The Flightline

Volume 38, Issue 6 | Newsletter of the Propstoppers RC Club | AMA 1042 | June 2008

President's Message

I would like to thank everyone who helped out at Pride Day it was a big success. Bill Tomasco picked up some small planes to be given out and John Tripier donated two flying machines which one was given out and we still have the other to be given out.

The club Picnics will be on June 28th and July 26th at Sleighton field .The Walt Bryant Fun Fly will be at Christian Academy on Aug 23rd.

A reminder, the next four meetings will be held at the Sleighton Field; June 10th, July 8th, Aug 12th, Sept 9th. Flying 5pm to 7pm then the Meeting then flies till dusk. These are all second Tuesdays; please mark your calendar.

We can fly fuel planes and helicopters if you like .These will be short meetings so bring out show & tell or bring something to fly.

Dick Seiwell

Agenda for June 10th Meeting
At The Sleighton Field;
Fly from 5pm, Meeting 7:00pm.

1. Approval of May Meeting Minutes
2. Membership Report
3. Finance Report
4. Discussion of picnic plans
5. Show and Tell
6. Continued Flying

Inside This Issue

Minutes of the Monthly Meeting

May 13th**, 2008 at the Middletown library**

The meeting was called to order at 7:30 p.m. by President Dick Seiwell

Roll-call by membership chair Ray Wopatek found 21 members and 1 guest present

Minutes of the April meeting as printed in the newsletter were approved by the membership

Treasurer's report was presented by Phil Oetinger and approved

Old Business:

Middletown Pride Day on Saturday was a success except for one plane that ended up in a tree.

New Business:

Three senior and one junior new members signed up.

President Seiwell said that both fields are ready for flying. We have a swampy field problem at Christian Academy whenever we have heavy rains. Otherwise it is fine.

This summer meetings will be held at Sleighton field at 7:00 p.m. to allow for flying in the calm evening whether.

President Seiwell suggested that we have a picnic in June and again in July. The Walt Bryan fun fly will be held in August. All dates will be posted in the newsletter.

Show and Tell:

Dave Harding showed the remains of his 72 in. Trenton terror salvaged from a tree after pride day. (See Middletown Pride Day p 5)

He also showed his new Stardust Special that he previously described in the newsletter. It is been set up for competition in the speed 400 electric event.

Bill Tomasco showed his new LiPo charger that is inexpensive and charges a 2 to 3 cell pack automatically.

Chuck Kime showed a Kiel Kraft Scorpion old-time model that had been built by Mick Harris. He plans to use it for the speed 400 electric event. He also showed a very small Cox powered U/C biplane that his kids learned to fly thirty years ago.

Adjournment took place at 8:45 p.m.

Dick Bartkowski, Secretary

Calendar of Events

Club Meetings

Summer Monthly Meetings at Sleighton Field, Second Tuesday; gas flying ok.
Fly 5 till 7. Meeting 7, fly till dusk.
9 June
14 July
11 August
8 September

Club Picnics at Sleighton Field
28 June
26 July

Tuesday Breakfast Meeting
The Country Deli, Rt. 352 Glenn Mills
9 till 10 am. Just show up.
Flying after at Sleighton Field 10 am.

Regular Club Flying

At Middletown / Sleighton Field
Monday - Friday;
10 am until dusk - Electric Only
Saturday
10 - 3pm-for FUEL PLANES and
10 - Dusk for Electric
Sunday - 12 - Dusk – Electric Only

At Christian Academy; Electric Only
Monday through Friday after school till dusk
Saturday 10 am till dusk
Sunday, after Church; 12 pm till dusk

Special Club Flying

Saturday mornings 10 am Sleighton Field
Tuesday mornings 10 am Sleighton Field weather permitting after breakfast.

Beginners using due caution and respecting club rules may fly GWS Slow Stick without instructors.

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Delaware County, Pennsylvania.
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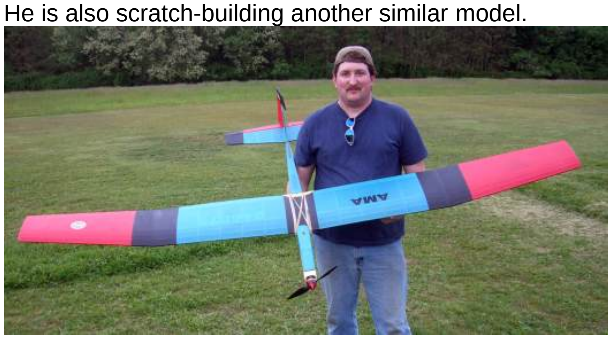
Around the Fields

We have had sufficient good weather for a good start on flying for 2008, including an excellent Thursday evening at the Christian Academy field. The cover photo shows four simultaneous fliers with others waiting their turn! A recent club record?

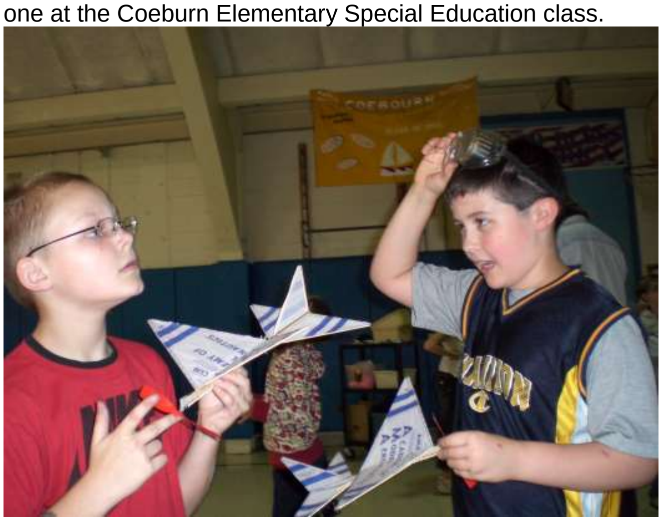
Bill Tomasco is regularly flying one of the excellent Cub RTF models, also owned by Chuck Kime and new junior member Drew Resweber.
Brian Williams flies his helicopter regularly but he is expanding his fleet of fixed wing airplanes too.

He picked up this glider for a song at the Lebanon Swap. The cunning devil waited till the last minute to “harvest” some deals including this one.

He is also scratch-building another similar model.



Chuck Kime and your editor did another Delta Dart program, this one at the Coeburn Elementary Special Education class.



Note that we have now automated the most boring part of this activity; winding countless motors. All it takes is a reversible electric drill and a piece of wire. “Why reversible” you ask? You did, didn’t you? Well the answer lies in your ability to extract said drill wire from a fully wound motor. All you need is a burst of reverse while pinching the last inch of motor and you are ready to disengage and hook up.

Despite the small gym the kids loved it and we didn’t have to resort to the two-motor rocket ship trick to keep them interested in the second half.

The Saturday of the Memorial Day weekend was forecast to be sunny but windy. Nevertheless a good sized group of Propstoppers with their heavy weather planes turned up for some fine flying and conversation. Brian Williams put on a display with his gliders and helicopter. Dave Harding brought out the B-24, Hanger 9 Cub, Jerry hot liner and assorted others.

Mick Harris brought his new Milligan Wakefield for photo taking.

This is how you get those shots!

Dave Harding

Middletown Pride Day

Middletown Pride Day

Despite daunting weather predictions we had a grand time at this year's Pride Day. The Propstoppers turn out was excellent and we entertained more spectators than ever before. Even the arrival of the Med-Evac Helicopter didn't diminish the fun; in fact it aided us because when people came over to inspect it they could see our layout.

Al Basualdo and Steve Boyajian entertained the crowd with expert aerobatics with their T-Rex 60 powered helicopters. The noise and smoke trails added to an experience that we rarely see at our fields because of the gas powered airplane limits.

New member Vick Williams brought three models to display and we await flights from him now that he is a signed-up member.

Chuck Kime also took the opportunity to fly a gas model, a ½ A Texaco powered by a Cox 049.

Indeed, Chuck performed magnificently when his model was at very high altitude and we were suddenly told to clear the sky. It only took a minute for Chuck to dive this floater into the tiny patch from which we fly at Williamson.

You editor brought out one of the obsolete Old Timers, a Miss America, now used as a club trainer. New member Drew Resweber tried to fly his Hawk trainer on 27 MHz but had interference problems so he took the sticks on the MA. This young man has good hands.

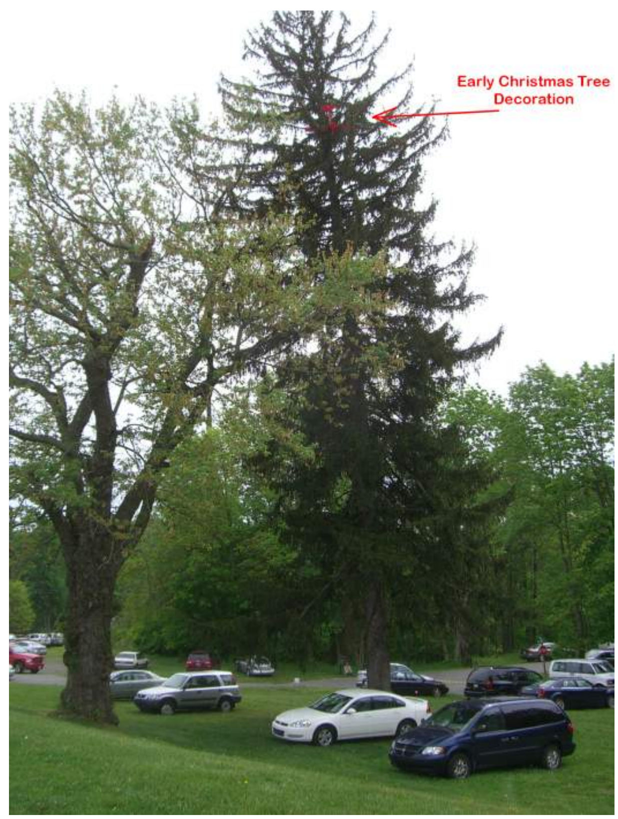
These Old Timers have such gentle flight characteristics that they make excellent initial trainers. I have found that the instruction can be made verbally with the student in command. There is usually enough time to take over if the model runs into trouble.

One happy young man!

The other Old Timer trainer brought out by your editor was his venerable Trenton Terror; A veteran model of four years competition flying with Ohlsson 60 ignition and electric power. It is (was) currently powered by an AXI outrunner (the prize for one of its victories) and a big NeuEnergy LiPo from the European LMR model.

The editor's Trenton Terror at the Muncie Champs in 2004

Unfortunately, a long downwind turn to land in the small patch allocated for our flying, resulted in contact with a very large spruce tree on the edge of the field. It was waaaaaay high. A request to one of the hook and ladder teams also on display at the event resulted in an agreement to try a rescue. Unfortunately with all the cars parked on every street it was not possible for them to erect the stabilizers necessary when using the very tall ladder. So the model remained in the tree through the subsequent three days of extremely high winds



Calls to tree surgeons to extract the model were unsuccessful due to the massive tree damage throughout the county from the storm. President Dick Seiwell watched the model over this period and eventually asked the Williamson School Arbor teacher if they could help. He said they would try but in the event another group of students "brought it down". See below;

The model had been hooked by its landing gear over a stout branch so during the storm is waved like a flag. We think that it flayed itself to pieces within the "plastic bag" of the covering. The motor and electrics were Ok but the big LiPo had been connected to the ESC for best part of four days and so drained the voltage below the LiPo damage level of 6 volts for a two-cell pack. It is somewhat puffed at 4.7 volts and so is an expensive loss.

Nevertheless, we, the Propstoppers and spectators had a good time. Bill Tomasco had arranged the purchase of 100 small gliders that we handed out to the kids. We gave away almost 50 of them, an indication of the extent of interest in our activities.

Well done team, we have once again made our mark on our host township. We can only hope it results in continuing good relations so we can maintain our excellent fields.

Dave Harding

But Wait ~ what is this?

The Trenton Terror: reborn.

You know how it is; "hey, looks like that stick came from the ragged end of this one". I wonder if it fits. How about that a little thin Hot Stuff and it is back in place. Wow, look, all those sticks are still attached to that piece of covering. How about that they are all in place and aligned, some more glue…. There are a whole bunch of joints in that longeron, better add some graphite.

Hmmm… missing a whole bunch of ribs but the root end and tip are there. Glad I always make extra ribs and keep them where I can find them. TE is in three pieces but they fit together. Glue them in place over a straight edge and add graphite to both sides; there better than new. Need a long piece of LE and some spars, but that is just strip-wood. The TE aligns everything and the old glue spots indicate the rib locations; there, a complete wing…. Wait; better add some more graphite, the spar wood seemed a little light. Put the servos back in place, seems like they fit and still work. Connect the wire pushrod ends back into the graphite tube push rods. Align the controls, zero the servos and glue it back together. Hey, it is late on Friday night and we plan to fly at Sleighton tomorrow, better start covering. Love that Doculam, it is strong, glues well to bare balsa and takes paint readily. And so it went. Why did I do it? Because it was there?

Dick Miller with his new Hobby Lobby Telemaster, AXI outrunner powered. Check-out at Sleighton.

Carl Goldberg and his Valkyrie

From an Aeromodeller article by Alex Imrie and related to the editor's story about his "west coast" Valkyrie.

Every vintage enthusiast is aware that Carl was one of America's greats. He started modeling in 1928 at the age of 14 and soon made a name for himself in the design of indoor models - he was using polyhedral as early as 1930.A keen competitor who had for a number of years placed high in every national meet and who created World Records in 1934 and 1935.

At the time of Valkyrie's conception (first design work commenced in the spring of 1936 and construction began in July) the rules for competition power models were in a state of flux. The yardstick for rubber-driven models was duration, but as Bassett had shown in 1934, without some sort of restriction records and competitions would become meaningless. Bassett got his model away with fuel for over 2.1/2 hours; it flew over three states and covered a straight line distance of 52 miles at a height of 8000 feet followed by a light aircraft. In addition, the difficulty of actually running a competition for such models demanded more control over the participants. Many different solutions were suggested. The NAA ruling, which was most commonly used at the time, was the allocation of 1/8th ounce of fuel per pound of model weight. The CGMS used a 45 seconds engine run, while another approach was to allocate fuel depending on engine size.

The model was first flown in March 1937, powered initially with small low fuel consumption in order to get the longest engine run from his allocated fuel amount in competition. But more power was needed to hoist Valkyrie as high as possible and finally the .60 cu. in Brown Junior was fitted. The model weighed 4 lbs 12 ounces with the Brown and had a wing loading of some 5.85 ounces per square foot; the glide ratio was considered to be about 12:1. The model took 2nd place in the 1937 US Nationals at Detroit when, on 11 July, it flew for 53 minutes using Vernon Boehle's borrowed Brown Junior Model B to be lost in the Canadian bush.

Yet another rules idea was to allocate fuel according to wing area (l/16th oz per square foot). This method would tend to induce manufacturers to produce better engines and it promoted aerodynamic efficiency, since two models identical in size getting the same fuel allowance would show the aerodynamic superiority and/or improved engine performance one over the other. Additionally, it did not favor either the large or the small model.

It is considered that Carl had these thoughts very much in mind when he created Valkyrie; all this model's features were allied to improved aerodynamic efficiency and clever construction proved that an 'ultra-streamlined' model could be made lightweight. As regards the wing mounting, with Valkyrie one could hardly resort to the strut and wire braced cabane commonly used on parasol designs - thus emerged the clean sheeted mounting that had been 'worked out several years before'. It was not referred to as a 'pylon' until some time afterwards, and its secret was the provision of a high centre of lateral area giving excellent spiral stability.

The six foot long fuselage was a basic box structure from 1/8 inch square erected in diamond fashion and faired by circular bulkheads, the whole being stringered and covered with 1/16 inch sheet. Suitable strengthening was provided in the top of the fuselage for the 1/16 inch sheet covered wing mounting but this was not permanently attached until the model was almost complete to ensure that its position allowed the correct centre of gravity.

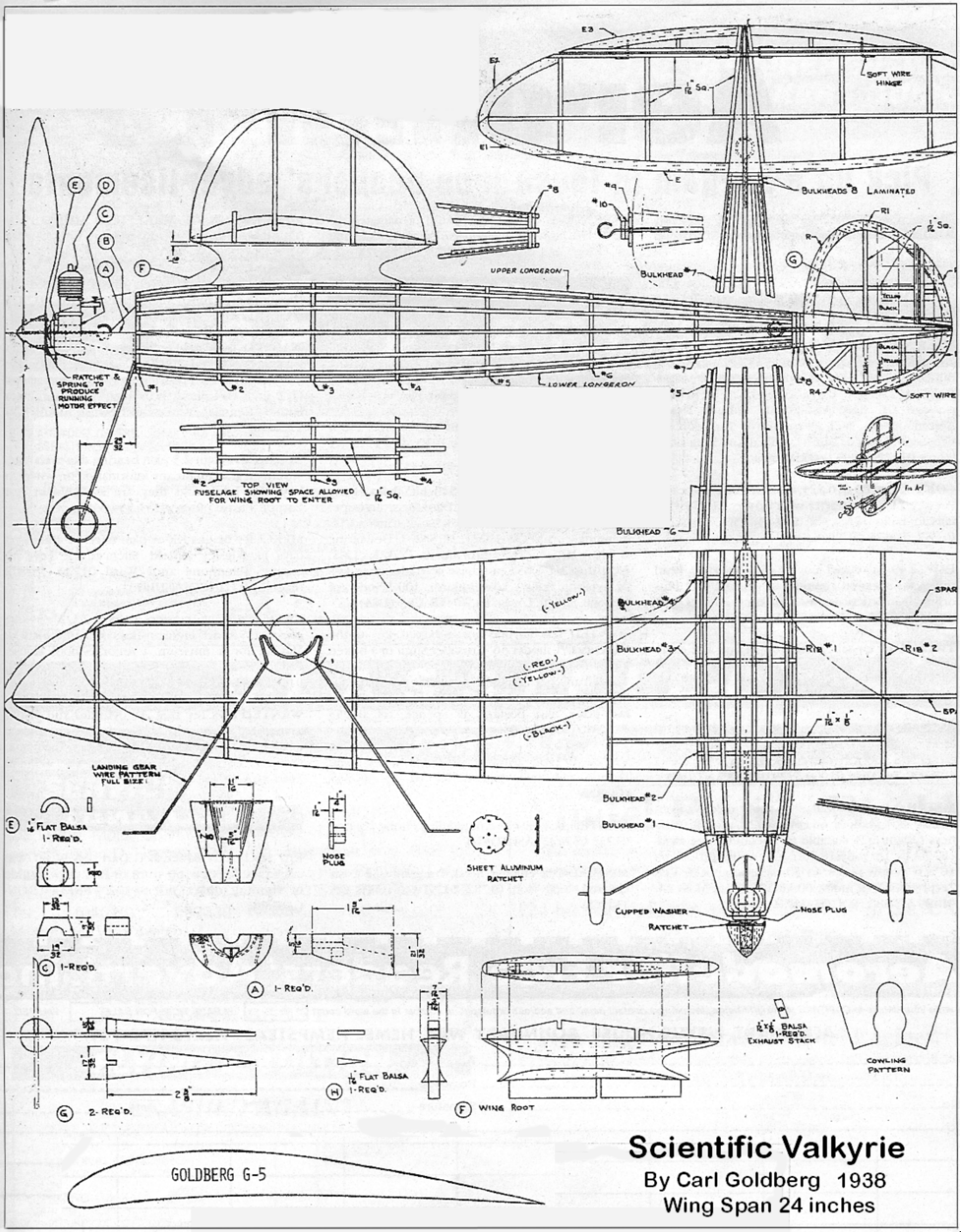
The beautiful elliptical wing employed 17 hard 1/8 inch square spars. Ribs (29 in each wing panel) were built-up also from 1/8 inch square, the top and bottom outlines being sliced from sheet. A panel on each wing measuring 10 x 20 inches employed diagonal inter-rib bracing, and this stiffened the wing considerably at the centre section, which was covered top and bottom with 1/16 inch sheet over the two root-rib bays of each wing half. The wing halves were later glued together with 10 inches dihedral under each tip. It was 'extremely rigid', especially after covering with heavy bamboo paper and given two coats of thinned clear dope followed by two coats of thinned yellow; it weighed 20 ounces. There were over 1,100 individual pieces in the wing and Carl stated that 'While this construction is not difficult, it is tedious". He also considered that the wing was so strong that it could sustain considerable damage without showing any sign of serious structural weakness.

The 48 inch span elliptical tailplane employed built-up ribs in a similar manner to the wing. Made in two halves, these were glued to the fuselage by inserting the spar ends into holes cut in the fuselage covering. The upper and lower rudders were similar in construction and attachment to the tailplane and had a total area. equal to 6% of wing area.

In keeping with the aerodynamically clean appearance, four inch diameter streamline section laminated balsa wheels were fitted to the single strut 1/8 inch diameter wire undercarriage legs, but the engine was not cowled nor did the propeller have a spinner. The engine was installed without downthrust and had no offset thrust 'of any amount' to counteract torque. The wing was flown at 2 degrees positive incidence and the tailplane had 1/2 degree negative incidence.

Goldberg did not build a duplicate model for 1938, although that year's requirement of an 8 ounce per square foot wing loading could easily have been met without 'any decrease in flying and soaring characteristics'. Apparently he had wind of the introduction of the NAA 30 seconds engine run requirement which was adopted early in 1938 and this stipulation sounded the death knell of large gas models for competition work. He produced a 72 inch span high-wing cabin design, the Clipper, whose elliptical wing and tail surface outline resembled those used on Valkyrie This model powered by the Ohlsson Gold Seal or Brown Junior was a serious competition threat in mid-1938 - some modelers even fitted the 1/3rd hp Forster 99 engine in attempts to achieve the rocket climbs that limited engine runs demanded.

Scientific kitted a 24 inch rubber powered Valkyrie in 1938. Looks like it would make a Jim dandy SoS or sport flier!

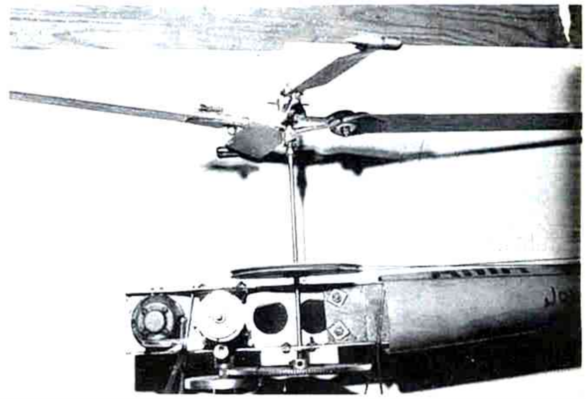


Scientific Valkyrie

By Carl Goldberg 1938

Wing Span 24 inches

Role of the RC Helicopter Model in Engineering



A 25-in. free-flight helicopter developed by Author Burkam. Hiller paddles are set at positive collective pitch for better speed stability. The model is equipped with an .020 engine.

By John E. Burkam and Eugene F. Rock
Boeing Vertol Co.

With Froude scaling, the radio-controlled model helicopter is emerging from its role as a hobby into an engineering tool for economical measurement of dynamic stability, transient aerodynamic effects and other phenomena

A Look into the Past

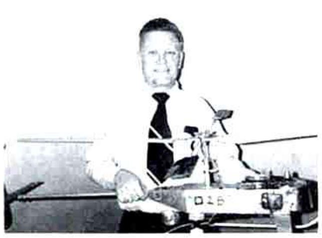
A bit of the history of the development of remotely-controlled (RC) model helicopters will help to appreciate their usefulness and their possibilities in the future.

The first well-known model helicopter experimenting was done by Arthur M. Young[1] in the late 1930s and early 1940s. His greatest success, the invention of the gyro-stabilizing bar, came from testing models powered by electric-drill motors and controlled by tiny electric motors or by solenoids. He started out with propellers on the blades, discarded that idea and next tried the coaxial configuration with some success. Eventually he developed a single-rotor model with stabilizer bar and tail rotor and learned to fly it slowly around on the end of a loosely-hanging umbilical cable. This was at a time when all other helicopters were notoriously and catastrophically unstable. Bell Aircraft Corp. became interested and bought his patent rights and his services and developed a stable, easy-to-fly helicopter. Art Young continued to use models to solve vibration problems, rotor-weaving, and flapping-limit problems by developing the underslung hub, dynamic-flapping stops and possibly the dynamic-balancing weights called Chinese tops.

The next significant model helicopter experimentation was done by Ray Prouty of Lockheed-California Co. when in 1959 he helped to develop the control gyro for hingeless-rotor helicopters. The model used for this project had a 5-ft rotor diameter, weighed 10 lb and was powered by a McCoy 60 engine. A Citizenship reed-type radio outfit controlled lateral and longitudinal cyclic and throttle. Tail rotor collective pitch was ground-adjustable only. It is unlikely that this model could be hovered without having yaw control. Nevertheless it paved the way for the CL-475 experimental helicopter and then the XH-51A.

The Bell and Lockheed models were mostly professional, company-funded efforts. Individual hobby-type efforts were being made in all the more technically-advanced countries. Unfortunately most of these efforts were spent in building scale models of unstable prototypes. Ken Norris' beautiful Sikorsky Flying Crane is an example. Flight time on these scale jobs was limited to two or three seconds—just long enough to take off and roll over.

In 1968 an event took place in Germany that brought these isolated private efforts out into the open and really began the hobby of model RC helicopters. The Simprop Co. sponsored the first international RC helicopter competition at Harsewinkel[2] and offered substantial cash prizes. At least a dozen different home-built models, both scale and non-scale (mostly the latter), appeared. Flight times of those which did manage to become airborne were still limited to two or three seconds. Only Biesterfeld's machine, a beautiful scale model of a Bell UH-1D, had any kind of stabilizing system. Apparently he had not ex-



John Burkam, an aeronautical engineer (University of Cincinnati, 1943, MS in 1949), is a vibrations R&D specialist and holder of five patents on vibration-reduction devices, and rotor and control systems. Shown at left holding his RC model, Square Tubie, he joined Boeing Vertol in 1958 as dynamicist. He holds the first world duration record for model radio-controlled helicopters. **Gene Rock,** right, flying his SSP helicopter, is a mechanical engineer (Marquette Univ., 1968) and responsible for blade design in the Boeing Vertol Wind Tunnel. He holds the world altitude record for model helicopters.

perimented with it enough to discover that larger bar weights were required to make it flyable. This shortcoming was later corrected and that rotor system, together with a JetRanger fuselage were produced in kit form by a German manufacturer, Franz Kavan.[3] Dieter Schluter kept on building more scale models at a prodigious rate until in 1970 he discovered the Hiller rotor system with its stabilizing and controlling servo paddles. His 14th model, a HueyCobra, used this rotor to achieve sustained controlled flight and soon increased the world record for model helicopter duration to 27 min, 11 sec and set a closed-course distance record of 9.3 miles. This model, with a new fiberglass fuselage, was brought out in kit form, first by Schluter, then by Kavan, and then by the Schuco-Hegi Co.[4]

In the U.S. Dave Gray built a small torque-reaction-driven rotor helicopter based on the long experience in this country with that type aircraft. On it the small airplane type propeller rotated in a horizontal plane to provide the lift force and the torque reaction from this prop turned the engine and a larger diameter rotor in the opposite direction. The only functions of the larger rotor were stability and control. These it accomplished with a two-bladed adaptation of the Lockheed hingeless rotor system. With this model Gray in 1970 became the first person in this country to achieve sustained controlled hovering flight. This model was soon produced in kit form by Du-Bro Products, Inc.[5]

Close behind Dave came the authors,[6,7] who had been experimenting with RC helicopters since the mid 1960s. Both of them learned to hover in the summer of 1971. The junior author soon set a world altitude record of 650 ft that still stands.

State of the Art

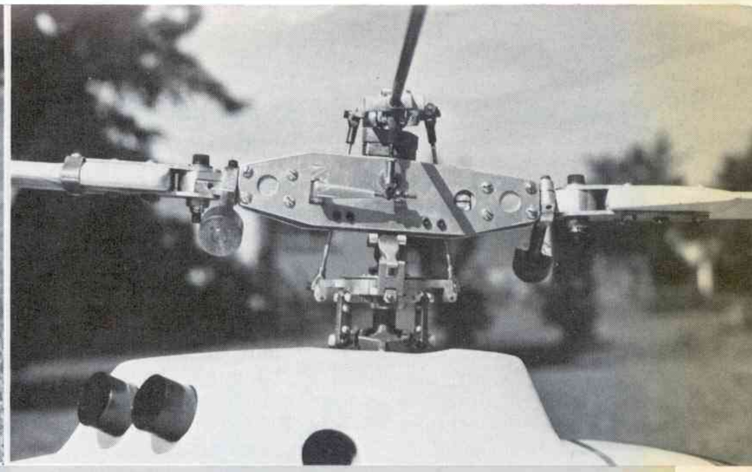
Models flown by the authors use the Hiller rotor system; each started using geared transmissions, then discovered the ease and simplicity of timing belts. We now use a two stage timing belt reduction from engine to rotor. Timing belts with aluminum or plastic pulleys have been popular with builders who start from scratch because they are inexpensive, light weight, efficient (even when drenched in oil), require little or no machining to install, and require no lubrication or maintenance. Most of the kits of scale-model helicopters use gear transmissions that are more compact (though more expensive) than timing belts.

By far the most difficult problem encountered in flying model helicopters is stability. To our best knowledge no one has yet flown a RC model helicopter without a gyro-stabilized rotor of either Lockheed, Bell or Hiller type. It has been reported that in England a dynamically-scaled, electrically-powered model of a WG-13 helicopter with hingeless rotor has been flown by remote control in hover, but not in forward flight. Hingeless rotors have adequate damping in pitch and roll for good control in hover. But they have a pitch-up divergence in high-speed flight that may be difficult to control in a dynamically similar model, because of the scaled-down time constant. In order to be a useful research tool, the model must have a rotor dynamically similar to the prototype rotor. Logically the stability augmentation system (SAS) used in the model should also duplicate that in the prototype. In most cases this is impractical due to the complexity of the full-scale system, and because small, battery-powered rate gyros are not commercially available. A further complication is that the servo actuators used in model aircraft radio systems respond to pulse-width-modulated signals rather than analog voltages. In order for a gyro pickoff of the potentiometer type to be coupled differentially in with the pilot command to the servo it must be wired in series with the feedback pot in the servo. Another way of coupling in the gyro is to connect it to a pulse-width modulator similar to that in a transmitter, and plug it in the cable between receiver and servo. Both of these systems are being developed. The Kavan firm will soon have on the market a battery-operated rate gyro that can be plugged into the line between receiver and servo.

Dieter Schluter fueling his HueyCobra before a demonstration flight.

As part of the development of RC model helicopters certain characteristics of rotors affecting handling qualities have already been discovered. The Hiller rotors originally tried on models used regular Cardan joints between the rotor and shaft. These joints had low friction and contributed very little damping to motion of the fuselage. Hovering in gusty air was difficult. A quick control motion started a pendular swinging of the fuselage. Damping (friction) about the flap hinge was tried but did not help. The pendulum swinging became more circular and confusing, due to cross coupling between pitch and roll caused by the friction. Finally a spring about the flap hinge (subject of an old Hiller patent) was tried. Magically the model became steady and easy to hover, even in gusts. Some builders went to extremes and eliminated the teetering hinge entirely, keeping only the feathering hinge.


Dave Gray prepares to start his own design of the Hughes 300.

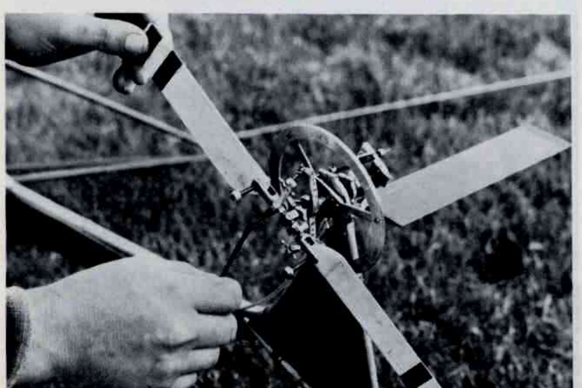


Author Rock's Froude-scaled Boelkow BO-105 and its main rotor. This 11-lb model has a 54-in-diam rotor and is powered by a Webra 61 engine. As seen in photo at right, the main rotor features a Hiller bar, collective pitch control and Chinese-top weights to minimize collective control force.

Those models were rock steady in hovering but somewhat slow in maneuvering. And of course, having two blades and no flap hinges, they vibrated severely in quick pitch and roll motions. These more or less "rigid" rotors, even though they retained the Hiller servo rotor, also displayed some of the undesirable pitching up tendency at high speed, especially at low rotor rpm.

Vortex ring state is experienced often by model helicopters when their pilots try to descend vertically too fast, especially if the model has fixed collective pitch. Those models with coupled throttle and collective pitch (the Kavan Jet Ranger[3] and the Graupner Bell 212[9,10]) also experienced power settling if their coupling, poorly adjusted, called for too much collective in relation to throttle, or if the engine's needle valve (mixture control) was set too rich or too lean.

The effect of horizontal stabilizer size and location has been the subject of some experimentation. A location on a long nose-wheel strut in front of the rotor downwash (on Rock's SSP) gave some needed pitch damping and some speed stability. Size was limited by static instability tendencies. A location up high and well aft, opposite the tail-rotor center, gave good pitch damping but also required large cyclic control to overcome the nose up pitching moment as the stabilizer entered the rotor downwash going forward. A good location seemed to be just ahead of the tail rotor, in the edge of the main rotor downwash. A slightly forward helicopter C.G. balances the stabilizer download moment and allows hovering with neutral cyclic. An increase in stabilizer area from .67% to 1% of disk area was found to improve the behavior of Burkam's Square Tubie in transition from forward flight to hover. With the smaller area and stiffer flap springs, the model tended to nose-up, and required full forward cyclic to prevent a stall and backslide.



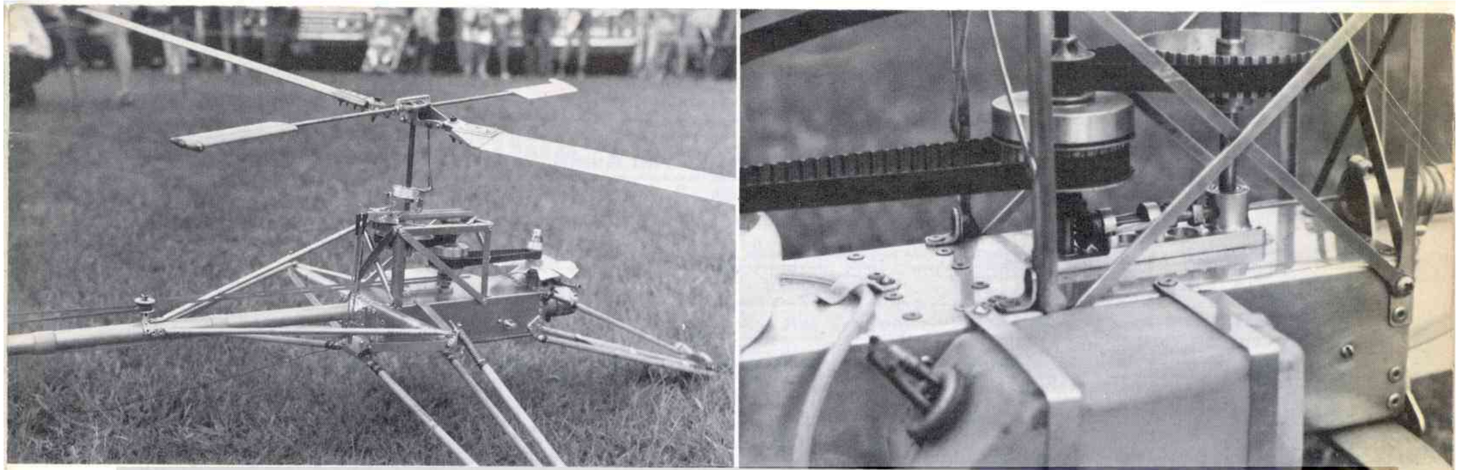
The tail rotor and mechanical yaw-rate gyro on Author Rock's SSP. (Adapted from a Lockheed patent.)

The collective pitch of the Hiller servo paddles was discovered early to have a significant effect on forward flight. Zero collective seemed to give zero speed stability. Positive collective gave positive speed stability and was used on free-flight models to give static as well as dynamic stability. A small amount of positive collective was used on Burkam's model in its recent world record attempt so that its speed would be self-regulating and require less attention. Too much positive and the model would run out of forward cyclic before it reached maximum level flight speed.

Looking into the Future

Until now, except for the work of Young and Prouty, model helicopters have been considered a hobby. As can be seen from the references, the hobby is flourishing and growing by leaps and bounds. However this report is not concerned with the hobby aspect. We have often talked about a semi-Froude-scaled model and what it could be used for. A semi-Froude-scaled model is one in which the frequencies bear the same relationship to rotor speed but density is less than Froude, so time is slowed down. Although a compromise from Froude, we felt a semi-Froude-scaled model could still be useful. Previously all our models had been lighter and had lower tip speed than Froude.

Rock's project last winter was to build a scale model of a rigid-rotor helicopter. The Boelkow was selected for many reasons, one of the strongest being the cooperation of the Boelkow group at Boeing Vertol. The first successful flight took place in the middle of last July. It was readily noticeable that the model flew very differently from any model previously flown. Some of these characteristics were found to be consistent with those of the full-scale BO-105. Two of the similarities were the tail rotor sensitivity and the attitude of the model when hovering. Other factors not necessarily coincidental were the quickness of response to lateral or longitudinal cyclic inputs. To get a better insight into this, some of the full scale parameters were reduced according to Froude's scaling laws. It was found that the weight, tip speed, horsepower and cyclic rates of the model came within 5% of scale values. No longer do we have to think in terms of semi-Froude scale. Completely Froude scaled radio controlled helicopters are now feasible. The only limitation is that we are not Froude-scaled pilots. Our reaction time is not the square-



Economy with efficiency is provided by timing belts instead of the more compact and expensive gear transmissions. Above, Author Rock's SSP with timing-belt-driven main rotor and tail rotor. The main transmission of the model is pictured in the close-up at right. Centrifugal clutch is on intermediate shaft.

root-of-the-scale-factor times faster-than-normal. One way to resolve this is to develop a SAS to slow the model down to rates that a pilot can cope with. The external gyro bar presently accomplishes this, but it is not scale by any means. It would be difficult to measure its cyclic input to the rotor system. An internal electronic SAS is currently being developed. When it is operational it will be installed in the BO-105 along with a Froude-scaled, four-bladed rotor. An internal SAS allows scale rotors and facilitates measuring the cyclic inputs. It also enables a SAS on-and-off switch to be incorporated in the system. Since this development is being carried out on an individual's own time, the rate of progress is slow.

What can be done with RC helicopter models? To begin with, just about everything we do in the wind tunnel with sting-mounted Froude-scaled models. To keep costs reasonable, RC components can also be used for telemetering. The largest number of channels available today in a digital proportional transmitter is eight. In using this as the telemetering transmitter in the aircraft, four pots connected to the outputs of the flight control actuators can be substituted for the four pots normally operated by the control sticks on the transmitter. Three more data channels could be connected to resistance-type accelerometers and the last to an rpm counter. By adding slip rings one could obtain other information such as flap, chord and torsional moments and pitch link loads from strain gages. For example, using the Boelkow model as an engineering tool, 3 lb of unnecessary scale detail could be replaced by instrumentation. The bare transmitter would weigh approximately 1.5 lb, which leaves another 1.5 lb for strain gages, signal processors and wiring. The ground station would be a compatible receiver connected to plotters, tape or what have you. Manufacturers claim approximately ½% position error in the systems available at this time. The control inputs from the ground transmitter need to be recorded to be able to calculate SAS inputs. If SAS were not used, total control inputs could be measured directly from the ground transmitter.

In July, 1972, Rock's SSP helicopter[6,7] was flown in the Boeing Vertol 20-by-20 foot wind tunnel without any serious mishaps in winds up to 25k. This speed represented approximately 90k full scale. It was felt that greater speeds were not obtainable due to higher than necessary collective pitch of the servo paddles. It was a simple test and no data were telemetered.

With the possible exception of the Lockheed model of 1959, we believe the Boelkow to be the first Froude-scaled model to fly completely free. True, it is not completely true to scale at this time because of the main rotor. We believe the dynamics of the main rotor as it is now are giving flying qualities very similar to those of a scaled one. The next step is a logical one; the rotor.

The ultimate in precise measurement of performance and stability would be testing in the controlled conditions of a wind tunnel. For the majority of the data acquisition the model should be rigidly mounted, such as in measuring loads, forces, performance and natural frequencies. The most useful types of program which make use of the free-flying model would be those aimed at measuring dynamic stability, transient aerodynamic effects and other phenomena which cannot be readily analyzed, or measured with conventional wind-tunnel models. The complete freedom of the model eliminates the nagging question of what effect, if any, restraint would have had on its dynamic behavior.

Although the tunnel provides the controlled environment, the proximity of the walls increases the risk of model damage and severely restricts any flight maneuvers. Even a normal transition to forward flight could not be performed in a tunnel because of slow velocity buildup. Outdoors a model can perform any maneuver performed by the real thing, plus a few of its own. Things like horizontal stabilizer configuration and location, vertical fin area and offset, tail rotor collective effectiveness, tail rotor stability with different delta-three angles, pitch-roll cou-

RC Model Helicopter Kits Available

Rotor Dia, In	Model or Type	Manufacturer	Source in U.S.*	Approx. List
60	Bell 212	Graupner	2, 4, 5, 8	$450.00
60	Enstrom	Schuco-Hegi	1	390.00
60	HueyCobra	Schuco-Hegi	1, 6	390.00
60	JetRanger	Kavan	9	450.00
60	JetRanger	RC Helicopters	7	400.00
57	Hughes 300	Du-Bro Products	3	350.00
55	JetRanger	Kalt (Japan)	1	300.00
50	HueyCobra	Kalt	1	300.00
41	Whirlybird 505	Du-Bro Products	3	125.00

*1. Aristocraft, 314 Fifth Ave., New York, N.Y. 10001. 2. Associated Hobby Manufacturers, 621 East Cayuga St., Philadelphia, Pa. 19120. 3. Du-Bro Products, Inc., 480 Bonner Road, Wauconda, Ill. 60084. 4. French Motor Co., Inc., 33 Barry St., San Francisco, Calif. 94107. 5. Midwest Model Supply Co., 6929 West 59th St., Chicago, Ill. 60638. 6. Model Heli-RC Helicopters, Inc., 4550 White Plains Road, Bronx, N.Y. 10470. 8. Royal Products Corp., 6190 East Evans Ave., Denver, Colo. 80222. 9. John Simone, 26071 Via Viento, Mission Viejo, Calif. 92675.

pling, etc., are easily studied in forward flight.

Hovering lends itself to the study of down loads on the fuselage and horizontal stabilizer. Should the stabilizer be in the downwash? How bad is the longitudinal stick bump if it is not? Rooftop or ship's deck landings in any condition of wind (or sea state) can be simulated in miniature at very low cost and with no danger to personnel. Measurement of vertical damping and vertical control sensitivity can be obtained without guessing as to the treatment of the downwash. Angular acceleration and velocity response to various control inputs can be measured. Results of all these studies would need to be interpreted in light of the low Reynolds number at which the model had been operated.

A third feature of this type of testing is that maneuver limits and loads can be determined without risk to a pilot. For example, an automatic program of control sequencing following tandem rotor de-synchronization could best be studied, and pilot's confidence built up, by flying RC models. Carrying of external sling loads also lends itself to this type of modeling. (Of course, for paint schemes and camouflage studies the model need not be Froude scaled. The model has the ability to dart between trees and pop above them just like the real ship.)

The last and most important feature of this type of modeling is low cost in time and money. Although the design, fabrication and elaborate instrumentation can be as costly as most existing Froude-scaled models, this is only a fraction of the cost of the man-carrying helicopter now required to obtain the same test results. The low cost and rapidity with which changes can be made is another advantage of RC models over full scale. Not all types of testing need elaborate instrumentation. Much useful data can be obtained with a ground-based movie camera trained on the model for visual feedback and synchronized with recorded control pickups from the ground transmitter.

We predict that after radio controlled helicopters become an accepted means of testing, only then will the full capability and usefulness of these models be realized. Then these few possibilities mentioned here will seem like mere scratchings on the surface.

We have treated flying radio-controlled model helicopters as a hobby until now, but it is rapidly getting to the point where it can be a very valuable engineering tool. We have started the ball rolling but we're not sure we can keep up with it.

References

1. Young, Arthur M., "The Helicopter and Stability," *American Helicopter Mag.*, March, 1948. (Reprinted from "*Interavia, Review of World Aviation*," copyright by Interavia.
2. Schluter, Dieter, "First International Helicopter Competition," (English translation) *Model Airplane News*, April, 1969.
3. Murphy, Bernie, "Building the Kavan JetRanger," *Radio Control Modeler*, Aug., Sept., Oct., 1973.
4. Dewey, Don and Murphy, Bernie, "Building the Bell HueyCobra R/C Helicopter," *Radio Control Modeler*, July, Aug., Sept., 1972.
5. Murphy, Bernie, "Whirlybird 505 Kit," *Radio Control Modeler*, March, 1972.
6. Rock, Gene, "SSP Helicopter," *American Aircraft Modeler*, August, 1972.
7. Rock, Gene, "Learning to Fly the SSP," *American Aircraft Modeler*, Sept., 1972.
8. Murphy, Bernie, "Building the Hughes 300," *Radio Control Modeler*, April, May, 1973.
9. Anon., "Graupner Bell 212 Twin Jet," *Model Helicopter News*, March/April, 1973.
10. Huber, Ernie, "Field and Bench—Graupner Bell 212 Twin Jet Helicopter, Kraft Radio System, HB 61 Engine," *Model Airplane News*, Jan., 1974.

John Burkam and RC Helicopter Developments.

I have written before about the accomplishments of my friend and colleague, the late John Burkam. But it occurred to me that it was a long time ago (December 2001 newsletter, on the Propstoppers website) and our present day helicopter flyers probably don't know how much of their hobby is rooted in the local events. John was a highly respected engineer with Boeing Vertol as it was in those days. He really understood helicopter technology and his interest in the various rotor systems led him to his modeling activities. Almost everyone has built or at least seen the rubber powered Penni helicopter. www.dream-**models**.com/docs/**penni**FF**helicopter**.pdf

Penni is John's eldest daughter and it was a joy to meet her at Pride Day. I have sent her some material I have on John's early work and decided to publish this article for our members.

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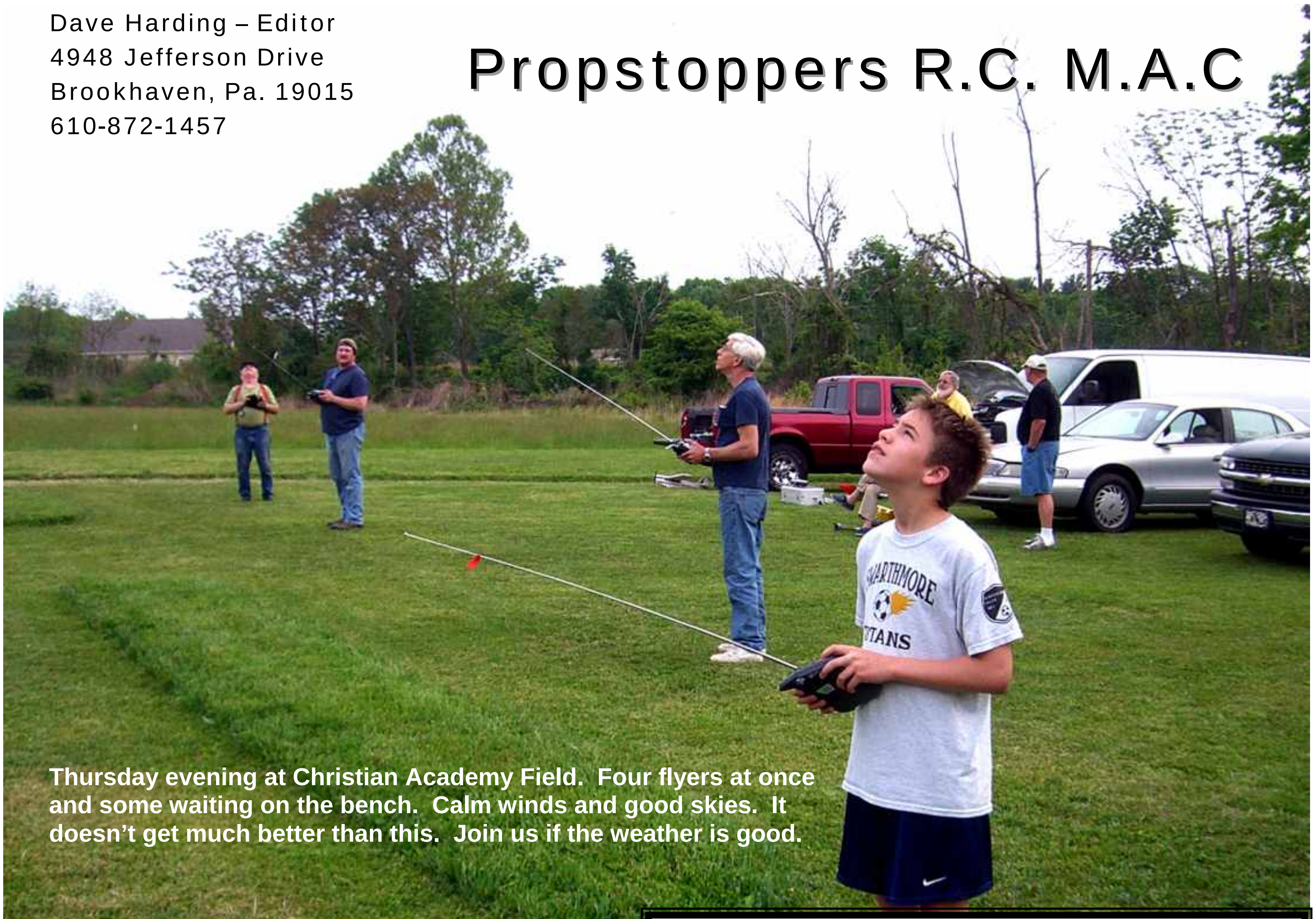
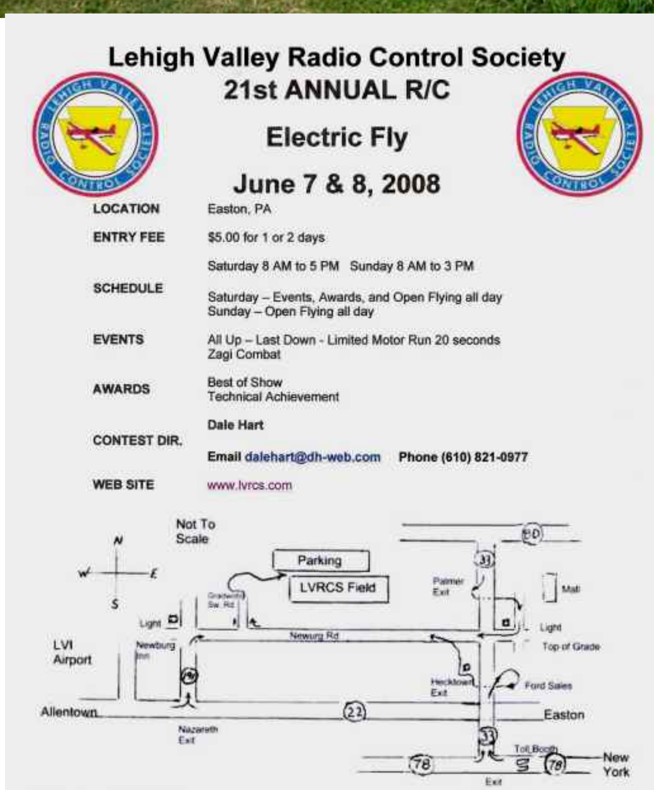
Propstoppers R.C. M.A.C



Thursday evening at Christian Academy Field. Four flyers at once and some waiting on the bench. Calm winds and good skies. It doesn't get much better than this. Join us if the weather is good.



Lehigh Valley Radio Control Society
21st ANNUAL R/C
Electric Fly
June 7 & 8, 2008

LOCATION	Easton, PA
ENTRY FEE	$5.00 for 1 or 2 days
SCHEDULE	Saturday 8 AM to 5 PM Sunday 8 AM to 3 PM Saturday – Events, Awards, and Open Flying all day Sunday – Open Flying all day
EVENTS	All Up – Last Down - Limited Motor Run 20 seconds Zagi Combat
AWARDS	Best of Show Technical Achievement
CONTEST DIR.	Dale Hart Email dalehart@dh-web.com Phone (610) 821-0977
WEB SITE	www.lvrcs.com

Up and Coming Activities

The NEXT four club meetings will be at Sleighton Field; Fly at 5 – 7, meeting at 7.

10 June
8 July
12 August
9 September

Club Picnics at Sleighton
28 June
26 July

Walt Bryan Memorial Electric Fun Fly at Christian Academy Field 23 August

Hey, let's fly in the Electric Texaco Postal Competition again.

Please mark your calendars