



**April 2015**

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<b>APRIL MEETING</b>	<b>WHEN:</b> Thurs. the 9th 7:00 pm	<b>WHERE:</b> <b>FISHER COMMUNITY CENTER</b>	<b>PROGRAM:</b> <b>Airplanes of AirVenture</b>
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**WHAT'S FLYIN' THIS WAY !!!**

Our next meeting on the 9th should be fun. Dan Adams will do a presentation for our Homebuilders Tips Tech talk about ForeFlight, a very popular avionics suite available for phones and tablets. Dan will talk about how it applies to VFR travel, how it works with various hardware, the option to obtain weather on the screen, and the new upgrades for 2015.



**ForeFlight**  
Intelligent Apps for Pilots™



We will have the video we have missed the last couple of meetings if we have time, after Dan's presentation.

And don't forget Taco Johns at 6 pm before the meeting.

**WHAT FLEW BY !!!**

Rumor was that Prez Paul Adams was floating on water somewhere in the world and could not be with us at the last meeting, so VP Lorin Miller filled in as shepherd. He also gave an outstanding presentation on Radio Noise as it pertains to homebuilders and pilots of aircraft. Lorin is an electrical engineer as well as a homebuilder of aircraft, so his experience is of great value to those who are wiring avionics into their airplanes. His presentation was so good, some have asked him to make it available for review and for those who were not in attendance. Lorin is working on it now and it should be available soon. A notification will go out when it becomes available.



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# CALENDAR

For those of you on the internet, all of the information for aviation events are available in many places. Links to the websites that have all the info you need are listed below. If you do not have internet access, and a specific event you are interested in is not listed in the newsletter, just call me and I will be happy to look up the info for you.

Apr 9	7 pm	FCC/T in Marshalltown	Chapter 675 Meeting
Apr 18	8 - Noon	Independence Airport	Fly-in Breakfast/Tailwheel Flying Ground School @ 10am
Apr 18	7 - 11am	Ames Municipal Airport	Flying Cyclones Annual Fly-in Breakfast
Apr 19	8 - Noon	Dubuque Regional Airport	Fly-in/Drive-in Breakfast -Univ. of Dubuque host
Apr 21-22		West Des Moines	Iowa Aviation Conference <a href="http://www.iowaairports.org">www.iowaairports.org</a>
Apr 25	11 - 2pm	Fort Dodge Regional	Chili Fly-in/Drive-in
May 9	7 - 10 am	Pella Municipal Airport	Tulip Time Flight Breakfast
May 9 - 10		Davenport Municipal Airport	Quad City Airshow
May 14	7 pm	FCC/T in Marshalltown	Chapter 675 Meeting
May 16	7 - 11 am	Orange City Airport	Fly-in Breakfast
May 16	9am - 4pm	Ankeny Airport	Ia. Aviation Heritage Museum Antique Fly-in. Lunch served
May 23	8am - 1pm	Spencer Municipal Airport	Fly-in Lunch served from 10am - 1pm

FCC – Fisher Community Center

T – Taco’s Johns at 6:00 before the meeting

[www.eaa.org/calendar](http://www.eaa.org/calendar)

[www.FunPlacesToFly.com](http://www.FunPlacesToFly.com)

[www.flyins.com](http://www.flyins.com)

[www.iawings.com/calendar/yearly.htm](http://www.iawings.com/calendar/yearly.htm)

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## News Briefs

### ***The FOGz List Expands***

After a very frustrating winter, the Flying Old Geezers were finally able to take advantage of a rare break in the snow/wind/rain/low temps the middle of March, to resume the weekday breakfast flights.

The big news though, is the availability of many more opportunities to fly with the addition of the Waterloo EAA Chapter 227 FlyOut Group list to the FOGz group list. They fly whenever the mood hits them and will notify all who are on the FOGz list when they know they are taking off. Usually with at least a 12 hour notice. Ed Boehm notifies each list every Monday where and when the FOGz are headed.

Recent successful flights have been to Newton and Belle Plaine.

If you would like to be on either email list, notify Ed Boehm at [e.boehm@mchsi.com](mailto:e.boehm@mchsi.com). He can get you fixed up.



**Left to Right: Gary Witcombe (Tri-pacer), Doug Boyd (Waix), Bruce Devick (X-Air LS), John Beck (Tri-pacer), Ed Boehm (Ercoupe), Garry Brandenburg (Cessna Skylane). Sitting in the Newton Perkins.**

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### ***Oshkosh Attractions***

It has been reported from EAA headquarters within the past month that there are going to be some big attractions at this years Airventure. The first ever **LANDING of a B-52 Stratofortress** will take place. There have been fly-overs before, but never a landing. The **F-22 Raptors** will be back. And the **Valdez STOL** competition demonstration was so popular last year, they are bringing it back this year.

With everything else that happens at Oshkosh, this one should not be missed!



**An F-22 Raptor takes off at Oshkosh in 2008. (What's that funny looking plane in the foreground? And whose tail number is that??)**

## The Taming of the Screw The Airscrew that is.

From what I've read, the term "airscrew" was the original name for what we now know as the "propeller". If you think about it both nomenclatures are vary appropriate in terms of defining the function of such a device.



Leonardo da Vinci's original airscrew as can be seen above actually looks the part, that is it looks like a screw and was intended to raise into the air once a rotation motion was applied. There are videos on line that show how people have duplicated the design in order to study how it works. All I can say after watching the video, I'm glad the Wright Brothers studied the "propeller" and designed and used one on the Wright Flyer. I read that their propeller was studied in NASA's wind tunnel and found to be very efficient. They used a very scientific approach to designing their Wright Flyer propeller.

I imagine the word propeller was derived from the word "propel". I actually didn't read that somewhere but I figure, go figure, correct. No matter what, I like "propeller", it sounds more techie. What brought me to this point in my thinking was the proverbial bucket list. I've always wanted to make one and now I am on my way down that path. I must say, so far it's been fun and interesting. And as usual a learning experience. I won't have any trouble checking that box when filling out the paper work for the Double Eagle.

To start I borrowed a set of how to instructions from Dave McCurry. The instructions were detailed and somewhat complete, thus a great start. However, some confusion did exist either from the authors writing style or my reading ability. So off to the internet I went and found all the clarification I was looking for, but also came up with more questions. There are many types and shapes of airscrews, I mean propellers. Dave's instructions gave simple formulas to calculate pitch and length. I did this. The author detailed three different blade styles, a straight leading edge, a straight trailing edge and a somewhat standard looking blade where both leading and trailing edges were curved. He stated the straight leading edge was the easiest to build and there was little performance difference between the three blade styles. I chose the easier to make, the straight leading edge. The author said once the length and pitch calculations were made

it was a good idea to check with someone who might be flying a similar plane and engine combination. Thinking this sounded logical I emailed Leonard, Leonard Milholland, not Leonardo da Vinci, (sick joke) to ask what prop he was using. He gave me some good details along with a 60" length and a 24" pitch. The problem was, by using the authors formulas, I came up with a 56" length and a 30" pitch. I could account for the pitch difference since I am using a 75 hp engine and Leonard uses a 60 hp. Horse power is used in the pitch calculation, but both engines are the same type and rpm (rpm is the main determinant in length), thus it seemed the length should be the same, plus my Q2 prop was a 56. What now? I decided to ask some prop makers and this resulted in some interesting information. Slow airplanes use longer props and the designers run the prop speeds at a higher mach number. Why, I never found out, but instead of a mach limit of around 80% of mach they run all the way up to 92%. Maybe it has something to do with the combined speed of the propellor and the forward speed of the aircraft. Prop makers make 62 inch props for VW engines. I stayed with a 60. I found a prop calculator on the Culver site and used it to do some studies and make a simple spread sheet and after doing that I decided on a 29 pitch. With these two numbers it's easy to lay out the design. From the internet I found a picture example of how this is shown to help the reader.

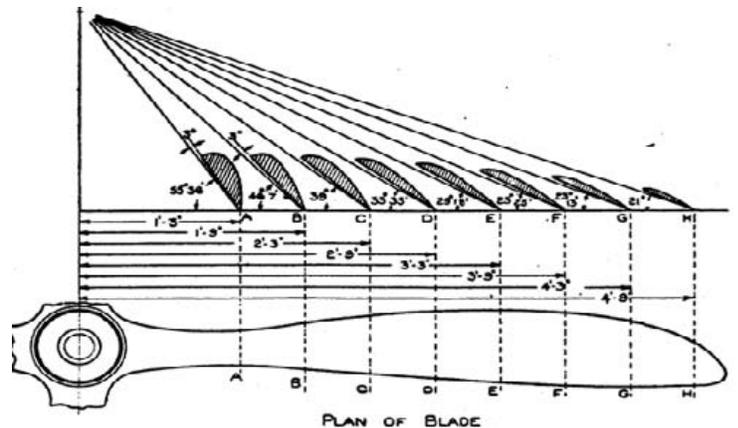


FIG. 219.—Lay-out of an Airscrew.

On the vertical axis is pitch and on the horizontal axis, the length of one blade ( when laying it out there is more to it than in the picture. You multiply length times 3.14 and measure off the stations but I believe you get the idea).

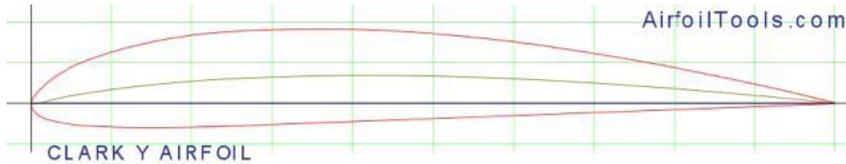
On the paper in the background in the photo below is my layout. You might understand from the picture to make things useable you scale the size down. Also you can see the 14



cardboard triangles along the bottom. The whole intent of the layout is to make these triangles. They represent the changing angles from the prop hub to the tip. An alternate design is a constant angle and you might have seen one on some of the black composite blades. Constant pitch is more efficient than constant angle. The triangles are used at 2 inch stations on the back or flat side of the prop blank. A saw is used to cut into the blank until the depth and appropriate angle is achieved. Sounds harder than it is to do. Just take your time and I used a simple guide for the saw. Now the fun begins. You carve out the excess. At first I used a hammer and chisel because that's what the author said to do and this was also done on the Internet. After chiseling it close a SurForm plane is used, then good old sand paper. Five hours of chiseling, five and a half of planing and another four hours of sanding I had the blade back side done except near the hub. Now the other side. They all say just use a Clark Y airfoil the best you can. I found a study on line that supported that claim.



The photo above shows the back side after the SurForm plan and sanding. The other prop is my Q2 prop. It is a straight trailing edge design. Also you can see it is a little narrower. I had trouble finding anything I could use to determine width, so I stuck with the authors width. I did find on the Internet that the max aspect ratio of 10 to 1 was suggested. Both of these props are in the 7 to 1 range.



I copied the above Clark Y off of the Internet and used it. Of course, to use all that I had first made the blank per the authors directions; well almost his directions. I added some material which he said you could use or leave off to smooth the transition near the hub.



Here is the blank glued up. It is four layers of 3/4 inch poplar. Poplar was used for easy carving since I plan to use Dave's duplicator to make the final prop out of hard wood. You can use soft wood but you must apply fiberglass on the exterior.

I started the front or curved side with a chisel. Hit my poor, sore finger many times while working on the back and decided there must be a better way. There was. Although I didn't think my electric plane would work, it worked great. That, and with a small palm plane, I had the front cleared in an hour, ready for the SurForm plan. I worked the hub areas and did the sanding and had the front done in way less time than the back. Still had a sore thumb however.

Wider props help transmit the power to the air but that seemed to be needed in low aspect blades on ultra high hoarse power power plants, like turbines i.e. the C130. Also prop hub diameter has something to do with it and my Revmaster has an SA hub of six inch diameter which is large for a VW which normally have five inch hubs. Thus my finished blade does appear a little wide, but from what I read it is good to go. Also while at the ski plane fly in I went to the museum to look at props. I found others that looked a lot like mine and they were all on slow airplanes. Slow is good!



Once carved I put two heavy coats of West Systems epoxy on to harden the surface. When the duplicator is used this helps stop the stylus from grooving the pattern. Of course you sand in between each layer of epoxy. By the way the nob on the tip end is for use in the duplicator.



Next I painted it all one color to look for flaws. Fixed a couple of small cosmetic areas just for the heck of it, then repainted it. The second coat crinkled because I applied it to soon, more sanding. Once done I rechecked the back side pitch angles at each station. I was actually amazed how accurate it came out, when what first appeared an archaic way of profiling the pitch. It came out within the lines of a bubble on a level. If you worked with a level much, that's accurate. I hope the design is correct!

There were some interesting facts about propellers that I learned along the way. In the past I have been in numerous discussions about pitch. I read in more then one place what pitch is in a constant pitch propeller and they were all consistent answers. Pitch is defined as the angle at distance 75% from the hub. Why you ask. The majority of the thrust is obtained at distances between 60% and 90% from the hub. A quick math study shows 75% is half between these to marks. The hub area does not produce much thrust but is important for engine cooling especially during ground operations. We found this to be true on the Q2 between two different prop designs. The curved front or airfoil shape helps reduce slipping. Slipping is more prominent in air then say water due to density. Race planes use short thin props with ultra high tip speeds so they can develop more hoarse power. Previously when at the Reno Air Races we noticed they covered up their props so the completion could not see them! We did notice the leading edges appeared to be sharp. I plan to make a scimitar shape down the road. Their shape is difficult to determine and this may be a pipe dream. It seems they exist to help efficiency by two means. One is more

“effective” length but without higher tip speeds and to reduce noise. Noise is just wasted energy so quieter props are more efficient. I found it interesting that some props from the 20's and 30's were of a scimitar shape. Makes you wonder if they new what they were doing. The old question of tip ends was discussed in various internet articles. It seems square

is best for traditional prop design, maybe not true for the scimitar prop. Rounded prop tips are used sometimes to control the sonic flow off the square corner tips in some designs. But not a true issue at prop speeds in our type of installations. So keep em square. Longer is typically better with mach speeds being the determinate. But interestingly enough the max mach speed changes with expected use. If an engine/prop combination is not working because the engine does not have enough hoarse power the shortening of the prop will lose efficiency while letting the engine turn higher rpm's thus producing more power What should be done is to re-pitch the propeller. This becomes obvious when you see how props are designed and the formulas used. Or another way to look at it is go up to the second picture in this article with the prop layout.

Cutting the end off changes the horizontal line which is actually a tip speed issue. By re-pitching you are changing the vertical line which is a hoarse power issue. The old prop saying of “keep it longer longer” applies here. Dan had his prop reworked. After this study I can truly see why an out of spec prop would loss efficiency quickly. The next report on the “Taming of the Screw” will be after the duplicator portion, probably late summer or spring. This report will later be followed by how does it work. Also I have instrumented the panel with a vacuum gauge on the Double Eagle to allow me to test propellers. My plan is to some day make the other configurations and do some comparative testing.



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*EAA Chapter 675*

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