



# THE RAMS HORN

The Official Newsletter of the Rainbow Aero Modelers Society  
Metro Milwaukee Area Franklin, WI Founded Nov. 6, 1980

AMA—Academy of Model Aeronautics Club #1264, Operating for Public Benefit, Milwaukee County RC Flying Field, S.70 & W. Oakwood Rd.

**Next Meeting: Wednesday, Sept. 3, 2008**  
**WaterStone Savings Bank, 6560 S. 27<sup>th</sup> Street, 7PM**  
*(formerly Wauwatosa Savings Bank)*

**Volume 29 – Number 9 – September, 2008**

## **THE PRESIDENTS REPORT** by *Tom Ryan*

***BETTER and BETTER!*** The field is really nice, people are enjoying it, and the word I hear is “*it’s getting better and better as each day goes by.*” It is great to see that all the work is paying off.

I was out shooting the breeze with the guys at the field today and could hear everyone laughing and having a good time. The jokes were flying as much as planes were, and I couldn’t help to think that “*this is what it’s all about. People enjoying each other’s company, and doing what they enjoy doing, flying their RC aircraft.*” It was great.

I’m seeing new faces arrive and some old one’s too! One former member said “*I’ve never seen the field look so good or so many people having fun!*” That was encouraging to hear from someone who was around way back when!

There are so many people who are now jumping in and helping out because they can see their effort working and enjoy the new sprit of the RAMS and its members.

This September 20<sup>th</sup> the RAMS will host a picnic for its members only and their guest. The field will be closed to everyone else and it’ll be open flying for RAMS Club members only, 10AM-4PM.

There will be food and soft drinks free, and each member can bring a dish to pass if they like, or toss five bucks into the cash cup to help cover the meat cost. There will also be some door prizes, and everyone should have

a good time. Our bulletin board will show further details, but remember, this is for RAMS & Guests only, not those who only hold a field license. Pilots can of course sign up to be a RAMS the day of the picnic, too. (Our \$15 annual dues drop to \$7.50 after Sept. 1<sup>st</sup>, Ed.)

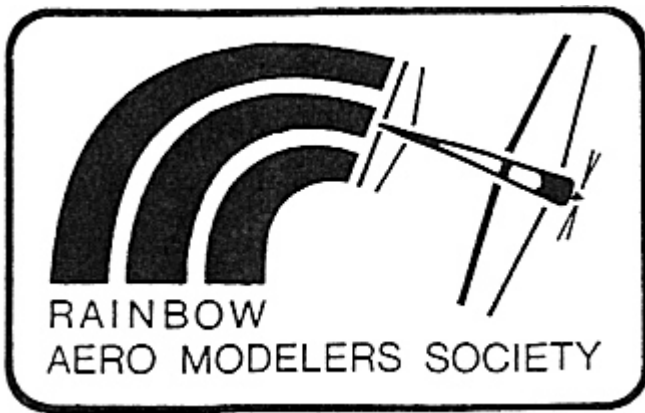
The Rosholt, WI trip (17 mi. NE of Stevens Point) is well underway and those of you who are going should sign up with me ASAP, as I need to know who’s going (September 6<sup>th</sup>) and what you’ll be flying. The food and beverages are being provided by their club and we’re their guest. The pictures taken there will be in Model Aviation along with a story on their club. The Rams will be in it, too, as a club who cared and shared their moment. So let’s make it very special for them as we are the only invited club who’ll be in attendance.

I know this season was a shaky start with all the rain but, it’s what we’re doing now that counts. We’ve bounced back as a club and are flying daily. The north flight line is once again filled with pilots and the excitement of model aviation. It’s very evident on everyone’s face. The fun is back and we’re all enjoying it so, if you haven’t been out in a while, come on out and see for yourself. Bring a friend or, make one there.

Last, I’ve gone to several Fly-Ins this summer and can honestly say “*our field can compete or is better than most.*” And ours is getting noticed. Are we where we want to be? No, but we’re well on our way. Our 2009 season should be better than 08, and ’09 will be a great year, because we have a plan for better... thanks to you, the RAMS Club Members. Hope to see you at the next meeting, until then...Cleared to land! Tom Ryan, Pres.

***Pilot Profile This Issue: Mike Jankowski***

- Visitors at Meetings or the Field Always Welcome -



Founded Nov 6, 1980 Club #1264 Academy of Model Aeronautics

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RAMS Club is  
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Pilot License to  
Fly at Milwaukee  
County Field \$40  
\$15 under age 18

#### **MEETINGS-7PM**

First Wednesdays  
\*WaterStone Sav.Bk.  
6560 S. 27 Street

Membership Dues  
are \$15 per year;  
except \$7.50 /year  
for ages under 18,  
or disabled.

Dues paid after  
April 1. add \$1.00  
Dues paid after  
May 1, add \$2.00  
Membership ends  
June 1 if not paid

Terms of Office  
and Dues Year  
Mar. 1 - Feb. 28

## All Flight Instruction is Without a Fee

#### **Contact:**

#### **FIXED WING – Reciprocating Engine**

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William O'Dell\* 414-543-6518 Art Schmidt\* 414-543-7100  
Dave Simonson, 414-427-1783 Bill Stilley, 414-541-4702  
Tom Ryan, 414-881-0070 Milan Zdrubecky, 414-282-3997  
\*Retiring March, 2008--Will You take their place?

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#### **ALL TURBINE POWERED**

Jeff Borowski, 414-483-4377 Darrell Hossalla, 414-651-0968  
Roger Olsen, 414-764-3257 Tom Ryan, 414-881-0070

#### **HELICOPTER – Reciprocating Engine or Electric**

Russ Schneider, SWARM instructor coordinator, 262-642-2790



*"When you're facing the plane,  
did you say left was right?"*

Courtesy of Le Journal d'Escadrille  
114<sup>th</sup> Aero Squadron, E. Grammont, Editor  
Grapevine, Texas

**Keith Kittoe**  
President

**RCSLOT**

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# Happenings at the Meeting

RAMS Club, August 6, 2008

by Russell Knetzger, Librarian & Editor

The meeting was back at the bank, our usual 1<sup>st</sup> Wednesday of the month, and will remain so, said Pres. Tom Ryan. Not enough members who asked for “Saturday-at-the-Field” showed up in July. Our club treasury is quite low, under \$100, reported Craig Manka, but will bounce back when monies advanced for the cancelled July 12<sup>th</sup> Fly-In are returned. The Field License report by Jim Hatzenbeller showed the license count has jumped from 103 last meeting to 112 at present. An analysis of the 112 shows 31 are neither RAMS or SWARM members. Potential new members attending were Dennis Kukla of Eagle Lake, and Frank Burton.

On the theme of encouraging more licensed pilots to join the RAMS, Tom Ryan offered possibilities. Others came from members. One is the usual Sept. RAMS Fly-In (this year Saturday the 20<sup>th</sup>) can be a picnic format limited to RAMS and their families. Some members thought only pilots who actually fly should vote on field rules changes. Another idea is to have a discount on the license fee for club members. To encourage field work volunteerism, of say 4 hours per season, the dues might be lower for volunteers.

Field Reports: The 3-foot deep flood of early June saturated the First-Aid kit under the frequency board. Tom Ryan asked Marv Anderson, as Safety Officer, to restock it. A new wind sock sensitive to lower wind speeds is being donated by Mike Lutzenberger. Bob Kabella, field manager, gave his cut & roll report, and praised Dale Champagne and Roger Olsen for extraordinary help. Tom Ryan said the new style pit benches are being used, and the cloth-roofed pit canopies near the frequency board also seem appreciated.

Bob Kabella also reported that grading contractors DK Contractors, Inc. of Kenosha have bid \$4920 to increase the depth and size of the west runway project started last year by Marv Anderson’s 100 cubic yards deposit, brought in by truck. DK would average 9 inches thick, a 90 ft. wide runway, 210’ long east-west, or just over 500 cubic yards. That would push wetness farther west so mowing does not rut the field west of the crown each spring. The

other bid is for \$4031 to build a 265 ft. long berm, bridge to bridge, on the south side of the creek to prevent the creek overflow washouts of our north-east runway. Since the city has told us we no longer can truck-in soil under flood plain zoning rules, each bid would transfer earth from north of the creek, over a temporary culvert in the creek, using a “paddle-wheel” earth mover, which can operate in our high water table conditions. That’s what was used in 1987 to build the north-south runway. Marv Anderson said the job should cost less. Plugging or moving westerly the cut in the creek bank was discussed.

Raffle Winners at the August meeting were Andy Mudrick of a metal transmitter carrying case; Nick Johnson of a gallon of 10% nitro fuel; guest Dennis Kukla of surplus U-Control objects; and Carl Goldberg’s Center of Gravity measuring device

## Notice of Field Rules Vote

The RAMS Club hereby gives advance notice as required by its By-Laws that at its September 3, 2008 meeting two rules will be placed before members for final vote. All persons will be heard. In concept these changes were approved in past meetings, and now exact wording is ready for voting and insertion into the Field Rules. (Italics below denotes the proposed added rule wording).

“General 1. Power to enforce these rules has been vested in the RAMS Club by Milwaukee County through its land use permit with said club. A warning or suspension of flying privileges may be issued by the Club officers and/or directors for violations. *A Safety Officer may ground any pilot for up to 24 hours. (May 7, 2008).*”

“Flying Safety 24. Beginners absolutely may not fly without the assistance of a pilot who has soloed. A soloed pilot can safely take-off and land the aircraft. *Fixed-wing beginners shall be taught via the dual transmitter-trainer cord (buddy box) system. (Sept. 3, 2008)*”

\* \* \*

A website is maintained for the RAMS Club by RCSLOT, LLC hobbies at S. 51<sup>st</sup> St. & Ryan Road.

[rcslot.com/rams](http://rcslot.com/rams)

The shop features on-line eCommercce Operations (RC cars, etc.) and is owned by Keith Kittoe.

## RAMS Members Again Aiding MIAD Professor Build A Model

by Russell Knetzger, RAMS Editor & Librarian

During the 2007 summer break between college classes, RAMS members Bill O'Dell, 80, (a fellow MIAD professor), Art Schmidt, 90, and Russell Knetzger, 71, helped Milwaukee Institute of Art and Design Professor Frank Lukasavitz, 77, build a model of the 1914 Curtiss Flying Boat.



*Above: MIAD Professor Frank Lukasavitz test fitting the lower wing to a 1914 Curtiss two wing Flying Boat fuselage.*

This summer the help is being coordinated by Russell to involve Steve Ward, 48 and Al Jones of the Richard I.Bong plastic modelers club, so that Lukasavitz can build a Polish PZL P.11c, as pictured below.



With its 900+ hsp engine it was the first Polish aircraft to shoot down a German bomber in the 1939 invasion of Poland. Ward has supplied the three views and other written documentation, and Jones supplied a Mirage brand 1/48<sup>th</sup> scale plastic kit, made in Poland, with all Polish language instructions. Lukasavitz can read and write Polish. Such kits supply good surface detail and outline accuracy.

## Grafton 8-2-08 Fly-In, Down 45%

by Russell Knetzger, RAMS Editor & Librarian



Whether it was \$4.00 a gallon gasoline, or overlap with EAA, or “just one of those things,” the Astro Wings had only 37 pilots signed up by mid-afternoon compared to 68 most years. Plane count was down less because many smaller models were entered. All were photographed, and will be shown at the Sept. 2, MARKS Club meeting. All RAMS members are invited, to help a grand old club regain meeting attendance. This is the MARKS club’s 50<sup>th</sup> Anniversary Year.

## Art Schmidt & 911 News

by Russell Knetzger, RAMS Editor & Librarian

Last year at this time, Art Schmidt, 91, donated his entire collection of 2,100 photographic 35 mm negatives to the RAMS Club. The negs cover the period 1984-1992, and are of activity at the Milwaukee County R/C Field on Oakwood Road. The Milw.R/C Assoc. built and operated the field from 1978-1988, and the RAMS thereafter. Art was a professional photographer for model train magazine publisher Kalmbach Publications. At our field he could take candid photos of pilots and work parties without their noticing. This year, again in August, he donated several hundred shots, as 5x7” prints.

Not a week later, Art slumped over at his usual field pit table, and 911 cell calls were immediately made, to no avail – 911 did not answer. Luckily, former pilot Marv Wolff was visiting. He knows by heart the Franklin Police non-emergency number, **425-2522**. That quickly brought an EMT crew from the new fire station on S. 60<sup>th</sup> St, visible from our field. They rushed Art to the new hospital on Oakwood Rd., at S. 27<sup>th</sup> Street. His daughter, Carol, brought him back a few hours later – dehydration was his problem. The lessons learned: make Art drink fluids; cell phone calls in southern Milwaukee Co. are often routed through Racine Co. When they answer, if they answer, announce you are calling from Franklin, and they will reroute the call accordingly. If no answer, call the **425-2522** number and say where you are.

## Pilot Profile: Mike Jankowski

By Russell Knetzger

In 1976, when Mike was 12 years old, Mike helped his mother, Diane, rescue Mike's father, John (an early R/C flyer at our field) from flames that were engulfing most of John's clothes, especially his pants. John had been working with solvents in kitchen refinishing and the fumes exploded when a spark from the refrigerator motor started up. The intense heat made John's clothing burn. Mike and his mother jumped on John to smother the flames. They were successful, and John was saved.

From that experience Mike knew he wanted to become a fire fighter, to more effectively prevent, or put out fires, and to rescue the injured. Now, at age 44, since January, 2007, Mike is the Fire Chief of the Village of Hales Corners Fire Department, in southwestern Milwaukee County. Before that he was an early full time employee of the Volunteer (paid only on call) Franklin Fire Department. Mike grew up and still lives in Franklin.

Because Mike knew from such a young age exactly what he wanted his life's work to be, he tailored his education to that goal. After attending Oak Creek High School, (its district takes in the part of Franklin where Mike grew up), Mike went to MATC-Milwaukee Area Technical College and earned his Fire Science Associate Degree.

For every fire call that Fire Departments now make, they make 10 to 20 Emergency Medical calls. Foreseeing that trend, and remembering his father's injuries, from MATC Mike worked 5 years as an emergency room technician at Columbia Hospital, next to UW-M on Milwaukee's east side. Then he pursued for 2 years Paramedic training and experience in Michigan earning his Certificate in Paramedics.

On top of his job-specific certificates, Mike has added a degree in Public Administration via Iowa University's distance learning program, which took him 6 years. Now he is pursuing a 5 year masters degree program through the National Fire Academy, which has included on-site work near Camp David in Maryland.



***Above: Mike Jankowski, standing in front of one of his Hales Corners Village Fire Department's engine trucks, a Seagrave, made in Clintonville, Wis. While squinting into the bright morning sun, Mike is holding his Pitts Special ARF biplane made by Cermark. It has a 60 inch wing span, weighs about 10 lbs, and is powered by a four-stroke YS 120 engine. Mike is the Fire Chief.***

Mike's interest in model aviation started with AMA Delta Darts in his boyhood. From there the transition to radio controlled model aircraft comes with his father, at the old Franklin field south of Ryan Road and east of 60<sup>th</sup> Street, now the Franklin Industrial Park.

Mike took flight lessons from Leonard Mlynarski, a longtime loyal member of the MARKS Club and frequent visitor to our field, though less so in recent years as age and infirmities advance.

Mike lives with his wife, Christina, and children Alyssa, 9, and son Matthew, 7 on Madison Ave. in central Franklin. While in the three or so years Mike has belonged to the RAMS he has not as yet been an officer, in Nov., 2007 he gave free training to about a half dozen RAMS members in CPR-Cardio Pulmonary Resuscitation.

***RAMS HORN***, September, 2008, Russell Knetzger, Editor  
Rainbow Aero Modelers Society, Franklin, Wisconsin

# Electric Flight News - IX

By Dennis Vollrath, Editor, "The Flightline" – May, 2008  
Racine R/C Club, Inc., Racine, Wisconsin – Reprinted in the  
RAMS HORN, Russell Knetzger, Editor, Franklin, WI

## High powered electrics: Electrobreak & Showtime

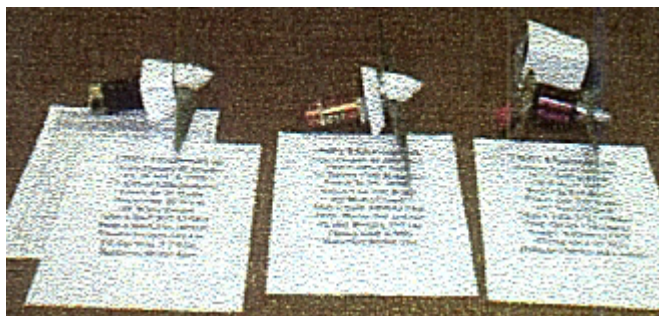
Last issue I mentioned using MotoCalc for glow/gas powered models. I'd like to delay that for an issue to update on the current situation.

Most of this club's members are aware of my 150% version of the Electrobreak model that was very popular in the early 2000's.

The original model was powered by an Astroflight Geared 40 brush motor, with my design brush type speed control. This combination flew fairly well, and was used for several years. Typical flight time was around 3 minutes. (A 4 minute flight resulted in a power off landing.) After a flight, the motor and a 22 cell RC2400 NiCad pack was so hot, an external blower was required to cool the thing down during recharging.

Next, this model was converted to an Astro 40 geared brushless motor, along with a 22 cell NiHyd battery pack (made up from Radio Shack batteries!) This combination was flown for two years, and worked fairly well, Typical flight time was around 5 minutes. Needless to say, those 22 cells were quite heavy, weighing in at 51 ounces alone. And, again, the battery pack had to be cooled by an external blower during the charging process. These cells were heating up to about 140 degrees F during a flight, even with air blasting through the model during flight.

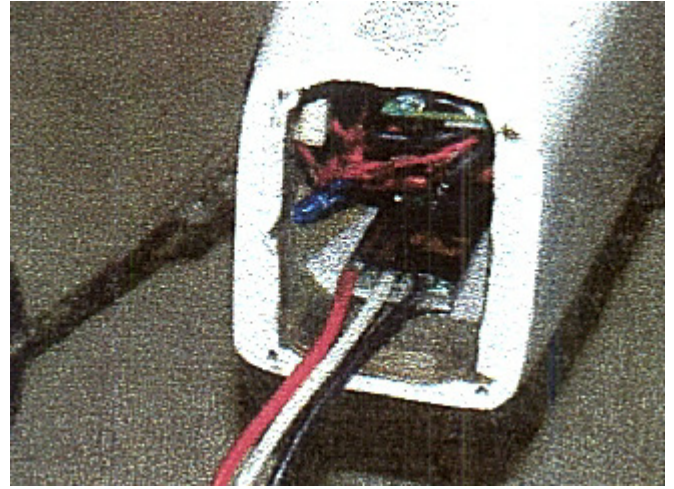
This same model (built from scratch in 2002) has now been upgraded in 2008 to a Hacker A50-12S motor, with a 14x8.5" APC-E prop, and 12 A123 cells, configured as 6S2P (six series, two parallel for 21 VDC output.) The combination is pulling 48 Amps at 19.6 volts under full load, and turns the 14x8.5 prop at 7700 RPM. This combination resulted in a weight LOSS of just under 16 ounces, an increase of power to the prop of about 300%, and an increase in flight time to 8-10 minutes per



charge!

Photo of different motors used in the 150% Electrobreak.

**Left**, Astro brush geared 40, **Center**, Astro brushless geared 40, **Right**, HackerA50-12S, 14x8.5" @ 7750 rpm, 6-S2P A123 cells.



Nose of 150% Electrobreak with 2-56 Blind Nuts in all four corners to accept each of three different motor setups.

This is a totally different airplane. I've ordered two APC-E 14x10 props to see what happens. As previously indicated in this series of articles, electric powered models are *far* more critical as to what props are used, as compared to glow/gas models. A difference of an inch or two in prop diameter or pitch can change a good flying model to a dog, or vice versa.

**What is absolutely required in all of this, is you must measure the current pulled from the battery to verify that you are not going to burn up anything.**

You want to run the motor right at its maximum power rating while on the ground for best performance.

I also have put together a Hanger 9 Showtime 50 model with electric power. This is a model with 57 inch wing span, 722 square inches wing area, and rated 6-7 pounds weight The Spektrum radio is set up for spoilers on the wings. The Hacker A50-16S with APC-E 16x12 prop weighs in at 7 1/2 pounds, with 116 watts per pound input, 102 watts per pound at the prop. This thing has a take off of about 20-25 feet, and will climb out at 45 degrees until out of sight

Flight times are in the order of 9-10 minutes with no reserve battery power, so I limit flights to around 6-7 minutes. The interesting thing about this is, after a flight, the motor is barely luke warm, the batteries are also barely luke warm. Something else, not expected, is this motor turns the 16x12 prop at 5900 RPM right after a battery charge, and turns the same prop at 5850 RPM after a 7 minute flight. Most other batteries drop off power noticeably after a flight.

Notes on this Hacker A50-16S motor and Showtime 50 setup: the Hacker motor is putting out about one horsepower at 5900 RPM. That represents a torque on

the motor shaft of 0.92 foot pounds. I've found out on two touch and go flights that giving this motor full power after an aborted touch and go is NOT a good idea. The danged motor torque represents suddenly placing a dead weight of 1/2 pound on the left wing tip. The result is a violent left rotation of 45 degrees of the model while the motor is winding up, when your model is close to the ground

You may be noticing that lately I only fly Hacker motors. There is a reason for this. Efficiency is the name of the game in electric powered models. One competitor to the Hacker is the E-Flight series of motors. On similar sized motors, the Hacker motors have 1/3 of the winding resistance of the E-Flight motors. This has a direct effect on how hot the motors will run, and how long of a flight you can have. On the other hand, I've seen the E-



Flight motors fly. They do fly very well.

Hanger 9 "Showtime 50" with a 16x12" prop on a Hacker A50-16S motor, Six S2P A123 Cells, weighs 7-3/4 lbs.

**Receiver power:**

Electric models have been using the motor battery to power the receiver through a voltage regulator located inside the Electronic Speed Control (ESC). The problem is, for technical reasons, these ESC units cannot be used for receiver Power when you have more than 6 to 8 volts on the motor battery.

Recently, Castle Creations has designed a Battery Eliminator Circuit (BEC) that can be used with up to 6 series LiPo batteries- You simply wire the input of the BEC to the input wiring of the ESC, and connect the output to the receiver battery input. I've purchased one of the Castle Creations BEC units for my Hanger 9 Showtime 50 units. It works well.

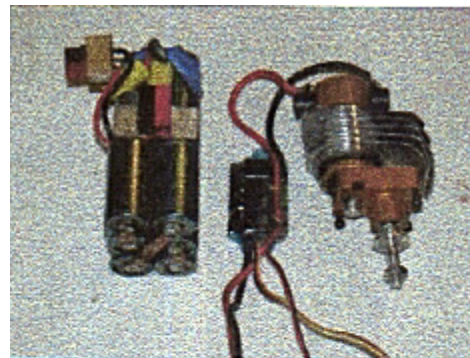
Based on recommendations from Greenfield Hobby, I purchased a Common Sense BEC for the Electrostream 150% model. Looking at both of these units with my Tektronix oscilloscope, the 5 volt output of the Castle Creations BEC has a lot of high frequency electronic

noise on it. These devices use what is known as a switching power supply, that use a high frequency switching circuit to reduce (or increase) a DC voltage to another value. Problem is, this switching noise can appear on the DC output, such as the Castle Creations unit. I'm certain they work well on all radios, but this much noise on the 5 volt DC input to a radio receiver makes me nervous.

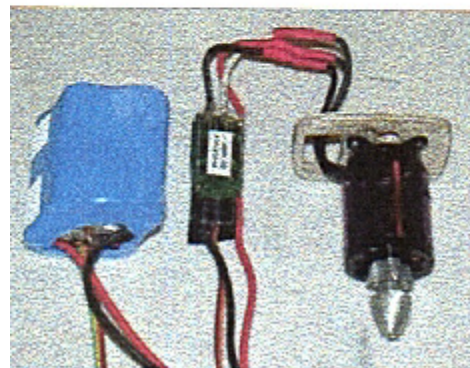
The Common Sense BEC (which costs less!) uses a similar Switching Power supply to reduce your battery voltage to a lower level. I didn't measure it, but its likely around 8 volts DC. THEN, a common Linear voltage regulator reduces this 8 Volts DC down to the 5 or 6 volts (Selectable) for your receiver. The Output of this BEC was absolutely clean, no electronic noise at all.

So, take your choice, but I'd limit the Castle Creations units to the 2.4 Ghz radios.

Be careful when you use these BEC's while setting up your radio. **THE MOTOR IS ALWAYS POWERED UP WHILE THE RECEIVER IS POWERED UP!** (Like when you are setting up servo directions and reversing). Reversing the motor channel will result in full motor power! (Take the prop off during setup!)



Denny's original setup for the "Limbo Dancer" from the early 2000's. This is 10 2400 MaHr nicads with an Astroflight motor modified with "Fins" to keep it from melting. Vollraths ESC also shown.



Note firewall mount with (4) 2-56 Allen Head screws similar to Electrostream. Works very well.

Set up for Hacker 40 version of the Limbo Dancer. Setup saved 13 ounces, has double the horsepower, and three times the flying time of the Astro set up above. All parts run quite cool after a flight.

## About Our Radio Systems, XIV

by Dennis Vollrath, Editor, "The Flightline" – April, 2008  
Racine R/C Club, Inc., Racine, Wisconsin – Reprinted in the  
RAMS HORN, Russell Knetzger, Editor, Franklin, Wisconsin

### How it works the RC Radio System

So far on this series, we have been pretty much dealing with radio frequency signals. This signal has been tracked through the transmitter and its transmitted radio frequency signals, the receiver and its antenna that receives the radio frequency signals. And then the progression of these signals through the receiver as they are converted to lower and lower radio frequencies, in an effort to create a very narrow band that is required for our radios in today's environment. Now, for the first time, we will be dealing with what really amounts to audio frequencies, that is, if we tied a headphone to the signals, we would be able to listen to them.

Way back in the beginning of this series we indicated that the transmitter is sending out a series of pulse signals, one pulse for each channel being transmitted. These pulse trains are being sent about 50 times per second. This pulse train is received in the receiver as a series of pulses, again repeated about 50 times per second. In the earlier days of our equipment these pulses were separated by what is called a "ring counter", or similar circuitry. I won't go into how they work, since they have likely been replaced by a little microcontroller that performs this function along with many other functions. The bottom line is this circuit pulls the first pulse out of the pulse train, and sends it to servo #1, it then pulls the second pulse, sends to servo #2, third pulse, third servo, you get the idea. Then after all pulses have been received, the receiver goes on vacation for about 50 milliseconds, waiting for the next string of pulses.

Now, this pulse is standardized on all RC radio signals, where a pulse of 1.5 milliseconds (0.0015 seconds) will drive the servo to its center position. A pulse of 1.0 milliseconds will drive the servo full "left rudder," and a pulse of 2.0 milliseconds will drive the servo full "right rudder."

One more thing on the receiver. This receiver must be able to work with both very powerful signals when you hold the transmitter over the model, and very weak signals when you are at the maximum


range of the RC system. This will be about a mile or so with the transmitter on the ground and the model in the air. The signal variation is at least a million to one from close to far away.

The result is severe overdriving the receiver circuits when you hold the transmitter over the receiver. This is handled by what is called the Automatic Gain Control circuit of the receiver. The terminology is AGC control. Several other terms are also in use such as Automatic Volume Control and similar names. The AGC control circuitry reduces the electronic gain of the various radio circuits such that the output signal to the ring counter doesn't vary when the transmitter is moved from nearby, to a mile or so away. Some radio systems have been bragging about their AGC controls in their receivers. The AGC is nothing new. These gain level schemes have been around for 80-90 years, and are part of every AM-FM radio, TV, CB radios, cell phones, you name it.

The XV issue (May, 2008 publication) will conclude this radio series, with coverage of the

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## About Our Radio Systems, XV

by Dennis Vollrath, Editor, "The Flightline" – May, 2008  
Racine R/C Club, Inc., Racine, Wisconsin – Reprinted in the  
RAMS HORN, Russell Knetzger, Editor, Franklin, Wisconsin

### Series Conclusion: Servo Motors

One thing our RC systems all have is the servo that activates the various control surfaces of our models. This applies to model airplanes, model cars, and a lot of other equipment. The average full scale commercial jet plane is full of them.

So, just what is a servo? A servo is a device that has a signal input that controls an output shaft of some sort. You could even consider power steering in your car as a servo controlled by your steering wheel.

The servos we use are motor controlled with an internal gear box, and an output shaft that we are all familiar with. Our servos have two power leads, the red (+) and black (-) wires, along with a third wire that contains the signal input from the receiver. As previously mentioned, this is a repeating pulse signal, 0.001 to 0.002 seconds in length, that repeats about 50 times a second. The exact width of this pulse determines the servo's output shaft position. Note that a time of 0.0015 seconds represents the center position of the servo. Now, if you could wire up a toggle switch to the red and black wires, and switch the signal input to the servo by properly flipping the switch, you would be able to control the servo. Problem is, you've got to flip this switch about 50 times per second with exactly 0.0015 seconds "on time" to have the servo move to its center position. That's where electronics does its stuff.

So exactly what inside this servo is controlling the servo output shaft? Well, way back in the beginning of this series, we mentioned a device called a capacitor. This gadget stores energy in the form of voltage, and it can be charged by many things, including a battery and a resistor. You connect a 5 volt battery in series with a resistor across a capacitor, and depending on component values, you can create a time delay that can vary from millionths of a second to minutes or more. With proper selection of parts, you can create a time delay of 0.0015 seconds. (Now where did that come from??) If you make that resistor variable with a potentiometer (another name is volume control on your TV) and drive the position of that variable resistor with a mechanical connection to the servo's output shaft, we can use electronics to make it work.

So, the servo gets an input from the receiver of say 0.0019 seconds (1.8 milliseconds) and the servo's internal time delay with its internal capacitor, and resistor driven by the output shaft, might be at 1.1 milliseconds. The servo electronics recognize that the servo does not match the input signal, so the electronics drives the motor in the proper direction such that the servo's internal timer matches the input signal from the receiver. This is a description of what is called an analog servo, something we've had for RC models for 40 years.

Now, we've got what they call digital servos. What is the difference? Well we still need the motor, gear box, potentiometer, and so on. But, we've replaced the internal time delay capacitor and associated parts with a computer chip. What's the advantage? Well one of the problems with the analog electronics is a design issue where you need to have the servo respond with very close accuracy. But if you make the servo "too tight", the dang thing can hunt back and forth while trying to zero in on the exact position required, which is hard on the receiver battery and electronics.

The digital electronics makes it possible to program-in exactly how this servo responds to the commands sent by the receiver. And, digital electronics will always respond exactly the same way, where component value tolerances have little or no effect on how stable the whole entire servo package is.

What can go wrong with these things? Well, early on, back in the 1960's, they used all "stand up" parts that were very susceptible to vibration. Nowadays, they all use surface mount parts that are pretty much immune to this sort of thing. Even with glow/gas powered models, servo failures are rather unusual. Early on, the servo potentiometer used radio grade materials, We've all had AM-FM radios that developed noisy volume controls. Long ago, these pots have gone to a ceramic based resistance element, a material that is very hard and difficult to damage.

So, this concludes the *How It Works RC System* series of articles. Hopefully it has provided some insight on how these devices work, and how to avoid problems with them due to vibration, battery problems, and the like.

*Dennis Vollrath*

**Postscript:** Reader Larry Danko writes: "For those with Spectrum radios, you can send in the receivers for a free software upgrade. You should know that if the receiver voltage drops below 3.5V that the receiver will shut down and it could take 2 to 5 seconds for a reboot. With this firmware upgrade, the reboot is almost instantaneous.

"The upgrade is free except for postage to **Horizon**. I sent six receivers to them and got them back in a week. They also upgraded the cases on the AR7000s so that the antenna wire exits now have a plastic gripper to hold the wires more securely. Food for thought. Here's the info on their web site.

<http://www.spektrumrc.com/Articles/Article.aspx?ArticleID=1756>



*Above: aircraft carrier launch as seen at MARKS Club in August 2, 2008 video "Flight Deck" by Aviation Week magazine*

(A joint program for both clubs to bolster MARKS attendance)

(The August 5th program was the video "Flight Deck" on aircraft carrier operations by Aviation Week magazine, photo above)

# Upcoming Events - September

**Wednesday, September 3, 2008**  
**RAMS Club Meeting-7PM**

***Back at the Bank !***

*(WaterStone Savings Bank – Formerly  
Wauwatosa Savings Bank, - 6560 S. 27<sup>th</sup> Street,  
Oak Creek)*

**\* \*Planning the Sept. 20<sup>th</sup> RAMS  
& Guests-Only Picnic, 10AM-  
4PM \* \***

**Tuesday, September 2, 2008 MARKS**  
**INVITATIONAL – RAMS, 7PM**

**"Screen Photos of Aug. 2, 2008 Astro Wings Fly-  
in Aircraft" (82<sup>nd</sup> & W. Forest Hill Ave.)**

**Sunday, September 7, 2008 Lodi Area RC**  
**Club – 16<sup>th</sup> ANNUAL Fun Fly, Lodi. WI**

*(Take I-90-94 north of Madison to STH 60 Exit, west to  
Lindsey Rd., north to "Quarry Field")*

**Saturday, September 13, 2008 ABC/RC**  
**Fly-In, Town of Concord, Jefferson  
County**

*(Take I-94 to Oconomowoc, Exit STH 67 south, west 1/4 mile  
to CTH DR, west to Concord Center)*

**\* \*Saturday, Sept. 20, 2008 RAMS Club**  
**Members & Guests-Only Picnic 10AM-  
4PM\* \***

*(Franklin, Wisconsin, Oakwood Rd. at S. 70<sup>th</sup> Street, Milw.  
County R/C Flying Field)*