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DIXIE EXPRESS

OFFICIAL NEWS FROM THE DIXIE AEROMASTERS

MARCH 2007 EDITION **AN AMA GOLD LEADER CLUB**

*********NEXT MEETING:**********
MARCH 19th 7PM at "OLD TIMES COUNTRY BUFFET" (on Gray Highway next to Wal-Mart) If you want to eat and fellowship be there early (6PM ish) Your presence counts, So make it count!!!!!
BE THERE!!!

YOUR ELECTED OFFICIALS:

Wayne Stevenson, President	986-6067
Jim Turner, Vice Pres.	719-5787
Mason Bryan, Sec/Treas	405-2284

DIRECTIONS TO THE FIELD:

Going North towards Gray, or South from Gray, on the Gray Highway, (GA St 129) watch for the new Traffic Light at LITE-N-TIE road. There is an Exchange Bank on the Southeast corner. Turn East onto LITE-N-TIE Road. Go about 1.5 miles to OVERLAND WAY and turn left. The field will be approximately 0.9 miles on the right.

UP AND COMING EVENTS:

Quickie Race, 10AM (Mac's)	March 24
DA FLY-IN (New Club Field)	March 31
Pop Curtis Mem. (Mac's)	April 13 & 14
SEFF (Mac's)	April 26 thru 29

EDITORIAL RAMBLINGS:

Editor: "Mr. P-51 Bob" O'Neil
Phone: (478) 788-2916
E-Mail: p51rcpilot2@cox.net

"FOOD FOR THOUGHT"

Copied from: Model Airplane News
"PRO FLIGHT TIPS" (As promised last month)

"Airframes and Prop selection"

Though various model designs may call for the same displacement engine, each requires a specific prop to perform at its best.

The topic of propping an airframe, and not the engine, is so important-and so often misunderstood-that both Dave Gierke's, and the writers opinions (his technical, mine practical), are herein presented.

I am so often asked a question to which, without more information, I'm unable to give a meaningful answer. That question is, "Which prop should I run on my .25, .45, or .60-size brand-X engine?"

The question that should be asked is, "Which prop is appropriate for my model's airframe?" This is why engine manufacturers often recommend a range of props of varying diameters and pitches

in the instructions for a specific displacement engine in their lines.

Let's take, for example, a strong, twin ball bearing sport .45 and consider it on three vastly different airframes with broadly desparate wing areas, wing loadings, and drag factors. Let's look first at a very dirty, high drag Foker triplane, with 750 square inchesof wing area; then a super-clean, low-drag Ultra Sport with retracts and 550 square inches of wing area; and falling in between these two, a medium-drag Spacewalker with 650 square inches of wing area. To keep things simple, let's assume each weighs 5,5 pounds (88 ounces, for a total weight of 100 ounces when the approximate 12 ounces of a sport .45 size engine is added). This gives each airframe a power loading (power to weight ratio) of 222 ounces per cubic inch. The preceeding is one of the factors designers consider when determining the correct engine displacement for a certain model to insure that it will be adequately powered. But this still tells us nothing about which prop will make best use of the engine's power when considering a specific airframe's unique drag and lift charactersistics.

There's one thing that, for now, you're just going to have to accept on trust: ideally, a generic prop with a given pitch, rotating at a given rpm, will attempt to achieve a specific airspeed (in level flight) at which the engine / prop combination will be operating at peak efficiency. This efficiency will be realized if, and only if, the airframe it is matched with will allow it to do so.

To illustrate the point, let's suppose we have a 10X9 prop turning at 12,000rpm on our sport .45 engine. Using a nomograph (a graph consisting of three coplanar curves, each graduated for a different variable so that a straight line cutting all three curves intersects the related values of each variable) from Andy Lennon's book, "R/C Model Aircraft Design," the estimated speed this pitch / rpm combination would produce is approximately 125 mph; that is, if the airframe in question and its inherant drag will allow.

Now lets move this spinning prop to the nose of the Foker triplane. Obviously, with the drag presented by a .45-size model with three wings, a round cowl, fixed landing gear and cabine and interplane struts, It's never going to fly any where near 125mph. If you attempt to force the issue in a power on dive, dangerous control surface flutter would surely result. If, by wizardry, the Foker's engine displacement was magically doubled in the middle of this already daunting power dive, the poor little triplane just might self destruct in a mass of airborn confetti faster than you can say "VNE" (Velocity Never Exceed)

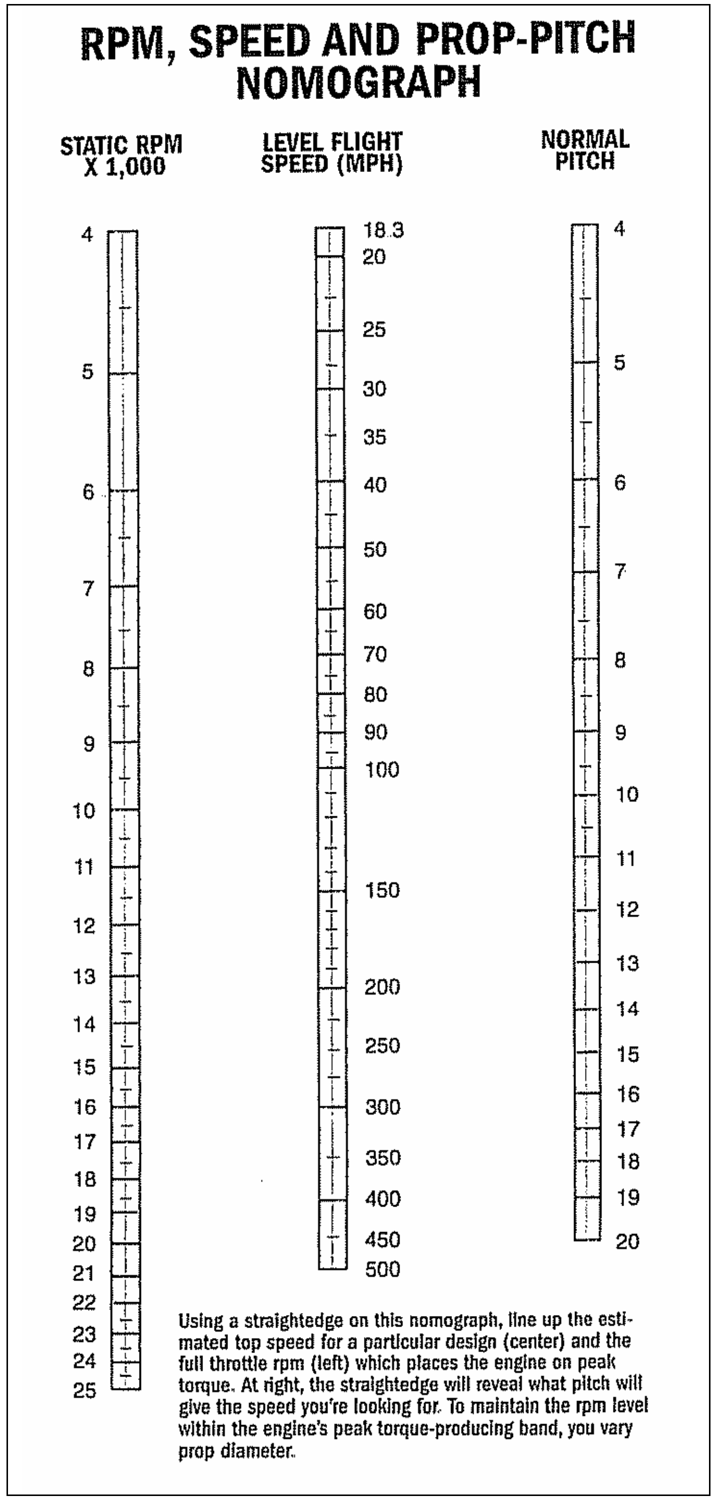
The inherent drag of the Foker will not permit it to reach sufficient speed, thereby preventing the engine from unloading to sufficiently high rpm levels that would put it in its optimum torque-band range. Simply stated, the engine is too "loaded" under these conditions.

Conversely, let's assume the Foker's airframe allows a top speed of only 60mph. Again, if we use a chart, we find that in the ballpark of 12,000rpm, a 4-inch pitch would match this speed nicely. Since the pitch has now been drastically decreased, we must now manipulate the diameter to keep the engine turning in the 12,000rpm range. Moving from the original 10-inch diameter to a

12-inch diameter will probably do nicely. If the 12-inch diameter happens to reduce the rpm to 11,500, for argument's sake, this would bring the speed to about 55mph which would still be correct for a .40 size model of this type. At the very least, a 12X4 prop would be an excellent starting point for the Fokker. Using the 10X9 prop or anything close to it would be like driving uphill in a pickup truck loaded with firewood in fourth gear.

The otherside of the picture, of course, would be to put the .45 engine / 10X9 prop combination on a clean design like a .40 to ,45 size Ultra Sport. With retracts, this airframe would have no problem whatsoever attaining 130mph. This would allow the engine to go ahead and unload at 12,000rpm. So a 10X9, or possibly an 11X8 would be a good match. In terms of lift, drag, and top speed, the Spacewalker would fall somewhere in between the Ultra Sport and the Fokker,making an 11X6 prop a good starting point for this design. At 12,000rpm, the 11X6 would be looking in the neighborhood of 80mph, a very comfortable neighborhood for a Spacewalker.

These are some practical examples that make use of the nomograph, with some empirical thought added to the mix reguarding the overall "dragginess" of your RC airplane. If you would like a little more technical insight to nail your prop selection dead-on, See the next article by Dave Gierke titled "The Load Factor Formula." It is an easy-to-use arithmetic tool you'll find very useful during testing at the field.



Using a straightedge on this nomograph, line up the estimated top speed for a particular design (center) and the full throttle rpm (left) which places the engine on peak torque. At right, the straightedge will reveal what pitch will give the speed you're looking for. To maintain the rpm level within the engine's peak torque-producing band, you vary prop diameter.

"The Load Factor Formula"

by Dave Gierke

You're at the flying field trimming out a shiny new sport model when one of your more experienced flying buddies asks, "Are you at full throttle? The engine doesn't sound like it's turning fast

enough. I think you are using too much prop … maybe you should try one that doesn't load the engine as much."

Too much prop? Loading the engine too much? To many modelers, these terms are meaningless---Something for the experts to fuss about. After all engines are engines, right? Fasten a prop to the shaft, fuel it, fire it up and fly. What could be simpler.

Why is it important to match the propeller to the engine? If you read the instructions that accompany your engine the manufacturer probably recommends a size, right? In many cases, this prop will put you in the ball park for a trainer-type Model. But what happens if your model is somewhat different from the hypothetical trainer? What if it's a biplane? It may be heavier, generate more air drag and fly slower, or it might require a propeller with more diameter and less pitch. Alightweight, monoplane with a relitively thin wing, streamlined fuselage, wing fairings and a low drag cowl will probably produce less drag, fly faster and demand a prop withless diameter and more pitch. How do you determine which prop to use?

<u>WHICH PROP SHOULD I USE</u>?

For a given engine displacement and horse power, there are propellers that are either too big or too small to function properly. Some foul up the engine's operation; others are inadequate to fly the model; some are guilty of both. If the propeller is too large, it has too much diameter and/or pitch. Changes in diameter effect engine load the most. Oversize props force the engine to operate too slowly, and this limits the horsepower needed to fly the airplane and invites overheating; especially with 2-stroke engines. Experience has shown that most 2-stroke engines abhor being operated below 10,000rpm at wide open throttle without special modifications.

Engines outfitted with props that have excessive pitch and marginal low-speed thrust production may not be able to achieve minimum takeoff speed: they run out of runway! After taking off into the wind, propellers with insuffcent pitch may not maintain the minimum flight speed required to avoid the dreaded stall spin. In general, undersized propellers allow over speeding, increase fuel consumption, and reduce engine longivity.

Most flyers learn about propellers by trial and error or copy what their buddies are using, and sometimes that's a good idea, especially with a new airplane. But after the bugs have been worked out many desire improved performance: better climbing ability (vertical performance?), top speed, or take off acceleration. Sorry, unless you increase the engine's horsepower, you probibly can't realize these atributes simultaneously. Without changing the power, propeller selection becoms a compromise. A shorter ground run prior to takeoff is accomplished with a lower pitch prop, resulting in improved acceleration … at the expence of reduced top speed. Top speed can be improved dramatically with a higher pitch prop at the expense of a much longer takeoff run and reduced vertical performance. Most sport fliers prefer a performance smorgasbord: a little of each, thank you!

<u>UNDERSTANDING THE NUMBERS</u>:

If you like to experiment, the following technique allows you to manipulate flight performance

incrementally—not wildly, or from one extreme to another. This strategy allows you to change (or modify) the propeller in terms of its diameter, pitch, or both, while maintaining, or selectively changing the load on the engine. Sounds complicated, but you'll find it really isn't.

Propeller load and engine rpm are inversely related: as load increases rpm decreases and vice-versa. Load is represented by the propeller; change propeller size, and load is changed. By using the "Propeller Load Factor" (PLF) formula, Lprop = $D^2(P)$, incremental propeller load changes can be determined and applied to the engine/model combination.

- **Lprop = PLF**
- **D = diameter**
- **P = pitch**

For example, if the sport model at the beginning of this article was fitted with a 10x8 propeller, PLF would be 800 (10x10x8 = 800). Because propeller rpm increases as PLF decreases, we need to find a prop with a number that's less than 800. I have compiled a listof APC sport propellers and calculated their PLF to illustrate the technique:

From the list, the next smallest PLF below 800, is 729 and is represented by the 9x9 propeller. This prop allows engine rpm to increase and would generate higher top speed at the expence of a longer, slower takeoff run. Climb performance would probably also suffer. The 11x6 propeller with a similar PLF (726) offers almost the same load as the 9x9 but provides better takeoff and climb performance while sacrificing some top speed. Another possibility would be the 10x7 (PLF 700). It allows the engine to speed up a bit more than the 9x9 and 11x6 while allowing an in-between top speed and takeoff potential

Notice that I haven't included propellers from a variety of manufacturers on the PLF list. Because blade shape, area, airfoils and pitch generation all have an effect on load, you should limit PLF to families of propellers from specific manufacturers.

Although the PLF system doesn't provide an initial propeller size for your engine / model combination, it points you in the right direction based on your observation of engine rpm, takeoff distance, climb rate, and flight speed (among others). You and your friends can now make objective evaluations of a models performance based on how the engine and propeller are functioning. There may not be agreement but now you have a tool that tells you where you are and in which direction you should head.

Linear Siais	rearranged by load	PLF
9x6	11x3	363
9x7	10x4	400
9x8	11x4	484
9x9	9x6	486
9x10	10x5	500
10x4	9x7	567
10x5	10x6	600
10x6	11x5	605
10x7	9x8	648
10x8	10x7	700
10x9	11x6	726
11x3	9x9	729
11x4	10x8	800
11x5	9x10	810
11x6	11x7	847
11x7	10x9	900
11x8	11x8	968

Your Editor has received an E-Mail from Mr. Doug Gerdes, concerning the GAMA swap meet which follows in part, for the most part:

We were very successful! The total tally was $2487.20! I will cut a check to the club for $2500.00 (don't like uneven numbers!) I figure I will cut one check that way it will be easier for the treasurer. A great big "Thank You" to all that donated products to sell, and to those who stopped by to assist. We may want to do this again next year???????
Later, Doug

Talk about Dedication; He deserves our appreciation and "THANKS" For a good job, well done! Your Editor