The Flightline

Volume 34,Issue5 Newsletter of the Propstoppers RC Club AMA 1042 May 2004

Editorial: Field Fix Up Matters

Well, the Sleighton Field fix up day was washed out but Dick Seiwell and Bob Crowell went out a few days later and accomplished the primary task, which was rolling the flying surface. It is imperative to get this task done, and done at the right time. With grass slowly filling-in on our runway, wintertime frost heaves and the deep tractor tire tracks the farmer made we urgently needed this treatment. However, it must be done when the soil is soaked deeply but the surface layer is dry enough to support traction. Dick has been working on an old diesel self propelled roller he acquired somewhere in his travels. He has it working but only in reverse! But it is fairly narrow so in the end he borrowed farmer Dallett's towable job, just like we did last year. See the picture on the next page of Mike Black doing the honours last year. Since there were only two dedicated workers this year the event was not recorded.

Having accomplished this rolling job Dick Seiwell declared Sleighton Field ready for action and no significant further work is required, although Rusty is preparing a new lockable storage box for the sound meter and first aid kit and Jess Davis is working to get the emergency contact notice we discussed in last month's Flightline and at the monthly meeting. It seems that the local EMS people will not have GPS until the end of the year so they advise that we identify the location by other means. They also recommend that if we do request EMS response that we post someone at the gate.

The second field matter involved a Moore Field incident. Upon arriving at Moore with the intent to do the first grass mowing of the season Dick Seiwell discovered that there had been a good deal of vandalism. It seems that some people chose to party at our shelter and this / these parties involved not only drinking a good deal of beer but smashing the bottles too. Many bottles were broken by smashing them on both the shelter and the metal table that we use for model preparation. These individuals also smashed the old picnic table and the cage we use for transmitter impound at the electric fun fly. The trouble is that there are thousands of small sharp glass fragments all around these places. Dick decided that it would be too dangerous to mow with this debris in place so he called for help.

Dick's call was echoed to the Propstoppers e-mail Group requesting that members turn out on the Saturday morning to clear up the mess. Dick was anxious to get this done as he needed to mow and apply the pre-emergence chemicals before the weeds began to germinate.

Several members did help out including Dick Bartkowski, Dick Klekotka, Ed Goretzka, John Drake and yours truly.

Beer bottle debris collected from Moore Field.

Moore Field Fix up Stalwarts, Dick Bartkowski, Dick Klekotka and Ed. Goretzka.

We tried to pick up all the shards but as we chewed the fat once we were finished we kept finding more and more as the pieces glinted in the sun. We have concluded that there will always be some there so in the future you had better bring your prayer mat if you plan to kneel in preparation for holy flight.

Dave Harding

Agenda for May 4th Meeting Marple Newtown Library, 7:30 pm

- Approval of April meeting minutes
- Membership Report
- Finance Report
- Field Report – Sleighton plans and search.
- Plans for Picnic
- Show and Tell

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Calendar of Events

Club Meetings

Regular Meeting 7:30 pm
Tuesday 4th May
Marple Newtown Library

Tuesday Breakfast Meeting
The Country Deli, Rt. 352 Glenn Mills
9 till 10 am. Just show up.
Call Dick Klekotka 610-692-4527
Flying afterwards, weather permitting

Flying Events

Saturday May 15th Old Eagles Electric Meet Hope NJ. Join Dave Harding in the RV for a pleasant club trip to this enjoyable meet.

Annual Club Picnic and Fun-Fly, Saturday June 19th

Regular Club Flying

At Moore and Sleighton Fields

Daily	**10 am til Dusk**
Saturday	**10 am til Dusk**
Sunday	**12 p.m. till Dusk**
	(Electrics 10am till Dusk)

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Propstoppers Web Site; www.propstoppers.org
Check the web site for back issues of the newsletter, pictures of club events and the calendar of future events.
Pictures courtesy of Bob Kuhn and Dave Harding

The President's Message

Dear Fellow Propstoppers,

A special "thanks" is in order for Bob Crowell and Dick Seiwell for rolling Sleighton Field, also to all those who helped out with the mess at Moore's Field - good job guys!

We still need a volunteer to help run the club Picnic. It is not a whole lot of work but an essential role in support of Mark Berkemeyer who has offered to run the event for the second year. Come on members, the club does not ask much and you all get a good deal in return. See me at the next meeting.

Some items to remember as our flying season kicks off:

- first in unlock the gate and last out lock up.
- keep to the edge of the field when driving in. (stay off the farmers cultivated area)
- when flying keep your flying to the side of the field away from the houses.

With these simple things in mind we should all enjoy a great flying season.
Come join us at our May 4th Club meeting at the Marple Newtown Library.

Keith Watson, President

Mike Black gets to drive in the 2003 Sleighton fix up. Dick Seiwell and Bob Crowell were too busy to record the moment as they handled the job in 2004

Minutes of the Meeting, April 6th, 2004 at Marple Library

Vice President Dick Seiwell called the meeting to order at 7:30 p.m..

The roll call taken by membership chair Ray Wopatek showed 30 members and 1 guest present.

The treasurer's report was given by Treasurer Al Gurewicz and accepted by the membership.

The minutes of the March meeting as published were accepted.

Old Business:

Club President Keith Watson stated that the annual club AMA charter and insurance were renewed this month. The lease for Sleighton field is in in the renewal process.

Dick Seiwell is planning to roll the field flat as soon as the rainy weather dissipates. He is also planning to apply pre emergence control at Moore field.

Rusty Neihammer has a weatherproof ammunition box he will modify as a secure enclosure for the club's noise meter.

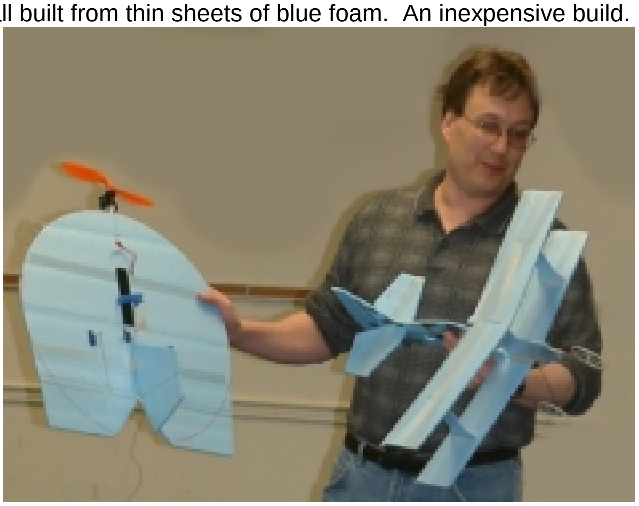
Mickey Callahan told the group he is moving for job reasons. We're seeking a replacement volunteer for the club's annual fun fly to work with Mark Burkmeyer.

Keith requested that we all stay to the edge of the field when driving in to Sleighton and not cut across the farmers' cultivated land.

Three new members were inducted into the club. They are Arthur Blose who is trying to decide what kind of a plane would work as a starter. Next is Charlie Eshlemmer who is interested in R.C. gliders. We also inducted Joe Mesco comes to us from the old Delaware County Club bringing with him several electric flyers.

Show and Tell:

New member Joe Mesco showed his 2 foam home built light electrics. One is a bipe and one is UFO like. They're all built from thin sheets of blue foam. An inexpensive build.



Dick Seiwell showed his recently rediscovered his single channel galloping Ghost transmitter and receiver from the 1960's. We would all love to see it in action.

Rich Klekotka showed his newly built electric Dragonfly. It is a 48-in. span 9-oz foam wing model flying on a speed 400 electric. It can easily ROG and flies very gently.

Sam Nevins showed his Great Planes ARF "Headwind". A geared electric motor and a lithium poly battery power it.

Rick Grothman showed his new profile speed 400 Mustang. He says it flies very well. It has a feature whereby you can insert a different wing joiner to vary the dihedral.

John Trepier showed a foam cup flyer from NASA research.

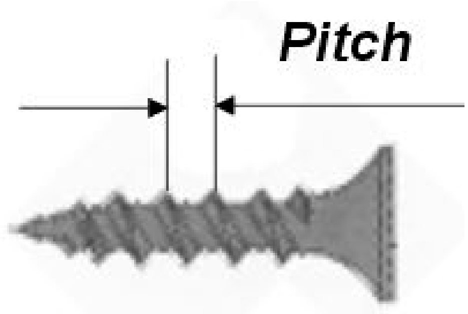
The meeting was adjourned at 8:30 p.m..

Richard Bartkowski, Secretary

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.



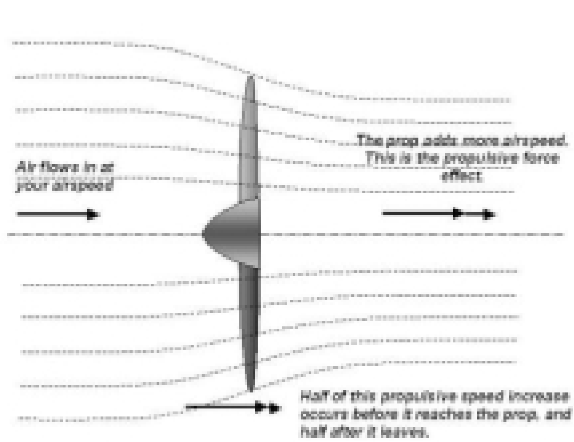
"Pitch speed" is what we get by multiplying the distance the prop theoretically travels in one revolution: the "pitch" times the speed of rotation. A close approximation is achieved when we use RPM and pitch in inches, then divide by 1000;

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.

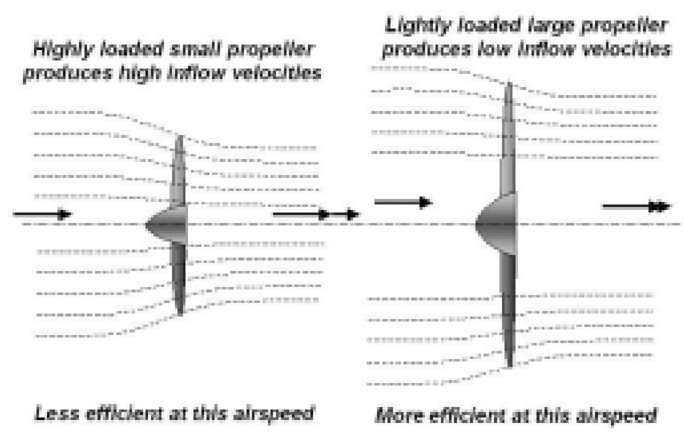
A prop makes thrust by pulling in the "working fluid" (air in this case) from in front of itself, and shoving it out behind. The force the propeller applies to accelerate the air results in an equal and opposite reaction force from the air against the prop. Its Newton's third law again, the one about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



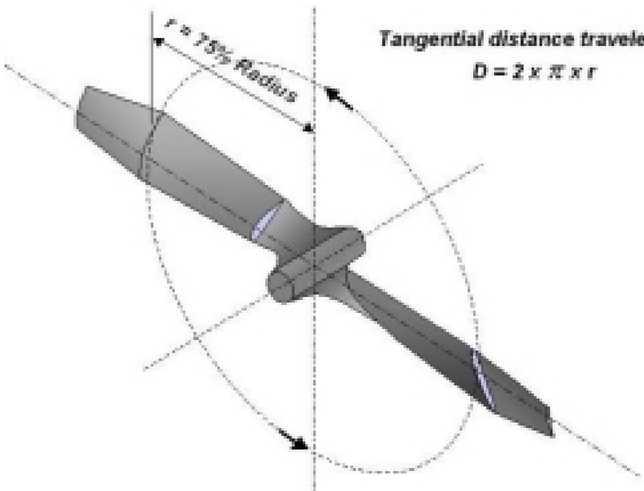
We can also infer from this that when we are trying to absorb a lot of power, make a lot of thrust and/or operate at low airspeeds (such as takeoff and climb), the efficiency of a given prop will not be as good as it is for lower powers and higher speeds (such as cruise).

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.



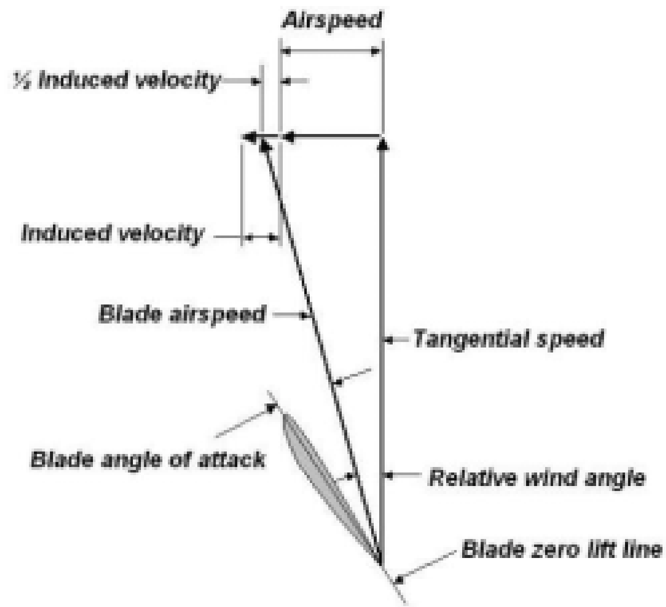
If we multiply that by the revolutions per second that the prop is spinning, we get the velocity in the plane of the prop disk of that location on the blade. We call this the "tangential velocity".

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.

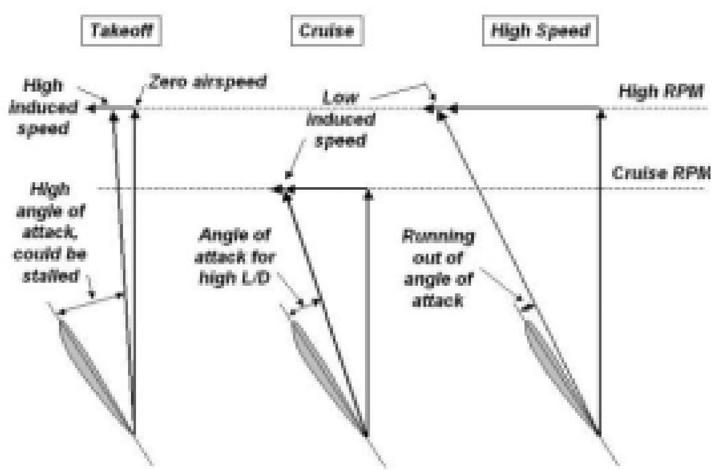
The difference between the angle of that relative wind and the angle of the airfoil at that blade location is that location's angle of attack. When the plane is just beginning the takeoff run, the rpm is high (due to the high throttle setting), while the airplane's airspeed is very low. At the very instant 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.

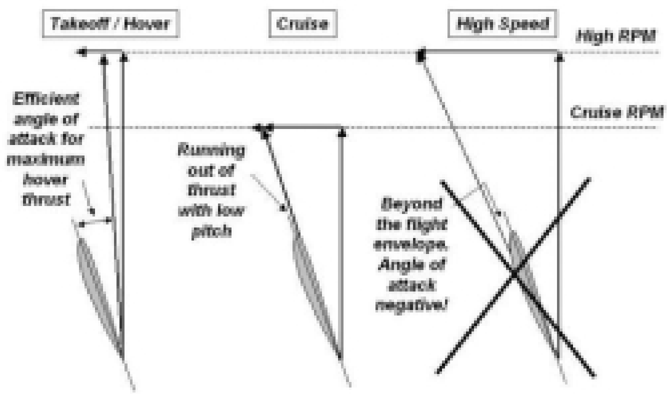


At higher airspeeds, there is more air flowing through the prop, so that air needs less acceleration to convert the power into thrust. This means lower lift coefficients, and therefore lower angles of attack. At the highest speeds the increased airspeed causes the prop angle of attack, and thrust to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

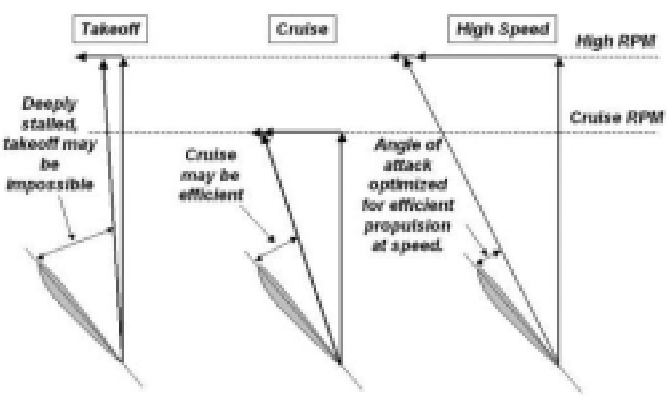
Consider the case where we want to have hover performance. Here we see that this requires the best blade angle of attack at zero airspeed. The result of this choice is limited cruise performance and no high-speed flight is possible. Indeed, if it were possible to "jump" the plane to this speed condition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

Low Pitch "Hover" Propeller Performance



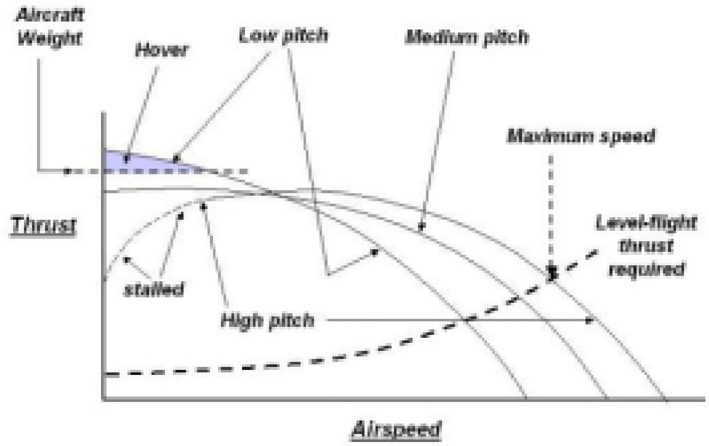
If we select our propeller to match the high-speed flight performance we may not be able to take off due to the propeller operation in deep stall, although the cruise condition may be efficient.

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.

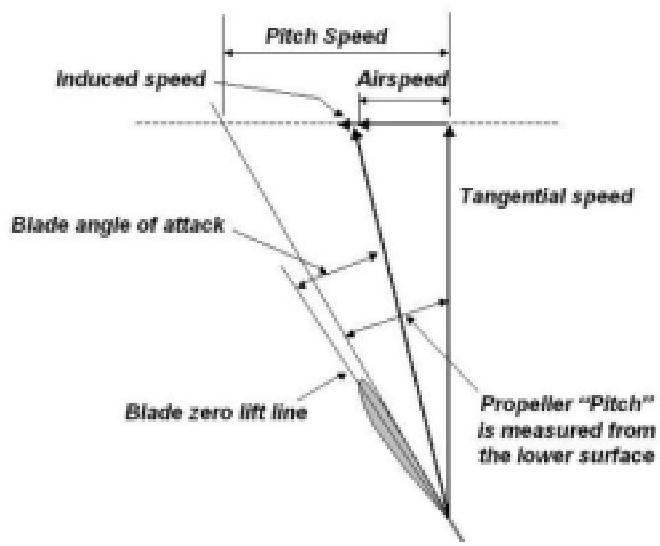
These issues and choices are depicted as they vary with flight speed below.



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.

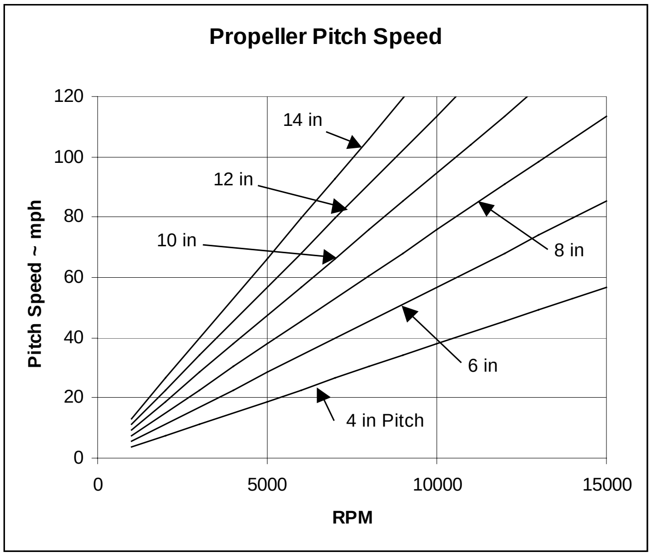
The table of blade angles applies to all propellers.

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***

AMA EMERGENCY SAFETY ALERT

Lithium Battery Fires

Lithium batteries are becoming very popular for powering the control and power systems in our models. This is true because of their very high energy density (amp-hrs/wt. ratio) compared to NiCads or other batteries. With high energy comes increased risk in their use. The, principal, risk is FIRE which can result from improper charging, crash damage, or shorting the batteries. All vendors of these batteries warn their customers of this danger and recommend extreme caution in their use. In spite of this **many** fires have occurred as a result of the use of Lithium Polymer batteries, resulting in loss of models, automobiles, and other property. Homes and garages and workshops have also burned. A lithium battery fire is **very hot** (several thousand degrees) and is an excellent initiator for ancillary (resulting) fires. Fire occurs due to contact between Lithium and oxygen in the air. **It does not need any other source of ignition, or fuel to start**, and burns almost explosively.
These batteries must be used in a manner that precludes ancillary fire. The following is recommended:

1. **Store, and charge, in a fireproof container**; never in your model.
2. Charge in a protected area devoid of combustibles. Always stand watch over the charging process. **Never leave the charging process unattended**.
3. In the event of damage from crashes, etc, carefully remove to a safe place for at least a half hour to observe. Physically damaged cells could erupt into flame, and, after sufficient time to ensure safety, should be discarded in accordance with the instructions which came with the batteries. **Never attempt to charge a cell with physical damage**, regardless of how slight.
4. Always use chargers designed for the **specific** purpose, preferably having a fixed setting for your particular pack. Many fires occur in using selectable/adjustable chargers improperly set. Never attempt to charge Lithium cells with a charger which is not, specifically, designed for charging Lithium cells. **Never use chargers designed for Nickel Cadmium batteries**.
5. Use charging systems that monitor and control the charge state of each cell in the pack. Unbalanced cells can lead to disaster if it permits overcharge of a single cell in the pack. If the batteries show **any sign of swelling**, discontinue charging, and **remove them to a safe place outside** as they could erupt into flames.
6. Most important: **NEVER PLUG IN A BATTERY AND LEAVE IT TO CHARGE UNATTENDED OVERNIGHT**. Serious fires have resulted from this practice.
7. Do not attempt to make your own battery packs from individual cells.

These batteries CANNOT be handled and charged casually such as has been the practice for years with other types of batteries. The consequence of this practice can be very serious resulting in major property damage and/ or personal harm

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Propstoppers R.C. M.A.C

John Drake with his new Gently Lady

Ray Wopatek with his trusty Armadillo

A Spring Sunday Afternoon at Sleighton

Glorious weather. Just warm enough to be in shirtsleeves and gentle breezes, what more could you want? Well more flyers for a start. How is it that our club has over sixty members and two fields but only a handful fly at any one time? Nevertheless, those who did fly enjoyed it. Here, is John Drake after first flight of his electric Gentle Lady. He launched into a giant thermal for a thirty-minute flight. What a grin! His first stick-build too.

Stalwart Membership Chairman, Ray Wopatek with his indestructible and long toothed Armadillo blew away the winter cobwebs with a few flights. John Drake is over his shoulder in his second successful flight of the day. Bob Crowell had already used his fuel allotment by the time we got there. Now there is a flyer!