The Flightline

Volume 40, Issue 4 Newsletter of the Propstoppers RC Club AMA 1042 April 2010

President's Message

The weather is a little better, but the ground is still very soft so be careful .

We got a lot done at the last meeting.

We are going to change the May meeting to a meeting at the field and the Sept. meeting to a indoor one. This may work out better with short daylight in Sept.

The Township Pride Day is May 8th. 11:00 till 4:00 I hope we will have a good turn out Please try a make this event

The days for the Picnics are June 19th July 17th. Aug. 14th We could use some volunteers for these events.

We have one more indoor at Brookhaven rec. center April 17 6:00 till 9:00.

Chuck will handle all indoor flying . Eric will handle all out door flying.

It seems that Chester Park is the better place to fly during all this wet times.

As always bring in your show & tells. See you at the meeting

Dick Seiwell

Agenda for April 13th Meeting
At the Middletown Library;

Doors open 6:00 pm, Meeting 6:30pm, Library closes by 8:00 NEW HOURS

1. Membership Report
2. Finance Report
3. Middletown Pride Day Plans
4. Year Round Indoor Program Discussion
5. Show and Tell

Inside This Issue

Minutes of the Propstoppers Model Airplane Club

March 9, 2010 at the Middletown library

Call to order took place by President Dick Seiwell at 6:30 PM.

Roll call by membership chair Ray Wopatek showed 21 members present.

Since the February meeting was cancelled there were not minutes to report.

Treasurer's report was presented by Pete Otinger and accepted by the membership

New Business:

Dick Seiwell found several open dates for indoor flying at the Brookhaven gym in April. The membership chose Saturday the 17th. He also said he will arrange dates for indoor flying next year.

President Seiwell noted the Christian academy field is very soggy and almost impassable.

The membership decided to have the summer meetings from May to August outdoors at the field.

Dick Seiwell also set the dates for the summer picnics at the Christian academy field. The dates will be printed in the newsletter.

Pride day in Middletown Township is Saturday May 8. Events will take place at the Williamson trade school. Again we have been invited to participate with both static and flying demonstrations.

Show and Tell:

Dave Harding showed an original copy of Model Airplane News volume one, number one from 1927. It is one of the world's only existing copies. He will be hand carrying it back to the David Baker Memorial Library in England.

Calendar of Events

Club Meetings

Monthly Meetings
Second Tuesday of the month.
Middletown Library
Doors open at 6:00, meeting at 6:30 pm.

13th April

Tuesday Breakfast Meeting
Tom Jones Restaurant on Edgemont Avenue in Brookhaven.
9 till 10 am. Just show up.
Flying after at Chester Park 10 am.

Indoor Flying

At Brookhaven Boro. Gymnasium
Saturday April 17th 6 till 9 pm

Regular Club Flying

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
Thursday evenings in the Summer
Tuesday mornings 10 am weather permitting after breakfast at Chester Park.
Check our Yahoo Group for announcements;
http://groups.yahoo.com/group/propstoppers/

Beginners

Beginners using due caution and respecting club rules may fly GWS Slow Stick or similar models without instructors.
The club also provides the AMA Introductory Pilot Program for beginners without AMA insurance.

Propstoppers RC Club of
Delaware County, Pennsylvania.
Club Officers

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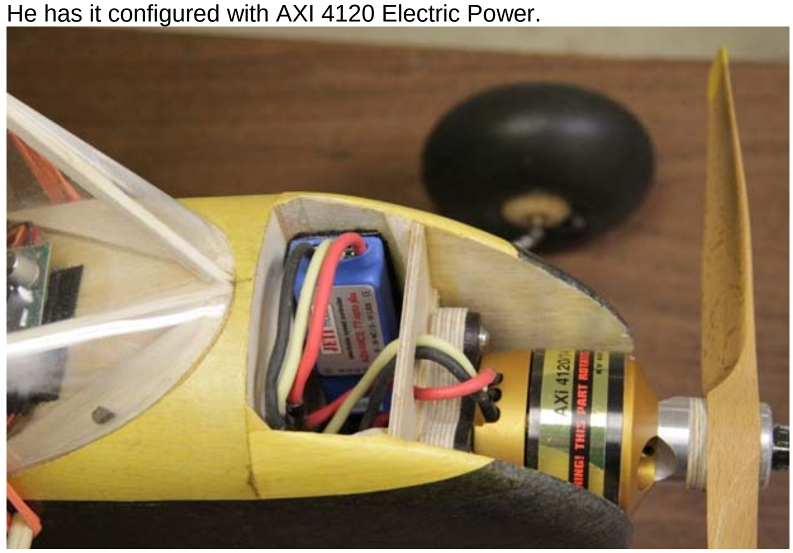
Propstoppers Web Site; www.propstoppers.org

Mick Harris showed his latest build, a SCRAM old timer from 1938.

He has it configured with AXI 4120 Electric Power.



Joe Mesko showed his latest circuit design. He is sampling electric current and voltage from inside the plane. He also equipped it with the GPS System. All of are designed to transmit the data live to the ground while the plane is in the air. (Subject of a future article; Ed.)

Rick Grothman showed the bones of a Turbo Porter ARC kit that he would like to use as a tow vehicle for gliders. Here he is figuring out where to put the tow release and how to beef up the adjacent structure.

Bill Fili quizzed the members on the possible origin of a hand carved propeller. There were no good answers.

Pictures curtsey of Craig Meyer

Adjournment took place at 7:50 PM

Richard Bartkowski, Secretary.

Editorial

I have been editing the Propstopper's newsletter for the last ten years; Yep, 120 or so monthly editions of at least eight pages; on time.

I took the job after getting back in the hobby on my impending retirement after a lifetime in aviation. I had joined the club a couple of years earlier. At that time we had a limit of 75 members with a waiting list. We had two fields; Dallat and Moore Fields where most members flew glow models, most of them kit built, some ARFs and a few scratch built. There were a few electric flying pioneers including the late Walt Bryan and our Secretary Dick Bartkowski.

Membership Chairman Ray Wopatek with his glow powered Ardvark in years past.

I had started back in the hobby of my youth while living in California where I met several electric flyers. This piqued my interest to the point where I decided to fly electric until I found something that couldn't be done that way. My "trainers" were a Sig Kadet LT40 with an Aveox brushless motor and a ton of NiCad subC cells and a Hobby Lobby Skimmer powered glider.

Interest in electric flying grew among the members although each new plane was a challenge as there were few suppliers and even fewer "standard" power systems apart from the powered gliders with Speed 500 or 600 brushed motors and NiCad batteries. Indeed, many of the electric models flown at club fields were powered gliders and they didn't fly like the glow powered models members were accustomed to.

Then we began to loose our fields, some due to the noise of glow powered airplanes and some due to politics. So we began to fly mostly electric airplanes, sometimes with glow allowed at weekends etc. Some members moved to clubs that had glow fields others just melted away. But one problem was most electric powered airplane kits were rather anemic flyers and we still suffered from a lack of motor choices or the understanding to apply those that were available. All this was compounded by the weight of the NiCad batteries, a factor in poor performance for many airplanes.

Over this period there was considerable interest in what made things work and how to design and build satisfactory models; fertile fields for many technical articles.

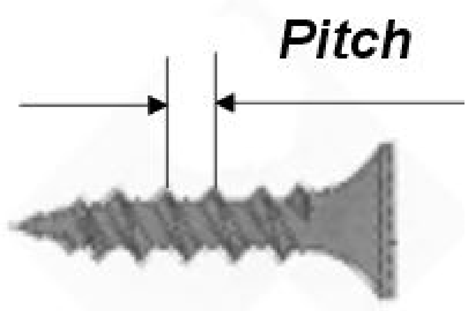
How things have changed! Now most models we fly are purchased ready to fly, and fly they do; magnificently! So what do we write and talk about? The latest offering? You tell me, please. Meanwhile, perhaps we can get some innovation in building foam planes from our new "how to" series at the Gun Club on Thursday 8th April and future such events.

Dave Harding, Editor

Tech Note; Propeller Pitch Speed and Related Factors

Pitch speed is a primary factor in the success of our propeller driven airplanes, yet it is not well understood by most modelers.

The lineal "pitch" of a propeller is just another way of describing the angle of the blades relative to the hub. If we envision the propeller as a screw, an "airscrew" in this case, the "pitch" is the distance it would screw itself through the air in one revolution, assuming there was no "slipping" between the screw and the air.



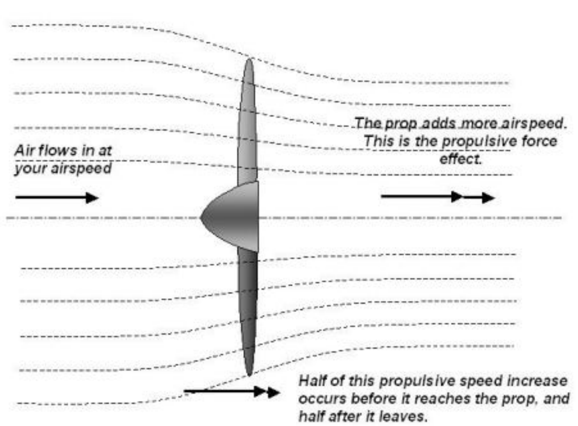
"Pitch speed" is what we get by multiplying the distance the prop theoretically travels in one revolution: the "pitch" times the speed of rotation. A close approximation is achieved when we use RPM and pitch in inches, then divide by 1000;

Pitch Speed in mph = RPM / 1,000 x Pitch (in inches)
For example; we have our OS 40 turning a 10 x 6 at 10,000 RPM

Pitch speed is 10, 000 / 1,000 x 6 = 60 mph.
Hey, it works!

OK, so now let's look at the complications. First of all, for there to be zero "slippage", the prop has to be 100% efficient. As we all know, that's absolutely impossible. Theoretically there can be 100% efficiency at exactly zero thrust, but in a real world fluid that has viscosity, even that doesn't work.

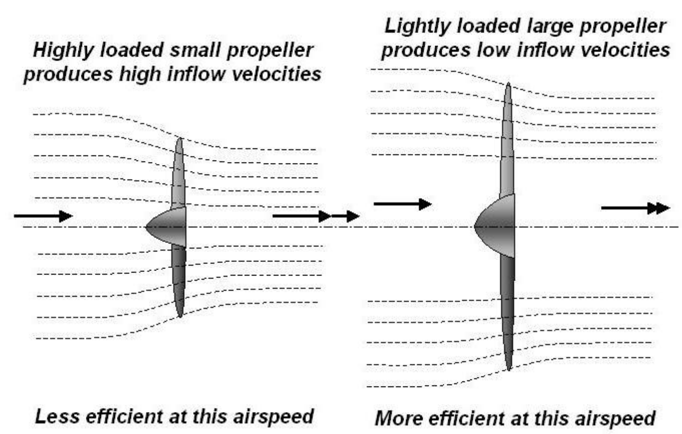
A prop makes thrust by pulling in the "working fluid" (air in this case) from in front of itself, and shoving it out behind. The force the propeller applies to accelerate the air results in an equal and opposite reaction force from the air against the prop. Its Newton's third law again, the one about action and reaction. Typically about half the acceleration occurs in the "inflow" in front of the prop, and the other half occurs in the wake behind the prop.



If the air has to be accelerated in order to make thrust, then the speed of the air in the slipstream behind the prop MUST be faster than the airspeed of the rest of the airplane. This speed difference is what we loosely refer to as "slippage".

The ideal efficiency is the ratio between the free stream airspeed divided by the airspeed in the fully developed slipstream (the air continues to accelerate for a few prop diameters downstream of the prop, so we have to take the measurement far enough downstream that the acceleration is essentially complete). For example, a prop with an ideal efficiency (just the induced losses resulting form the production of thrust, not counting the profile drag of the blades, etc.) of 80% would have a free-stream airspeed of 80% of the velocity of the fully developed slipstream. If the plane were flying at 20 mph, the average airspeed in the fully developed slipstream would be about 24 mph.

The ideal efficiency depends in part on the speed of the plane and the diameter of the prop. We're making thrust by accelerating air. For a given amount of thrust, we can take a small chunk of air (small prop diameter and/or low forward speed) and give it a huge, violent acceleration. Or, we can take a big chunk of air (higher forward speed and/or larger prop diameter) and give that bigger mass of air a much gentler push. The difference between inflow and outflow velocities for the large chunk of air is much smaller, so the ratio of those velocities is much closer to 1, equating to a much higher ideal efficiency.



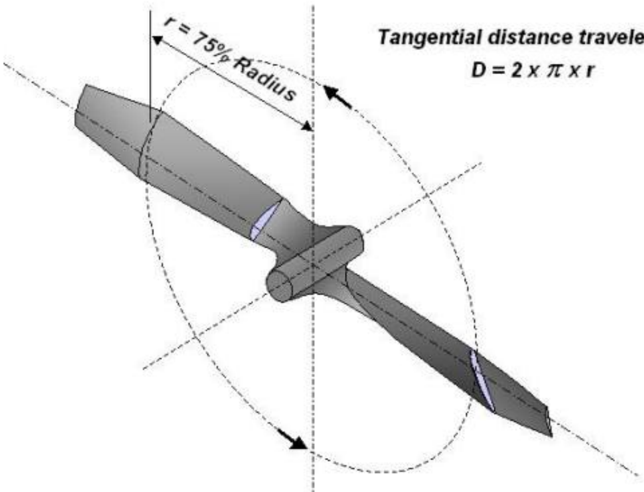
We can also infer from this that when we are trying to absorb a lot of power, make a lot of thrust and/or operate at low airspeeds (such as takeoff and climb), the efficiency of a given prop will not be as good as it is for lower powers and higher speeds (such as cruise).

In addition to the induced losses from making thrust, we also have to include the losses due to other factors such as the profile drag of the blades. Total efficiency of a typical prop might therefore be somewhere around 60% during takeoff, increasing to somewhere in the 80's in cruise assuming the prop, motor and airframe are well matched with each other. I have seen cases of props that were exceptionally well matched to their applications that achieved cruise efficiencies in the 90's. On the other hand, a poorly matched propeller/motor/airframe combination might have trouble breaking 50%. Props are like shoes, not only do they have to be well designed in and of themselves; they also (perhaps even more importantly) need to be well matched to their application.

Much of the myth that "two blades are always better than three" is due to just sticking the closest available 3-blade prop on a 2-blade application, without properly allowing for the effects of the extra blade in the overall size of the prop. By the way, one of those props I mentioned that had cruise efficiencies in the 90's was a 3-blade, and if I'd used a 2 bladed prop instead, even a properly fitted one, the cruise efficiency in that particular application would have been lower.

OK, so how does all of this relate to the original question? To answer that, we need to understand the relationship between the "pitch" of a blade in inches, and the "pitch angle" in degrees. Let's take a spot on the blade 3/4 of the way out from the propshaft towards the tip of the blade. This 75% radius location is approximately where the aerodynamic center ("AC") of the blade is located (this is because the tip is moving faster than the shank, and therefore the outboard portions of the blade are aerodynamically more important than the inboard portions).

If we multiply the radius at this point times 2 π, we get the circumference of the circle this spot on the blade traces out at the prop rotates, or in other words the distance this spot on the blade travels in the plane of the prop disk in one revolution.



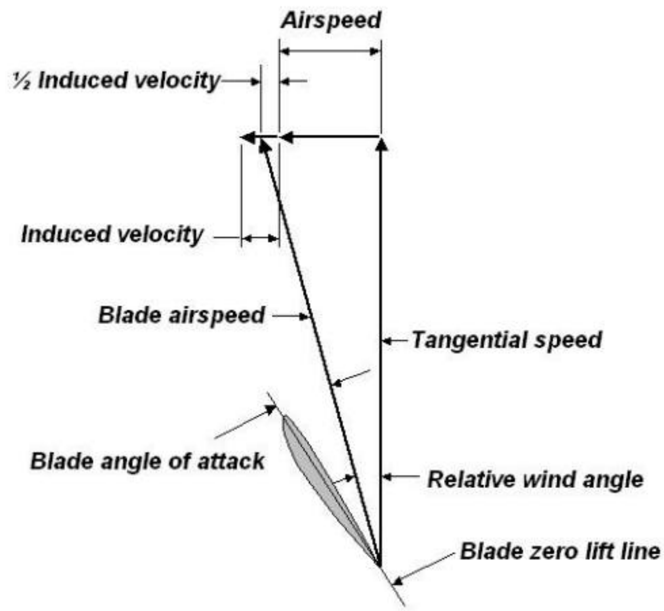
If we multiply that by the revolutions per second that the prop is spinning, we get the velocity in the plane of the prop disk of that location on the blade. We call this the "tangential velocity".

However, in addition to spinning around, that spot on the blade also moves forward during that same revolution. From the point of view of the airfoil at that spot on the blade, it moves forward by the forward airspeed of the airplane plus one half of the speed increase in the slipstream (remember, one half of the acceleration of the air going through the prop occurs ahead of the prop disk, and the other half occurs behind).

Now, let's make a right triangle. One leg is the tangential velocity. The other leg is the plane's airspeed, plus half the acceleration of the air by the prop (the "induced flow").The length of the hypotenuse of this triangle is the airspeed that spot on the blade sees, and the angle between the hypotenuse and the tangential velocity leg is the angle of the "relative wind" that spot on the blade sees.

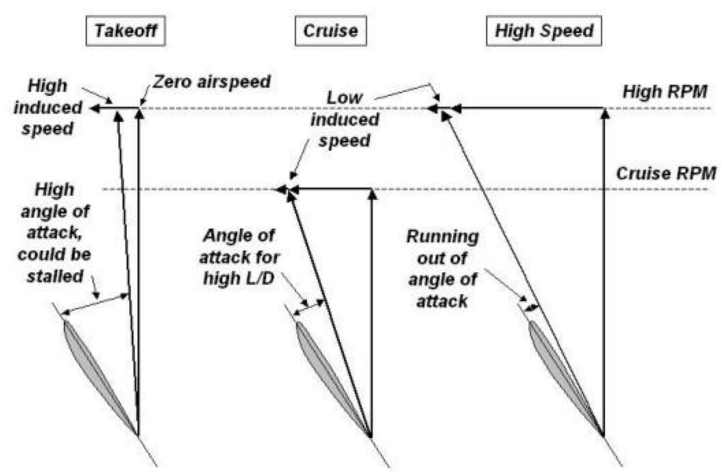
The difference between the angle of that relative wind and the angle of the airfoil at that blade location is that location's angle of attack. When the plane is just beginning the takeoff run, the rpm is high (due to the high throttle setting), while the airplane's airspeed is very low. At the very instant of starting the takeoff run (assuming no wind), the plane's airspeed might even be zero. The "induced flow" is fairly high, because of the high throttle setting. However, the total of those two still tends to be fairly small, resulting in a right triangle that is relatively flat.

There is a big difference between the blade's airfoil shape and the angle formed by the tangential velocity leg of the triangle with the hypotenuse, so the airfoil's angle of attack is relatively high. If it's too high, the airfoil will be stalled.



As the plane accelerates, the plane's airspeed increases, so that leg of the triangle increases. This increases the angle between the hypotenuse and the tangential velocity leg, which therefore reduces the difference between that angle and the pitch angle of the airfoil. The angle of attack that local airfoil sees is reduced.

In general, at high powers and low speeds, the inflow to the prop is low, so the prop needs to accelerate this small inflow of air a whole bunch to convert the power into thrust. To do this, the airfoils along the blade need to have very high lift coefficients, which therefore means they need a lot of angle of attack to generate those lift coefficients.

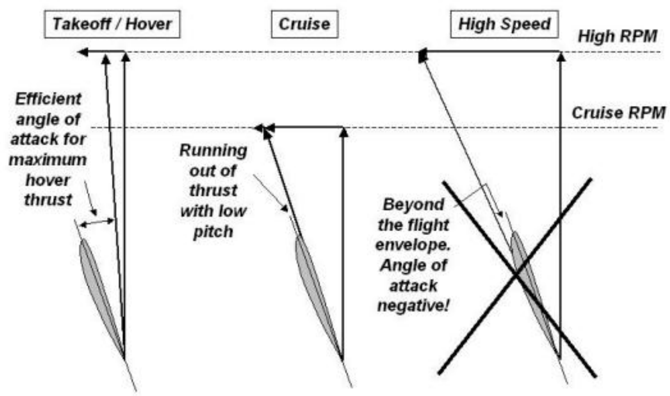


At higher airspeeds, there is more air flowing through the prop, so that air needs less acceleration to convert the power into thrust. This means lower lift coefficients, and therefore lower angles of attack. At the highest speeds the increased airspeed causes the prop angle of attack, and thrust to reduce until thrust equals drag at maximum speed.

Since the fixed pitch propeller cannot efficiently match all flight conditions we are faced with the choice of just where to make it "work".

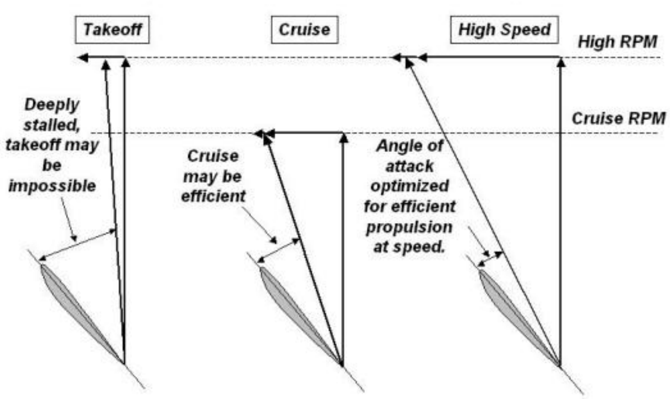
Consider the case where we want to have hover performance. Here we see that this requires the best blade angle of attack at zero airspeed. The result of this choice is limited cruise performance and no high-speed flight is possible. Indeed, if it were possible to "jump" the plane to this speed condition the propeller would exert considerable braking force in the form of reverse thrust, until the speed dropped.

Low Pitch "Hover" Propeller Performance



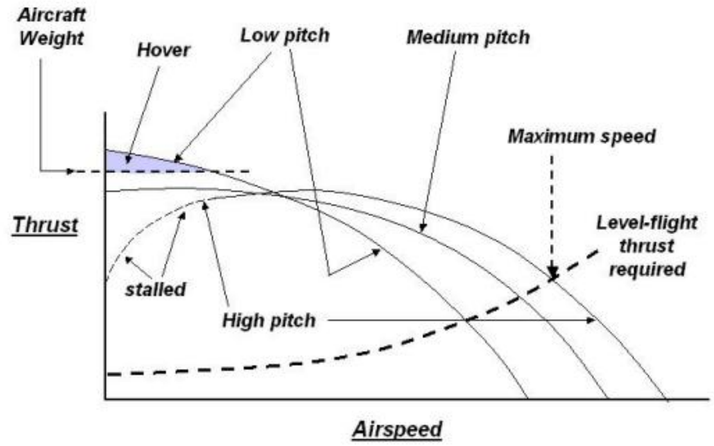
If we select our propeller to match the high-speed flight performance we may not be able to take off due to the propeller operation in deep stall, although the cruise condition may be efficient.

High Pitch "Speed" Propeller Performance



One of the few cases where this kind of fixed pitch propeller was acceptable was on the Schneider Trophy airplanes because, as seaplanes, they could use the unlimited "runways" for takeoff. Look closely at the very high pitch, fixed pitch propeller on the Supermarine S6B in this photo. It achieved a world record of 407.5 mph in 1931.

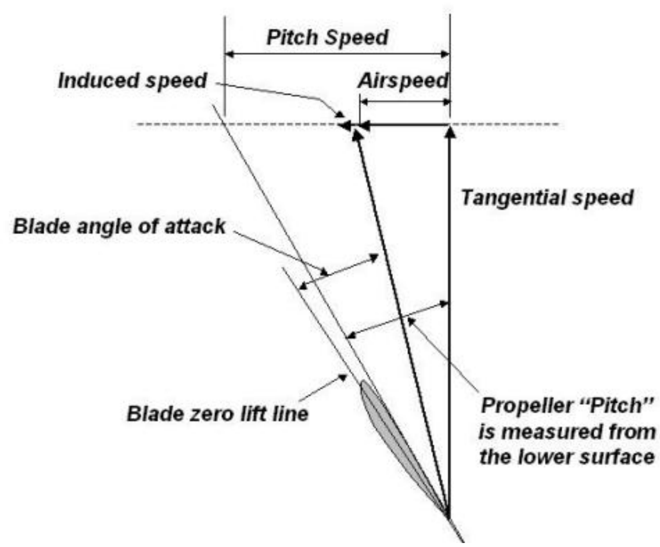
These issues and choices are depicted as they vary with flight speed below.



Propeller Performance Issues and Choices

Let's examine the various pitch measures. The manufacturers define the pitch as that measured from the bottom of the blade airfoil. Usually, for gas props these are so called flat bottom airfoils like the Clark Y. The significance of this is that in terms of blade lift or prop thrust the Clark Y zero lift angle of attack is about 4 degrees negative. So if we define the datum as the lower surface, the blade is already at a four-degree angle of attack. Now props typically have thicker airfoils inboard so this nominal four degrees might easily be six or more.

This is not accounted in the definition of Pitch Speed but it does affect the thrust at speed. If we just for a moment ignore the inflow velocity (sorry Don!) then we might expect the prop to make zero thrust when flying at it's pitch speed, but we can see that the actual angle of attack allows thrust to be made even beyond the pitch speed.



Now let's put some numbers into all this. In the table over leaf are the blade pitch angles for various propellers. We use the definition pitch-to-diameter ratio: P/D, for the propeller because it is this ratio that determines the blade angles.

So, the 75% radius blade pitch on a P/D = 0.5 prop, is 14 degrees, whether it is a 6 x 3, a 10 x 5 or a 12 x 6.

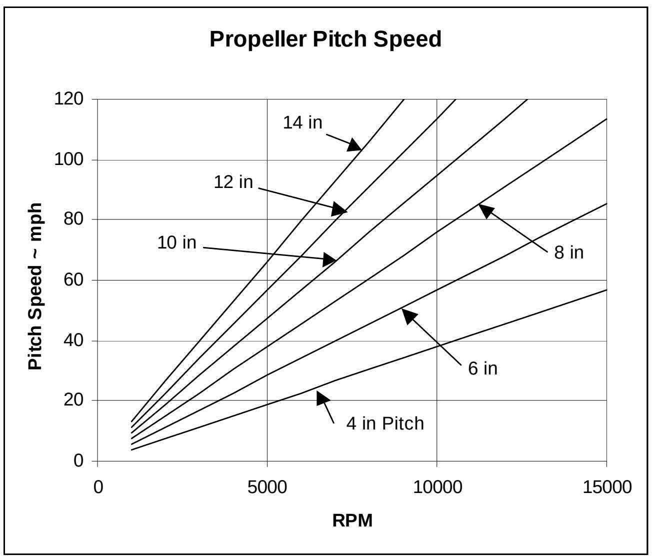
The table of blade angles applies to all propellers.

Pitch/Dia.	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
% Radius										
20%	10.6	20.6	29.8	38.0	45.0	51.1	56.2	60.6	64.4	67.7
30%	7.1	14.0	20.6	26.9	32.7	38.0	42.8	47.2	51.1	54.6
40%	5.3	10.6	15.7	20.6	25.4	29.8	34.0	38.0	41.6	45.0
50%	4.3	8.5	12.6	16.7	20.6	24.4	28.1	31.6	34.9	38.0
60%	3.6	7.1	10.6	14.0	17.4	20.6	23.8	26.9	29.8	32.7
70%	3.0	6.1	9.1	12.1	15.0	17.8	20.6	23.4	26.0	28.6
75%	2.8	5.7	8.5	11.3	14.0	16.7	19.3	21.9	24.4	26.9
80%	2.7	5.3	8.0	10.6	13.2	15.7	18.2	20.6	23.0	25.4
90%	2.4	4.7	7.1	9.4	11.7	14.0	16.3	18.5	20.6	22.8
100%	2.1	4.3	6.4	8.5	10.6	12.6	14.7	16.7	18.7	20.6

Propeller Blade Angles ~ degrees

Just bear in mind that for these airfoils and Reynolds numbers the maximum lift occurs at about 10 degrees angle of attack, beyond which stall begins to reduce the lift. Below this angle the lift is roughly linear with angle of attack.

Now, let's get back to your OS 40 turning the favorite 10 x 6 prop, a P/D = 0.6, at 10,000 rpm. At the 75% radius station the pitch is 16.7 degrees. At takeoff the induced velocity is fairly significant so the actual angle of attack is somewhat less, but probably a little above stall.



The Pitch Speed of this prop at this rpm, as shown in the graph, is about 60 mph. Takeoff probably takes place at about half this speed so the blade angle of attack, considering this inflow, will be about half the 16.7 plus the four degrees of incidence, or about ten degrees. So, we have maximum thrust at takeoff. At cruise the throttle is reduced to say 8.000 rpm, which would match a flight speed of somewhere near 50 mph. At maximum speed the engine unloads so the rpm might increase to 12,000 and the pitch speed to 65 mph. Flight to 70 mph might be possible: this prop is well matched.

Now if you want to go faster you must use a higher pitch prop, say a 9 x 8. With this higher pitch you will have to reduce the diameter to maintain the desired rpm and power. Takeoff will be more sluggish as the blade is probably stalled with the angle of attack at almost 22 degrees,. Maximum speed might be over 80 mph although this assumes the engine has the power and the propeller has the thrust to achieve this speed. Just matching the pitch speed with the performance desire does not mean you will achieve it. But that is a subject for another time.

Don Stackhouse (http://www.djaerotech.com)
and *Dave Harding (from May 04)*

Stall Speed is a Misnomer

By Bruce Cronkhite

This short article is prompted by a batch of traffic on the EFLIGHT mailing list on the Internet related to the difficulty of determining the correct landing speed for a model.

The reason this is difficult is that there is no such thing. There is, however, a correct approach Angle of Attack.

Many people worry about slowing their model down to a reasonable approach speed for fear that the model will stall. Consequently they fly too fast on approach, and run off into the mulch, or the local equivalent.

The U.S. Navy had the same problem when trying to get pilots to land on carriers. It is critical that the airplane approach the deck at the slowest possible speed consistent with some margin above stall to account for turbulence and other unavoidable occurrences while on final.

The Navy discovered that while their airplanes of different sizes and configurations had widely varying stall airspeeds, they all stalled at very nearly the same *Angle of Attack.* This is regardless of type, number of wings, or prop or jet. This angle of attack is very near 15 deg. Not pitch angle, but *angle of attack.*

So the Navy developed a system of measuring and referring to AQA by a system numbered in *Units.* In this system a 'Unit" is approximately 2 deg, modified by some small quantities determined from the flight test data on the aircraft itself.

Now here's the magic. ALL Navy airplanes stall at 30 units AOA. Sure. There are some Navy pilots who can keep an airplane under control at higher than 30 units but they probably graduated from test pilot's school, and were working hard the whole time.

Well, what does that mean to us? Ready for this? Learn to see your model's angle of attack on final approach. You certainly can see 15 deg. so if you are less than that you *won't stall* if your model is aligned along your approach slope; you're going too fast at too low an angle of attack

That is the reason that I tell my students to keep the model fuselage level with the ground on final approach. This is a neat crutch that stabilizes the AOA at a reasonable number less than stall, but higher than supersonic, regardless of the angle of approach.

Try it.

From the Silent Electric Flyers of San Diego Newsletter 2000

Brookhaven Boro. Gym
Indoor Again
Saturday 17 th April
6 pm till 9 pm

Dave Harding – Editor
4948 Jefferson Drive
Brookhaven, Pa. 19015
610-872-1457

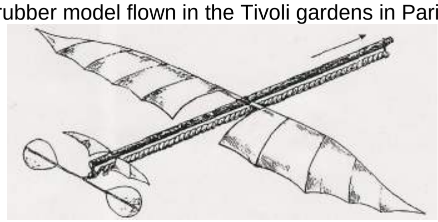
Propstoppers R.C. M.A.C

Propstoppers fly at Chester Park after Tuesday breakfast on a wonderful warm and calm day in early April
Chuck Kime, Mike Williams, Evan (Larry's grandson), Eric Hofberg and Larry Kuzmin

The Old Days

There are many descriptions of our hobby's history but recent events lead me to recount some of it.

Model airplanes have flown successfully for about 150 years. Perhaps the first really successful model was Alphonse Penaud's Planophore rubber model flown in the Tivoli gardens in Paris in 1871



Development really took off after Lindberg's flight to Paris and model airplane club membership topped half a million. During the 1930's, frequently called the Golden Age of model airplane development, planes as we know them today were developed using balsa wood and the newly developed ignition engines. These models were mostly freeflight although radio control development began at this time.

In the 1940's Walker developed U Control where gas or glow powered models flew in circles on wires which also provided control input. This form of flying took off rapidly and became a dominant part of model aviation.

Radio control developments progressed slowly through the '40's and '50;s although the equipment was heavy and limited in control. The '60's saw the rapid development in this area as transistor and digital type technologies were introduced allowing increase in control capabilities and reduction in weight. These models however were still usually quite large, heavy and fast.

U/Control models were still popular partly because they could be flown in any space of 100 ft square or so and flying in school yards and parks was popular. But then came the Enforcers! Flying in parks and school yards was condemned for various reasons but noise was probably the dominant cause. Almost overnight all school and park custodians learned that model airplanes were banned and pursued the policy with vigor. There are many stories among the old timers about their brushes with the "authorities". So U/C flying almost died out and RC flying was confined to club fields (which were regularly lost due to noise complaints.)

For thirty years or so little flying was conducted in school yards and parks. So people forgot about "The Rules" and eventually all the school and park custodians died out or retired. And guess what? They forgot to pass on the "The Rules" to the current custodians.

So fast forward to the current "Golden Age" where we fly small silent electric powered models on 2.4 GHz radios anywhere we like. Not only are we not chased away, but often the custodians stand and watch. What a blessing.

But be forewarned, this situation will not last unless we are good stewards of our fortunate situation. In California, when I fly on the Rose Bowl lawn we find some people that have begun to fly larger heavy missiles; planes that can fly at over 100 mph, while sharing the land with others who play soccer or walk their dogs. It is only a matter of time till something bad happens and we are once again chased off. Same will be true if we fly noisy airplanes.

Fly responsibly and let us all enjoy it. Dave.