



THE WEAK SIGNAL

Nov. / Dec. 2008

Toledo Weak Signals Radio Control Club, Inc.
TOLEDO, OHIO CHARTER NO. 521

From the President

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November 15th was the Club Banquet at Central Park West. It was an enjoyable time and the food was great. Brian Harris did a fantastic job putting it together, thanks Brian.

Remember that in December there will be only one meeting. As usual there will be no second meeting due to Christmas. Also, make sure that you show your 2009 AMA card to Tim Jesky before December 31st. Contact Tim if necessary. Noember 1st our club held a flying demonstration for Great Starts pre-school at the club field. Tim Jeskey put the event together including a lunch for all. Many members showed up to help. The event was great success, thanks Tim. The Expo Committee is gearing up for our 2009 event. There are openings on several committees. If you are interested in helping on any specific committee contact that committee chairman for details. If you are not on any specific committee you will be assigned as door security. Working the Expo is a requirement for Regular, Associate and Perspective members.

Ed Crotty from the R/C Hall of Fame has contacted me. Mr. Crotty is looking for pictures of R/C radios from the Expo in the 1960's. His current project is to write the history of their recently acquired first ever Kraft proportional and Min-X proportional. These were both shown at the 64 show and maybe 63 as well. He can be contacted through his web site www.rchalloffame.org at ed@rchalloffame.org. Anyone that can assist with old Expo pictures or information is encouraged to contact him, sounds like an interesting part of history for the hobby.

As the year comes to an end I would like to highlight the major events of our club and members for 2008:

- Dedication of new club house and club picnic and the recognition of Dave Howard and the field committee of their efforts for the new club house,
- City of Toledo and Lucas County recognized the Expo with Resolutions and Proclamations, April is now "Weak Signals R/C Club" month,
- AMA Award of Excellence,
- Successful Expo,
- Successful Hirobo Cup, open pattern contest and open Old Timers contest,
- Another year of the Sailplane League with more participation,
- Open house and demonstration for Great Starts pre-school,
- New picture roster and by-laws
- Joe Vislay received an AMA Fellowship,
- Andrew Jesky – 2nd Place National Champion, World Team selection,
- New Life Members Dale Rupert and Tom Como.

I would like to thank the Board and membership for the honor of a Life Membership. I am very grateful for having this distinction. We have a top notch and unique club, to be a Life Member of our organization says a lot, I truly appreciate the accolade.

It has become a tradition for many club members to go flying on New Year's Day. I have gone a couple times myself. Sometimes the weather is nice other days may be one that prohibits all but the hearty fliers. I encourage members to participate in this tradition.

Wayne Yeager is out of the hospital now. He is the Tendercare Health Center of Adrian.

The newsletter always can use articles, pictures or equipment for sale. Send any of these to Brian Harris at toledoweaksignals@yahoo.com. If you have any special techniques for winter storage of equipment this would be a great time to have that article published.

I would like to wish everyone a Merry Christmas and a Happy New Year. Have a safe holiday.

Safe Flying
Dale Rupert

Congratulations to our latest LIFE members

Life member #50

Tom Como

Tom has been a member with the club since January 26th 1984. Tom served as Security chairman with the Expo for many years and has served on the board.

Life Member #51

Dale Rupert

Dale has been a member with the club since November 9th 1989. Dale has served an officer in the club and is the present Security Chairman for the Expo.

CONGRATULATIONS to both of these Great Members.

Any Artist out there?

2009 Expo Patch and Pin Artwork Challenge: \$25 gift certificate to the winner. Draw and submit to Rick Lederman rick@soaringsoftware.com a design for the 2009 Expo patch and pin. This Challenge is open to any one. Winner chosen by January 10, 2009 or we will hire Fly R/C to do the work for us. Good luck to all! Drawing doesn't necessarily need to be in final form, we can do that if necessary.

Newsletter

I realize that the newsletter has been less than prompt and I apologize to the membership for this. I will be making the newsletter a monthly event starting in January of 2009. Again I apologize. Thanks Brian

**YOUR AMA MEMBERSHIP CARD MUST BE SHOWN
MUST BE SHOWN TO TIM JESKY! IF YOU HAVE NOT
DONE SO MAKE SURE TO GET IT DONE OR YOUR
MEMBERSHIP IN THE TOLEDO WEAK SIGNALS WILL
BE IN JEAPARDY! Scan and email it to Tim or show it to him at
last meeting of year. This is YOUR responsibility as a member.**

Bob's RC Electric Basics

There is increasing interest in electric powered aerobatic aircraft. The common availability of high energy rechargeable Lithium Polymer batteries and high efficiency brushless motors has made electric powered high performance aircraft possible. This overview will cover some electrical basics as they relate to DC electric motors and Radio Control. There is some simple math involved, but there will be no test at the end.

Terms:

There are three basic electrical concepts we must define to help us understand how our motors operate. I will relate these terms to their hydraulic equivalents.

1. Voltage (V): The “pressure” in an electrical system. The higher the voltage, the higher the pressure. Units are Volts. (also referred to as “Electromotive Force or EMF)
2. Current (A): The “flow” of the electrical system. Units are Amperes or Amps
3. Resistance (R): The “friction” in the system, similar to pipe diameter. The bigger the pipe, the lower the friction. Units are Ohms.

Other terms:

1. Circuit: a collection of components forming one or more paths for electric current to flow.
2. Power (W): The measurement of work, units are Watts.
3. Potential Energy: Stored ability to do work
4. Kinetic Energy: Motion, heat, light, sound.

Basic Formulas:

The characteristics of electrical circuits are related by the formula known as Ohms Law:

Volts = Current * Resistance or $V=I*R$.

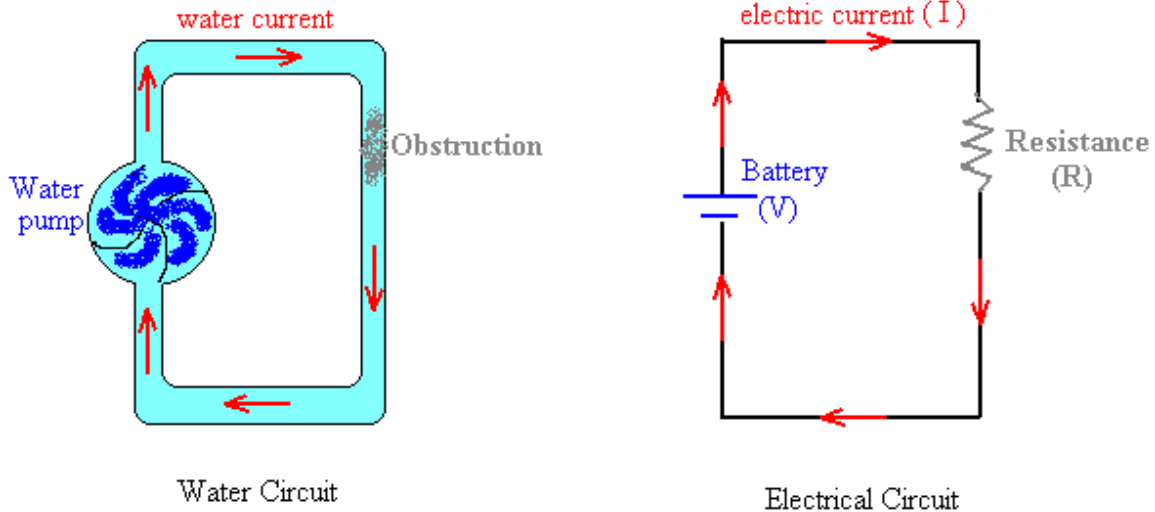
Another formula we need to know is Power as expressed in electrical units:

Watts = Volts * Current or $W=V*I$.

Since $V=I*R$ we can also write the power equation as $W=I*I*R$

Simple Electric circuit:

The following diagram is about the simplest electric circuit possible, and fortunately for us, works well to model the power system of an electric aircraft.



In the above example, if we assume a battery of 10V and a resistance of 5 Ohms, then the resulting current will be $V=IR$, or $V/R=I$. $10V/5\text{Ohms}=2$ Amps

Electrical components:

The primary components of the power system in an electric aircraft are wire, the battery, the controller, and the motor. Each is important and worth discussing.

Wire is the “pipe” of our circuit, used to connect all the other components together and allow current to flow. All else being equal, a larger diameter wire can carry more current. The only significant electrical characteristic we need to consider about wire is its resistance. It is usually provided by the manufacturer or from standard tables and is stated as Resistance per unit length, Ohms/Foot.

American Wire Gauge Sizes and Resistances

Gauge Number	Ohms/1000 ft at 70F
10	1.02
12	1.62
13	2.04
14	2.57
18	6.51

Notice the chart gives the resistance for copper wire per 1000 ft at 70 F. We would use perhaps 3 feet of wire between the motor and battery. So the resistance for a 12 gauge wire would be $3 \times 1.62 / 1000$ or 0.00486 Ohms. The resistance of a material is proportional with temperature; it goes up as temperature goes up. We will ignore this effect since we should choose a wire size appropriate for the current of our motor, and heating will be minimal. As a starting point, go with the wire size recommended by the manufacturer, if no recommendation is given, use the following chart as a guide:

CURRENT CARRYING CAPACITY OF COPPER CONDUCTORS (Measured in Amperes)

INSULATION MATERIALS AT GIVEN TEMPERATURES					
CONDUCTOR SIZE	POLYETHYLENE NEOPRENE POLYURETHANE POLYVINYLCHLORIDE (SEMI-RIGID) AT 80°C	POLYPROPYLENE POLYETHYLENE (HIGH DENSITY) AT 90°C	POLYVINYLCHLORIDE PVC (IRRADIATED) NYLON AT 105°C	KYNAR POLYETHYLENE (CROSSLINKED) THERMOPLASTIC ELASTOMERS AT 125°C	KAPTON TEFLON SILICONE AT 200°C
30 AWG	2	3	3	3	4
28 AWG	3	4	4	5	6
26 AWG	4	5	5	6	7
24 AWG	6	7	7	8	10
22 AWG	8	9	10	11	13
20 AWG	10	12	13	14	17
18 AWG	15	17	18	20	24
16 AWG	19	22	24	26	32
14 AWG	27	30	33	40	45
12 AWG	36	40	45	50	55
10 AWG	47	55	58	70	75
8 AWG	65	70	75	90	100
6 AWG	95	100	105	125	135
4 AWG	125	135	145	170	180
2 AWG	170	180	200	225	240

I have personally measured the current of an electric FAI class airplane motor system and it was in the neighborhood of 70 amps at full throttle. The chart above would suggest a 10AWG wire be used, but our airplanes are not operated at full throttle all the time and the wire lengths are short, so you could use a 12AWG, silicone jacketed wire to save weight. The insulation on wire usually also has a maximum voltage rating. These are typically rated well above the 40 volts or so available from the battery and can largely be ignored.

Battery:

This is our source of potential energy. The characteristics we need to be concerned about are capacity, measured as the battery's ability to supply current to a load for a period of time, and the battery's internal resistance. The capacity is stated as Current*Time, usually milliAmpHours. As a rough rule of thumb, the physical volume of a battery determines its capacity, and its diameter determines its resistance. A fat cell will have a lower resistance and not heat up as much as a thin cell. The higher the internal resistance, the more a battery will heat up, and the less power it will deliver.

Batteries can be non-rechargeable or rechargeable. A non-rechargeable battery produces electrical current through a non-reversible chemical process. Once the battery is depleted, it is junk. A rechargeable battery can have its potential energy restored by reversing the current through the battery, which reverses the chemical process and restores the power of the battery. There are three main types of rechargeable batteries used in RC, Nickel-Cadmium or Nicad (NiCD), Nickel-Metal Hydride (NiMH), and Lithium Polymer (LiPo). The order above also represents increasing energy density, that is a LiPo battery will have more stored energy for a given weight than a NiCD or NiMh cell, and the NiMh cell will have more stored energy than a NiCD cell.

Single battery cells don't offer enough voltage or current capacity for our needs, so cells are arranged into a pack to increase the voltage and current capability. Prior to LiPo cells, most packs were made of series connected NiCD or NiMh cells. LiPo cells with similar high current capacities are not yet available so they need to be connected in parallel to increase their current capacity. Parallel connected cells create a problem if all the cells are not matched very closely. Each cell may not get its fair share of the charge current and not be fully charged. If left unchecked, the cell may be damaged by being discharged below a critical level. Many of the charging systems now offer "cell balancers" to insure each cell receives a full charge.

Fun Stuff (sometimes)



Can you name the plane?

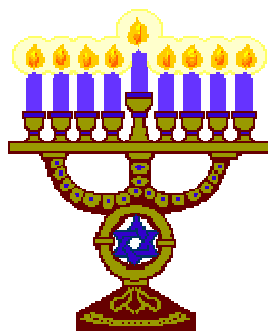
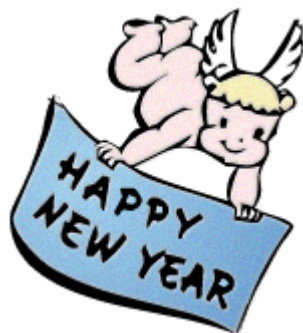
Last months answer was the P-80 Shooting Star.

Veterans of the United States Armed Forces,

We Cannot Thank You Enough

To all our members and especially to all those who are or have served in our armed forces we would like to wish you and yours a very

Merry Christmas



IMPORTANT DATES

Dec. 11th	Meeting 7pm Legion Hall
Dec. 25th	Christmas (NO MEETING)
Jan. 8th	Meeting 7pm Legion Hall
Jan. 22nd	Meeting 7pm Legion Hall