The Flightline

Volume 36, Issue 8 Newsletter of the Propstoppers RC Club AMA 1042 August 2006

President's Message

Well the picnic went well; we were right between the rain; thanks for all that showed up.

The next event will be the Walt Bryant Electric Fun Fly this will be Aug. 12th at the Christian Academy and is an all-electric event

What ever happened to small Warbirds everyone was building? If you have one done bring it in, I'm sure the members would like to see them.

When flying a high performance plane check it over good before flying. If you think you are out of control first CUT the Throttle; the plane will slow down and you may get control back and do less damage. And please remember, if you do have an off field crash you are required to inform us so we can be aware of any potential community issues.

Dick Seiwell, President

Agenda for Tuesday August 8th Meeting
At Sleighton Field
Flying from 5 pm, meeting at 7 pm

1. Approval of Minutes
2. Membership Report
3. Finance Report
4. Flying Field Status
5. Plan for Walt Bryan Electric Fun Fly
6. Show and Tell
7. Continued Flying

INSIDE THIS ISSUE

Minutes of the Propstoppers Model Airplane Club Meeting July 11th, 2006 at Sleighton field

The meeting was called to order at 7:00 p.m. by President Dick Seiwell

The roll-call taken by membership chairman Ray Wopatek found 15 members and 1 guest present.

Treasurer's report was presented by Jim Barrow and accepted by the membership

Minutes of the June meeting had not yet reached everyone so approval was put off.

Old Business:

President Dick reminded us of the Annual Club Picnic to be held on the coming Saturday. The club is supplying food and drink. 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 Seiwell said that after discussion with the school that Christian Academy field is still approved till the end of the year.

Show and Tell:

Mick Harris (our most prolific builder) showed a new wing for a Fokker D-8 covered in a yellow and red pattern. He is currently finishing the fuselage.

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

Dick Bartkowski, Secretary

Calendar of Events

Club Meetings

Regular Meeting at Sleighton Field
Flying from 5 pm meeting at 7 pm
Tuesday 8th August, 2006

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

Thursday evenings at Christian Academy

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

Walt Bryan Electric Fun Fly, Saturday 12th August, Christian Academy Field.

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.

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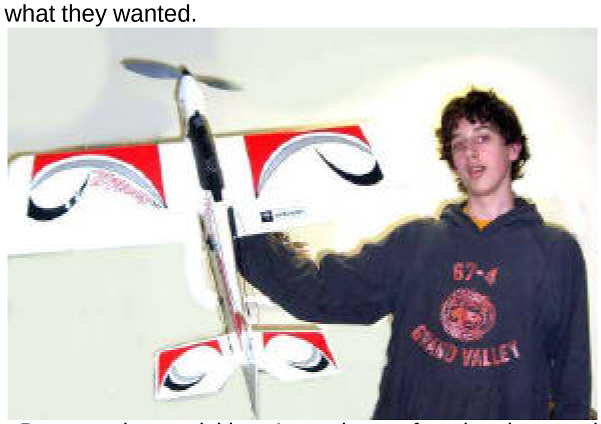
Propstoppers Support Middletown Township Summer Program

By Dave Bevan

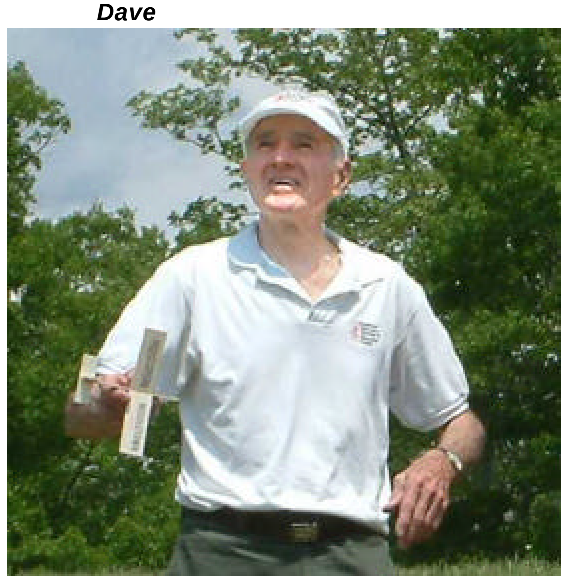
President Dick Seiwell called and said the Middletown Township wanted the club to help out with the camps that they run. I called Ashley Knauss last Sunday (she happened to be in Washington, DC) and asked what it was they needed, what day, what time, how many kids, etc. Ashley indicated that there are two camps, one for juniors and one for seniors. It seemed that there were two locations, one at the park off Lenni road behind Glenwood School and the other was at Penn State LIma campus. On Sunday Ashley was unsure of the days and times, but I told her I would see what we could do. That night I called several club members who I thought might help, and left messages for all of them.

Monday, while at the museum teaching kids how to build HLG's the Oetingers agreed to put on a 3-D aerobatic display. I called Ashley and told her we had selected 10am Thursday at Penn State for this week (last week) and she was pleased. Thursday morning Mrs. Oetinger took Phil out there and he put on a demonstration that was exactly what they wanted.



Due to other activities, I got there after the demo, while Phil was explaining all about the model its specs and behavior. I mentioned the origin of lift and threw up one of the Middletown Township gliders with the perfectly flat airfoil. It flew well judging by their reaction. I told some of the students (one or two wanted to be engineers) about civil, mechanical electrical, chemical, and aeronautical, etc. I had a HLG with me and threw it up and it got a good ride. I have not promised anything for this week.

Dave



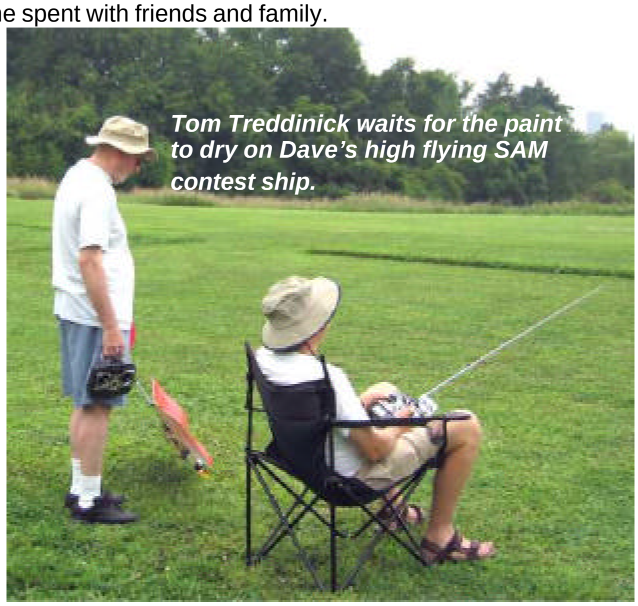
The Propstoppers Picnic

The annual Propstoppers picnic looked to be in jeopardy as Saturday dawned to cloudy skies and a grim forecast for hot humid weather with thunder storms. And so it seemed, as a good sized group of members and their families huddled in their cars at Sleighton Field. It was raining steadily and the skies continued to threaten the feared thunder storms, however, we decided to give it another fifteen minutes before making the decision to cancel.

The skies brightened a little so we erected the big Subaru canopy where we could commiserate about our fate. But once the canopy was up the rain stopped and we decided to declare the picnic "on". Whereupon the whole event seemed to self organize as tables, coolers, BBQ and food magically appeared. The railbirds and their "support" had the seats set out and comfortably occupied before the first plane hit the sky (see the cover photo).


Phil Oetinger flies Dave Harding's 3 D foamy (Dave can't its too hard!)

The warm, humid lazy day did not encourage a frantic pace in the flying, quite the opposite as members seemed to take it in turn to put in a flight then take a break. But the atmosphere was congenial and clearly everyone was enjoying the relaxing time spent with friends and family.


Tom Treddinick waits for the paint to dry on Dave's high flying SAM contest ship.

One of the more interesting events, judging by the attention it drew, was President Dick Seiwell and Secretary, Doctor of Science, Dick Bartkowski, igniting the huge pile of BBQ briquettes using one of those metal chimneys. Theories were postulated, debated and discarded by the onlookers, several of whom spent their entire professional carriers analyzing such phenomena. Eventually, and surprisingly, the "As Seen on TV" device performed "As Advertised" although I don't think it was intended to start a pile of coals sized to cook for the entire township, and this posed even more complex physics challenges. The hamburgers and hot dogs were soon available in abundance, perhaps rather more than was needed on such a hot day, but nevertheless the Propstoppers, as usual devoured the whole batch, and the coals continued to make the chemical conversion to ash and heat until they were finally put to rest with the contents of the much more useful coolers.

During most of the afternoon Vice President Dave Bevan made the suggestion that we hold a hand launched glider competition using his now diminished fleet of small gliders that he and John Tripier had made for the Middletown Township Community Pride day.


The Bevan-Tripier Hanger of HLG's is running low

However, we all suspected that the fleet is dwindling because Dave spends hours a day fine tuning his trimming and flying skills to the point that they regularly fly out of sight. There were no takers for the contest as we sat and admired one fine flight after another, but Phil Oetingers mother took the challenge to fly one under Dave's patient tutelage.

About three pm the skies again threatened and in one great community effort the big Subaru canopy was folded and tables, coolers and the remaining food was whisked away in a moment. None too soon as the rains again began to fall, this time in full force. But we had enjoyed an excellent picnic; one and all were satisfied with their day.

Dave Harding

Post Script

There is a reason that Dave Bevan, Phil Oetinger and Mick Harris appear so often in the Flightline; they, together with Joe Mesko, who flies regularly on our Thursday evening affairs at Christian Academy Field, are the most prolific aeromodelers in the club.

Want to get some press? Come on out and fly!

Installing Decals Like a Pro

By Mick Harris

I had finished the assembly of my Cox mini-fighter, and was thinking about putting on the water- slide decals. A few years ago I was into building plastic models, and one of the first things you learn is that decals can make or break your latest masterpiece- the most common problem being that the carrier film show "silvered" due to air bubbles being trapped under it. I still have some of my plastic modeling accessories, so I decided to do the job properly.

Mick Harris' Cox Corsair

To remove the decal from the paper most people soak it in a dish of water until it becomes free; first mistake. This subjects it to too much water, which can result in too much of the adhesive being washed away. The decal should be placed upside down on a paper towel, and the paper brushed with a wet brush, and allowed to sit for a few seconds.

The next step is the important part; brush the area on your model where the decal is to go with a wetting solution. This can be obtained at your local hobby shop, two popular types being MicroSet and MicroSol. The former is milder in its action.

All you do is position the decal by pushing it around with your brush, dab it with a paper towel and finish with a little more setting solution-then let dry. The MicroSol is more potent and can be quite disconcerting. When the decal is in place, brush some MicroSol onto it and then LEAVE IT ALONE. The solution softens the decal and allows it really conform to the surface allowing every small detail to come through.

Once set its almost impossible to remove, but sometimes while it is reacting, it will look a mess, like something that has just crawled out of a swamp- just resist your urge to dab it down, it will be o.k. when it has dried.

The finishing touch should be to overspray the whole model with a clear varnish, but I think this is overkill ......

Mick

Temperature Problems with Modern Airplanes

I have the bad habit of leaving my planes in the van after a day's flying. The reason it is a bad habit is associated with the temperature stability of the materials we use nowadays, and the percentage of temperature susceptible materials in our models is increasing rapidly. This is also true for full-sized airplanes as they move to greater use of composite structures, indeed, this is where I received much of my information on these phenomena, so let's start there.

Composite structures, typically glass, graphite and Kevlar reinforced epoxy or cyanate ester have been under steady development for five decades or more. Much of the motivation was in the easy of manufacture, as complex contoured surfaces could be produced by molding on master tools. Although the majority of such structures were fairings there were those who used composites and the geometric freedom they allowed to build whole aircraft. Typical of these was the Bellanca Skyrocket II, built in Wilmington in the late 1960's and early 70's.

All-Fiberglass Bellanca Skyrocket II

The Bolkow Phonix, which first flew in 1957, the world's first successful fiberglass sailplane, used the fiberglass and balsa wood sandwich technique. Here is the derivative Phoebus.

All-Fiberglass / Balsa sandwich Bolkow Phoebus, successor to the 1957 pioneering Phonix

Boeing Vertol began experimenting with composite rotor blades at about this time and continued on a path of successful development for four decades. Among the early outstanding examples was the Advanced Geometry Blade made under Air

Force contract. The design of this "Advanced Geometry Rotor" was aimed at achieving the optimum aerodynamics at every radius station. The geometry varied in cross section – airfoil, and chord continuously from root to tip. These blades were made from a Boron fiber - Epoxy composite. Boron was expected to be the preferred fiber material due to its light weight and high stiffness, but subsequent developments of graphite or carbon fiber and the aramid fiber Kevlar, became the dominant materials where high strength and low weight were the driving factors. Interestingly enough, rotor blades are not rewarded for light weight as the centrifugal forces are required to balance the lift forces in a way that does not allow excessive coning or flapping. Furthermore, damage tolerance is a key property and fiber glass has proved to be outstanding in this regard. So most composite rotor blades these days are made primarily from fiberglass.

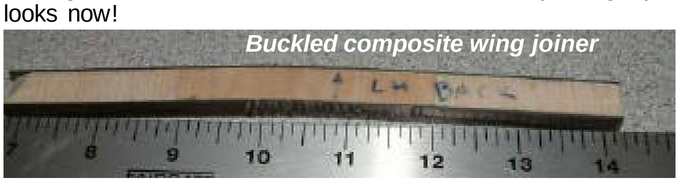
Now all of these structures were made by combining the fiber re-enforcing material with epoxy to form a, well, composite. The epoxy is mixed with a hardener and the whole structure heated (usually) till the epoxy polymerizes, or "goes hard". In fact what happens in the polymerization process is that all the epoxy molecules coalesce in a way that they form one giant molecule; or something like that.

Ok, you say, so where is the fire?

Well, along the way it was discovered that although the composite material was fully cured, there was a temperature where they began to soften and behave like a viscous fluid. Such structures would creep or deform under load and heat. The point where this happens is known as the "glass transition temperature" or T_g . Now there are all kinds of epoxy systems. We know the five and thirty minute, room temperature cure, systems but in the airplane world there are others that come in two general classes; 250 ^{0}f and 350 ^{o}f cure temperature. In the latter the glass transition temperature is somewhat lower than the cure temperature, and we all know we can soften our epoxy joints with a hot air gun. Furthermore, it was discovered that epoxy and most of the other matrix materials, absorb water from their environment and the "wet" matrix materials suffer a degradation in both glass transition temperature and strength. So the industry is focused on getting this aspect of things right.

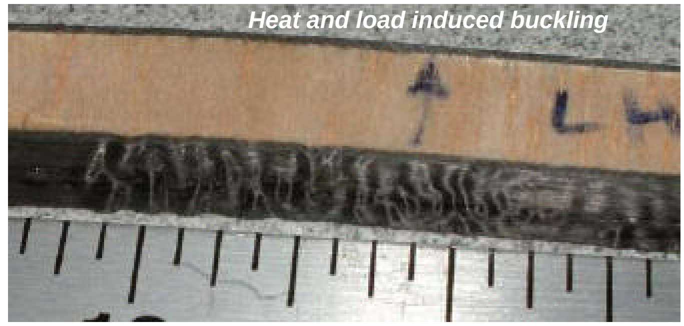
Now, coming from the other direction, we need to know how hot things get. The answer is that under the worst conditions of sunlight and dark paint an airplane's structure can reach 190 ^{0}f and similar temperatures may be reached inside enclosures like fuselages, tents and cars …… and vans.

Last weekend I attended the Great Grape Gathering SAM meet in Geneseo NY. The first day was wonderful, calm and warm in the almost limitless flat grassland of the Historic Aircraft Group's field. I flew a number of models and prepared to fly my new big Stardust Special contest ship. You may remember that the 108 inch wing on this plane is made in three pieces to fit into the golf bag shipping box. You may also remember that I had to engineer this model as it was beyond my comfort zone of TLAR (that looks about right), and I did so for the wing joiners too. I made them as a composite sandwich beam with graphite composite unidirectional fiber skins over end-grain balsa; just like Bolkow did. Well I left the assembled wing in the van with the tip resting on the dashboard. This is how the formerly straight joiner looks now!



Buckled composite wing joiner

It was several days before I noticed the wing was now bent. When I disassembled it I found that the joiner compression surface softened such that the fibers buckled.


Heat and load induced buckling

Now there are a couple of additional factors here and one of them is key to what we do with some of our models. First is the downside of what I did. The graphite unidirectional material I use, and have given many of you, is very old stock prepreg material. Prepreg is the form in which most composite materials are used. They are layers of the fiber material, woven or just laid flat in unidirectional tows, which are then coated with exactly the right amount of resin which is already mixed with the catalyst. This mix of resin and catalyst is formulated so that it goes to the consistency of stick chewing gum. In the freezer it remains in this state for several years. The structures are made by laying this material onto the mold in as many layers as required then covered by a bag or top half of the mold, and then they are compressed and heated for the period necessary for the resin to fully cure.

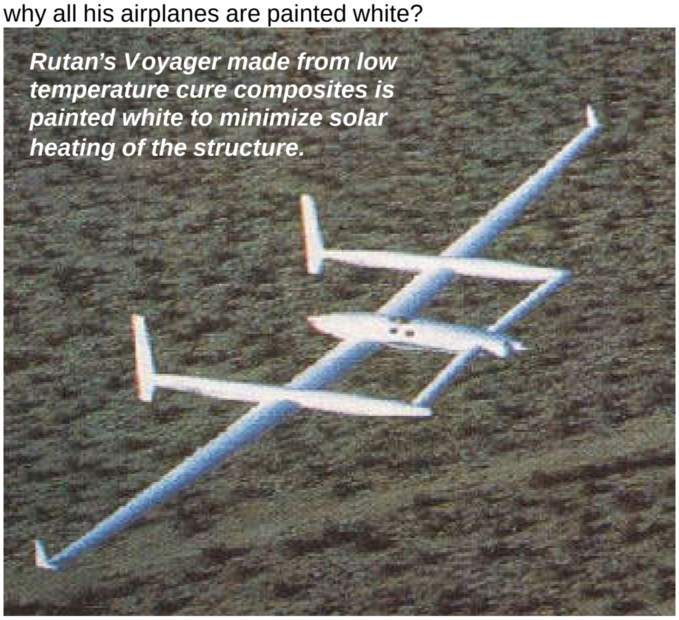
Stored in a freezer, these materials have a shelf-life after which they are discarded. (Good for me). If they are left out of the freezer they sort of cure to a fairly hard state, but they are not truly cured. Now we can use them by adhering them with another layer of glue, and in structures that remain unloaded most of the time this is fine. It is when the structure is continuously loaded that the problems may occur. In this case, not only was the structure loaded for several days but the "new glue" was a room temperature cure system that was almost certainly sitting beyond its glass transition temperature; and consequently crept.

Some time ago scientists found that if you took a part that had been cured at the normal temperature, then "post cured" it to a higher temperature; the glass transition temperature would increase. Because of this phenomenon I use the 30 or 60 minute cure system for parts that require strength and then post cure them for the increased temperature capability.

The model glider guiders who always buy molded composite planes, mostly made in Eastern Europe of the Far East, now routinely post cure their airframes prior to assembly. They make an oven from foam boards; install a light bulb or two and maybe a small fan to circulate the air. Then they install a thermometer so they can control the internal temperature. The model parts are then baked for a few hours to produce the higher strength and temperature capability.

Getting back to the manufacture of full-sized airplanes for a minute, this whole curing temperature thing has another very significant effect; cost. If you are making a fighter or plane that must withstand high temperatures you will use the 350 ^{o}f cure systems. This in turn means that the tools on which the parts are formed must be able to withstand these temperatures and remain stable while heated. This usually means metal tools, which are very expensive to manufacture, and use considerably more heat energy to bring up to temperature.

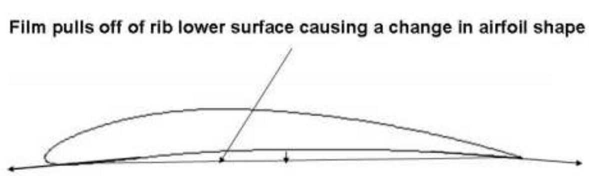
Burt Rutan and his team of "proof of concept" airplane builders use a different approach. He makes parts from low-temperature curing materials on soft tools and his ovens are not unlike what the modelers now use. His tools are usually cemented to the hanger floor for stability and the oven is frequently custom made from 2 inch foil lined foam in the form of an upside down box, hoisted to the ceiling. When the part is laid-up the oven is lowered over the tool and the cure made in situ, as we say in the business. Ok you say, but now he has a plane with minimal temperature capability. Yep, have you ever wondered why all his airplanes are painted white?



Rutan's Voyager made from low temperature cure composites is painted white to minimize solar heating of the structure.

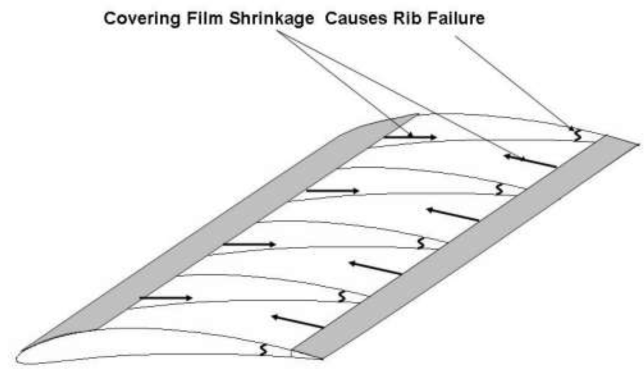
Over the last ten years or so the industry has picked up on this low temperature cure / post cure approach as a way of allowing the use of lower cost tools. There are even systems which use ceramic matrix that can be built on low cost tools then post cured to temperatures high enough to allow their use in exhaust ducts etc. operating over a thousand degrees.

OK, so now we know about the temperature sensitivities of epoxies etc, but our problems don't end there. We need to be careful with over-temping our film coverings as well. In fact my Stardust Special wing also suffered in this area in two ways. First, the film obviously reached a temperature where it shrank some more and pulled some of the seams over to the point that they became unattached. Also the shrinking pulled the film off the underside of the ribs in the region of the undercamber.

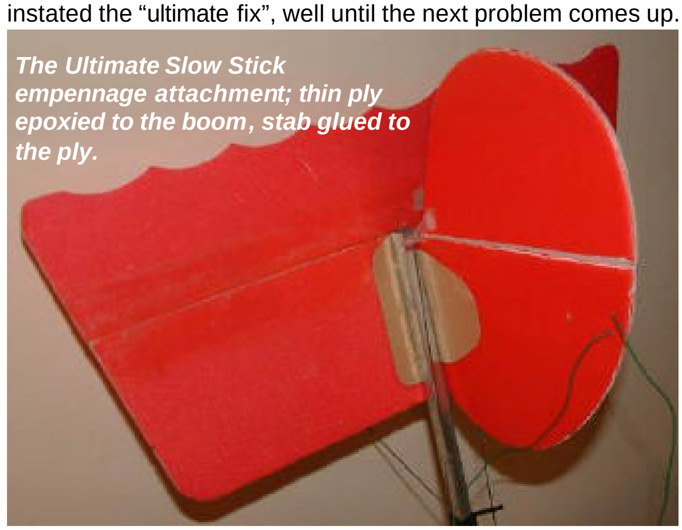


Now I believe there are differences in the various film coverings as some of them require a very hot iron; in the order of 300 ^{o}f whereas others require only 200 ^{o}f . I am sure they both work well but not if you plan to store them in your van in the summer.

A third problem with excessive covering film shrinkage due to high ambient heat is crippling of the wing ribs just ahead of the trailing edge. It is a good idea to add gussets in this area.



Sheet foam models have introduced another area of grief in higher temperature environments. The Slow Stick has a sheet foam empennage that is glued to the aluminum tail boom with double sided sticky tape. This stuff is so poor that it will pull away at my basement temperature if the tail is leaning on something. After screwing around with this problem for a year now I have instated the "ultimate fix", well until the next problem comes up.



The Ultimate Slow Stick empennage attachment; thin ply epoxied to the boom, stab glued to the ply.

I know I can bond 1/64 inch ply to aluminum with epoxy and I know I can bond the foam to ply if I have a large enough surface area. So far-so good. But what about the hinge tape?

Slow Stick hinge tape separates with time and temperature. What is the fix for this?

Sticky tapes of all kinds are susceptible to high heat and it doesn't take much to loosen the Slow Stick hinge tape.

Mick Harris is just building a 100 inch ARF electric powered glider, one of those Eastern European jobs with ailerons and flaps. Since Mick intends to provide this model with all the fancy glider adjustments and flight modes like variable wing camber and Crow breaking, he will be installing four servos buried in the wing. It is a thin wing, and of course, Mick wants to keep it slick and aerodynamically clean. I suggested he glue the servos to the servo covers and then screw those in place, but Mick likes to do things by the book so his view is to use servo tape (whatever that is). But these servos will be completely hidden once installed and Mick began to worry about the durability and reliability of the tape's sticky surfaces as well as the foam stability within the tape. He will not be able to inspect their condition once they are installed. What to do? Don't know; ask Mick, he is working the problem.

I guess at least us electric flyers aren't worrying about fuel proofing though as that is another can of worms.

Dave Harding

2- vs. 3-blade props

By Don Stackhouse of DJ Aerotech.

On a recent E-flight discussion the old subject of blade-number effects on prop efficiency reared its ugly head. The question relates to where you might use a three bladed prop in lieu of a two blades. The inputs are from an "expert".
Here is what Don Stackhouse, a professional propeller engineer, has to say about this old chestnut.

Why is a 2-way prop better than other-bladed props?

It all goes back to that tradeoff between induced losses (losses that are a side-effect of making thrust) vs. profile losses (losses related to just moving the blades through the air). More blades helps the induced losses (they spread the horsepower more evenly over the surface of the propeller disk), but hurt the profile losses (more objects being moved through the air, and for models in particular there's also the issue of more, narrower blades having lower Reynolds numbers).

One bladed props have the worst induced losses but the best Reynolds numbers, and usually have good profile losses. However, they also bring with them all sorts of really nasty dynamic balance issues, both aerodynamic and mass-related, enough so that they are almost never worth the trouble, even if they offer an efficiency benefit, which even for models is not necessarily the case. In most cases it's possible to have a one-way prop completely balanced at only one flight condition (that's one particular combination of airspeed, altitude, power and RPM), and even achieving that much tends to be difficult. The best efficiency comes when the total losses are as low as possible, and that happens when the induced losses and profile losses are exactly equal, for the same reason that a plane gets best L/D when its induced drag and profile drag are exactly equal. When you have one variable that decreases and another variable that increases, the minimum value of their sum occurs at the point where the graphs of the two variables cross, the point where the two of them are equal. For models, our prop diameters tend to be so large in comparison to the power being absorbed by the prop (or in other words, the power we're putting into the prop is small compared to its diameter) that the induced losses are ALMOST never the dominant factor (ducted fans being but one exception, although not necessarily the only one). We're generally always operating beyond the point where the two graphs cross, where profile losses dominate, and therefore fewer blades are more efficient, where one or two blades are best. Given the practical problems of one-bladed props, that leaves 2-ways.

It's not that they are always the best; it's that we almost always operate in the particular region where they happen to be the best. If you develop a model with more power going into a restricted-diameter prop, you could find yourself getting into the area where three blades or more might have an advantage. However, if you simply assume that "two blades are always best", then you would never know that, since you never bothered to even ask the question.

Good things come to those who keep their eyes and minds open.

Then the "expert" chimes in;

In no circumstances, on any model engine at the rpm we run will a 3 (or more) bladed prop ever operate in undisturbed air.

False, or at least not significantly more disturbed than a typical 2-bladed prop. If you're referring to the idea that the wake of one blade somehow interferes with the next blade following behind it and somehow "messes up" its efficiency, that's an old wives' tale. In actual practice, the wakes of the individual blades each form a helix, and the helixes neatly "nest" with each other, so that the blades do not significantly interfere with each other, unless you get so may blades (such as the fan of a turbofan engine) where it has to be designed as a cascade rather than a propeller. That's a lot more blades than even a model ducted fan uses. For the vast majority of our purposes, there is no significant interference between blades. Keep your eyes open for photos of propeller driven aircraft taking off in very humid weather, so the tip vortices at the propeller blade tips are visible as vapor trails. You will see this nesting effect.

It will never be more efficient than a 2-blade, or better yet a counterbalanced single blade (the most efficient).

Again, another old wives' tale. A ducted fan is nothing more than a shrouded propeller, and very few of those have only two blades. Most of them use three to five and some even more than that. The key here is that this is a case of trying to absorb power with a relatively small propeller diameter in comparison to that power. This is true even if the power being absorbed is very small, as long as the diameter involved is small compared to the power, i.e.: a high disk loading. The same reason that makes it worth the trouble to build a shroud around the prop also makes it worth the trouble to use more than two blades.

Full-size aircraft comparisons don't apply here, in other words comparing Re, tip velocity, blade area, and a slew of other factors make comparing the two inappropriate at best...

Again absolutely false. In fact, I think you'll find that the differences and adjustments required to adapt full-scale data and theory to models are remarkably small, and I speak from direct experience on that. You do have to know what you're doing, and you have to do your homework, but the data and principles are most definitely applicable.

Continued overleaf

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Propstoppers R.C. M.A.C

Railbirds and fliers take the load off at the Propstoppers picnic. It was warm!

Stackhouse on two vs. three prop blades continued.

What you're claiming is equivalent to saying that the aerodynamic design principles that evolved from the development of man-carrying aircraft do not apply to models. I've spent my modeling career demonstrating and proving exactly the opposite.

Although we do have to make adjustments (often surprisingly minor) for things like Reynolds numbers, the basic theory, the equations, the methods of analysis, and the basic principles are all the same. We can't apply it blindly, and the absolute magnitudes of the numbers may be different, but proportions, as well as proportionate comparisons between one propeller design and another, all continue to hold remarkably true.

I agree that for the vast majority of model aircraft applications a 2-way prop is optimum and that rarely is it aerodynamically advantageous to use more than that.

However, my point is that "rarely" is most definitely NOT equal to "never".

We need to keep an open mind, do the math, and evaluate each application on its own merits. Dismissing an entire design concept out-of-hand, without allowing for the fact that there can occasionally be exceptions, is a good way to miss opportunities as well as to increase the already burgeoning overpopulation of engineering "sacred cows".

By the way, a properly barbecued engineering sacred cow is quite delicious; in fact it's one of my favorite dishes.

Don Stackhouse @ DJ Aerotech

Antonov multi-blade propeller