THE KNIGHT FLYER

Jan - Feb - Mar **2000**

Editors: **Jim Devlin - Tim Ellis**

Christmas Party '99

The Flying Knights Christmas Part '99 filled the St. James Church hall with food, fun, and flyers on the night of Friday, December 17th.
Forty-five people risked nomination to attend the annual event, and their efforts paid off.

The Knights had been asked to bring desserts to accompany the traditional pizza and wings, and most members did.

The nominations went over pretty smoothly, with one exception. The Secretary's seat remained open at the end of the meeting prior to the party, and it appeared that without drastic measures the seat would remain vacant going into the new Millennium.

In this case, "drastic measures" amounted to a hostage situation - the incumbent president, Mr. George Gard, as his final act in the office, held the members in the meeting for almost half and hour, with the scent of rapidly cooling pizza wafting over the crowd.

Needless to say, this tactic did yield results and, finally, Mr. Stuart Brierley volunteered for the position. The hungry Knights appreciated his sacrifice, and thanks go out to him and all the volunteers for leadership positions. They are listed on the back of this newsletter. (Note: the President and Vice-President positions were filled by a "campaign coalition", consisting of Mr. Ron Partacz and Mr. Tom Filipiak.)

(Well, more accurately, Mr. Partacz refused to take on Presidential responsibilities unless Mr. Filipiak would ...ummm..."volunteer" with him.)

In a gesture appropriate in this Christmas season, the meeting was closed with a gift for Matty Partacz, who's help at the auction and the rally was greatly appreciated. He received a model truck which was surreptitiously filled with quarters by appreciative Knights as the party went on. Thanks again, Matty.

All told, the party and meeting went over quite well. The food was good, the desserts were good, the meeting was good - and best of all, no more nominations till next year! This party was an excellent close to a fun, exciting, and productive year for our hobby - hopefully this upcoming year will be as good.

Old Rheinbeck

Your editor while on vacation in Sept. happened to stop at the mother of all old airplane places, ‘‘Old Rhinebeck Aerodrome’’ just outside of Kingston, NY.

Over 100 models were on display. Prior to the show, the modelers were given the opportunity to fly and most did.

The Flying Knights, in the early years, as this writer vaguely recalls, used to go on excursion's to Rhinebeck to attend a meet there.

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Old Doc. Meyers, Norm McCormack, and Vern Krabel of VK Models used to be among some of the attendees. Some of our present members such as Gerry Piscatello and Bill Eberhart have a number of stories to tell about the great times there.

But I digress. My experience was not so much the models, but the presence of the really old airplanes that made their home at ‘‘Old Rhinebeck’’.

Who could not be impressed at the sound of a LeRhone rotary engine, the sight of a Fokker D-VIII diving out of the sky or the sight of a ‘‘Bleriot’’, the first plane to cross the English Channel, making a pass across the field.

Seeing these full scale aircraft, actually flying brought to life images of a time long ago and far away.

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Fun-fly introduces Scouts to flying

Sunday, October 3rd was a brisk autumn day. Despite the overcast skies a good number of Knights gathered at the North Collins field to take part in the first ever Fun-fly with training wheels.

The Boy Scout troops of Angola and West Valley were guests of the knights. Each scout was introduced to the sport of model flying and actually took the controls for portions of several flights.

Using the club Buddy Box, each scout was given control of a trainer aircraft for a portion of the flight.

Club Instructors handled the task of placing the planes in the air and ensured that safety prevailed. Even the Scout leaders were given a chance to actually fly an RC aircraft.

The members also brought advanced models and even some scale aircraft to demonstrate the finer aspects of the hobby.

After everyone had an opportunity to see and fly, the Knights put on a picnic lunch of Hot Dogs, Hamburgers and Roast Beef. Plenty of desserts were brought out to the field.

The scouts a great time and really appreciated the chance to actually fly one of the models instead of just looking on while someone talked abut it.

No major mishaps occurred, however Tom’s Corsair made a rough landing. Stu Brierley demonstrated the electric flying wing. Even your editor got a chance to try electric flight.

The late afternoon turned quite cold but by then everyone had their flights in and their Stomachs full.

On leaving, the word was that the event was a super success and definitely a ‘‘go’’ for next year.

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Successful Auction

The Flying Knight's Auction was held Sept. 25th. The hall of Trinity Lutheran School was filled with eager Modelers seeking that elusive bargain.

Our own multi-dement... dimensional Tom Filipiak at the last minute took over the awesome task of Auctioneer.

He did an excellent job, handling the many items that were put up for auction and kept the pace moving all afternoon. If you kept your eyes and ears open, there were many good items to bid on.

There were engines and airplanes of all descriptions on the table. More publicity is in the offing for next year.

An auction flyer had been included in the mailings for the Rally.

Mall show in the works

Tentative plans are being made for a show at the McKinley Mall in late February or early March. After several failed attempts, due to what seemed to be a lack of interest on the mall's part, the club may finally have an opportunity to put on a show.

Members were polled as to their feelings on the situation with McKinley. Sometimes it felt that we weren't really wanted there.

The new management, has however, portrayed a much more accommodating posture.

The members felt that having a show in our home town is a worth while endeavor so it looks like we will be going ahead with plans for a show.

Our show last year at the Eastern Hills Mall was quite well attended in spite of the travel distance involved. All those who participated seemed to have enjoyed it.

McKinley has not yet been cast in concrete, but having the Mall show closer to home would be a big advantage.

The next several meetings will determine whether we have a go or not.

Our New Website

The Flying Knights have been on the Internet for about a year now. Tom Filipiak, our venerable webmaster has maintained the site, posting numerous pictures of many of the events that we have participated in over the last year.

One of the features of having a website is that we can maintain links with other clubs around the world and in our own back yard.

The RCCR club maintains a very extensive site. The AMA also has a site.

Those who have computers can look at the many pictures that we have of our events. There are pictures of the mall show and of our scale rally.

By being able to access our fellow club sites, we can see the many activities that they are engaged in. Quite possibly they may plan to host an event that we are very interested in.

We'd never hear about it by other means. We already have many modelers from neighboring states and Canada who come to our Scale Rally.

Perhaps new modelers from these areas are looking over our rally scenes and deciding that they might like to come next year.

A great deal of information exists on the many sites to which we are linked.

Our old address, however has changed. The entire site has been transferred from "Froggernet" to the Adelphia network.

Our new address is: members.xoom.com/flyknights. Enter this address directly after the protocol, http://. No "www" however.

The entire address should look like this:

http://members.xoom.com/flyknights.

Also note the page entry. It is flyknights, not flyingknights.

Make this one of your favorites, you won't have to type it in again.

We also have a new e-mail address. It is:

"Flyingknights@Email.com".

So, How Fast does My Prop Have to Go...?

In the first article we saw that it was not difficult to determine the lift that would be generated by a particular size of wing. In the second article we saw how to determine the drag that would be generated by the various parts of our plane.

By separating the level flight forces in into vertical and horizontal components the problem was simplified. It's often said that one reason it took man so long to conquer the air was the fact that he did not separate the forces of lift and thrust.

By trying to emulate the flight of birds, man was unable to develop a flying machine. But this might not be so.

After all, how much technology is involved in a hang glider? And birds don't have engines.

An Ancient Mystery

Over 2000 years ago, in the Nazca desert which lies directly on the equator, the Nazca Indians may well have been the first people to fly.

Giant drawings on the desert floor, of perfectly executed insects and animals can only be seen from the air. Pottery from nearby grave sites display winged men and the burial cloth rivals the tightest weave of any modern machine.

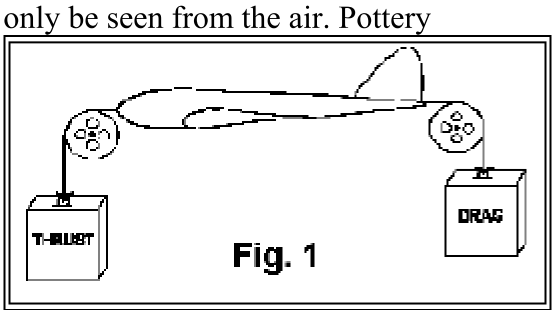

Fig. 1

No one will never know for sure whether these ancient peoples took advantage of the heated air rising from the desert floor, or the upslope winds off the nearby mountains, to become the worlds first hang glider enthusiasts.

Well, maybe not the first. Long before that sea gulls plied the shoreline cliffs taking advantage of rising air currents and hawks circle for hours using thermals with nary a flap of wing.

The Nazca secret is forever lost in the remote and desolate desert and we can only ponder the enigmatic drawings that remain.

The age of modern flight began with the Wright Brothers. They were the first to separate thrust from lift.

Lift and Drag

Following their lead we successfully computed the lift of any wing for any weight. Next we tackled the drag that was produced by the forward motion of the plane. It was complicated, but we simplified the total drag by adding up the drag of the parts.

In order for the airplane to fly, this drag force pulling the airplane back, must be balanced by the thrust pulling it forward as shown in **fig. 1.**
We have shown several values in **fig. 2** to show how the drag increases with the aircraft speed.

That's why it takes a lot more power (a bigger engine) or a lot less drag to make the plane go faster. You either increase power or decrease drag.

A 40 size engine produces about 1.2 shaft horsepower at 16,000 RPM.

Thrust is a force the same as drag and is also measured in pounds. The thrust at the speed we want to fly must be equal to the drag of the plane at that same speed.

The propeller

Now, enter, the propeller.

This little gadget is simply a device for converting the engine power into thrust. It is like an auto transmission.

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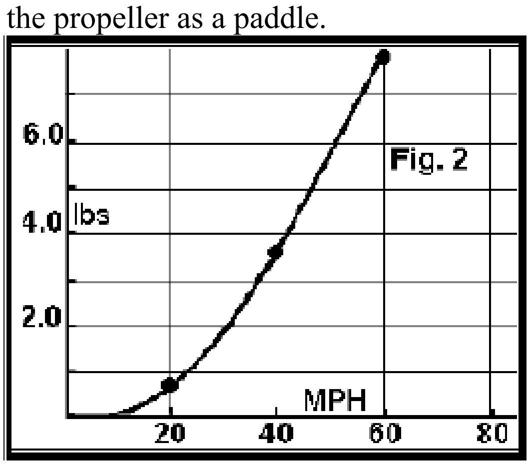
The propeller is a complicated device. Wilbur Wright said, thinking about it drove him crazy.

Yet, the Wrights developed a propeller that was nearly 80% efficient. No one else had ever done that before.

A Wing by Any Other Name

By thinking of the propeller as a tiny wing, they developed the idea of twist to keep the same attack angle along the length of the blade. Others still thought of the propeller as a paddle.



We will look at props like the Wrights did, because it is really the simplest way to understand them.

If the blade is a tiny wing, then it should develop a lift force perpendicular to its upper surface, just like a big wing.

But since the blade is moving vertically, the resultant force is in the forward direction as shown in **Fig. 3.**

Voila! Just what we need to balance the drag force pulling us back. And we already know how to calculate the lift of a wing, do we not?

Let's look at the Lift Equation again. There were four parts. The Lift force was equal to a **'Coefficient of Lift'** times the **'mass density of air'** times the **'wing area'** times the square of the **'velocity of the air'** over said wing.

That is, $\mathbf{L = C_l \times Density \times A \times V^2}$. Same equation, different flies.

The Thrust Equation

In terms of thrust, we write,

$T = Tc \times Density \times A \times V^2$, where "A" is the surface area of the prop and "V" is velocity of the prop.

Propellers have a diameter, a width and a pitch.

The width and the diameter determine the area of the prop. The pitch determines the attack angle.

The Attack Angle

The first thing to consider is the Thrust Coefficient. As you recall, this is similar to the Lift Coefficient, which was related to the Attack Angle of the wing.

So what's the "attack angle" of a prop?

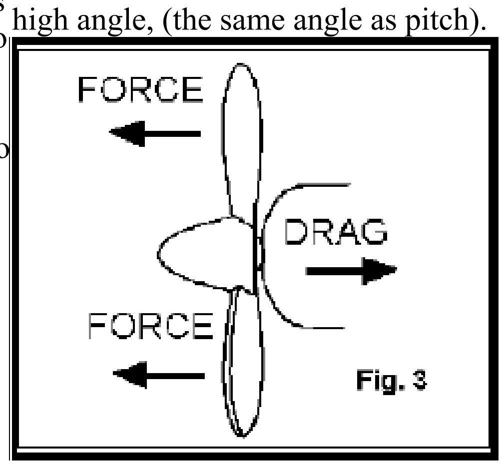
The propeller has a fixed forward velocity called its **pitch speed**. It moves forward the pitch inches for each rotation.

The higher the pitch or the faster the rotation the more it moves.

The "attack angle" is simply the **difference** between the propeller blade's advance and the airplane speed.

Whoa! These are vectors. We can't add them directly, so we will just discuss what the Thrust Coefficient means.

When the plane is sitting on the ground, it's prop is cutting the air at a high angle, (the same angle as pitch).



As the plane moves forward, this angle becomes less and less until the plane is moving close to the pitch speed. The actual attack angle will be somewhere in between.

The optimum attack angle of a wing was about 5 to 10 degrees which gave a coefficient of about 0.8 to 1.2. For a prop that is 80% efficient, the angle is small just like a wing in level flight.

The "thrust coefficient" therefore is very close to "one".

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We can assume that our plane in level flight is flying with an optimum Thrust Coefficient of about 'one'. Because the prop is twisted, it will be about the same all along the length of the prop. This leaves us with the rest of the equation.

Mass density of air.

The mass density of the air is the same as it was for the other equations. This numerical value is (.0024/2).

The prop area.

If the prop were a rectangle, the area would simply be the 'diameter' times the 'width'. It's not. We lose some in the center and some at the tip.

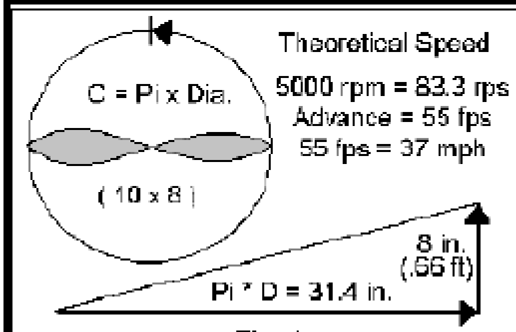

Fig. 4

However, it's safe to assume that the actual area is about 60 - 70% of the rectangular area.

Calculus would give an exact value but this is only a hobby. We'll just take the 60% value and run.

For our example, let's use a 10 x 8 prop. The width is 7/8". The diameter is 10" so the area is 8.75 sq. in.

60% of this is 5.25 sq. in. Naturally, we need this in sq-ft. (what else!), so we need to divide by 144. This gives us 0.034 sq-ft.

The prop speed

This is not as hard as it seems. First we need to take the circumference of the propeller arc. Multiply our 10" prop length by Pi (3.14), which gives us 31.4 in. Once again, we need this in feet, so divide by 12. This gives us 2.61 ft.

Now all we have to know is how many times the prop rotates in a second.

This is easy. Its just the RPM divided by 60. For 10,000 RPM, that's 167 rps.

Each revolution is 2.6 ft. Our prop speed is simply 167 times 2.6 (rev's x distance) or 436 ft. per sec.

By the way, that's 229 m.p.h.! No wonder that baby will cut your fingers off.

Thrust = .0012 x .0364 sq-ft x (436 fps) squared. This gives 8.3 lbs of thrust.

Of course **that wasn't the question**. We wanted to know what RPM we need in order to fly our Sig. Cadet at 30 MPH. That's where the drag was 2 lbs.

That's the thrust we must provide. How fast must our prop go to generate 2 lbs of thrust?

We need to re-arrange our equation as follows:

Velocity = Sq. root of (Thrust / (.0012 x Area)).

So for 2 lbs. of thrust we have: Sq. root of (2 /(.0012 x .0364 sq. ft.).

This gives us a prop speed of 214 ft /sec. Divide this by the circumference of the prop (2.61 ft) and we get 81.9 revolutions per second.

Multiplying by 60 gives us 4919 RPM. Our prop must turn at 5000 RPM.

More speed, More Drag, More RPM

We also found that at 40 mph our drag increased to 3.5 lbs. Let's see fast our prop has to rotate to maintain this faster speed.

Apply the same equation again for 3.5 lbs.

The answer: 283 ft/sec. Dividing again by 2.6 ft gives 108.4 rps. Multiplying by 60 we get 6507 RPM. That's an increase of 1500 RPM.

We now have equations (actually forms of the same equation) for Lift, Drag and Thrust. By making some rather simple measurements on our model, we can determine many of the model's flight characteristics.

This is especially handy if the model is one of our own design or we are going to modify the model in some way.

Sometimes a small change will affect the flight behavior in a big way. It would be nice to know before we make the change.