The Flightline

Volume 36, Issue 9 Newsletter of the Propstoppers RC Club AMA 1042 September 2006

President's Message

The Walt Bryan Memorial Fun Fly went great, the weather was perfect and we had a good turn out. Thanks to all that turned out to make this happen in celebration of Walt, our club electric-flight pioneer. He would have been proud.

This is the month for club officer nominations. Please come out and help us put together a slate of willing volunteers. We conclude this process with a vote in November.

At this meeting we will talk about field situations for next year and years to come. One thing is for sure if we want to blend in with the community our planes have to be friendly {QUIET}. ***Also we must have complete control at all times and FLY within the field limits.***

As far as this club goes we have been keeping our planes quiet and we have been flying within the limits of the field but we must be vigilant as one false step can lose us a field, and give us a bad reputation.

See you at the meeting and bring your planes and fly before and after the meeting

Dick Seiwell, President

Agenda for September 12th Meeting
At Sleighton Field
Flying from 5 pm, meeting at 7 pm

1. Approval of the July Meeting Minutes
2. Membership Report
3. Finance Report
4. Flying Field Status
5. Plan for Indoor Flying
6. Electric Texaco Postal Competition Help
7. Show and Tell
8. Continued Flying

INSIDE THIS ISSUE

Creating Insignia and Markings

Colorful appropriate markings, insignia, and lettering can bring our models to life. Suitable markings may be furnished in the kits we buy or can be purchased at hobby shops. Scratch builders can generate suitable markings on home computers or at copy centers such as Kinko's, but sometimes none of these options will do the job.

This describes an additional system of creating markings that has worked on half dozen or so of my models.

Obtain a piece of plate glass 12 x 12 or 12 x 18 inches with the edges ground round to prevent cuts. Coat one side with a sudsy, soapy film of water. (I use a bar of Oil of Olay hand soap.) When dry, spray with coats of dope. It can be clear or colored coats depending upon how you will go about creating the images.

The clear, doped glass can be placed directly over a full-size pattern of the image you are duplicating. Designs such as an Indian Head Squadron insignia or unusual lettering can be painted or inscribed directly above the pattern below using model dopes or FW Acrylic Artist ink. These inks can tolerate some handling and will not be affected by the protective clear dope overspray that will follow.

If there are large, unusual-style letters or numbers, then. spray the glass with that color. Trace the outlines on the plate and then cut around the outline with an X-Acto knife. The soapy film will act as a release agent and these images will easily lift off the glass.

Trace around where the image will be located on the model and paint that area with a very watery, thinned-out mix of Elmer's Glue and then apply the image to that area. Squeegee out any surplus glue and level out any bubbles. This application of glue sets the image to the model surface and will prevent crazing or distortions from occurring when a protective, clear dope overspray is applied to the area.

The colored dopes can be sliced into very thin strips and used for pin striping around lettering, etc. These thin strips and images you have created are surprisingly strong and will tolerate considerable handling without breaking up.
Here's to prettier models!

By Frank W. Beatty

From SAM NX-211, Saint Louis MO

Calendar of Events

Club Meetings

Regular Meeting at Sleighton Field
Flying from 5 pm meeting at 7 pm
Tuesday 12th September, 2006

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

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 11 am Sleighton Field
Thursday evenings 4:30 p.m., at CA field.

Note; only electric powered airplanes. Beginners using due caution and respecting club rules may fly GWS Slow Stick without instructors.

Propstoppers RC Club of Delaware County, Pennsylvania.
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Minutes of the Propstoppers Model Airplane Club August 8th, 2006 at Sleighton field

The meeting was called to order at 7:00 p.m. by Dick Bartkowski in the absence of club President Dick Seiwell
The roll-call taken by Jess Davis found 12 members and 1 guest present.
Treasurer's report was presented by Jim Barrow and accepted by the membership
Minutes of the June and July meetings were approved by the membership.

Old Business:
Dick remarked that the Club Picnic held on the previous Saturday was very successful and well attended. He also reminded us that future club meetings will be on the 2nd Tuesday continuing through the winter at the Middletown library beginning Sept or October.

New Business:
Dick took a vote of the membership about the September meeting. They voted to hold it at Sleighton.
Mike Black is negotiating for the winter indoor dates at the Tinicum Elementary school. Dick reminded the group that small inexpensive R/C planes, perfect for indoor fun are available at several chain stores.

The meeting was adjourned at 7:30 p.m. so that members might enjoy a good night of flying.

Dick Bartkowski, Secretary

Dr. Mike with his Wen Mac powered model. Yes, that's right, Wen Mac you oldies!

Hanger 9 Cub on the patch at Sleighton. 24 x 3000 mah NiMh cells might be called ballast! No problems with wind though Mick

You have to stick with this training stuff. Tom Treddinick and Dave fly till dark.

The big Cub is a bit of a handful to take off and land on the Sleighton patch; it weighs something like ten pounds so not exactly a park flyer with its high approach speed...

The flying was excellent and continued till dark when Tom Tredinnick with Dave Harding's assistance finally called it quits because he couldn't see the model any more.

Push Rods

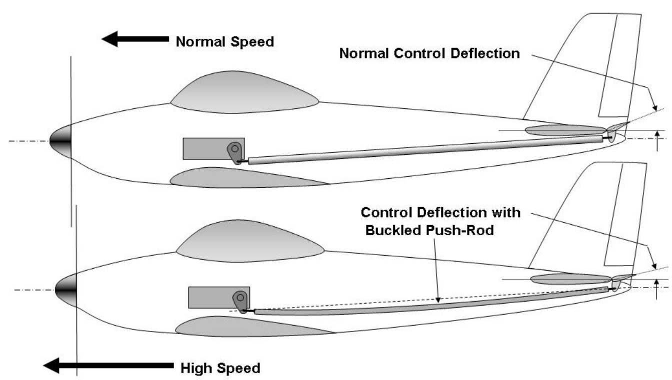
After months of dreaming, ages of saving and justifying the purchase and weeks of building your new masterpiece, you are finally at that moment of truth; the first flight.

Takeoff is uneventful, response to mild control inputs satisfactory, a little trim adjustment and you are in heaven. A smooth approach and perfect landing sets you up for a time to contemplate while watching your buddies fly.

Time for another flight. Takeoff a little more aggressive and hot climb to altitude; let's see what this baby can do. A few big maneuvers followed by some more aggressive, oops, nose down and picking up speed fast. No worries, haul back on the stick…….back on the stick…. Oh no, not responding…. Too late now it's into the ground.

What happened? Examination of what is left of your masterpiece shows nothing obviously wrong. Controls intact and an examination of the elevator servo shows that it is still working perfectly; what could it be?

Euler's revenge – pushrod buckles on up-elevator command.



Whether you scratch-build or mostly build ARFs you will come to the point of deciding on the means to connect the servos to the control surfaces. Most times we decide to use pushrods. They are usually the simplest way.

There are several choices we must make; the routing, the basic pushrod material and dimensions, the terminations and connection to the servo and control horn. If we scratch build, we also must decide what side of the surface the horn will be mounted. Frequently this is determined for us by the geometry of the fuselage and the tail location. High mounted tails usually result in a lower surface placement for the elevator horn, and thereby lay the challenge associated with the good Dr. Euler; the push rod is in compression for an up-elevator command.

The problem with this compression condition is that the flight loads are not obvious to us, and neither is the true "strength" of our choice of pushrod design. In fact, the hidden problem is not one of strength in the classical sense, but rather one of stability; the long slender rod in compression can buckle even though the stresses are minimal. Remove the load and it will straighten again.

Dr. Leonhard Euler, an 18th century Swiss, is sometimes acclaimed as the world's greatest mathematician. He applied his extensive work to optics, electricity, magnetism and fortunately for us; mechanics, where he developed the equations that describe the stability of ……. Long slender columns. Of course, he was not an aero modeler, that hadn't been invented yet, but he did develop the equations we use in Computational Fluid Mechanics (the digital wind tunnel - But that is a story for another time, and only if enough of you ask me to do it.) Interestingly enough, Euler was tutored by Johann Bernoulli, the father of Daniel Bernoulli, the mathematician who developed our favorite equations of fluid flow, most frequently associated with wing lift.

So, Euler's equation for the critical buckling load of a pin-jointed long slender column in compression is;

Critical bucking load, $Pcr = (p^2/L^2) \times E \times I$

Where p is our favorite Greek symbol with the value 3.142
L is the length of our pushrod
E is the stiffness of the material
I; the Area Moment of Inertia. It is a function of the member's cross section dimensions.

For a circular cross section push rod; a dowel or a rod, the Moment of Inertia is;

$$I = p \times r^4 / 4$$

Where r is the radius of the dowel or rod

For a tube the Moment of Inertia is;

$$I = p/4 \times (r_1^4 - r_2^4)$$

Where r_1 is the outer radius and r_2 the inner radius. The difference between them is the wall thickness.

Using these equations I have developed the table below, which shows the bucking load and the weight of various pushrod alternatives; wood dowels and aluminum and graphite tubes 25 inches long.

Mick Harris has been building a big glider and was faced with the choice of push rods. He figured his design load; that which is a maximum within his design flight envelope, is 64 ounces (more on this later). Highlighted are the choices which satisfy these criteria and their weights. It is important for him to find the lightest practical solution as he thinks the model will be hard to balance with too much weight at the rear end. (Aren't they all?)

Interestingly, the lightest choice is a soft balsa 3/8 inch diameter dowel. However, Mick's modern glider has a very small diameter fuselage so he would not have room for this solution. The next choice, one that will fit is either a ¼ inch diameter spruce dowel or a ¼ inch diameter, 0.01 inch wall thickness aluminum tube. Now Mick is concerned that the aluminum solution might be fragile and prone to kinking. So he has chosen a thin walled, 3/16 inch diameter graphite tube.

There are some other provisos for the applicability of these formulae, chief among them is the assumption that the member is straight and the loads have no offsets. We frequently violate these conditions when we make the adaptation for passage through the fuselage and alignment with the control horn. You could calculate the effects of these migrations from the ideal, but suffice to say this is only a hobby and much of the fun is in making designs TLAR. So be forewarned and watch these factors by putting a little more margin in the basic push rod.

But there is more to it than this. For instance, you might decide to find a way to make the elevator horn attachment to the top side so the high pull-out loads are in tension. You could get away with a very much smaller push rod in this application, unless it was an aerobat and you needed the same strength for push-over maneuvers as for pull-outs. The popular T-Bird beginners electric RTF glider has a pull string for up elevator and a rubber band return for down; perhaps the extreme solution of this genre.

There is a more elegant solution that frequently works, and that is to guide the push rod half way along its length. Now if you do this there are a few additional considerations.

Length L, ~ inches **25**
Cripling Load ~ oz, Pcrit, for Circular Tubes and Rods, of Length L

		Aluminum		Graphite		Balsa Soft	Balsa Hard	Spruce	Maple
Material Modulus E psi		10,000,000	10,000,000	20,000,000	20,000,000	300,000	600,000	1,600,000	2,000,000
Diameter	Thickness	0.01	0.02	0.02	0.032	Solid			
1/8	0.125	15	24	48	57	1	2	5	6
3/16	0.188	56	95	191	251	5	9	25	31
1/4	0.250	137	243	487	672	15	29	78	97
5/16	0.313	276	502	1003	1428	36	71	191	238
3/8	0.375	483	891	1782	2586	74	147	393	491
1/2	0.500	1168	2199	4399	6542	233	465	1241	1551

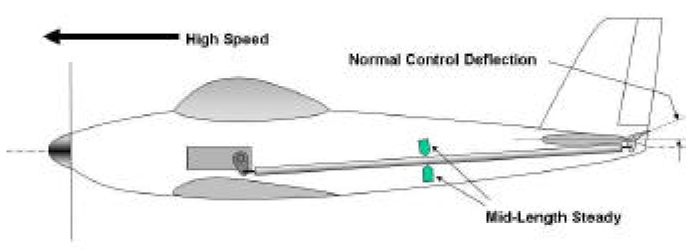
Weight for Circular Tubes or Dowels of Lenth L, ~ oz

		Aluminum		Graphite		Balsa soft	Balsa Hard	Spruce	Maple
Material Modulus E psi		10,000,000	10,000,000	20,000,000	20,000,000	300,000	600,000	1,600,000	2,000,000
Diameter	Thickness	0.01	0.02	0.02	0.032	Solid			
1/8	0.125	0.16	0.31	0.16	0.25	0.02	0.03	0.07	0.13
3/16	0.188	0.24	0.47	0.24	0.38	0.04	0.07	0.16	0.29
1/4	0.250	0.31	0.63	0.31	0.50	0.07	0.13	0.28	0.51
5/16	0.313	0.39	0.79	0.39	0.63	0.11	0.20	0.45	0.80
3/8	0.375	0.47	0.94	0.47	0.75	0.15	0.28	0.64	1.15
1/2	0.500	0.63	1.26	0.63	1.01	0.27	0.50	1.14	2.05

Length L, ~ inches		**12.5**							
Cripling Load ~ oz, Pcrit, for Circular Tubes and Rods, of Length L									
		Aluminum		Graphite		Balsa Soft	Balsa Hard	Spruce	Maple
Material Modulus E psi		10,000,000	10,000,000	20,000,000	20,000,000	300,000	600,000	1,600,000	2,000,000
Diameter	Thickness	0.01	0.02	0.02	0.032	Solid			
1/8	0.125	61	95	191	229	4	7	19	24
3/16	0.188	225	382	764	1005	19	37	99	124
1/4	0.250	550	973	1947	2689	58	116	310	388
5/16	0.313	1106	2007	4013	5711	143	286	762	953
3/8	0.375	1932	3564	7128	10343	294	589	1570	1963
1/2	0.500	4673	8797	17594	26168	931	1861	4963	6204

Weight for Circular Tubes or Dowels of Lenth L, ~ oz									
		Aluminum		Graphite		Balsa soft	Balsa Hard	Spruce	Maple
Material Modulus E psi		10,000,000	10,000,000	20,000,000	20,000,000	300,000	600,000	1,600,000	2,000,000
Diameter	Thickness	0.01	0.02	0.02	0.032	Solid			
1/8	0.125	0.08	0.16	0.08	0.13	0.01	0.02	0.04	0.06
3/16	0.188	0.12	0.24	0.12	0.19	0.02	0.04	0.08	0.14
1/4	0.250	0.16	0.31	0.16	0.25	0.03	0.06	0.14	0.26
5/16	0.313	0.20	0.39	0.20	0.31	0.05	0.10	0.22	0.40
3/8	0.375	0.24	0.47	0.24	0.38	0.08	0.14	0.32	0.58
1/2	0.500	0.31	0.63	0.31	0.50	0.14	0.25	0.57	1.02

First you must determine if the push rod motion is mostly axial; that is, there is little side motion throughout the full travel. Second, the guide must be absolutely smooth such that it does not restrict or impede the control motion. These criteria will probably eliminate consideration of balsa dowels and maybe hardwood too, unless you can treat the surface in the region of the steady.

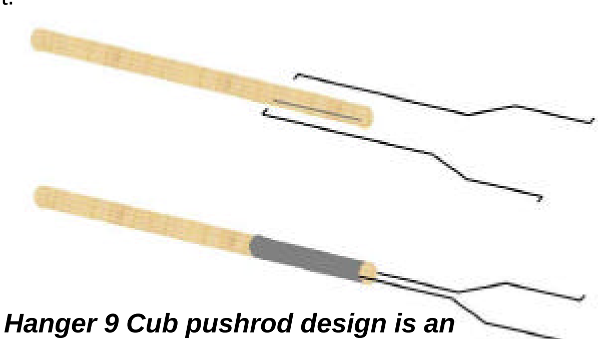


Once you convince yourself that these criteria will be satisfied we can go back to Euler and calculate the design for such an installation; pin-ended with a central restraint. If the restraint allows the push rod to bend at that location, and if the restraint is in the center of the length then the pushrod will look like one of half the length in Euler terms, hence, since the bucking load is a function of - one over the Length squared - we have increased the buckling load by a factor of four. The second table shows how the buckling loads would look if we halved the length between supports. This table shows the weight for one half of the push rod so double it for the full length.

In this case Mick could use a ¼ inch hard balsa, or 3/16 inch spruce dowel, or a 1/8 inch diameter graphite tube, all of which are lighter than the unsupported design with the exception of the unsupported 3/8 inch diameter soft balsa dowel that would not fit. But it is hard to build a satisfactory restraint half way down a long slender molded tube, which is the challenge faced by the modern glider guider.

For the truly anal among you another approach is to use a soft balsa core and reinforce it with thin graphite strips on each side. I have done this with a square balsa core and four strips of graphite and find it has worked very well for years on my big Miss America. Just remember, this is not a strength issue in the classical way where the material is sundered, it is a stability issue, where the stresses are low. Hence lightweight means to make the member stiffer pay off significantly (so to speak).

My Hanger 9 cub came with large diameter balsa push rods (plenty of room for them) and a cleaver way to attach the wire terminations at each end. The approach uses a groove in the push rod while the wire has a 90 degree bend at the end; that pierces the dowel. The whole thing is held together with a shrink wrap tube. The split elevator control has two such identical but opposite handed wires at the aft end. It works just fine as the offset loads balance each other out.



Hanger 9 Cub pushrod design is an elegant solution for split elevators

But wait, all this is well and good, but you can't do the math if you don't know the loads you are designing for.

Mick and I did some fairly simple calculations and a separate sanity check. First we opined that the load on the control surface is about the same as the, so called, dynamic pressure at the maximum speed. The dynamic pressure is that which you experience if you bring the free stream flow to a dead stop.

Now in the real world it is possible to generate much more pressure than that, on the upper surface of a wing leading edge for example, but we think the basic dynamic pressure is reasonable for a control surface that will only deflect twenty to thirty degrees.

In Boeing, we designed the front end of our airplanes to twice this level, but there is a lot of rushing air finding its way past the cockpit etc.; a different case to the control surface. (I suppose I could go on-line and calculate the actual pressure with one of these new fangled codes. Did you know you could do that? Do a search on X Patch and Mark Drella of MIT. Actually, I could do it with Profili www.profili2.com a free airfoil drawing program that can do more if you send Stephan some money).

Anyway, just remember that the dynamic pressure in pounds per square foot;

p = 0.0012 x speed squared.

Where speed is in feet per second.

Now a fair approximation is that 60 mph equals 88 ft per second, so now we can do the math and also, while we are at it, convert the pressure to pounds per square inch; psi; see the chart at the bottom of the page.

Mick's elevators are about 1.5 inches chord and 15 inches span so the area is 22 square inches and at 75 mph (don't ask) the load is about 0.1 times 22, or 2.2 pounds. This load acts at the centroid of the surface (the middle). So as far as control forces are concerned they act 3/4 inch back from the hinge (half way back along the chord), so the hinge moment is;

2.2 x 0.75 = 1.65 inch-pounds.

Mick is reacting this with a half inch horn so the control rod "sees" 3.3 pounds;

1.65 / 0.5 = 3.3 pounds; which we rounded up to four pounds, or 64 ounces in the tables.

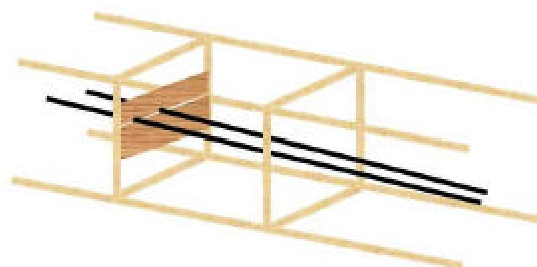
Of course, for this to be real, the servo has to react this force too. So if he uses a ½ inch arm on the servo the servo torque will be;

64 x .5 = 32 inch ounces

The Hitec HS 81 MG will handle 41 inch ounces so he should be ok there too.

We will see if all this works out shortly as Mick's model is nearly finished.

Now this whole story is what I experienced with my Trenton Terror. It flew exceptionally well as a contest ship, where we climb straight up at about normal flight speed then glide down at modest speeds. After the contest I flew it at Moore Field and thought "hey, this is a pretty good sport plane too: So I began to throw it around like an aerobat; well, maybe just a sport plane. Regardless, I did put it in the top of my least favorite tall tree at Moore Field, and following its recovery (it was not badly damaged) I did indeed discover that the graphite tube pushrod buckled under modest loads. My fix was a half distance restraint that was easy to install on this strip balsa structure; just strip the covering over one bay and add the pair of transverse sheet balsa supports – a bit like the Pilgrim stocks clamped around the pair of pushrods, like legs. Add the covering and I was back in business, but I wish I had done it that way from the beginning.



Mid-point steady installation on the balsa structure of the Trento Terror.

There are, of course, other ways to tackle the control problem including pull-pull and snake-in-tube types, each has its advantages and disadvantages, so, as with much of our hobby, the fun is in thinking out the options and selecting the one you like best. But while you are doing so, think about the push rod buckling problem and tip your hat to Leonhard Euler.

Dave Harding

Speed mph	20	30	40	50	60	70	80	90	100
Pressure psi	0.007	0.016	0.029	0.045	0.065	0.088	0.115	0.145	0.179

Dick launches and Dave flies his Trenton Terror with the Ohlsson 60 ignition engine at the SAM Champs in Muncie. Subsequently found to have unstable pushrods.

The Walt Bryan Memorial Electric Fun Fly

Yet another fine, well attended but laid back Propstoppers event in the heat of summer. Don't you love that big Subaru canopy? Thanks to Martyn Harding, Dave's son who works for Subaru and saved this reject a few years ago.

Dick Seiwell's daughter-in-law graced the meet with her presence and did the chores at the grill.

The models this year were slanted towards the aerobat type with small foamies from Joe Mesko and Eric Hofberg, and larger ones from Bob Crowell, and Al Basualdo.

Bob Crowell with his fine flying Cermark Banshee ready to taxi out

Dick Seiwell's daughter-in-law took care of the BBQ chores

Al brought his large sized Yak and a somewhat smaller Extra (CAP?), both flew extremely well.

Friend, KRC club member, and Walt Bryan meet regular, Dave Garben, brought a couple of his whimsical foam home cooked planes including one with a foam wing and plastic baseball bat fuselage.

Dick Bartkowski took the opportunity to check out his venerable Sal Taibi Pacer C, this time with the Texaco powerplant and battery. He is getting ready for our team entry into the World Wide Electric Texaco Postal Challenge contest. (See following article)

Dick Bartkowski's venerable Pacer C Ready for the Electric Texaco Postal

Bill Tomasco and Dick Seiwell admire Al Basualdo's fleet.

Volume 36, Issue 9 Newsletter of the Propstoppers RC Club September 2006

Propstoppers R.C. M.A.C

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Dr Mike Cirigliano prepares to enter the jet age, well, pusher age perhaps. Fine looking model Mike. Picture from Show and Tell at the August meeting at Sleighton Field

Propstoppers to Fly in the World Wide Electric Texaco Postal Competition.

Back in May I explained that we planned to fly in this competition and that Mick Harris, Dick Bartkowski and I will provide some airplanes for Propstoppers to fly so we will have a chance to put on a good show. Or maybe even win this event this time.

The event concludes by the end of September but what with the SAM Champs during the week of the 11th it only leaves a few days on which to make our attempts. This year we are allowed to have several attempts, so it would pay us to plan for them.

We will have a fleet of first class airplanes but to beat the West Coast crowd (and all East Coasters want that) we must fly when there are thermals present. This means during the day, so we can fly some Tuesdays after breakfast with us retired guys and then some Saturdays and Sundays 17th 23rd 24th and 30th

What we need are some volunteer pilots that are willing to give it a go. Easy really, just fly smoothly at altitude and watch for the thermals, then turn. We will show you how. Just give us a call - ***Dave***