The Flightline

Volume 30,Issue 9 Newsletter of the Propstoppers RC Club AMA 1042 September 2000

Editorial

Battery - Health and Fitness

We all feel bad at the wake for a favorite model, especially one that has given four years of service. It is even more difficult when "the event" occurs at the hands of a friend, particularly a skilled one.

"What happened?" "I lost it, it didn't respond, something was wrong".

This was the scene at Dallett Field a few weeks ago. It involved Al Tamburo and Joe Scavitto. The model was Al's four-year-old Morris the Knife and the forlorn pilot was Joe.

A quick check of the battery showed the voltage to be at the bottom of the scale on an expanded scale voltmeter.

Al said that the 1000-mAh Panasonic receiver pack was relatively new and that it had been charged before the flying session. Two flights should not have depleted it.

As I have the world's second most expensive battery charger (the Schulze is costs more), he asked me to check it.

I charged it at a 1-amp rate and it took about 900 mAh to peak. Not good! With perhaps 80% charger efficiency it should have charged to about 1200 mAh.

On discharge, it showed only a little over 700 mAh and the voltage dropped early in the cycle. Something was clearly wrong but it didn't show from a simple check of the charged voltage.

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Tech Note; We Have Your Number Mr. Reynolds.

Everything I have told you about aerodynamics is correct, sort-of.

But, I didn't tell you that the forces generated by airfoils vary depending on their size relative to the fluid they operate in.

I know, you knew that, but just in case you forgot the formula let's cover what the good Dr. Reynolds discovered a hundred or so years ago.

Take a walk on the beach. Your feet sink deliciously into the warm sand. Now scale yourself down to the size of a flea on the same beach, and try to get on with your walk. Help! You're tripping and stumbling among knee-high boulders, and you hardly make any headway at all.

The same principle applies to airplanes moving in air. Air is really a granular substance, like sand, made of separate molecules a certain average distance apart, and with a certain "stickiness," or mutual friction.

You can scale down the airplane, but you can't scale down the air. So the same airplane behaves differently at different scales, or, to put it anthropomorphically, air "feels" different to airplanes of different sizes.

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Still Time To Build or Fix for the Club Electric Fun Fly
Sunday 27th August 13, 2000
9 a.m. till Dusk?
If you can't bring a suitable plane plan to attend anyway, I will bring one of my fleet for you to fly.
Dave Harding, Event Director

Inside This Issue

Calendar of Events

Club Electric Fun Fly
Sunday 27th August
Dallett Field, 9:00 am till 4:00 pm

Harrisburg Area Flying Society – IMAA Scale meet.
Saturday and Sunday 4/5th September

Club Meeting *NOTE TIME AND PLACE*
Tuesday 5th September 2000
Marple Newtown Library 7:30 p.m.

Pennsbury Land Trust, Balloon Fest
Saturday, September 16, 2000
Pennsbury Township, PA (near Chadds Ford)

Club Night Fly
Saturday, September 16, 2000
Dallett Field, dusk till?

Regular Club Flying at Dallett Field
Every Saturday and Sunday weather permitting

Daily	**10 am til Dusk**
Saturday	**10 am til Dusk**
Sunday	**Dawn till Noon Electric and Gliders only!**
Sunday	**12 p.m. till Dusk**

Propstoppers RC Club of Delaware County, Pennsylvania.

Club Officers

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The President's Message

Mike Black

Dear Fellow Propstoppers

Rusty Neithammer and Marty Bakalorz have been taking on the bulk of the training duties. I'd personally like to thank both of them.

They have been helping two young people that I brought into the club along with many others.

I was out at Squire Cheyney today (Sunday, August 13.) The field looks great.

I was able to give one new member his solo test. Congratulations to Greg Dugan for earning his solo wings. Greg did a fine job in windy conditions and made two nice dead-stick landings. Greg credits Rusty for the excellent training he received.

I also assisted Ed and Mark Glatfelter with their first flights on their Duraplane 40 trainer. Father and son both did well on their first flights.

It's sometimes odd how things occur in time. I was unable to be at the field for various personal and professional responsibilities for much of the summer. Now those responsibilities are easing and I'm planning to spend more time at the field. This comes at a time when Rusty will be unable to get out for a while. I just found out today that he is having some medical difficulties, but is on the mend and will, hopefully, be back on his feet soon.

For those of you looking for training help, Marty Bakalorz, Steve Boyajian, Jess Davis, Joe Scavitto, and I are willing to help anyone when we can be at the field. There are two or three other fellas that I will approach to help out. I feel they are capable and ready, but I must check with them before naming them in the newsletter.

Please plan to come out and enjoy the Electric Fun Fly. Many members have joined the electric ranks over the last two years. If you are hesitant, come out and look at the wide variation of model types, ask those questions and join the electric flight community.

I look forward to seeing all of you at the field. Keep those wings level and enjoy the remainder of the summer.

Mike

August 1, 2000 Meeting Minutes

The meeting was called to order at 7:00PM at Squire Cheyney/Dallett Field by Vice president **Dick Seiwell.**

President Mike Black read the roll call - there were 16 members and 2 guests present.

The minutes of the July 2000 meeting were approved as published in the August newsletter, by the membership.

Treasurer **Al Gurewicz** gave the treasurer's report. We have a total of $2,475.10 in the treasury.

Old Business

Fuel Order Pickup: All fuel was sold as of August 1

Thornbury Township Summer Day: scheduled for Saturday, July 15, was canceled by Mr. Sherman, because of the threat of thunderstorms. We expect the Township to reschedule by early fall. Ed Schumacher would like to thank everyone who volunteered to help out. Food purchased for the event is being stored

Electric Fun Fly: Sunday, August 27. **Dave Harding** is coordinating this event. Outside AMA member participants have been invited through their Internet group. No raindate is scheduled. Please plan to come out and participate in this fun event.

The Pennsbury Land Trust, Pennsbury Township, PA (near Chadds Ford) is holding their annual Balloon Fest (hot air balloons) on Saturday, September 16, 2000, and has asked if we would be willing to bring and fly RC planes (and helis) as part of their event, from about 2 – 4 PM. It appears that enough members are willing to attend, so we will commit to do this. They have been advised that they will need to prepare a suitable runway, and seem to be willing to do that. See **Rusty Neithammer** for more details.

Night Fly: This is planned for Saturday, September 16 (i.e., over the September new moon), following the Pennsbury Land Trust flying demonstration.

New Business

Thanks to **Kathy DiDomenico** for the repair/replacement of the windsock at Squire Cheyney.

There is a Harrisburg Fly-In September 4 and 5 from 9 AM till dusk. Look for details in the newsletter.

First Aid Kit Replacement - Ray Wopatek volunteered to purchase a new waterproof first aid kit for the box at Squire Cheyney Field. Chuck Kluzynski volunteered to keep it stocked with supplies.

Squire Cheyney driveway - Elijah Dallett requested that we alternate the area that we drive over when we enter the field. Driving over the same area denudes it of vegetation and allows erosion to occur. Please drive to the right or left of the well-worn area.

The 50-50 winner was Del Glennon, who graciously donated his prize back to the club.

There was no show and tell, but there was lots of good flying.

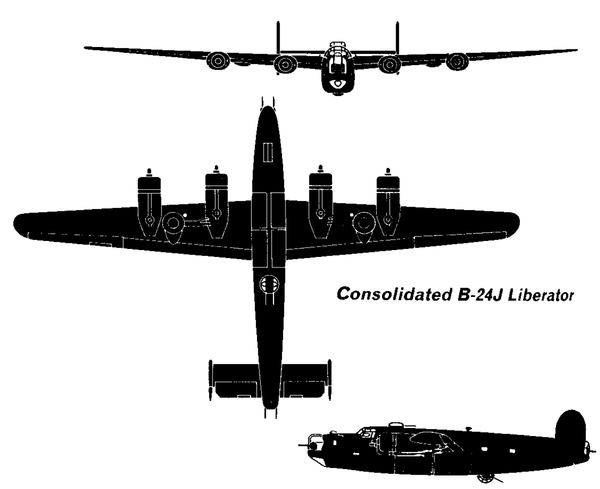
Reminder: On September 5 we will return to our regular meeting schedule. That is at the Marple Library Meeting Room at 7:30 PM. Please plan to be there.

Several members have expressed interest in club hats and shirts. We will discuss a new sale at the September meeting.

The meeting was adjourned by, Vice President, **Dick Seiwell**, at 7:20 PM.

Special thanks to Mike DiDomenico for taking notes in Rusty's absence.

Mike Black



I have the four Speed 400's and I'm ready to build, ……..Well, after a few other projects. Anyone else?

Heat Treating Music Wire

by **Roy Vaillancourt**

The music wire used by modelers to make landing gear and cabin struts is medium carbon steel heat-treated to spring temper or about 45 on the Rockwell C scale of hardness (RC45).

On this scale, RC20 is soft, RC45 is tough, and RC60 is hard. Tough wire can be bent and cut using the proper tools and techniques, but sometimes it's just too difficult to work with.

One way to soften steel music wire is to heat it, which makes it easy to bend and form. But after heating and forming, the subsequent cooling -- often at an uncontrolled rate -- can make the finished wire too hard or too soft since its hardness is determined by the rate at which it cools.

For some parts, the final hardness isn't critical. But a landing gear formed from wire softened too much won't spring back to its original position; and a gear made from wire cooled to a harder than normal state will snap on its first use.

Continued on page 4

To restore the wire to its original specific spring temper, it must be heat-treated a second time and cooled at a controlled rate.

To form wire easily, first anneal it; next, form or bend it to the desired shape; and then heat-treat the part back to spring condition -- that is, temper it.

First the wire should be annealed at the location to be bent.

To anneal it, heat the wire with a torch until it becomes a bright cherry red -- about 1400 degrees Fahrenheit. Let it cool completely to the touch. Don't quench it or blow on it. Just let it cool naturally away from any drafts. The wire should now be in the RC25 soft range, and it will bend easily.

After forming once again heat the wire with a torch until it becomes bright cherry red, but this time quench it -- that is, cool it rapidly by immersing it in room temperature water. Plunge the steel into the water with a twisting, swirling motion to keep water vapor from insulating the wire against the cooling action of the water.

At this point the wire should be very hard, probably above RC60.

To test the hardness, try to make a mark on the worked area with a file. The file should slide off without cutting into the steel at all. If it cuts the wire, try the heat and quench cycle again. If the file still cuts the wire, it isn't high carbon steel. Get another piece of wire and start over -- you won't be able to add the necessary carbon to low-carbon steel.

When the file test signals success, the wire is ready for the final step, but not for use, because it's very hard and quite brittle, and will probably snap off.

The final step is to temper the wire back to the desired hardness.

Tempering is a form of annealing but is controlled so that the steel achieves a specific hardness. Start by sanding the wire with steel wool or emery cloth. Then heat it gradually with the torch.

Watch for the following colors as a guide: straw color (350 degrees), followed by dark blue (600 degrees) and then medium blue (750 degrees).

At this point, remove the wire from the heat and allow it to cool slowly. Don't quench it or blow on it; just let it cool naturally in still air. Once the steel returns to room temperature, it should be at the target RC45 hardness, which has a good spring temper. Try the file test again. You should be able to make a mark now, but only with some effort. If it passes this test, the wire is properly tempered.

Besides parts for model planes, tempered music wire can also be used to make special purpose tools. Instead of tempering to 750 degrees (medium blue), stop at the straw color stage. The wire will be at about RC60, which is still very hard, but not brittle. Wire at this temper can be used to drill wood and plastics, and most aluminum and copper.

From the E-Flight list server.

Tech Note; Reynolds Number Continued from Page 1

The relationship between the size of an object and the feel of a fluid medium surrounding it is summed up-and has been for more than a century now in a wonderfully powerful mathematical shorthand called the Reynolds number.

The discovery of Reynolds number, or RN as it is usually abbreviated, arose not from aerodynamics but from plumbing. The size of pipe needed to carry a certain flow, and the amount of pumping power required to overcome the resistance of a pipe over a given distance, are fundamental problems of hydraulic engineering.

Efforts at experimental measurement had yielded baffling discontinuities and apparent contradictions. Fluid flow was a Jekyll-and-Hyde kind of phenomenon, swapping identities and behaviors for reasons that seemed to defy comprehension.

Osborne Reynolds (1842-1912) was a classic absent-minded professor. Irish born, a lifelong professor in engineering at the University of Manchester in England,

He was known for sometimes drifting off in the middle of a lecture and working out the mathematics of his newest insight on the blackboard while bewildered students twiddled their thumbs. Reynolds was, however, an original scientific thinker with the practical instincts of an inventor. He did significant work in several areas, but his most lasting contribution was to the field of fluid mechanics.

The experimental apparatus that led to the discovery of Reynolds number can still be seen today in a gallery documenting his work at the University of Manchester. It consists of a horizontal glass pipe with a trumpet-like flared inlet. The pipe is immersed in a tank of water and vents to the outside. Reynolds would open a valve to allow water to flow out through the glass pipe; at the same time, he allowed a small nozzle to inject a fine stream of dye into the pipe's inlet.

Reynolds could control the speed of flow in the glass pipe and watch the behavior of the filament of dye running through it.

He observed the same phenomenon that one used to observe back when indoor smoking was permitted. Just as smoke would, in still air, rise several inches from a cigarette in a smooth stream and then abruptly burst into disorderly eddies, the dye stream would remain perfectly straight and coherent at first, then explode in turbulence and lose its identity in the larger stream.

Today we call the two types of flow Reynolds observed laminar and turbulent.

In laminar flow, the path of each small packet of fluid; a "packet" is an arbitrarily small volume, but much larger than a single molecule, is parallel to those of its neighbors. The flow resembles well-combed straight hair.

In turbulent flow, on the other hand, small whorls and eddies develop in the overall flow, so that as they all travel downstream, each packet of fluid moves in a different direction from its neighbors.

Reynolds discovered that whether flow in the pipe remained laminar or became turbulent depended on a simple arithmetical relationship of four factors:

- diameter of the pipe,
- speed of the flow
- density of the fluid
- Viscosity of the fluid.

Laminar flow has only half as much resistance as turbulent, so engineers try to maintain laminar flow over as much of an airplane's surface as possible in order to reduce drag. But the significance of Reynolds number goes well beyond simple drag reduction.

Reynolds number is a "similarity parameter" that allows designers' to account for scaling effects and for different regimes of operation.

Here is Reynolds' equation:

RN=VD r /m

Despite the Greek symbols rho **r** and mu **m** this is a very simple expression with very clear implications.

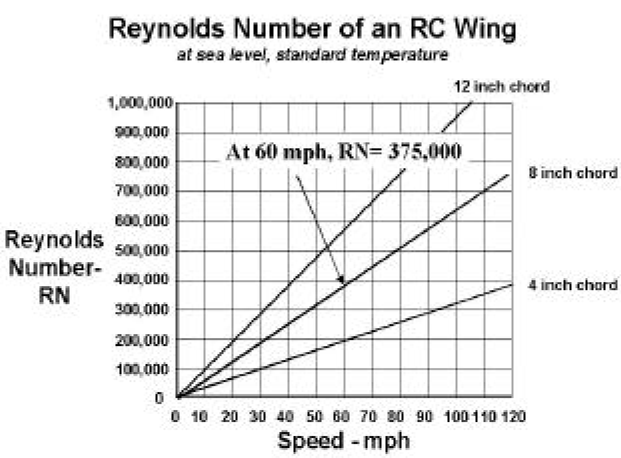
V is speed,

D is a dimension-in the case of wings, it is chord, the distance from the leading edge to the trailing edge;

r is the density of the fluid, and

m its viscosity.

Once you pick your fluid it gets even simpler, since ρ / μ is a constant. Its value is about 6,400 in air at sea level, so to get the Reynolds number for ordinary airfoils flying at low altitude all you have to do is multiply the length of their chord in feet by their speed in feet per second, then multiply that result by 6,400.



Since you multiply by speed, density, and size, but divide by viscosity it follows that as the speed, density, or size increases, the Reynolds number increases,

Whereas as the viscosity increases, Reynolds number decreases.

The fact that flows at similar Reynolds numbers behave similarly implies that, for example, a slow flow in a thin fluid behaves just like rapid flow in a thick (more viscous) one. Or a small object in a thin fluid is similar to a large object in a thick fluid.

One of the convenient consequences of these relationships is that the Reynolds number of the keel of a $sailboat_1$ operating at low speed but in a relatively dense medium, is similar to that of an airplane wing traveling many times faster in air. So all the research done to create airfoils for airplanes applies equally well to sailboats.

The almost magical power of the Reynolds number leads us to the strangest conclusion of all: Air feels to a gnat, the way oil, or even honey, feels to us. So flying, when you're very tiny, isn't flying at all anymore. It's swimming.

The laws of flight are consequently different for very tiny and or slow fliers. Consider the indoor duration model for instance. Beyond that, the things that aerodynamicists normally strive to optimizing airfoils, wingspan, surface smoothness cease to mean anything.

The wings of small living fliers may even cease to be continuous surfaces, and may be replaced by collections of hairs more like palm fronds than wings. The smoothly curving flows that generate lift on the large scale are replaced by swirling eddies; tiny insects paddle rather than soar.

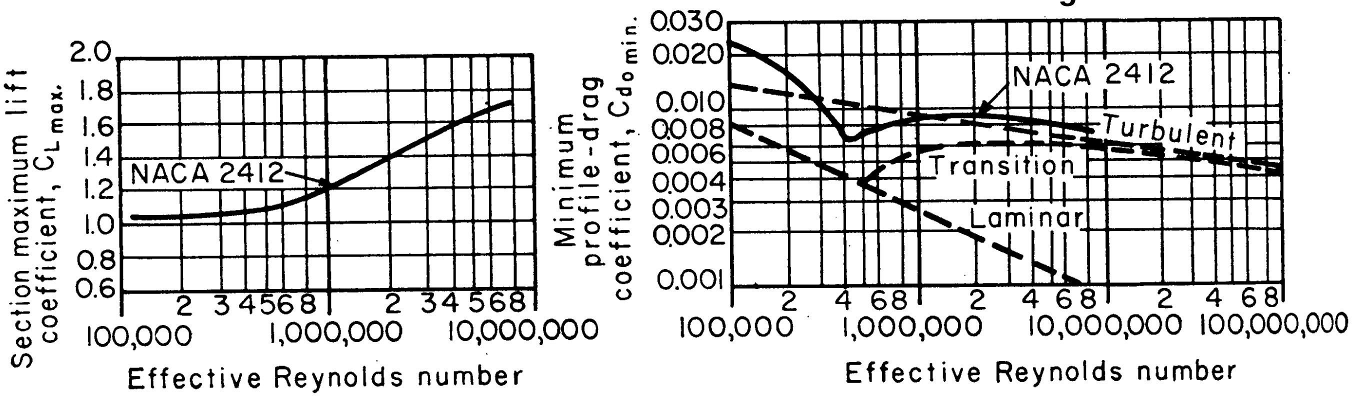
But what about our RC airplanes, what does this all mean?

Well, we don't operate down in the sticky atoms region but we do operate in the region where things begin to change from low speed laminar phenomenon to the higher speed turbulent region.

If you don't want to calculate the RN for your model directly, you can estimate it from the chart on the left. It shows the RN for a typical RC wing at various speeds. We might typically fly a 8 in. chord trainer / sport models at sixty miles per hour, and at that speed the Reynolds Number is just less than 400,000. However, at landing speed it is down to 200,000. A fun flier operates at much lower values.

What does all this really mean? Well, in this range the maximum *lift* does not vary that much, although it is much less than for a full size airplane, but it is the *drag* that really changes.

Maximum Lift **Minimum Drag**



Scale effects on the maximum lift and minimum profile drag on the NACA 2412 airfoil

Consider the range of data shown in the chart above, where the maximum lift and minimum drag for the venerable NACA 2412 airfoil are plotted verses RN.

In a future tech note, when we discuss aerodynamic drag, Reynolds Number *will* be something to consider.

Portions extracted from ***April/May 2000*** *Air & Space*

Dave Harding

Editorial - Batteries *continued from page 1.*

So how do we protect ourselves from such battery maladies?

Well, we need to perform several different checks but they are relatively straightforward and can be performed with simple equipment (although if I follow this path too far I will be in danger of invalidating my rationale for the Orbit charger purchase!).

First you will need a voltmeter, preferably a digital voltmeter; DVM (then you can say, "pass me the DVM Joe", and already you are an expert in battery maintenance). DVM's can be purchased for as little as $12 although shipping will increase this to closer to $20. Radio Shack has two on sale as I write this, one for $20, the other about $60. The latter has a twenty amp measuring capably and you can connect it to your computer to plot the voltage or current as you charge or discharge the battery. If you are really an AR person, you could perform this test on each battery and save it to memory for comparisons each time you charge it. Probably the ideal health check!

You will need some wire of course and a means of ***loading*** the batteries. What does that mean? It means something you connect across the battery so it will draw the desired current.

It could be a length of wire or a light bulb in a holder or several of them, it could be a resistor or several of them or it could be an old hair dryer or electric heater. How about a Monocoat iron or old heat gun? Just measure their resistance with your DVM.

Sorry folks, we need some math here.

The basic electrical relationships are;

Volts = **Resistance** times **Current**

so

Current = **Volts** divided by **Resistance**

and

Resistance = Volts divided by **Current**

The voltage, we know, is measured in **volts**! And we also know how to measure it; with our new DVM.

Resistance is also measured by the DVM and is expressed in **Ohms**.

Current is expressed in **Amperes**, may be measured by your meter but they are usually limited to very low currents (miliamps. or one thousand of an amp.) The less expensive Radio Shack DVM is capable of measuring up to 400 miliamps.

So, if we are concerned about our receiver batteries at 4.8 volts, and we want to check them at one amp, which is a typical current during servo movement, then we need to load them with a 4.8 ohm load;

Resistance = **Volts** divided by **Current**

Resistance = 4.8 divided by 1 amp = 4.8 ohms!

So take out your new DVM and start measuring the resistance of potential loads, but remember, they must also be capable of carrying the desired one amp current.

So you have found the load, now what. Well, we want to check two things;

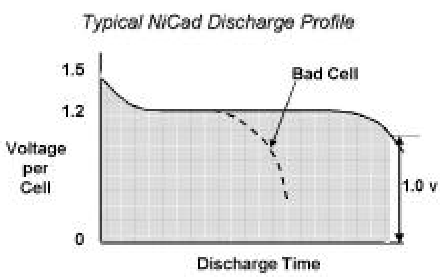
- First, the battery capacity
- Second the individual cell voltage as we discharge the pack.

The battery capacity is;
Capacity = **Current** times **Discharge Time**

This is usually specified in **Miliamp Hours**.
Capacity = **Miliamps** times **Hours**

For the test we will run, assuming you find a load that will produce a one amp loading, the capacity will be;
Capacity = **1000** times **discharge time** (in hours, or time in minutes / 60)

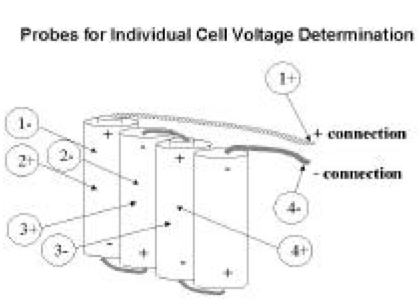
A typical discharge voltage curve for a nicad pack is shown below.



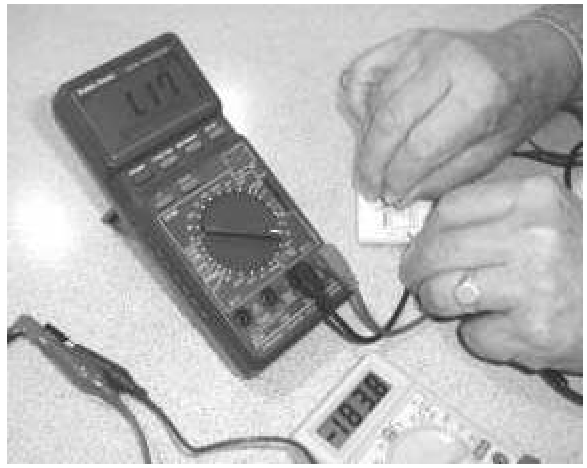
Customary end of timing is when the pack is down to 1 volts per cell. In the case of the Rx battery that would be 4 volts.

Also shown in the discharge profile above are the effects of a bad cell. This is one of the things we are looking for in our diagnostics. Notice that the bad cell will produce the 1.2 volts at the early part of the cycle but it "poops out" early, so what we need to do is measure the voltage of each cell during the discharge cycle.

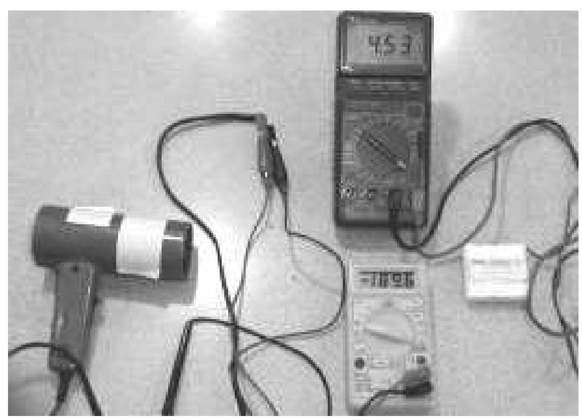
We can do this with a neat ruse as depicted in the following chart. We need to probe inside the batteries protective coating to measure the voltage at the points depicted in the chart.

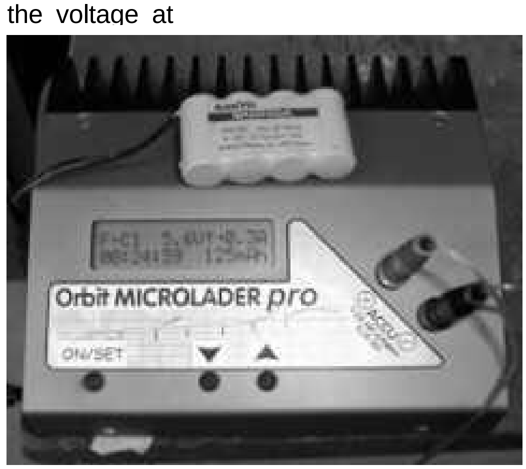


Do this with a pin or needle clamped in an alligator clip test lead and connected to our DVM. You need two pins and test leads so you can connect to both positive and negative probes. Just insert the probes, at the noted pairs of points, for measurement of cell 1, cell 2 etc.



The picture following shows the setup to load test the pack. The hair dryer is the load and at 4.56 volts it is producing 191 miliamps. Once you measure the load-current it is not necessary to measure both voltage and current simultaneously. Just measure voltage during discharge so you know when it's done.





Of course, you could buy a sophisticated charger, which keeps track of battery health! But it is really not necessary for basic protection. Just time the discharge cycle.

So, what was the story with Al's battery? It had one bad cell. Shoulda tested it. Now you can.

Dave

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Propstoppers R.C. M.A.C

Harrisburg Area Flying Society Annual Giant Scale Meet, 4/5 September, 2000.

The Harrisburg Area Flying Society is holding its annual IMAA sanctioned Captial City Classic Giant Scale Show on Saturday and Sunday, September 4 – 5, 9:00 till dusk. Parking available on premises. Concessions stand and picnic area available. The field is located at Elmerton Ave. and State Farm Road in Harrisburg, across from the PA State Police Headquarters. For information call 545-0974 or 761-8293 or see web page for field directions;

http://hafs_homestead.comhomepage.html