

Silver Lining

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Radio Control Flying Club
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Flying Field GPS location N42 48.596 W83 34.642

www.hollycloudhoppers.org

Be Safe, Have Fun and Don't Have Too Many Rules!

Behind The Flight Line

Scott Rhoades, *HCH* Editor

sdrhoades25@hotmail.com



Here is an interesting bit of trivia. Did you know that the HCH website consists of 140 different pages? What that means is, if you wanted to see every single section that makes up the entire HCH website you have 140 clicks of the mouse ahead of you.

Did you also know that usage statistics are recorded every month showing, amongst many things, a ranking order of which pages visitors looked at the most? For curiosity sake, I decided to look for trends and review this stat each month over the past year. This review did reveal something interesting. Out of 140 pages, there were three that made it into the top ten most viewed list every single month. Can you guess which ones they are?

If one of your guesses is the Homepage you are correct. Anybody that enters www.hollycloudhoppers.org into a web browser is automatically taken to the HCH Homepage. For obvious reasons, it's typically the number one viewed page every month.

On the Cover:

**Jim Finch's RCM Basic Trainer
Built from plans that originally
appeared in RC Modeler
Magazine in 1972**

Photo by Scott Rhoades

If your next guess is the Members Only section, you are correct again. Apparently a lot of members either forget the gate combination or want to get the phone number of fellow member from the roster.

Now if your third guess is a Newsletter I'll give you partial credit but is not the correct answer. It is true that a "Newsletter" was either number one or number two every month; however, the editions change throughout the year. For example, the Winter edition may be one of the top two viewed pages for a few months but then disappears off the list as soon as the next edition is released. Therefore, a new 'page' is on the 10 most viewed lists, even though it is a newsletter.

There is only one single page, out of the remaining 138, that visitors consistently accessed more over the past year than any other; more than club pictures and more than any single edition of the newsletter and certainly a lot more than club information, rules, bylaws or whatever.

Give up yet? The correct answer is the Classifieds.

That's right, despite no new ads being posted in the classifieds for several months; it still was one of the most regularly visited pages of the year. If that surprises you, you may also be surprised by this other bit of statistical data; the website averaged 940 visits a month last year.

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It doesn't take a mathematician to figure out that a heck of a lot of people looking at the classifieds. So where do you think the smart place is to try and sell that engine, plane or radio gear you no longer want?

About this time of year I always find myself wondering what kind of flying season the coming summer will be. I wonder about stuff like; is going to be windy a lot, and will I be doing more repairing than flying?

This year instead of wondering and guessing, I'm being proactive. I've decided to make use of a scientific approach for assessing future events. A system that:

- Has a higher degree of accuracy than the Farmers Almanac.
- Has been proven to out perform the best Wall Street analyst.
- Has been used in making colossal business decisions.

My high tech prognosticating apparatus is

none other than Mattel's Magic 8 ball.

With my kids done using the Magic 8 ball to do their homework, it was my turn to ask it a series of questions regarding what type of flying season 2011 will be.

I'm sure the one question all HCH members want to know is; will the winds be light and very favorable for flying all summer? I asked the magic 8 ball and it answered. Most Likely

Q: That's good news. Will the weather be nice for HCH events?

A: Don't count on it

Q: Does that mean all of them will have crappy weather?

A: Reply hazy try again

Q: OK you probably need me to ask about specific events. First one I'd like to know about is the Fun Fly. Will it have good weather?

A: Outlook Good

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Links to key HCH web pages

Home page

<http://hollycloudhoppers.org>

Officer contacts, Announcements, Weather, Club Dates, Etc

Members Only (password protected) <http://hollycloudhoppers.org/members.html>

Financial report, Meeting minutes, Club roster, Gate code

Classifieds

<http://hollycloudhoppers.org/classifieds.html>

Field Operation Rules

<http://hollycloudhoppers.org/documents/Field%20Operational%20Rules.pdf>

Newsletter Archives

<http://hollycloudhoppers.org/newsletters.html>

Club Frequency Usage

<http://hollycloudhoppers.org/documents/clubfreq.pdf>

Web page help

http://hollycloudhoppers.org/help_faq.html

Membership renewal

<http://hollycloudhoppers.org/renew.html>

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Q: How about the Open House?

A: Don't count on it

Dang!

Q: Will the club tractor operate trouble free all season so the club can keep the grass short?

A: Outlook not so good

Q: That's not good. Will it be motor trouble?

A: Most likely

Double dang!

Q: Is the club going to see an increase in membership numbers?

A: Very doubtful

Q: Is this because the price of gasoline will go way up as predicted this summer?

A: As I see it yes

Dang again!

Q: How about technology? Can we expect to see some exciting new products released this year?

A: It is decidedly so

Q: That's interesting. Is it going to be better batteries?

A: My reply is no

Q: How about radio gear then?

A: Yes

Ok, this last question will determine if I should even leave the house with an airplane this summer or not.

Q: Magic 8 ball will I crash a lot this year?

A: Better not tell you now



Q: What do you mean, better not tell me now? Is it bad news?

A: Ask again later

Q: OK it's later?

A: Concentrate and ask again

Q: For crying out loud I am concentrating... AM I GOING TO CRASH A LOT OF FRIGGEN PLANES OR WHAT?

A: Cannot predict now

Q: I give up. What a piece of crap! Where's the Ouija board?

A: Don't count on it

Q: Oh so you think you're better than the Ouija board?

A: Without a doubt

Q: You're scaring me. Can we be done now?

A: My sources say no

Help! †

Things to ponder

Map Quest really needs to start their directions on #5. I'm pretty sure I know how to get out of my neighborhood

2011 Chili fly

Photos by Scott Rhoades



Electric Powered Flight

By Scott Rhoades and Mike Wizynajtys

Part 2: Sizing the power system

Welcome to the second article in the series of de-mystifying electric powered flight for the glow pilot. In the first article we covered Volts, Amps and C rating, and you can view that article here. <http://hollycloudhoppers.org/newsletters/39%20Fall%202010.pdf>

Before we precede any further, a huge omission made in that first article that needs to be resolved. Mike Wizynajtys was credited for supplying the original PDF which much of these articles are biased but was not credited for his co-editing efforts. Mike's input has been absolutely instrumental in these articles.

In this segment we are going to talk about the area of electric flight that typically trips up those of us accustomed to using glow engines and that would be sizing the power system to the plane. There is one simple phrase that will make understanding electric flight very easy... Forget everything you know about glow engines!

Most guys want to mistakenly think of electric motors as having a direct equivalency to glow. To say electric motor X will work in a Y size glow plane would be misleading. Even though some motor manufacturers have started advertising such numbers, other factors beyond the motor must be considered. So such a numbering system is at best, very rough! Once you read this article hopefully you will understand why.

Watts = Power

Before getting into sizing the power system we need to introduce Watts to the

discussion. First a little refresher... Remember the analogy of comparing electricity to water in the first article? Volts (V) = pressure, while Amps (A) = flow. Volts is like pounds per square inch (psi.), however it says nothing about how much water is flowing, only how hard it is being pushed. While amps, on the other hand, is flow; similar to gallons per minute of water going through the pipes, regardless of the pressure. Does all that sound familiar?

Watts is simply Amps times Volts ($A \times V = W$). A single Watt is a unit of electrical power. The number of watts tells you how much electric power is being used. To explain watts, we'll continue with the water analogy. Picture a waterwheel like the ones that were used to turn grinding stones in watermills. For our example the waterwheel is the motor and the grinding stone is the prop. If we take a hose and direct it onto the waterwheel to get it to turn, the power generated by the waterwheel can be increased two ways. The first way is by boosting the pressure (V) of the water coming out of the hose, as it will hit the waterwheel with greater force. Second way is to increase the flow rate (A). The waterwheel turns faster because of the weight of the extra water hitting it. It's this combination of the two that equal's watts (power).

It can also be said that watts serve the same purpose as the horsepower rating of your car's engine. In fact 746 watts = 1 horsepower. As we will see, the size and efficiency of a motor and the load imposed on it by the propeller affects the Volts and Amps. Keep this in mind, Amps don't fly a plane and neither do volts. Watts are the measure of electric power that fly's a plane.

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You can have a high voltage and low current (amps) and generate as many watts as low voltage and a high current.

The Battery

A battery is more than a fuel source, it's the fuel tank, fuel pump and a supercharger all rolled into one. It feeds/pushes energy to the motor. So we must look at the battery and the motor as one complete unit when sizing power systems for electric planes. What we're about to tell you may seem completely backward... In many cases the size of battery is often determined first. The motor can't deliver the power to the prop if the battery can't deliver the power to the motor.

Matching up the pieces

The idea is to choose a motor, battery and propeller combination that will fly the model in a desired manner and within the specifications of the components. Ideally we want the motor to be operating near its peak efficiency.

Further away from peak that a motor operates, the more a battery's power will be turned into heat instead of performance.

Just like glow, we want a power plant suitable for the type performance we wish to have. Obviously a trainer plane will need considerably less power than a 3D model of the same weight. So to help figure out what is needed, below is a table providing performance in watts needed per pound of airplane, which includes motor and battery weight.



3S Lithium Polymer (LiPo) pack

70-90 watts per lb. Trainer and slow flying aerobatic models.

90-110 watts per lb. Sport aerobatic and fast flying scale models.

110-130 watts per lb. Advanced aerobatic and high speed models

130-150 watts per lb. lightly loaded 3D models and ducted fans.

150-200+ watts per lb. Unlimited performance 3D models.

Note: The general rule of thumb above was first conceived by Mr. Electric himself, Keith Shaw.

As an example

Using the above formulas let's calculate how many watts will be needed to fly a 5 pound plane. For this example we'll assume our plane is a slow flyer designed for medium aerobatics. According to the chart we need 70 watts per pound. Doing the math we need 350 watts to fly this 5 pound plane. ($70 \times 5 = 350$)

If we wish to bump the performance, we could figure 100 watts per pound for our 5 pound plane, now we're looking at 500 watts ($5 \times 100 = 500$). (Note: increasing watts may lead to the need of a bigger motor and battery thus increasing the overall weight)

Sizing the Battery

Deeming 100 watts per pound to be suitable, let's figure out what our amp draw will be. First we need to determine how many cells the LiPo pack will be flying our plane? For our

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example we can safely assume a 2S pack is too small so we're looking at either a 3S or 4S pack. Let's run the numbers on what a 3S will give us.

Since each cell of a LiPo is 3.7 volts a 3S pack will be 11.1 volts. ($3 \times 3.7 = 11.1$) Taking our target 500 watts and dividing it by 11.1 volts tells us our target amp draw will be 45 amps ($500 \div 11.1 = 45$).

Using a battery that will supply 45 amps or slightly above will fly our plane and probably do so very well. With the numbers we have so far, we can do more calculations to determine what size mAh pack we will need to provide a desired duration.

Even though it's unlikely a plane will be flown at Wide Open Throttle (WOT) for an entire flight, we use the duration (how long it takes to drain a full battery at WOT) as our starting point for getting the right battery capacity.

For a good balance between battery size and function, many modelers calculate for 4 minutes of WOT. Obviously this totally depends on the type of flying you intend to do. If you're a guy that just likes to putt around the sky at half throttle, you may want to calculate for fewer minutes of WOT. With this you very likely can get away with less expensive and lighter weight batteries by going to a lower mAh and/or lower C rated batteries.

Here's how duration calculations work. Take 60 (minutes) divided by the target amp draw. (For our example that is 45) Now divide the sum by the minutes of WOT looking to achieve. (We'll use 4 minutes) The result gives us a total of 3 amp/hours. ($4 \div (60 \div 45) = 3$)

The 3 amp/hour number is based on total capacity of the battery. Since we don't want

to completely drain battery, we'll take those 3 amp/hours and add in a safety factor so during our 4 minutes of flight we will use only 80% of the total battery capacity. To do this we'll use a multiplier of 1.25.

The final calculation will look like this: 3 amp/hours, multiplied by 1.25 equals 3.75 amps or 3,750 mAh ($3 \times 1.25 = 3.75$) ($3.75 \times 1000 = 3,750$)

There you have it; if the motor/prop combo does actually draw 45 amps at WOT. A 3,750 mAh battery pack is needed to get 4 minutes of WOT within the 80% safety factor.

Using a 3,750 mAh pack with a 30 C rating shows that we can safely draw 112.5 amps from this pack ($3750 \div 1000 \times 30 C = 112.5$). There should be no battery overheating issues here and the battery will live a long and happy life in that job. Now it needs to be noted that just because a battery can supply over 100 amps doesn't mean you should be using a motor/prop combo that will draw that much amperage because that is just crazy.

Maybe a 3,750 mAh battery is a little heavier or physically bigger than we want and a little investigating shows that a 3,200 30C pack is just right from a physical stand point. If we can accept a little less WOT time, then that's probably the right battery to pick.

A more feasible option for this plane just might be going up to a 4 cell pack (14.8v) which will lower the amperage. ($500 \div 14.8 = 33$ amps) As opposed to the previous 45 amps.

Same 500 watts but lower current which equals longer flights or you can buy smaller capacity battery and have the same length flights but in either case the equipment will

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run cooler at this lower current. You can see how there are a lot of options here with no single solution?

Motors

Once our battery needs have been calculated we can now think about a motor that will work in the parameters we've established i.e. amperage and battery cell count.

Various motors are available however outrunners have become the most common in recent years due to their low cost and simplicity. Geared inrunner motors still rule the day at the top levels of competition but for simplicity we'll keep the discussion to just outrunners.

What is an outrunner? It's a motor constructed with the copper windings on the inside. The shaft is attached to a "bell", or casing that contains the magnets, which spin around the copper windings. Because the extra weight of the bell and magnets are further out from the shaft it acts like a flywheel. Generally outrunners produce lower RPM and higher torque than other styles which enables them to spin a larger prop without the need of a gearbox.



Outrunner motor

What is Kv?

Kv is simply the revolutions per minute (rpm) that an electric motor will spin per volt, when under no load. What does the Kv tell us? Well it is related to the power output from a motor, or more usefully the torque level of a motor. This is all determined by the

number of winds on the armature and the strength of the magnets. There are so many variables with electric motors and Kv allows us to get a handle on the torque we can expect from a particular motor.

A low Kv motor has more winds of thinner wire - it will carry more volts at less Amps, thus producing higher torque and able to swing a bigger prop.

A high Kv motor has fewer winds using a thicker wire and will carry more amps at fewer volts, thus spinning a smaller prop at high revolutions.

You would not use a low Kv motor in a ducted fan because you need high rpm with the small impeller. You would not use a high Kv motor in a 3D performer because you want to swing a large prop more slowly and obtain a high output of torque.

Prop selection

Prop selection is the third and equally important piece of the power system sizing puzzle. The propeller is the component that puts a load on the power system. The larger the diameter or the steeper pitch of the prop, the more energy or more watts will be required to turn it. Therefore we need to balance the diameter and pitch with the power or wattage of the motor/battery system.

Knowledge of how prop pitch and diameter affect performance is necessary to understanding how a power system is sized, however since this article is directed to the experience glow modeler looking to get into electrics, we will skip those explanations. If you want more info on prop dynamics, here is a good link to start with.

http://www.airfieldmodels.com/information_source/model_aircraft_engines/propellers.htm

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To explain how a prop affects the motor and battery let's revisit the waterwheel example. Remember we said earlier that the grinding stone is equivalent to the prop? Consider what would happen if the stone was too big in relationship to the wheel or it was overloaded with grain to grind? A much greater volume or force of water would be required to turn the wheel and soon the extra force/volume will be too great thus damaging the whole mill. If you want a bigger grinding stone or want to grind more grain, you need a bigger waterwheel.

Fortunately motor manufacturers often publish suggested propellers to use with a given motor/battery combination, therefore making it easy for a modeler to know which prop to use. In the beginning, stay within these manufacturer guidelines. Generally figure your electric power system is going to be swinging a prop, two to three sizes larger than a glow power system would for the same sized plane. Future articles will discuss experimenting with different props.

The wrap up

Keep in mind all motors are made to work within a range of watts and volts. A motor might be fine taking 45 amps at 11.1 volts (500 watts). However going beyond its range and ramming higher voltage down its throat or forcing it to draw more amps than it is rated, will burn it out. The goal is a balanced power system.

As you may have surmised from this article, changing one aspect of the motor/battery/prop configuration will likely trigger a chain reaction requiring a change of the other pieces too. This can easily result in a lot of calculating and recalculating. Fortunately computer programs are available that make all of this combination calculating quick and easy. Once such program is MotoCalc.

<http://www.motocalc.com>

You may be wondering if fancy computer programs exist to figure all this stuff out why even know this stuff? If you can wrap your brain around the calculations above and take a few minutes to work through a couple examples yourself, you will have a much clearer view of the entire electric flight picture. Playing with a computer program and switching the different variables then watching what it does to the final outcome can be a valuable teacher too.

In this article we've provided the basic knowledge of how electric power systems are sized. Of course there is more to know and time and experience will teach you plenty, but with this basic understanding we're hoping electric flight has become less of a mystery for many.

Of course there is always the easy way of matching a suitable power system to a particular plane. Search R/C message boards for a plane that is similar to yours in size and performance and simply copy the set up. †

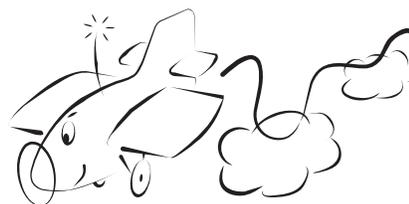
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HowStuffWorks.com. *What are amps, watts, volts and ohms?*



In The Know

By Scott Rhoades



- If you haven't renewed your *HCH* membership for 2011 yet, time is still available to do so with club secretary Jim Finch. You can renew your membership online with a major credit card or Paypal here <http://hollycloudhoppers.org/renew.html> Remember renewals were due March 1st and those paid after April 15th will be assessed a late fee of \$15.
- The club will have a plane to raffle off at the *HCH* Open House, August 6th 2011, although this year ticket sales will be handled a little bit differently. Instead of having specially printed tickets like those used the past few years, the club will instead be using the tickets that come in a big roll. (The style typically used for 50/50 drawings.) These tickets will only be sold on the day of the Open House.
- As usual much was covered at the annual *HCH* meeting held on February 27th. If you missed the meeting, you can catch up on what was discussed by reading Jim's minutes of the meeting in the Member's Only section. <http://hollycloudhoppers.org/members.html> If you're having trouble accessing the Member's Only section, a tutorial regarding logging in was printed in the Winter 10 edition of "In The Know". You can read it here <http://hollycloudhoppers.org/newsletters/36%20Winter%2010.pdf>
- During the annual meeting, *HCH* member Tom Andras asked about a fire extinguisher at the field. Tom brought this up because apparently another member had a Lipo battery fire in his aircraft last flying season. Tom's question brought up some good discussion at the meeting and here is the synopsis:

The club does have a fire extinguisher at the field. It is kept in the container closest to the road. The reason for keeping it in a locked container is the club has experienced vandalism in the past and would rather not see the fire extinguisher stolen or emptied for someone's amusement. Ed Kincer mentioned the fact that a fire extinguisher is not very effective on a Lipo fire and the best control method is smothering with sand. An agreement was made to provide a bucket of sand for such emergencies. This will likely be kept near the frequency board. Ed also pointed out that the AMA safety code has wording saying that modelers using gasoline engines shall have a fire extinguisher on hand. In other words if you run gasoline, it should be part of your flight box.
- Apparently some guys are still unclear on how the passport system that is replacing the DNR vehicle window sticker will work. Info on this can be found at "In The Know" of the Summer 10 newsletter. <http://hollycloudhoppers.org/newsletters/38%20Summer%2010.pdf>
- Last bit of news. Holly has a new hobby shop! Second Shot owner, Dave Ditner, attended the annual meeting to talk about his shop that has been open about a month at meeting time. Dave said his experience is with R/C cars, although he very much wants learn more about aeromodeling and definitely plans to cater to us airplane and heli guys. The shop is located on Saginaw St. in the yellow building across from the Holly Doughnut Shop. Be sure to stop in and check it out. (Closed Tuesdays) †

Events Calendar



April

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

May

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

June

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

July

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

August

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

September

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

HCH dates

Events around the area

Date	Event	Host Club/location/Link	Time
★ April 1,2,3	Toledo R/C Exposition	Seagate Center	
★ April 15	Final date for membership renewals before late fee		
★ April 16	Field Prep Party	HCH Club Field	10:00am
★ June 18	HCH Fun Fly	HCH Club Field	10:00am
★ July 4	Fenton Freedom Festival Parade	TBA	
★ July 9	Mid Michigan Fun Fly	Forest Aviators	10:00am
★ Aug 6	Open House	HCH Club Field	12:00pm

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