

Harbor Soaring Society  
P.O. Box 1673  
Costa Mesa, CA 92626



**FIRST CLASS MAIL**

WILL CONRAD  
9359 SHRIKE AVE  
FOUNTAIN VALLEY CA 92708

## **PLANE RAP**

**The News Letter of the Harbor Soaring Society**

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**"The Oldest Chartered Soaring Club In the AMA"**  
**Charter # 128**

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**OCTOBER 1996**

**OCTOBER 2ND CLUB MEETING**

**The October club meeting will be held on Wednesday, October 2nd, 1996  
at the Hobby Shack store, 18480 Bandlier Circle, Fountain Valley -**

**Rick Briggs will be the speaker.**

**See ya there at 7:30 P.M.**

**OCTOBER 1996**



P.O. Box 1673  
Costa Mesa, CA 92628

## Harbor Soaring Society Board Members

President: Matt Fourqer  
Past Pres: Roger Lackey  
Vice President: Larry Tuohino  
Secretary: Dave Nemecek  
Treasurer: Steve Hendry  
Contest Coordinator: Eric Marcussen  
General Director: Ross Thomas  
News Letter Editor: Bob Sliff  
News Letter Publisher: Will Conrad

## HSS Volunteers:

### Field Maintenance:

Dick Pantzar  
George Azvedo

### Librarian:

George Azvedo

### Winches:

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Eric Thornton  
Ross Thomas  
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### Electric. Coordinator:

Larry Tuohino

### Score Keepers:

Maxine Thomas  
Mike Aguirre

### Membership/New Members:

Roger Saville

### Slope Coordinator:

Lyndon Johansen

### Scale Coordinator:

Rick Briggs

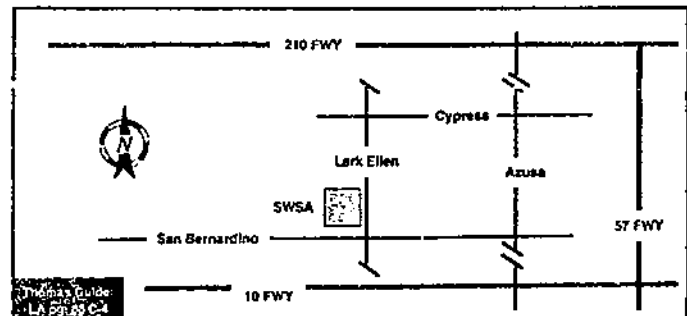
# THE PREZ SAYS!

## SWSA

October (SC)<sup>2</sup>

### Silent Wings Soaring Association

DATE: October 27, 1996  
TIME: Sign-in at 8:00 AM.  
Pilot's meeting at 8:45 AM.  
Contest starts at 9:00 AM.  
CD: Frank Corsaro (909) 984-4978  
CLUB PRESIDENT: Pete Olsen (909) 597-2095  
LOCATION: Las Palmas School, Covina, CA



EVENT: Four rounds Precision Duration with landing circles (standard 25' tape) on mowed grass.  
\$7.00 entry fee.  
Tasks: 4, 6, 6 and 8 minutes with maximum of 50 points per landing.  
All AMA and (SC)<sup>2</sup> rules apply (444 - open).  
WINCHES: 12 volt winches with retrievers. Approximately 600' to turnarounds.  
TROPHIES: Masters (3), Expert (3), Sportsman (3) and Senior  
NOTE: Channel 16 is unusable.

Encourage New HSS Members!  
"HSS Is Orange County R/C Soaring"

## **Vice is My Life: The VP Report**

### **October HSS General Meeting**

It's back to Hobby Shack this month after a great meeting last month at McGregor's Yachts! Rick Briggs will be the speaker/sideshow, talking about his recent trip to Europe, the Belgium and Holland F3J Inter glides, and pictures from the birthplace of soaring, the German Wassekuppe (Maybe we will also get the true story about how at the Inter glide Ben Clerx was "beat by a girl").

### **Storage Container Update**

Negotiations over the formal wording of the storage container contract with the city are now complete. The contract goes to the City Council for approval next (yes we missed last month's council meeting). Each step takes a little more time than expected when working with the government but I continue to be relieved at the positive light in which the city sees HSS. With a little luck we will break out the champagne before the year is out!

### **HSS at Sailplane Enterprises Hemet**

"That was much better than I expected!" Rick Briggs said as he climbed out of the Blanik. Ben Clerx flew entire flight from takeoff to touchdown...of course. And everyone else (Les Kenyon, Karl Hawley, Sue Smith, Randy Beloff, Steve Hendry, and Mr. "I-eat-360s for lunch" Will Conrad) all were sky-eyed after this latest HSS adventure. A big "thanks" really goes to Sailplane Enterprises in Hemet for the great deal they gave HSS so everyone could try full-size soaring. If Sailplane Associates will "solo" me, who's next!?

### **Holiday Awards Party**

The party committee is now forming and your spouses help is specially valued. It's time to get the ladies together again! Three choices are being considered - Kaplans, Don Joses and the Barn. We will review menus at the October meeting with a quick vote to decide. The Committee also needs input now from all HSS members on "special" humorous prizes to be awarded at the HSS Holiday Awards Party. If you know someone who needs to be recognized (or roasted) "for infamous 1996 exploits" get the name and the circumstances to a Committee Member ASAP! Finally, we need "donations" of all kinds for raffle prizes...time to hit up the retailers, the manufacturers, and...to clean out the garage of that kit you always meant to build but "never get around to it".

A special "party planning meeting" at the chosen restaurant for Committee Members is planned in mid-November, let me know if you want to be there.

### **Volunteerism**

Yes, it's that time again. Nominations for new Board Members open at the October meeting. This is your primary method to deciding the future direction/activities of the club. It's important that glider guiders from different phases of the soaring hobby participant in the Board to insure a diverse HSS program in 1997. Put your hand up now *or hold your grumbling for another 12 months!*

Sky Out or Die Out...Lars Tuohino

# HSS 1996 Calendar-October Update

Events of interest to "Team HSS" and the OC R/C Soaring Community. HSS sponsored or affiliated events in **bold**. All dates are subject to change. Best to confirm non-HSS dates with foreign club CDs. If you are aware of any errors or conflicts please advise Erik Marcussen @ 714 730-7998. Updated Monthly!

## October

10/2	<b>HSS Club Meeting- Rick Briggs European F3J Interglide Sideshow</b>
10/5	<b>SULA Monthly</b>
10/5-6	Fall Soaring Festival Visalia
10/13	<b>HSS Monthly TD</b>
10/13	ISS F3J
10/20	TPG Thermal Contest
10/22-23	SEF SD Electric Fall Fun Fest
10/27	SC2 at SWSA

## November

11/2	<b>SULA Monthly</b>
11/2-3	<b>SWSA 2 day X-Country Merrills in Rosemond</b>
11/6	<b>HSS Club Meeting</b>
11/10	<b>HSS Monthly TD</b>
11/16	<b>SULA F3J</b>
11/17	<b>SC2 at Pasadena</b>

## December

12/7	<b>TPG South HLG</b>
12/8	<b>HSS Monthly TD</b>
12/11	<b>HSS Holiday Awards Party</b>

NAME	SCORE	CLASS	NORMALIZED	PLACE
MIKE AGUIRRE	931	1000	989	7829
MATT FORQUER	934	0	932	7692
ROSS THOMAS	873	665	939	7069
DAVE NEISECK	974	990	847	6172
RICK BRIGGS	1069	898	833	7133
ERIK MARCUSSEN	853	887	958	7031
STEVE HENRY	820	428	979	6742
JOE RODRIGUEZ	980	1090	970	5796
BILL DUNCAN	752	683	935	6983
NORM KUTCH	866	959	993	5450
LARRY TUCHINO	943	882	833	6285
TOM VINCENT	944	948	872	5745
GEORGE AYBEO	718	895	838	4322
WILL CONRAD	885	848	757	3883
DAN FINK	677	568	980	4478
MIKE PARSONS	890	204	894	3469
PAT STONER	365	522	886	3354
ROGER SAVILLE	837	792	677	4986
DICK BUZOLICH	758	853	787	3920
BOB KUTCH	844	576	847	2946
AL CROON	844	576	847	3822
ROGER LAGREY	828	828	847	2589
BOB BERRY	748	842	788	2431
LARRY MARCUSSEN	833	772	862	2423
TOM KUMMER	678	873	873	2118
LENN BERNARDT	883	875	971	2729
ERIC THORNTON	990	813	704	1413
GORDON RITSCHKE	856	975	1000	1170
BOB CLERN	975	925	884	1975
BOB EBERG	925	884	925	925
RANDAL HOLZAPPE	302	493	863	1658
CHRIS KENYON	304	304	304	304
KARL HAWLEY	234	234	234	234
CHARLIE NEURANN	273	273	950	4VALUE
STEVE SCHUPAK	2288	ADVANCED	773	

September Open Contest

NAME	SCORE	CLASS	NORMALIZED	PLACE
REN CLERX	2961	MASTER	1000	1ST MASTERS
MIKE AGUIRRE	2860	MASTER	999	
DAN FINK	2934	EXPERT	991	1 ST EXPERT
MATT FORQUER	2826	EXPERT	988	2 ND EXPERT
RICK BRIGGS	2900	EXPERT	979	3 RD EXPERT
TOM VINCENT	2899	EXPERT	978	
LARRY TUCHINO	2880	EXPERT	973	
DENNIS BRANDT	2874	EXPERT	971	
BILL DUNCAN	2870	EXPERT	970	
NORM KUTCH	2838	EXPERT	969	
ERIK MARCUSSEN	2767	EXPERT	934	
DICK BUZOLICH	2759	EXPERT	932	
ROSS THOMAS	2655	EXPERT	922	
AL CROON	2517	SPORTSMAN	853	1ST ADVANCED
CHRIS KENYON	2517	SPORTSMAN	850	1 ST SPORTSMAN
STEVE SCHUPAK	2498	EXPERT	844	
STEVE HENRY	2288	ADVANCED	773	

September Classic Contest

NAME	SCORE	NORMALIZED	PLACE
LARRY ENGER	2917	1000	1 ST
RANDY BRATRUD	2916	999	2 ND
WILL CONRAD	2850	977	3
DICK PANTZAR	2836	972	
KARL HAWLEY	2669	915	
CHRIS ADAMCZYK	2641	905	
BOB SLIFF	2601	892	
ROSS THOMAS	2487	853	
NORM KUTCH	2009	689	
JOE DE LA CRUZ	1671	573	
ROGER SAVILLE	1485	513	



PHOTO BY R. BELLOF

## SAILPLANE ENTERPRISES

(Lookout below - The publisher will try his hand at writing!!)

As you can see by the photograph, there was a group of ten who went for a ride and a chance to pilot a full size sailplane, thanks to the efforts of Larry Tuohino. All of us had a wonderful time.

My wife and I arrived at the airport about 12:00 noon. There were nice picnic tables under pine trees. We enjoyed a great picnic lunch while enjoying a soft breeze blowing across the field. I was scheduled to be the last up - about 1:45. While eating lunch we saw two water dropping planes (C54's) take off and land after about a 25 minute flight. A bit of nostalgia for me as I worked on that kind of airplane when in the Navy 1945-46 on autopilots and instruments.

My turn came to fly in a *Blanik*, with Instructor/Pilot "John". Ben Clerx helped me get settled in the cockpit, enlarge the seatbelts and pointed out the tow hook release, wheel brake and canopy levers. The instrument panel had an altimeter (indicating 1500 ft. altitude of Hemet Field) air speed, magnetic compass, rate of climb. The most important 'instrument' was not on the panel. It was a 5 inch piece of yarn attached at the base of the canopy. The objective is to keep that yarn straight up the canopy, sounds easy but was difficult for me to accomplish. We took off on tow and climbed to altitude of about 3000 feet AGL. John pulled the cable release and we were on our own. Almost immediately John went into a steep right bank (60 degree). The rate of climb indicated we were rising at about 600-800 feet a minute. Boy, could you ever feel the G's pushing you down into the seat. John asked if I wanted to take over, which I declined, too much too fast for me! After reaching 7500 ft altitude we leveled off and flew west at which time I did take the controls - flying straight. Wow, did that piece of yarn show how bad a pilot I was. We continued to rise, riding a wave. John suggested a few 360 degree turns (left and right). After gaining a little confidence, the circle became tighter and tighter and the speed went from 45 to 70 knots. We were losing about 200 ft. a minute. I kept pulling back on the stick and slowed to 50k and gained altitude. The wings were at about 70 degrees and the G forces were sure being felt, almost needed the barf bag! John indicated it was time to land, he told me where to get lined up on the base leg and turn on final at which time he took the controls for a very soft landing. My ride in a full size glider was over. Thanks again Larry for arranging a great day!! Those of you that didn't go, missed a wonderful experience

# NI-CAD BATTERIES

by Paul Flory

**Editor's Note:** Paul Flory is an electronics engineer who designs two-way (voice) radio systems for law enforcement agencies. Most of the systems he has designed use portable radios with rechargeable ni-cad batteries. In addition to purchasing over 30,000 ni-cad battery packs (8 - 12 ni-cad batteries per pack), he has taught many classes on how to care for them.

It seems that we are besieged with a never-ending number of articles (opinions) on ni-cad batteries, chargers, cyclers, and discussions of what they are, which one is the best, and on and on. Does it leave you confused? Me too! Well, if you're interested, read on, I'll add my two-cents-worth.

Most articles on ni-cad batteries discuss small specific technical details without regard to the overall big picture. This article provides an overview of what ni-cads are and how they work.

## BATTERIES AND ALL THAT JARGON

Many people think a ni-cad battery is a power source. I call it a power storage tank. A power source is something like the generator that makes the electric power which is provided by the local electric utility (such as SMUD here in Sacramento). The power from this source is transferred into the ni-cad battery through a charger. Then, when we fly our airplanes, the power is transferred from the ni-cad battery to the radio and servos. From the servos the power is transferred into altering the direction of flight of your sailplane.

Before we begin, I need to explain a couple of terms which will be used to describe the ni-cad batteries:

The term 'voltage' refers to the amount of energy (or potential energy) contained in the electricity. It is a rating just like the octane rating of gasoline. The standard voltage used in your household lights is about 120 volts. The standard voltage of alkaline batteries (the du-racell flashlight type) is 1.5 volts per battery (cell). The standard voltage of ni-cad batteries is 1.2 volts per battery (cell).

The term 'milli-ampere' (abbreviated 'ma') is a measurement of how fast the electricity is flowing into (or out of) the battery. The term 'ma' is quite often interchanged with the term 'current'. This is similar to the term 'current' in a river which is a measurement of how fast the water is traveling down the river. A milli-amp is 1/1000 of an am-

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pere (amp).

When you add time onto the flow of electricity you have the term 'milli-amp-hours'. The term milli-amp-hours (mah) is used as a measure of the capacity of ni-cad batteries just like the term 'gallon' measures the capacity of a gas tank. The term 'milli-amp-hour' refers to the amount of electricity that can continuously flow out of a battery for a period of one hour. A 100 mah battery will provide 100 ma of electricity for one hour. A 600 mah battery will provide 600 ma of electricity for one hour (or it will provide 300 ma of electricity for 2 hours and so forth). After that, the battery will be empty (dead) since all of the electricity has been used.

## BATTERY CHARGERS

Before you can transfer power from a ni-cad battery to the radio and servos, you have to fill it up with power from somewhere else. It's real simple to do, just charge it!

A battery charger is something that regulates how we put electricity into the ni-cad battery, and it regulates how full the battery gets. Let's take a look at how chargers work. There are two basic types of battery chargers. One provides a constant voltage (potential energy), and the other provides a constant current (constant flow of energy into the battery). Remember that current (milli-amps) is how fast the electricity flows. Voltage is the potential energy of the electricity.

A constant current charger pumps electricity into a ni-cad battery, at a constant rate, no matter how full the battery gets. When the battery is full, a constant current charger will keep trying to cram in more and more electricity. Most of the constant current chargers will shut off when it (the charger) thinks the battery is full.

A constant voltage charger will also pump electricity into a ni-cad, but as the battery becomes fuller, the current rate will become lower, until the battery is fully charged. When the battery is fully charged, and it's voltage is the same as the charger's voltage, the current stops flowing. Another characteristic of constant voltage chargers is that they are designed to limit the current to about 1/10 of the battery capacity (in ma).

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Quick chargers are constant current chargers that pump electricity into a battery at a rate which is often equal to or higher than the ni-cad battery's mah rating. Remember that the manufacturers recommend a maximum charging current of 1/10 of the battery rating. Some field chargers will charge a battery in 1/2 hour. That means the charging current is about 20 times the recommended charging rate for the battery. When you charge a battery this fast, you will quickly notice that it isn't too happy and it gets very hot under the collar! That's not good. Do this very many times and the battery will develop a personality...one that may not like you too much...one that may get very upset with you...one that may belch when you're in that boomer thermal...It's kinda like trying to chug-a-lug a gallon of A&W Root Beer in 5 minutes!

In addition, quick chargers depend on external measurements to determine when the battery is full and when the charger should shut down. These external devices range from sophisticated microprocessors to simple timers. No matter which, they are making a guess. Only the battery knows when it's full!

Now I've said it....In my opinion, quick chargers are bad horrible for your batteries. But, sometimes there's a tradeoff. If your spending the weekend at Los Baños you either bring lots of batteries or a quick charger. So, go ahead and use them once in awhile, just remember that each time you do, you've caused another ulcer and shortened the life of the battery. It's your gamble. Spend money on spare batteries or spend money on a new sailplane. Simple as apple pie.

Recently we have read several articles about which 'quick charger' is best? The \$100.00 one, the \$75.00 one, or the \$10.00 one? In my opinion, there isn't much difference. They all stuff the batteries as full as they can get, as quickly as they can. Some shut down quicker, some pulsate the charge, some do other fancy gimmicks, but they all stuff the battery. Kinda like eating a 20 lb. turkey just before you start the marathon! Eat it in 30 minutes, 45 minutes, or 15 minutes, I don't care. Eat it fried, smoked, baked, stuffed, or however you want. Just remember, you're gonna get sick!

In conclusion, I recommend that you charge your ni-cads with the charger that came with your radio, and let it charge for at least 14 hours. Leaving it on the charger for a longer time won't hurt the

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O.K., so what's the difference? They both charge the battery, and, it seems that the constant current charger makes sure the battery is filled to overflowing! Well, that's right, but, let's approach charging from another point of view. Imagine the ni-cad battery as an athlete. It's the day before the Boston marathon. The final day of training. It will be a long hard day and the athlete will need a lot of energy. So what does he do? Spend the day stuffing himself full of food (energy) until someone takes the food away, or will he eat healthy meals, and quit when he is full? It's simple. An athlete eats well, and he works hard. He is in great shape. He can easily finish the marathon. What about a couch potato? He sits down just before the race begins, and eats pizza. As long as there is pizza on the table, he eats it. When the couch potato runs the marathon, he'll probably be zapped within a few blocks! Constant voltage (a healthy diet), or constant current (cat till your stuffed)? Which should it be? It's your sailplane!

You're not convinced yet? Well, consider the charger that came with your new radio. It's a constant voltage type. Why would the manufacturer of the best transmitter, the best receiver, and the ultimate servos provide you with anything but the best battery charger? If I was in the business of providing the best R/C products, I would make sure everything I provided was the best!

Ni-cad battery manufacturers stipulate that the constant voltage chargers should limit the current flow into the battery to a maximum of 1/10 of the battery capacity (mah). This means that a 600 mah battery should be charged with a 60 ma current maximum! Simple algebra shows that it will take 10 hours to fill the battery (60 ma times 10 hours = 600 mah). But, with a constant voltage charger, the current becomes lower as the battery becomes fuller (charged), so it will take more than 10 hours to fully charge the battery. It actually takes 14-16 hours to completely charge ni-cad batteries with a constant voltage charger. That's why the label on most batteries says to charge it for a minimum of 14-16 hours!

### QUICK (FIELD) CHARGERS

How, you ask, do quick chargers work? Quick chargers (field chargers) are very convenient, especially when you're out for a day or weekend of flying. You fly, recharge, and fly again. Although quick chargers are convenient, it is important to understand how they work and what they do to your batteries.



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battery, because when it is fully charged, the charger quits trying to stuff it. If you must use a quick charger, only use it when you have to. Each time you quick charge a ni-cad, you cause damage to the battery. Continuous battery damage leads to sailplane damage!

## NI-CAD BATTERY MEMORY

We previously learned that a ni-cad battery is simply something you use to store electricity in. When you fly your sailplane, you take the energy from the ni-cad battery and use it to make the sailplane change directions or speed. When you charge the ni-cad, you put energy into it and store it for future use. Now we will learn about this weird term called 'memory' and how it affects the performance of your batteries.

In reality, a ni-cad battery is more than an empty can waiting to be filled. The positive plate of ni-cad battery is made from nickel hydroxide (the 'ni' in ni-cad) and the negative plate is coated with cadmium (the 'cad' in ni-cad). These elements utilize all kinds of scientific chemicals and wonders to store the electricity. The best way to describe how a ni-cad battery works is to compare it to a human body. Humans (even R.C. sailplane pilots) eat food for energy. If they don't eat, they don't have any energy, and eventually they expire (pass away, die, cash out, buy the farm, crash, or whatever you want to call it). But, we have learned that if we eat a good diet and get proper exercise we will probably have a long and happy life.

Guess what? ni-cad batteries function just the same. Give them a good supply of energy and proper exercise and they will be strong and healthy for a long time.

Previously, we learned how to give a ni-cad battery some good nourishment (energy) and what can happen when the nourishment is not so good. As you know, good health involves more than getting good nourishment. As human beings, we are inundated with the terms 'Diet and Exercise'. Now we will focus on 'exercise' for the ni-cad batteries.

How can a ni-cad battery exercise? It's real simple. Give it a good workout. That means use all the electricity up before you re-charge it. A marathon runner and a couch potato can eat the same balanced diet, but without exercise, the couch potato can only run to the refrig-

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erator. He won't be able to run around the block. Ni-cads arc just the same. If you repeatedly charge a ni-cad, go to a contest and fly 20 minutes, then do it over and over, it will eventually turn into a 20 minute (couch potato) battery. You can charge it up (full) and it will only fly your sailplane for about 20 minutes, then it will buy the farm (and you will buy another sailplane). Preventing this is simple. Proper exercise.

## PREVENTING AND ERASING MEMORY

O.K., you can exercise your dog by taking it for a walk, but how in the world do you exercise a ni-cad battery? The key to exercising a battery is to use all of its energy before you refill it. This means that you need to discharge the ni-cad before you recharge it. Discharging a battery can be done in several ways:

One way to discharge the battery is to find an awesome thermal and fly in it for a couple of hours. Another way to discharge the battery is to leave your radio on. Leaving the radio on will eventually discharge the battery, but it could take a long time, especially for a receiver pack when the servos aren't being used. You can tell when the receiver battery is discharged because the servos will become very slow and sluggish. You can tell when the Transmitter battery is discharged by watching the meter on the front of the radio. When it gets below the red line (or green or whatever depending on the radio), it's empty! NOTE: (I do not recommend that you use this procedure to discharge ni-cad batteries. Without going into a lot of detail, I'll just say that it is very easy to totally ruin the batteries using this procedure.)

Since the above procedure is a time consuming task, and it can damage your batteries, several companies have developed a device called a battery cycler to do the job for you. These devices automatically cycle the batteries in two stages. First, they will discharge the battery at a constant current (usually 1/10 of the battery capacity). As an added bonus, most of them measure the time that it takes to empty the battery. The time reads out on a display. After the battery has completely discharged, the cycler automatically starts the second phase which is to charge the battery. When the battery has been completely discharged and recharged, it has had good workout (exercise).

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To determine if the exercise was successful you need to calculate the capacity of the battery. This is done by dividing the discharge current by the time it took to discharge (mili-amps/hours). The result should be within 20% of the battery's rating. If it isn't, then cycle it through the discharger - charger a few more times until it improves. (This is how you erase the memory...Diet and exercise!) If there is no improvement after cycling a battery 3 or 4 times, it's seen better days. Toss it out!

These cyclers really work well, and they take the guess work out of exercise. As an added benefit, they provide you a with a measurement of the condition and capacity of your battery. Batteries do not need to be cycled each time they are used. I recommend cycling about once every 25 charges.

By the way, the normal life of a ni-cad battery is not based on it's age, it is based on the number of times it is charged and discharged. As a general rule of thumb, a ni-cad battery will survive about 500 charge - discharge cycles.

Sometimes ni-cad batteries will develop internal problems that do not show up when you exercise them. What will happen is that the battery will have an internal short circuit, and within a few days after a full charge, the battery will be empty. To test for this condition, exercise the battery and keep track of it's capacity. After it has been fully charged, let it set for several days, then discharge it with the cycler, and determine how much charge still remains. If it has lost more than about 10% of it's capacity, it is not a reliable battery and should be replaced!

### HOW LONG CAN I FLY ON A FULLY CHARGED BATTERY?

As we previously discussed, if a 600 mah battery provides 600 ma of current to your radio, it will be dead in an hour. This is great theory, but how much current does your radio use? The average amount of current your sailplane uses depends on how many servos you use, how big your plane is, as well as many other variables. Therefore the amount of energy provided by an airborne battery varies with each plane and each pilot.

Once you know the capacity of your battery, it's just a matter of

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measuring a few things to determine how much electricity your sailplane uses, and to determine how long you can fly before the battery pack will expire. To begin, you need to determine the capacity of your batteries, and then fully charge them. Next, go do what you enjoy most...fly the plane. While you are flying, keep track of how long you fly (total time of all flights)! When you get home, connect the battery to your cycler and discharge it (don't charge it up first), and determine the remaining capacity of the battery. By subtracting the remaining capacity from total battery capacity, you will know how much energy was used when you flew. Now you can determine the average amount of electricity which was used during your flight by dividing the energy used by the flight time. If you flew 1/2 hour and used 300 mah of the battery's energy, your plane used an average of 600 ma (300 mah / 0.5 hour) of current. If you have a 900 mah battery, you can fly for 1.5 hours (900 mah / 600 ma = 1.5 hours).

Be sure to measure both the transmitter and receiver batteries. If your receiver will last 3 hours and the transmitter will only last 2 hours, you may have a disaster waiting to happen! Same thing if those numbers are reversed.

Now that you know how much energy your transmitter uses, and how much energy your sailplane uses, you can easily determine what size of batteries you need. If you want to fly your sailplane for 1 hour, and it uses an average of 200 ma of energy, a 200 mah battery will work, but without any safety margin. I recommend a 50% safety margin! (Use a 300 mah battery in this case!)

### SUMMARY

My goal for this review was to present an overview of ni-cad batteries and how they work. Just as it is important for a person to eat a balanced diet and get regular exercise, it is important for a ni-cad battery to have a healthy charge and receive regular exercise. This isn't to say that you should always completely discharge your battery before you recharge it. And this isn't to say that there won't be times when an unhealthy charge is the expedient way to go. Just use caution when you do, and don't get into a routine of continuous quick charges.