SKY CORRAL R/C CLUB
EST. 1970
PUEBLO, CO

THE BULLPEN

NEWSLETTER OF THE SKY CORRAL RC CLUB

NEXT MEETING-WED. APRIL 3RD, 2019

AMA 946 GOLD LEADERCLUB
Pueblo, Colorado
1970-2019

CLUB OFFICERS
ROB PIKE—PRESIDENT
MARK SIEMEN-VICE PRESIDENT
LARRY OSBORN-SECRETARY/TRES.
JOHN BOREN-SAFETY OFFICER

SUNDAY FLYING – AND BS SESSION

MINUTES OF THE MEETING OF MAR 2019

MINUTES READ AND APPROVED, TREASURERS REPORT

OLD BUSINESS

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CURRENT MEMBERSHIP 55

SANCTION FOR ELECTRIC FLYIN RECEIVED

MARK DISCUSSED DISTRICT 9 AMA MEETING HE ATTENDED

FAA MAINLY INTERESTED IN COMMERCIAL USE OF DRONES

AMAZON IS DRIVING FORCE OF REGULATIONS, MODELERS SHOULD HAVE FAA # ON PLANE OR QUAD, NO SIZE OR LOCATION MANDATED. AMA WILL NOT ENFORCE FAA RULES OR REQUIRE CLUBS TO ENFORCE RULES. IF CLUB IS IN FLIGHT PATH OF AIRPORTS IT IS SUGGESTED THAT THE CLUB MONITOR COMPLIANCE. MOST LIKELY THAT IN THE FUTURE RADIO RECEIVERS WILL INCORPORATE IFF (IDENTIFICATION FRIEND OR FOE) BUT FOR NOW TECHNOLOGY IS NOT REQUIRED-JETS AND FPV QUADS ARE THE FAA'S MAIN CONCERN

AMA RULES ARE ALL LINE OF SITE FOR FPV- SAFETY RULES

APPLY- THE REST ARE SUGGESTIONS- NEW QUAD RULES PROBABLY COMMING SOME TIME ESPECIALLY IF FIELDS ARE IN FLIGHT FOR LIFE FLIGHT PATH.

NEW BUSINESS

VOTED TO SPRAY WEEDS- $620 TO COLORADO VEGETATION

WILL HAVE WAR BIRD WARMUP – SATURDAY, MAY 11TH IN CONJUNTION WITH CLUB SWAP MEET- WE WILL PROBABLY HAVE POP AND HOT DOGS- EVERYBODY WELCOME

MEEING ADJOURNED

FIELD MAINTENANCE ON THE AGENDA FOR APRIL MEETING-WEDENSDAY THE 3RD.

Brushless Motor Basics

Written by Greg Gimlick
Selecting the Correct Motor
As seen in the Winter 2019 issue of Park Pilot

This motor primer is designed to help a normal, everyday park pilot feel comfortable choosing a motor for his or her new project or replacing a motor in an existing airplane. If you can buy an exact replacement part, easy peasy, but what if you can't? What if you've built or acquired an airplane with no motor? You need some basic understanding, and that's why I'm here!

Keep it simple: Longtime electric fliers sometimes muddy the waters by wanting to lay out all sorts of information regarding torque constants, winding types, armature turns, magnet types, and everything else engineers consider when designing motors. Fortunately, they don’t really need to know all of that stuff.

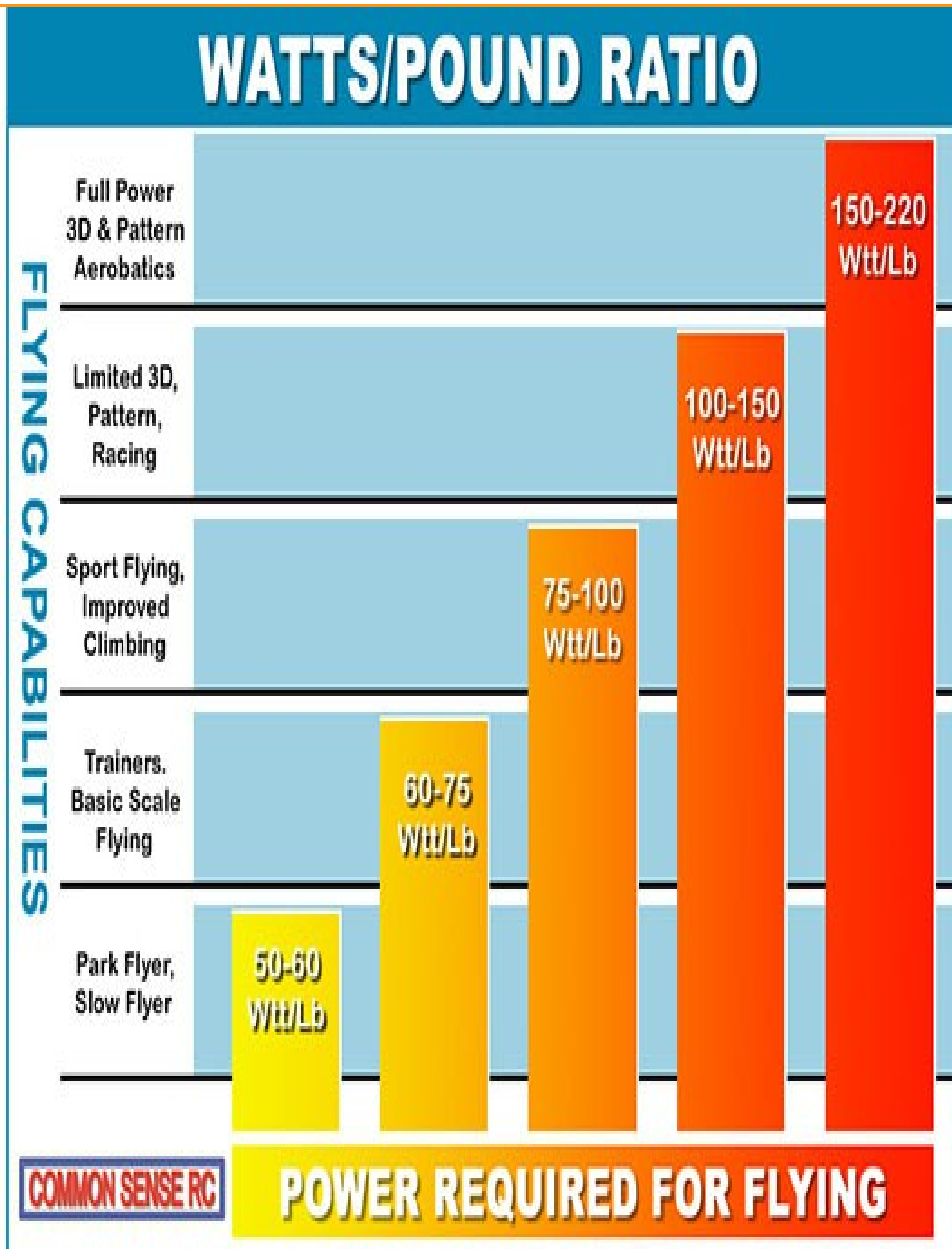
They do need to know how much power is needed. For that, I like the chart from Common Sense RC (commonsenserc.com). It’s simple to understand and provides a good base from which to start.

The sample airplane: For the purpose of this tutorial, let’s assume I have a simple, ready-to-fly sport model that weighs 3 pounds. I want it to be sporty and capable of solid aerobatics so I will need roughly 100 watts per pound, according to the chart.

I know I want to have approximately 300 watts of power (3 pounds x 100 watts per pound = 300). This is my starting point—it’s all downhill from here. I also want to fly for roughly 6 minutes, and expect to use a common 3S LiPo battery pack found in many airplanes of this size.

Step by step: The main part is figured out and I merely need to work the math a bit to get the details nailed down. It’s easy!

Power (watts) is amps times volts. I know that the 3S pack will provide 11.1 volts under load and I want 300 watts, so I only need to know current (amps). Three hundred watts divided by 11.1 volts = 27 amps, which would be a full-throttle setting, and I know that the average current over the course of a flight is approximately 66% of the full-throttle setting. Two-thirds of the 27 amps would average 18 amps for the flight.



This chart shows watts-per-pound recommendations, courtesy of Common Sense RC.

When figuring what pack is needed to achieve the current demands and flight time expectation, I need to do a bit more math. I don't want to completely discharge the battery, so I don't use 100% of the battery capacity. I want to leave roughly 20% in the pack at the end of the flight, so I'll use 80% as a guideline.

Packs are rated in milliamp hours, but instead of using the full 60 minutes, I only want 80% of that and will figure the requirement based on 48 minutes—that's 60 milliamp minutes times 80% = 48 milliamp minutes.

Using 60 and dividing that by 6 minutes to get the C-rate of discharge would drain the pack to zero, but by using 48 (80% of 60) and dividing it by 6, I get an 8C discharge rate, leaving 20% in the pack for safety.

To choose a LiPo pack, I take the average current draw for the airplane (18 amps), divide that by the discharge rate (8C), and find that a 2,250 mAh LiPo battery pack is required to achieve a 6-minute flight time. This pack size is common and economical.

Now I need to select a 300-watt motor and propeller combination that delivers what I need using the 3S 2,250 mAh LiPo pack.

The Cobra motor line on the Innov8tive Designs website (innov8tivedesigns.com) offers a 2814/12-1390 motor that is capable of 450 watts of continuous power on a 3S pack. This is a slight overkill because it can handle 40 amps continuous current when the maximum requirement is only 27 amps, but that's okay. It means I won't be burning this motor up and I'll have the ability to push it harder should I decide to increase the aerobatic capabilities of the airplane later or increase to a 4S battery pack.

The propeller selection guide for this motor shows that an APC 9 x 4.5E propeller on 3S power will pull 28.9 amps, providing 321 watts. The goal was 27 amps and 300 watts, so this looks to be nearly perfect!

Cobra C2814/12 Motor Propeller Data

Motor Wind	Motor Kv	No-Load Current	Motor Resistance	I Max	P Max (3S)
12-Turn Delta	1390 RPM/Volt	Io = 1.44 Amps @ 10v	Rm = 0.030 Ohms	40 Amps	440 W

Outside Diameter	Body Length	Total Shaft Length	Shaft Diameter	Motor Weight
35.0 mm, 1.38 in.	34.1 mm, 1.34 in.	54.0 mm, 2.13 in.	5.00 mm, 0.197 in.	109 gm, 3.84 oz

Prop Manf.	Prop Size	Input Voltage	Motor Amps	Watts Input	Prop RPM	Pitch Speed	Thrust Grams	Thrust Ounces	Thrust Eff. Grams/W
APC	7x4-E	11.1	13.64	151.4	13,361	50.6	740	26.10	4.89
APC	7x5-E	11.1	17.64	195.8	12,985	61.5	775	27.34	3.96
APC	7x6-E	11.1	18.64	206.9	12,887	73.2	847	29.88	4.09
APC	8x4-E	11.1	20.78	230.6	12,700	48.1	1062	37.46	4.60
APC	8x6-E	11.1	31.14	345.6	11,716	66.6	1216	42.89	3.52
APC	8x8-E	11.1	39.36	436.9	10,961	83.0	1079	38.06	2.47
APC	9x4.5-E	11.1	28.94	321.3	11,941	50.9	1477	52.10	4.60
APC	9x6-E	11.1	33.09	367.3	11,528	65.5	1427	50.34	3.88
APC	9x7.5-E	11.1	45.90	509.5	10,253	72.8	1395	49.21	2.74
APC	10x5-E	11.1	39.26	435.8	10,967	51.9	1739	61.34	3.99
APC	10x6-E	11.1	41.43	459.8	10,745	61.1	1829	64.52	3.98

Prop Manf.	Prop Size	Input Voltage	Motor Amps	Watts Input	Prop RPM	Pitch Speed	Thrust Grams	Thrust Ounces	Thrust Eff. Grams/W
APC	6x4-E	14.8	13.62	201.5	18,164	68.8	748	26.38	3.71
APC	6x5.5-E	14.8	17.29	255.8	17,760	92.5	770	27.16	3.01
APC	7x4-E	14.8	23.66	350.1	17,063	64.6	1282	45.22	3.66
APC	7x5-E	14.8	29.87	442.0	16,394	77.6	1279	45.11	2.89
APC	7x6-E	14.8	31.12	460.6	16,260	92.4	1352	47.69	2.94
APC	8x4-E	14.8	35.42	524.2	15,764	59.7	1684	59.40	3.21
APC	8x6-E	14.8	51.00	754.8	14,043	79.8	1772	62.50	2.35
APC	9x4.5-E	14.8	46.49	688.0	14,590	62.2	2343	82.65	3.41

Propeller Chart Color Code Explanation

- The prop is to small to get good performance from the motor. (Less than 50% power)
- The prop is sized right to get good power from the motor. (50 to 80% power)
- The prop can be used, but full throttle should be kept to short bursts. (80 to 100% power)
- The prop is too big for the motor and should not be used. (Over 100% power)

This chart shows watts-per-pound recommendations, courtesy of Common Sense RC.

Results: A motor giving everything required and then some will power the 3-pound airplane. The math was simple and the process was easy to follow. Nothing is being pushed beyond its limit and there is plenty of room for adjusting later.

Other options: The Cobra 2814/12-1390 motor was selected, but what if I wanted to compare other options? The process is the same, but I can also reference the chart Lucien Miller has provided on the Innov8tive Designs website. In the Turnigy SK3 line is a 3536-1400 motor that is similar and would work too.

This Cobra motor has its name and information inscribed on the case. Cobra motors suggests a matching ESC, making it easy to put a system together.

What about Kv? Unlike what many think, Kv doesn’t stand for kilovolt. It refers to a velocity constant that tells how many rpm a motor turns per volt with no load. Apply 11.1 volts from a standard 3S pack and you'd expect the 2814/12-1390 motor to turn 15,429 rpm with no load. Of course, efficiency, load, and other factors play into it, but for planning purposes, that's close enough.

One problem new fliers run into is when an "expert" at the field tells them Kv is all they need to know. You might as well tell someone gravity is a state of mind. Kv means nothing by itself. It's a useful tool as part of a total package, but not alone.

These two motors have the same Kv, but are obviously different in size, and consequently, capability. Don't believe people who say you only need the Kv to select a motor.

What do all of those numbers in the name mean? Some manufacturers use the size of the stator and others use the outside dimensions of the motor case to come up with the numbers. We need a way to compare them and that's where Kv and weight come in to even the playing field.

With a motor such as a Cobra 2814/12-1390, I know that the dimensions of the stator are 28 mm diameter and 14 mm length with a 12-turn design and 1,390 Kv. To find another motor similar to that, we might check out the Turnigy SK3 3536-1400. This is essentially the same motor, but the measurements reflect the case size in diameter and length, then the Kv.

If Cobra listed its motor using this naming convention, it would be roughly 3534-1390, so they are roughly the same size. Comparing the weights, the Cobra is 107 grams and the SK3 is 110 grams. With similar Kv, weight, and size, the motors are nearly the same.

These motors are disassembled to show the difference in how numbers reflect sizes. The stator (the part with wire wound around it) is much smaller than the case itself. Find out whether your motor manufacturer uses stator or case dimensions in its nomenclature.

It's important to know which method a manufacturer uses to identify its motors, otherwise you end up comparing apples to oranges. If you're not sure, compare the Kv and weights. If a kit calls for a certain size, find out whether the manufacturer means stator or motor case dimensions.

Bottom line: Don't get caught up in the "Kv only" argument. Define your requirements for the airplane and do some simple math to figure out the right motor to use. It only takes a few minutes to search manufacturers' websites for a match. Sites such as Innov8tive Designs provide the type of information that's needed to make the right choice. If a site doesn't provide the necessary information, you might want to inquire.

This is a basic course to get you going successfully. Down the road we can look more closely at details.