



Communiqué

Issue # 1 Volume # 1

A New Emergence

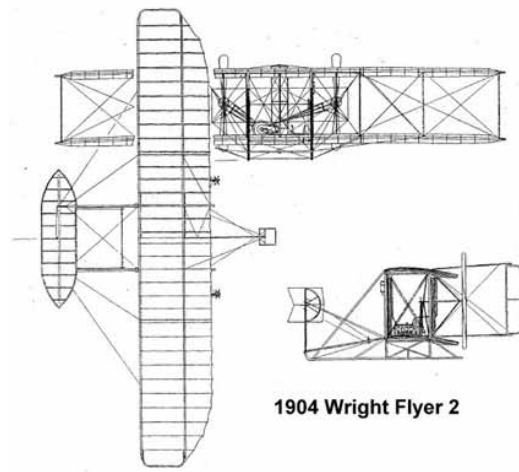
Once upon a time, there was a Design Group. It grew out of EAA Chapter 40 (San Fernando Valley) and its members were people who wanted to learn more about aerodynamics, structures and aircraft design. It met monthly for almost two decades. Some of you were there, more were not. Those of us who went to Design Group have fond memories.

The format of the meetings varied but in general the first part was devoted to brief reports from members on individual design projects. A number of DG'ers designed and in some cases built airplanes. Others improved existing designs. We looked forward to learning each month of the progress of each project.

For the feature of the meeting, there were several possibilities. Often we would have a guest speaker, like Irv Culver, the great Lockheed aeronautical engineer, and Ladislav Pazmany, who literally "wrote the book" on landing gear. Another feature was a "symposium" on some particular topic. For example, during the middle years of the Design Group, composites were just beginning their inroads. Some of our old timers were skeptical, noting that the failure mode of composites was abrupt, that inspection techniques were primitive, and that they perceived a risk of finding oneself, upon hitting a gust, transitioning rapidly from flying an airplane to sitting in a cloud of glass fibers. This and other interesting topics stirred lively discussion and often genuine learning. Another activity was actual design and construction. The DG designed and built 1.5 aircraft. The .5 aircraft, an all-metal, two-place, tandem pusher, still exists and might make a good project to complete.

Reviving The Group

Thanks to the hospitality of [EAA Chapter One at Historic Flabob Airport](#), we are going to try a modern version of the Design Group. We plan to



1904 Wright Flyer 2



meet monthly. The participants will decide what to do but our initial ideas are these:

We have the long-lost Alexander Lippisch educational TV series "The Mystery of Flight" on DVD, 13 half-hour shows on aerodynamics, which are great fun and very educational. We will show one episode a meeting and leave room for discussion and questions.

We will continue the tradition of great speakers. Our inaugural speaker is Jack Norris, who with his colleague has just completed a very long study which has produced the definitive treatise on propellers. We will get a pre-publication sneak peek at his principal findings.

We may revive the group project. On the day of our first meeting, Flabob Airport will dedicate the Capt. Ray Melberg Builders' Center, a well-equipped machine and metal shop and project area, for the use of homebuilders and restorers. It is named in honor of DG'er Ray Melberg, renowned designer-builder and a stalwart at our meetings.

We may assign homework, such as reading a section of Hurt, Aerodynamics for Naval Aviators, or Hoerner, Fluid Dynamic Drag, for discussion and explication at our meetings. And we are sure that many more good ideas will come along.

Our kickoff meeting will be Saturday, November 19, at 10:00 a.m. at the Chapter One Hangar at Flabob. We picked that time and day so as to be late enough so people can get to Flabob, but early enough so as not to spoil the entire weekend. Future meeting times are up to the group.

Anyone wanting to learn more about aerodynamics and aircraft design is welcome. It's free; we might pass the hat for the stamp and coffee fund. Whether you are a complete novice

in this area, or a working aeronautical engineer, we expect to have something of interest for all. If you are interested but cannot make this meeting, please let us know. If you know others who might be interested, please get this information to them.



November 19, 2005 Learning Begins

Jack Norris, our first and very informative speaker spoke to this group of approximately forty on propeller designs. He is a retired aeronautical engineer who has been researching and experimenting since he started designing and building models in the 1940s. What he did was present the complex subject of propeller design using "understandable horse sense" with words and pictures. Efficiency theories based on Theodorsen; "Minimum induced and minimum profile drag propellers made understandable."

After explaining how they work, he introduces his theory that places the blade's minimum area to top efficiency. Jack stated that during 1930 they were starting to make propellers with the right shape. Also by 1948 most of the theory and math was developed for proper propeller blade development.

A propeller should have a shape similar to a canoe, which helps get the load off the tips. Dynamic pressure is many times higher at the tip loads which can cause efficiency to go down. Simple reason the dynamic pressure is so ridiculously amplified at the tip of the prop. On a simple aircraft like the Luscombe it is 25 to 1 and this becomes a big factor. This is why one must pay attention to the shape of the propeller. Norris acknowledged that the trick is to connect the theory dots when they are so far away and do not look all that related.

With simple mathematics on a wing you see 20 to 1 on L/D and 7 to 8 aspect ratio wing. This is also where you might make a lot of prop blades. A 20 to 1 L/D is 1/20 drag over lift which is 5%. This tells you something about the efficiency and loss on a regular wing. Props never get better the 95% efficiency and a low pitch is more like 85%. If you don't do your design shape correctly you could lose 10% of those numbers a lot easier than most people suspects you can.

So, a propeller which is just a rotating wing will always have 2, 3, 4, or 5 times as much loss and lower efficiency than a comparable wing. Jack stated it has taken him a long time to get to where he could see this in that simple of terms. Bottom line, you can not be sloppy in your design

of a propellers shape compared to a wing. It might be a rotating wing but you must design it with a proper shape due to the high amplification of pressure and propeller wanting to work inside out. It has taken years of work for Jack to get it down to this simplification.

The prop should have a mid span load. The work needs to be near the center of a prop, the tips are working hard and at high dynamic pressures at the tip load. (Working from the inside out as Jack states it) The shape should look like a canoe.

Jack Norris stated he was completing a book on this subject. I hope he has it out very soon. The time has come for someone to write a book which explains all the math and theory in very useful manner. After listening to Jack Norris speak, I can not wait for his book.

Jack should also write a book on how to own an aircraft for a few dollars a month. After the meeting he discussed his Luscombe with a few members and cost of ownership. Ask him how to do this?

EAA HAS an Excel program on Prop Design on line at

www.eaa.org/benefits/sportaviation/S407-PropDesign.xls

Analytical Help **Theodore Theodorsen**

Until Jack Norris brought Theodorsen's name up in his discussion I had never read or heard of him. So, it was time to do a little internet research. Theodorsen worked for the NACA and contributed many theories in use today in aircraft design.

Theodore Theodorsen (1897-1978) earned an engineering degree from the Norwegian Institute of Technology at Trondheim, Norway in 1922 and later earned a doctorate in physics from John Hopkins University. He joined NACA in 1929 and



was appointed the head of the Physical Research

Division at Langley Aeronautical Lab. He worked on airfoil theory, fire prevention in aircraft, theories of wind tunnel design, and engine cowling improvements. He left NACA after World War II. ("Theodore Theodorsen," biographical file, Lek 8/3/2 #002289, NASA Historical Reference Collection, NASA History Division, NASA Headquarters, Washington, DC.)

During the robust periods of NACA experiments in aerodynamics many paralyzing and confusing issues arose which caused some experimental impasse. Langley's research needed some analytical help. It was eventually provided by the head of the laboratory's small Physical Research Division, Theodore Theodorsen. A Norwegian-born engineer-physicist with a trigger mind and tremendous power of concentration. Theodorsen had seen at Langley's the need for experimental routine to be fertilized with a stronger dose of theory. Not everyone at the NACA saw this need which caused some opposition. Theodorsen was not worried about expressing his opinions. This can be seen in the curious introduction to his seminal 1931 report on the "Theory of Wing Sections of Arbitrary Shape". Curious at least in a NACA report for stating a bold personal opinion and implicitly taking part of the parent organization to task, Theodorsen had asserted that

“A science can develop on a purely empirical basis for only a certain time. Theory is a process of systematic arrangement and simplification of known facts. As long as the facts are few and obvious no theory is necessary, but when they become many and less simple, theory is needed. Although the experimenting itself may require little effort, it is, however, often exceedingly difficult to analyze the results of even simple experiments. There exists, therefore, always a tendency to produce more test results than can be digested by theory or applied by industry. “



Theodore Theodorsen, head of the small physical Research Division, prepares to give a conference talk on the physics of a four-blade propeller in 1945

What Theodorsen believed the NACA needed in order for it to move beyond the impasse temporarily blocking the progress of its experimental program was more attention to the "pencil-and-paper" work that could lead to a

complete mathematical and physical understanding of the basic internal and external aerodynamics of a subject. Theodore Theodorsen, at times complained that many engineers were weak in mathematics.

Little Dipper or Tin Trooper

A circa 1940s photo (courtesy of Dan MacPherson) of famous test pilot Tony LeVier & Milo Burcham at Newhall Airport in a "Little Dipper" (a personal aircraft developed by Lockheed in the 1940s but never mass produced).



First offered to the Army in 1944-45 as the Air Trooper, to be an "Aerial Jeep". After being passed over by the Army, Lockheed offered the Model 33 to the public as the Little Dipper. The market never developed, and only two were ever built.

Little Dipper aka Air Trooper (Model 33) 1944 = 1person; modified 50hp ACM/Franklin 2AL, later 40hp Continental A-40; span: 25'0" length: 17'7" load: 300# v: 100/90/30 range: 210 ceiling: 16,000'; ff (as Air Trooper):



John Thorp. POP:1 [NX18935] and 1 unfinished prototype. Originally intended as a "flying motorcycle" for Army D-Day ground troops, as the war drew to an end the focus shifted to a civil market and its name became Little Dipper. However, the market never developed, and the planes were scrapped.

The original design for the Little Dipper was conceived by John "Johnny" Thorp, an engineer working for the Vega Aircraft Co. Mr. Thorp - and Vega - were exploring the feasibility of replacing some of the missions executed by troops parachuting behind enemy lines with a piloted soldier. Therefore, the plane would have to be simple to fly, forgiving, and able to land anywhere at very slow speeds. Vega never managed to sell the concept to the Army, and Thorp got Vega to

release the design to him, and he attempted to enter the open market with the design. Three 2 place Dipper prototypes were built with 85HP engines, were certified, but Thorp was never able to attract enough investment dollars, and the design died. Johnny went on to create several all metal designs for the homebuilder, and his T-18s went on to be built around the world.

Read the attached article it does better justice to this aircraft than this write up.

Why is this in the newsletter? Our coordinator would like to redesign and build a flying example of this aircraft. What a great idea, with a little knowledge and help from the Design Group, get in, fly low and land slow.



We have a schedule:

2006 Meeting Schedule 10:00 am FlaBob Airport Chapter One Hanger

January	28
February	25
March	25
April	22
May	27
June	24
July	22
August	26
September	16
October	28
November	18
December	16

What this is and what it is not!

It is important to remember that this newsletter is merely a conduit for information passed among members sharing their experiences. Its established purpose is fellowship and encouragement. ***It is not the intent to give authoritative advice on aircraft construction or design.*** The Editor and the contributing writers disclaim any liability for accuracy or suitability of information that is shared. You can assume that all or some of the information in each issue is not correct for aircraft design.

This is simply a collection of notes which were taken at the Design Group meeting and placed with other items into a newsletter format. This is very informal, it will continue if you like it, BUT

leaving open the option to quit anytime it becomes time consuming. After saying all that, hope fully you will enjoy this news letter. Lots of items will come from the meeting as best as one can interpret what is stated. Many items will come from other sources such as books and internet files (Grabbing from any source to make it useful and a lot will come from the internet to expand what was talked about at the meeting, like the Theodorsen material in this issue).

Speak out if you were wrongly quoted or something misinterpreted, no harm was implied, only lack of knowledge in understanding and interpreting what was said. This will only be sent by email to anyone whom would like to receive it.

How many times a year this will happen is up for grabs at this time.

So with that said. Welcome to the first **unofficial** newsletter. This is the trial run. This is an effort to reach out and to help connect the design group.

If others would like to contribute articles, stories and material in the future feel free. The newsletter should provide a way for us to communicate with each other. It is a place for those of us who want to network, connect and share information to do so. Anyone can write anything to whomever about any aircraft or aviation design ideas. With any luck we will learn something from everyone and hopefully someone can learn one thing from us.

The right hand side of the first page is saved for aircraft designers and their designs. They usually will have nothing to do with the topics in the newsletter, but, what the heck.

Who is this guy selling BD-5's?



Design Group 2

Meeting

February 25, 2006

10:00 am

At FlaBob Airport

In Chapter One Hanger

Will Present

Low Aspect Ratio Aircraft Design

With Speakers

Ed Marquart

On Saturday – **February 25, 2006-*Design Group 2*** will have FlaBob's Master airplane craftsmen Ed Marquart of Maverick, Lancer and the popular Marquart Charger will be a guest speaker.



Barnaby Wainfan

On Saturday – **February 25, 2006-*Design Group 2*** will have as their guest aeronautical engineer Barnaby Wainfan

