citabrias towing banners. When I say "better", I am referring to initial climb to altitude performance.

I have heard that you would have to multiply the horsepower of an aircraft by 4 to equal the lift/climb performance of an aircraft with the span doubled.

Any thoughts?

Bill

I have never seen a formula regarding "flyability" or related to the aspect ratio. I don't know a lot about aerodynamics but according to Martin Simons, "… doubling the aspect ratio halves the induced drag coefficient."

To me it seems that it would take less power to get a better climb rate and reduced sink rate for a higher aspect ratio wing.

I doubt that the extra 18 inches of span is making any noticeable difference in the climb of the Citabria while towing a banner. My guess is that it is the changing of the airfoil to a higher lift airfoil by using flaps that makes the real difference. KM

Arming Switches for the Power Battery

Since I mentioned switches last month, I received quite a few emails regarding them, and everyone one of them stated that they believe they are a good safety idea.

It is my opinion that you should do anything that makes you feel safer at home or at the flying field. Use a switch if you believe that is the best way to go, for added safety.

I am NOT saying, "Don't use a switch!"

I am saying that I do not use a switch in most of my planes.

I outlined MY procedure last month, and restate it again here. When I am ready to fly, I turn on my transmitter, then the receiver and then connect the power battery. I button up the plane and go fly. After landing, I disconnect the power battery, shut off the receiver battery and then the transmitter. I remove the Li-Po battery from the airframe.

I have a switch in my Ryan STA that is very similar in concept to the one that I showed last month from Maxx Products. The plane uses a 4S 4000mAh Li-Po for power. I installed the switch because I prefer to take two 6-minute flights rather than a 12-minute flight. After the second flight, I remove the struts and wing and then remove the Li-Po pack. I do not leave it in the plane for transport or charging.

Here are some of the emails I received concerning power switches:
From Bill Mackey

On switches, I agree that charging outside the aircraft should be done with Li-Pos. However, I think an on /off switch would be a safety addition. Once we plug the main battery in, the motor is ready to go and an inadvertent bump of the throttle could cause trouble.

Now for a good laugh...Last week I flew my small Extra 330 with a Hacker A20 off our grass field. The wheels are so small it really won't taxi. After landing, still with transmitter on, wearing gloves due to the cold, I was walking out to pick up the plane when it suddenly powered up and took off! Carrying the trans in my left hand, I must have caught the throttle stick with my floppy jacket. I was able to recover quickly enough to save it. Good thing no one saw this!

Many decades ago, when I was flying glow, I picked up the habit of always holding my left thumb down on the throttle stick of the transmitter whenever I carried a running plane. Later, some transmitter manufactures, like Hitec, actually put this as a function button on the transmitter face; throttle hold. My Eclipse 7 has it. I still use my thumb.

Today, when I have a "live" plane and I'm touching the transmitter but not ready to take off yet, my thumb is holding the throttle closed. I don't think that the plane may not come on for some reason, so I am also restraining it as well, but since I am actively involved with the plane and preparing for takeoff, I can't "bump" the throttle stick, as I am actively holding it down. If you hold the throttle stick down when you go to pick up the plane after a landing, it won't take off again because you bumped the throttle stick.

But AGAIN, do what YOU feel is safe!

From Dave Segal, Keystone RC Club

I wanted to add a comment to the question raised by John Mrozinski on arming switches. Bob Kopski pointed out in his column in the August, 2004 issue of *Model Aviation* that brushless motor ESCs will kill any arming switch due to the very large capacitors in the ESCs and their low resistance. He said the effect is equivalent to a "dead short". He also explained that while the arcing will occur with Anderson Power Poles the ingenious design of the contacts limits the arcing to the non-critical tip of the connector. Bernard Cawley is given credit for this observation.

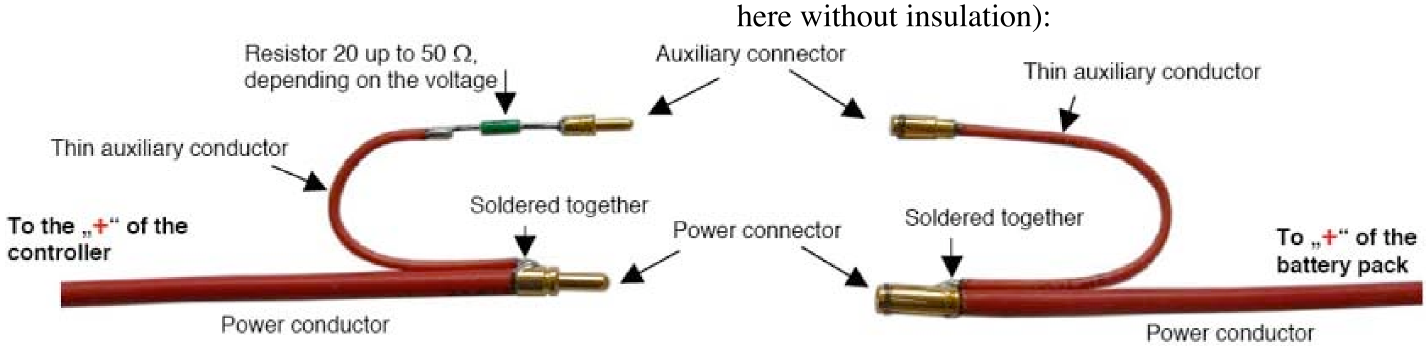
Thanks for the reminder about a possible problem. You can find the solution to the arcing problem at
http://mgm-compro.com/pdf/en-antispark-d230808.pdf

How to prevent sparking

When connecting a Li-xxx pack to the controller, strong sparking commonly occurs. Fast charging of the controller filter capacitors causes this. The higher the voltage (the higher the cell count), the lower the internal resistance (and the better the quality of the pack). The better the capacitors in the controller and the higher the capacity of the capacitors, the bigger spark occurs. Besides the small shock (due to the sparking), the charging current of the capacitors may be in, extreme cases, so great that damage or destruction of the capacitors occurs.

A simple procedure exists to eliminate sparking when connecting the battery pack. This inexpensive modification eliminates sparking and thus protects the filter capacitors.

How to connect the positive leg or wire (shown here without insulation):



Connectors, as well as the resistor, are insulated by heat shrink tubing.

How to connect the battery:
1) connect the "– " leg of the battery to the "– " on the controller.
2) in the positive circuit, first connect the "+" leg of the controller to the auxiliary connector (to which a resistor with tens of ohms is connected in serial). This will limit the charging current when connecting the wires and will charge the filter capacitors without sparking.
3) now connect the power wires (sparking will not occur). You may start the motor now.

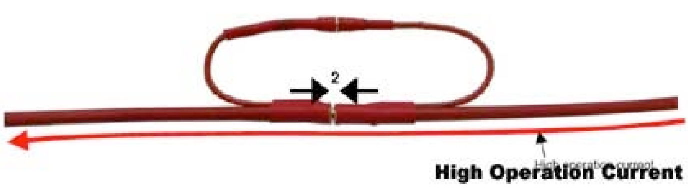
There are no special requirements on the auxiliary connector. The current is small (1- 2A) and lasts only for a short time.

There are also no requirements on the resistor, any type is sufficient, e.g. metallized 0.6W, size 0207, value between 20 to 50Ω depending on the voltage of the battery pack. E.g. for 4 – 6 Li-po use 20Ω, for 10 Li-po 33Ω, for 12 up to 15 Li-po 51Ω. However, it is not necessary to use these exact values because of wide variation.

How to connect the positive leg

Connect the new auxiliary connector first. Capacitors are charged with small current. Sparking will not occur.

Now connect the power connectors (sparking will not occur). Main current to the controller and the motor during operation passes through these power connectors and conductors.



From Scott Paschen

Ken, here is a quick story of what could have been a real mess and was a smashed up airplane. Also a good example of why there are AMA rules.

I was flying at a huge open area of about 1800 feet x 1500 feet. I was giving a father and son a little demo and landed to talk about flying. I parked the plane and placed the radio in the back of my open cargo van.

The gift of gab took over and we talked. It got quite breezy out. My three and a half year-old was playing with a foam glider and I asked him to place it in the back of the van. He did as instructed. The wing hit the throttle and the plane taxied across the ground right at the people and me while I am talking to them. My size 12 went up to deflect it and avoid the 14x7 spinning machete APC prop. It went right into the side of an S-10 pick-up. The crash broke my ship in half. It was going about 3/4 throttle when it hit.

Small electrics are probably not as critical, but this was a 5 cell 3700mAh Li-Po set up right around 1000 watts. I will have the external arming switch from now on.

The other thing I cringe at is plugging the battery in and having to be near the prop. This eliminates the fear of something going haywire at least until you can get hold of the plane from behind and plug her in.

After sharing my story and obviously embarrassed, I found out that several other really good flyers had done similar things.

Emeter II: First Impressions and Use
By Ken Myers

It is FINALLY here!

I have been using my Hyperion Emeter version 1 (Emeter I), shown on the left in the photo, for many years now. It has been my main test instrument for gathering electric power system data to add to Drive Calculator (http://www.drivecalc.de).

Unfortunately the Emeter I, because of the unavailability of certain parts, ceased production long before the demand ran out. The version 2 (Emeter II), shown on the right in the photo, is now available, and it certainly looks like it has been well worth the wait.

Mark and Phil Connolly have created a wonderful new tool for those who like to explore electric power systems, working together with David Radford who does development work for Hyperion products. I want to thank David for the preproduction unit that is being reviewed here. http://media.hyperion.hk/dn/em2/

Over the past couple of years, I toyed with the idea of purchasing and Eagle Tree Systems' eLogger so that I could record in-flight data, but that would have required the purchase of a new laptop computer that uses the Windows operating system. I really didn't want to purchase a new computer, and I am not a fan of the Windows operating system.

When I heard that the new version of the Emeter had remote logging and did not require a Windows computer, I was elated!

The Emeter II consists of the main unit that has the backlit screen, SD card slot, navigation buttons, and potentiometer dial to control servos and ESCs, and an optical tachometer. It has a 5-cell 750mAh NiMH battery pack and built-in charger. According to the documentation that I have, the battery should now last between 18 hours and 50 hours depending on how the meter is being used. The Remote Data Unit (RDU) has the ability to record data to its own memory for later transfer to the main unit. When the RDU is hooked to the Emeter II, the data can be captured and displayed on the main unit when bench testing. A Data Cable is used to transfer files to the main unit from the RDU and to communicate data from the RDU during bench testing. The Emeter II may also be used for Hyperion Titan and Atlas ESC setup as well as the Hyperion digital servos. A Power Cable connects the main unit's charger to a 12v – 15v power source.

The Emeter II does not come with a SD card. I picked up a 4GB SD card, the largest usable size noted in the Quick Guide, at Staple's for less than $16.00 including Michigan sales tax. That large of a card is NOT really required though!

The first thing I did was put connectors on the power cable and attach it to my 12v Marine/RV battery for charging.

Next I crimped Anderson Power Poles (APP) onto the leads of the RDU and weighed it. The power leads on the RDU appear to be 10ga. wire, and the APP connectors accept 12ga. wire. I clipped off the pre-soldered part of the power lead wires on the RDU. I opened the APP connectors using a fine blade screwdriver so that the connectors would accept the 10ga. wire when screwed onto the bare wire. Then I crimped the connectors and slipped on the outer housings.

The RDU, with four APP connectors, weighs 33.55g/1.18 oz. I chose APP connectors because that is what I use. They would not be appropriate if used near the unit's maximum power level of 150 amps and 70v!

The RDU is used instead of the shunts that were available for the Emeter I.

I should note that there were no supplied manuals or guides with this preproduction unit. The only guide I had available for use when I started writing this was the Emeter v2 Quick Guide 2.06 dated December 28, 2008.

I read through the On Screen Help and Navigation section of the guide to get an overview of the operation and learned that there are two modes of operation. The Bench Test mode is when the Emeter II is attached to the RDU and the Analyser data is recorded to the SD card or saved as 1 of 8 Snapshots. During the In-Action mode the data is recorded to the onboard memory of the RDU and later easily transferred to the Emeter II.

To me, the SD card went in the side slot of the Emeter II upside down, with the label on the SD card facing away from the screen when inserting it.

When the Emeter II is turned on, that last action used will usually be the first screen displayed when the unit is powered up again.

Since my Emeter II is a preproduction unit it arrived with firmware version 2.04 installed.

I downloaded firmware version 2.06 the Aircraft-world Web site onto my Mac. My Mac automatically unzipped the files from the download.

I decided to poke around the files a bit. I found that data is recorded in a .log file. It is a comma delimited text file. That means that the file can be opened in Excel or with the Open Office spreadsheet and the data can be viewed and manipulated with no other software needed. Cool!

I calibrated the meter using my Radio Shack #22-168A Digital Multimeter. It is not an inexpensive meter, but I have no way of knowing how accurate it is, but since I use it, I calibrated the Emeter II to it. The volts matched 100% and I adjusted the amps down on the Emeter II by 0.01 amps, which I'd call a close match. I used a short run of a motor I had on a test stand at no load as my constant amp reference to match the Emeter II to the multimeter.

I plugged my SD card reader into the Mac USB port with the SD card in it. The Icon for the SD card showed up on the desktop. Since the firmware update files were already unzipped, I dragged them over the SD card icon, and in a few seconds the files were transferred to the SD card.

The firmware upgrade to the Emeter II is done by holding down all four buttons, A, B, C, and D, and then turning on the Emeter II. The update started automatically, and was completed very smoothly. The hardest part to the update was holding down all four buttons at the same time and turning on the Emeter II. Luckily, I have pretty small hands.

Next, the RDU was updated using the easy to follow onscreen menu to RDU SETUP, holding down the D button for three seconds and then selecting Upgrade. That went smoothly by just following the prompts and confirmations.

The first batch of production units will have firmware version 2.06 or higher already installed.

I have always wanted a way to "run" my ESC without turning on my transmitter for bench testing. It can be done with the Emeter II. Plug the ESC lead into a servo driver port. Turn on the Emeter II. Plug in the power battery and control the ESC with the potentiometer dial on the front of the Emeter II. This will work no matter what other function of the Emeter II is being used. If a non-BEC type ESC is being used, a receiver battery can be plugged into the other open servo, as the two ports serve as a "Y" connector.

The Emeter II can display the pack resistance in Ohms in the READINGS section under the PEAKS menu. The cell resistance can be determined by dividing the resistance by the number of cells. There is currently a thread on RC Groups about a unit being designed by a fellow to do just this.
http://www.rcgroups.com/forums/showthread.php?t=980290
The Emeter II already does it.

I logged a "practice" Bench Test using the Emeter plugged into the RDU and an In Action "practice" test using just the RDU. The Bench Test, when ANALYSER mode is chosen, logs the file to the SD card with a push of the C button. When an In Action test is done, and data captured by the standalone RDU, the Emeter II automatically recognizes that the RDU has data on it when the RDU is connected to the Emeter II and the Emeter II is turned on. A button press transfers the data from the RDU to the SD card in the Emeter II.

Phil Connolly sent me a "preview" version of the upcoming manual. It arrived via email just before the January EFO meeting was to start, so I didn't really have a chance to go through it until the following day.

The Introduction to the manual really defines what this tool is:

"**Introduction**

Emeter II was designed as a standalone tool, which may be used to:

*Measure, record and analyse the key performance factors for electric powered models.

*set control parameters for Hyperion digital servos and Electronic Speed Control units (ESCs)

*simplify testing of components of an electric power unit with servo driver, servo tester, cell internal resistance and capacity checks

*support the operation of the model in the field with multiple stopwatches, countdown timer, altimeter and temperature gauges

It operates in the field or on the workbench without the need for a Personal Computer but can communicate simply with PCs if required. Unlike its version 1 predecessor Emeter II is also designed to capture data whilst the model is in action."

The Emeter/RDU is reverse polarity protected. Hooking up the main power pack will not "kill" the units, but it will not function properly.

After reading through the rough draft of the manual, I decided to see if I could program the Servo Tester to run up my ESC to full throttle and hold it there for 5 seconds. After a couple of tries, I had it programmed and ready to try a real world test.

I programmed the throttle on the Scorpion Commander V2 45 amps ESC to the Emeter II and then did my usual data collection for Drive Calculator with four different prop runs and two no load runs. The prop was mounted to the motor and then the Servo Tester started with its logging feature. Each of the six runs were logged, creating six logs files.

During this process, one minor, and I mean very minor annoyance showed up. The menus are moved through in a sequential order by pressing the D button. There is no way to "reverse" the order and go back up through the menu. The MAIN MENU, in order from top to bottom reads - READINGS, PROGRAMMING, STOPWATCHES, SERVO TESTER, LOG FILES, RDU SETUP AND EMETER SETUP. After using the SERVO TESTER to run my motor up to full throttle and log the data, I would then switch to the LOG FILES to see that the meter had captured usable data. When I was ready for the next prop, I had to continue to press the D button until I returned to SERVO TESTER, which was only one place "up" from LOG FILES, but it took 6 button presses to get back there following the sequential order. It is not really a big issue, but having a way to reverse the menu selection would be nice.

I opened up each log in turn using Excel and decided which data I wanted to add to the spreadsheet that I create for each motor that I test and put into Drive Calculator.

Next I opened Drive Calculator and input the data that I had gathered for the motor I was testing, a Scorpion S-3020-11T. The Drive Calculator virtual model was almost a perfect match to the data that I had gathered with the Emeter II.

This was much easier than taking the Snapshots and averaging them, as I had done previously with the Emeter I.

This is an amazing tool, and I am looking forward to more motor tests, as well as other uses of the neat features. I love this tool!

This tool should be available by the end of January 2009 and have a price of about $200US for the Emeter II and RDU. The phase tachometer and temperature sensors are sold separately for about $10 each.

Scorpion S-3020-11T & Scorpion Commander V2 45-Amp ESC Review

By Ken Myers

I have a "new" 3S1P "A123" design in progress and I wanted a new motor and ESC for it. I wanted to try the Scorpion brand, as I have been recommending it to my flying buddies for quite a while now. I have found that a 1200ish Kv works well with a 3S "A123" pack and 10-inch diameter props from my experience with my Son of Swallow. The SoS uses a Hyperion 3019-10, but my particular motor is odd, because it has a Kv of just over 1200, as I've noted before here in the *Ampeer*. The Hyperion 3019-10 weighs 145g. I looked at the Innov8tive Designs site (http://www.innov8tivedesigns.com) and noted that the 3020 series motors weigh about 154g, which is close enough, but the highest Kv available is the S-3020-12 with a Kv of 1088. I know that the winds and Kv are pretty much proportional. I multiplied 12 (the winds) * 1088 (the Kv) and divided that answer by 1200 (the Kv I wanted). (12 * 1088) / 1200 = 10.88, which indicates and 11 wind.

I contacted Lucien Miller at Innov8tive Designs and asked if I could get a special 11-turn wind S-3020. He suggested that I contact Daniel Sny at http://www.gobrushless.com.

I contacted Dan by phone and asked if he could make me a special 11-turn wind using a Scorpion 3020 kit. He said that it was no problem. I ordered the Scorpion 3020 motor kit and had Dan do a custom wind for me.

To wind an 11-turn, the first tooth in phase has 6 turns then the tooth next to it has 5 turns. The phase is completed by winding a mirror image of these two teeth on the other side of the stator (this is what they mean when they say distributed LRK). It ends up with a total of 11 turns per tooth.

This is the information Dan sent to me via email and also along with my motor pertaining to my custom wind S-3020.
"11 turns, 20AWG, DLRK, Delta, using a 6-5 winding pattern.
12300 RPM at 10V, 2.78A, 1230Kv"

As soon as I received the motor I ran the drill press test to verify the Kv. The results of the drill press test yielded a Kv of 1226. Yes, a motor where the supplier got the Kv right! ☺ Thank you Dan and thank you Scorpion.

I set up the Scorpion Commander V2 using the extremely easy to use IR programmer. I set the LVC to 6v for use with my 3S "A123" pack and left the timing on Auto. This is one very easy to use ESC programmer and beats the heck out of using a transmitter and the beep, beep, dah, doos. I think I may like it even more than the Castle Link, which I like a lot, since I don't need a computer to use it. The ESC's response is smooth and it has a good range. It has a linear BEC, but that's not a problem at all with a 3S "A123" pack.

The only real problem that I have had so far with this ESC is that the instruction and use sheet uses a font too small for me to read, way too small. I couldn't find the instruction sheet on the Innov8tive Designs' site and had to go to the Scorpion Systems site. Once I had it on my computer I could read it.

I reversed the shaft of the motor so that I could use the "+" mount. It was a very easy process.

First I gathered data using my four selected props. The props were balanced and then run from the largest to the smallest, using the SERVO TESTER program that I wrote. All testing was done on a single, non-recharged 3S "A123" pack. The no load data was then collected. Here are the results that I put into Drive Calculator. Remember that the values do NOT represent the highest values that might be seen on a fully charged pack for each prop.

No Load #1 10-cell 1700mAh NiCad pack
13.1v, 3.1 amps, 15900 RPM
No Load # 2 6-cell 2000mAh NiCad pack
7.78v, 2.5 amps, 9420 RPM
APC 9x7.5E
8.79v, 30.95 amps, 8880 RPM, Drive Calc eff. 75.8%
parkzone T-28 9.5x7.5
8.745v, 32.9 amps, 8685 RPM, Drive Calc eff. 74.9%
APC 10x7E
8.83v, 32.65 amps, 8820 RPM, Drive Calc eff. 74.9%
Master Airscrew 10x8 G/F 3 Series
8.82v, 34.55 amps, 8715 RPM, Drive Calc eff. 74.3%

The Specifications:
Scorpion S-3020-11 (1230 Kv) Outrunner
Motor weight/no prop adapter: 148.6g/5.2417 oz.
Measured Kv: 1226 rpm/V
Outside diameter: 37.5mm/1.47638 in.
Bell length: 27.5mm//1.08 in.
Bell length w/protrusion: 34mm/1.34 in.
Shaft length: 76.5mm/3.012 in.
"+" mount w/4 screws: 5.5g/0.194 oz.
MPI MAXX ACC378 Prop Adapter (motor shaft 5mm/prop shaft 8mm): 12.9g/0.455 oz.
Master Airscrew 10x8 G/F 3 Series: 22.2g/0.783 oz,
Scorpion Commander 45A V2 ESC
Weight with connectors (3 bullets & two APP): 47.6g/1.68 oz.
Size: 3.625 in. L, 1.16 in. W, 0.4375 in. T
Size, metric: 92.1mm L, 29.5mm W, 11.1mm T
Note that the size differs greatly from the specifications that are:
75 x 30 x 9 mm (2.95 x 1.18 x 0.35 in)
I measured the length of the ESC from where the wires can actually bend, not from where they exit the ESC.
3S1P "A123" pack
w/Velcro & connectors: 241.3g/8.5 oz.
Total Power System weight: 430.5g/15.19 oz.

Earlier I mentioned that Scorpion did not produce a 1200Kv motor at the weight I wanted. They do have a S-3014-16 with a stated Kv of 1187 and weight of 122.1g/4.3 oz. While this may appear to be a better choice because of the weight, it isn't. Using Drive Calc figures for the 3S "A123" pack and the MA 10x8 G/F 3 Series prop:
S-3020-11 8.83v, 34.9 amps, 8687 RPM, 307.9 watts in, 228.9 watts out, Drive Calc eff. 74.3%
S-3014-16 8.89v, 30.5 amps, 8224 RPM, 271.3 watts in, 194.2 watts out, Drive Calc eff. 71.6%

The 3020-11 weighs 26.5g/0.93 oz. more but increases the pitch speed by 3.5 mph, and watts out by 34.7, easily offsetting the slight weight increase of the 3020. Also, an outrunner motor with less weight/mass is generally not as efficient as one with more mass and the same Kv. That can be seen in the efficiency numbers. The higher the efficiency, the cooler the system runs.

Many times, if the smallest possible motor is used, the battery must be placed very far forward, which exposes it to more potential crash damage than when placed further back in the airframe. This is especially true when using Li-Po packs.

While I am talking about weight and Kv, I would like to note that a truly meaningful way to name outrunners is by their weight and Kv. Therefore, my 3020 would be known as a Scorpion 149-1230 and the 3014 used in the example above as a Scorpion 122-1190. All of the other outrunner motor nomenclature can be ignored. (Continued next month)

Ampeer Paper Subscriber Reminder

When subscribing to or renewing the paper version of the *Ampeer*, please make the check payable to Ken Myers. We do not have a DBA for the *Ampeer* or EFO. Thanks, Ken

Upcoming E-vents

All Tuesdays through the Winter Skymasters RC Club presents Indoor Flying at the Ultimate Soccer Arenas, 867 South Blvd, Pontiac, MI (west of Opdyke on the north side of South Blvd) from 11 a.m. through 1 p.m. Check the Skymasters' website (skymasters.org) for event status throughout the winter. Five Sessions for $25. Pilots must show proof of AMA membership For more information call Joe Hass 248-321-7934

January 23, Friday, indoor flying at the Saline Middle School Gym, 7190 N. Maple Rd, Saline, MI 48176
Cost: $10.00 per flyer Time: 7:30 p.m. to 10:00 p.m.
Coordinator: Phil Smith: 734-429-4707 (call if any questions) E-mail: jphilipsmith@verizon.net
Upcoming dates: January 23, 30, February 6, 20, 27, March 6, 20

February 5 Thursday, monthly meeting of the EFO, 7:30 p.m., Ken Myers' house, 1911 Bradshaw Ct., Commerce Twp., MI, 48390
Everyone with an interest is welcome!

February 7 & 8 4th Annual E-Fest Indoor Electric Festival, Champaign, IL info www.gpe-fest.com

March 13 - 15 Electric Flight Expo, Univeristy of Phoenix Stadium, info www.efexpo.com

April 3 - 5 55th Annual Toledo Weak Signals R/C Expo ("The Toledo Show"), Toledo, OH Info at: www.toledoshow.com

Important Notice!
The EFO WEB site has had to move.
Now at: http://homepage.mac.com/kmyersefo

The Ampeer/Ken Myers
1911 Bradshaw Ct.
Commerce Twp., MI 48390
http://homepage.mac.com/kmyersefo

The Next Monthly Meeting:
Date: Thursday, February 5 **Time:** 7:30 p.m.
Place: Ken Myers's House
Everyone with an interest is Welcome