

T.W.I.T.T. NEWSLETTER

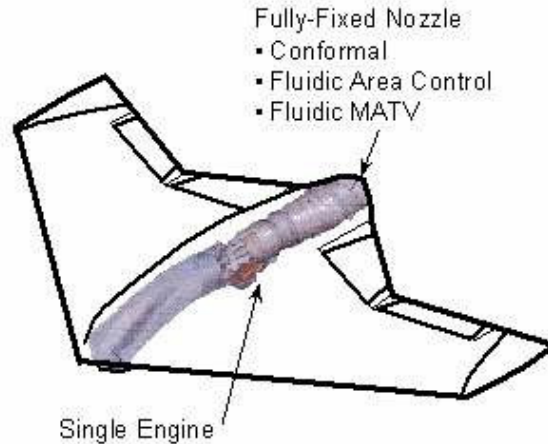
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T.W.I.T.T.

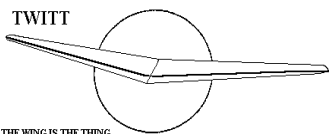
The Wing Is The Thing
P.O. Box 20430
El Cajon, CA 92021



The number after your name indicates the ending year and month of your current subscription, i.e., 0101 means this is your last issue unless renewed.

Next TWITT meeting: Saturday, January 20, 2001, beginning at 1:30 pm at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - Southeast side of Gillespie).

TWITT



THE WING IS THE THING

**THE WING IS
THE THING
(T.W.I.T.T.)**

T.W.I.T.T. is a non-profit organization whose membership seeks to promote the research and development of flying wings and other tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis. T.W.I.T.T. is affiliated with The Hunsaker Foundation which is dedicated to furthering education and research in a variety of disciplines.

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Meetings are held on the third Saturday of every other month (beginning with January), at 1:30 PM, at Hanger A-4, Gillespie Field, El Cajon, California (first row of hangers on the south end of Joe Crosson Drive, east side of Gillespie).

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PRESIDENT'S CORNER

This has turned out to be a super issue covering the work of Jim Marske. It has been a long time since we have had much on his designs until last month when Jeff brought down the Genesis 2 for us to inspect and ask questions about.

Then we had the piece by Serge on his latest visit to the Marske factory, which is concluded this month. Jerry Nolan then added to the pot with his letter about the development of his Monarch G.

The Nurlflugel mailing list has been quite active lately and one of the members asked a question about having structure forward of plank or swept forward type flying wings. I think to everyone's surprise Jim Marske came onto the list and put the matter into the proper perspective. I then asked Jim if we could use his text in the newsletter, which he agreed too and, then provided some additional material for everyone to digest.

So I hope everyone enjoys reading all of this. Perhaps it will generate some additional letters with comments on this whole subject area.

I do apologize for not having very many pictures in this issue, but I thought the text was much more important than adding pictures. I did manage to publish some other letters and still have room for an updated membership roster. This also had the affect of pushing the classified section out the backside so you would have all the information you need at one time. To make sure the roster fit, I only put it in alphabetical order by US members and all overseas members (Canada included).

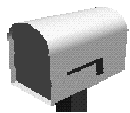
I hope everyone had a safe and sane holiday season and are back hard at work on your projects. Let us know what you are up do and pictures would be appreciated.

Andy



**JANUARY 20, 2001
PROGRAM**

The program for January will feature our own **Bruce Carmichael**. He will be give us his lecture on the aspects of sailplane design that he has come in contact with between 1949 and the present. This will cover the influences and contributions of: Lippisch; Raspert; Pfenninger; Johnson; Neimi; Maxi; Georgfalvy; Marsden; Eppler; Wortmann; Farrar; MacCready; Boermans; Horstmann; Quast; Beatty; and, then the emergence of the Sailplane Homebuilders Association and TWITT who have continued American technical developments with Hall, Maupin, Culver, Marske, Howell, Osoba, and Kicenuik. This lecture will include about 20 view graphs and he commented that it will only give a broad brush treatment to tailless sailplanes, just so you purest will know.

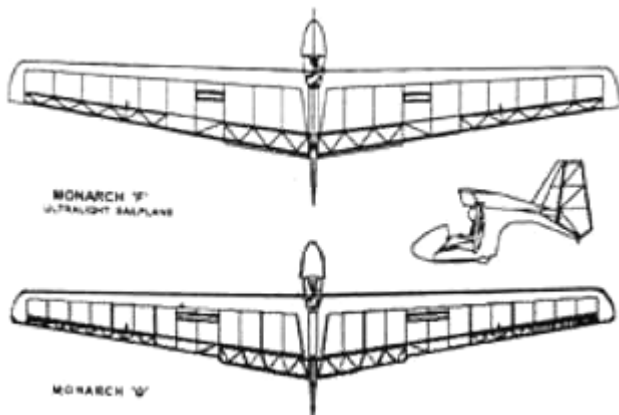


**LETTERS TO THE
EDITOR**

12/11/00

TWITT:

I just received newsletter today and was excited to see my comments there. I did not get to fly the Monarch as I do not yet have a glider rating on my license. My comment that it flies beautifully was my observation from the ground. It is hard to describe the effortless look of this glider in flight! The closest I can come is the look of an eagle or a large hawk as it circles looking for a thermal. I have always been fascinated by watching them and I think that is what attracted me to the Monarch. That and the fascination I have always had with flying wings.



ABOVE: Here you can see the difference in the wing layout for the “G” (bottom) from the earlier “F”.

My experience with composites had been nil until I started with the Monarch. But after some experience working with it I have become somewhat more confident. The biggest problem when working on your first airplane is the fear of making a big mistake. I made lots of those but with Matt Redsell's encouragement I corrected them even if I had to rip something out. This is the reason building an aircraft takes about 4 times longer then you think it will. I can only build in Marion since I have no room at home. I will be going back in may to do some more work on wings, and start on fuse. I had a trailer built here in St Paul and towed it to Marion. I may have to build a top for it also with the help of Mat. All in all I can say building your own glider is an experience I will remember all my life and if any members are dreaming of building their own glider, I say go for it! I am certainly looking forward to flying it and getting my glider rating, which I will do when I am closer to completion. That way my experience will be fresh. I want to thank you for working so hard on newsletter and encouraging all builders and potential builders and providing so much info for all wing enthusiasts.

Jerry Nolan
nolanjm@juno.com

(ed. – Thanks for the additional information on your project. Your encouragement to others for taking on building an aircraft is very welcomed. There always seem to be a lot of people out there who want to build something, but don't know how to get started or what kind of time it will take. Obviously, it is not a short-term venture even with a well-manufactured kit, but I am sure getting in and flying the finished product makes it all seem worthwhile in the end.)

12/6/00

TWITT:

I am a senior at Iowa State University and next semester I am doing an independent design of a 6 passenger blended wing body that I hope to start a kit aircraft company with someday. One of the most time consuming aspects is expected to be the design of a suitable airfoil. I was wondering if you could direct me toward a good starting point or any technical information on blended wing body design.

Have you guys checked out www.wingco.com? Somebody has already beaten me to a four-seater!

Thanks in advance,

Jesse Hilton
Aerospace Engineering
Iowa State University
Ames, Iowa
fatfrank@iastate.edu

(ed. – I referred Jesse to Al Bowers when I first got his e-mail message. I'm not sure how that contact has gone, but I am sure we will hear more about it later.

12/5/00

I also have added a new section to the website called "Requesting Help". I am putting e-mail and other letters in there from anyone who has a question related to flying wings. I hope that this accelerates people getting answers to important, to them, questions. Bruce Carmichael helped greatly with one item through a direct contact and that's what it's all about, people helping people. Thanks to all who have taken the time to provide guidance to others.)

12/4/00

TWITT:

I am separately sending an application to join TWITT, which I would like to start Jan 2001. I recently talked to Bob Fronius and he suggested that I enclose the description of an interest of mine, hoping that you might post it somewhere your members could see it.

I am interested in a new approach to the design of sport aircraft. What would be the ideal shape of a designed lifting body capable of holding two persons in comfort, plus some baggage, carrying 600 pounds or more and cruising over 200 mph with a single engine of not more than about 200 hp? These requirements are not rigid, but serve to suggest the kind of personal, cross-country type of airplane I would like to have.

This holistic view is opposed to the tradition of designing wings, control surfaces and joining them to a fuselage and trying to make the best of it. The resultant, integrally designed flying body should be clean, aerodynamically stable and (I hope) simple to build. Has anyone worked with or heard of such an idea? (Where can I find more about this?)

Jim Wixson
McMinnville OR
jwixson@pobox.com
503/472-7676

(ed. – I added this to the new website page for others to have an opportunity to contemplate and maybe come up with some ideas. I hadn't thought about it before, but perhaps he should look into Barnaby Wainfan's FacetMobile concept since that has already been proven in the prototype proof of concept unit that Barnaby flew for a while.

Is it just my imagination or are there more people coming onto the flying wing scene looking for new ideas on how to design and build a better tailless aircraft? This is great for the movement and the sport of home building. And I just read where the Nurflugel mailing list now has 248 members and it has been very active in the past several weeks with both model building projects and desires for full size aircraft.)

TWITT:

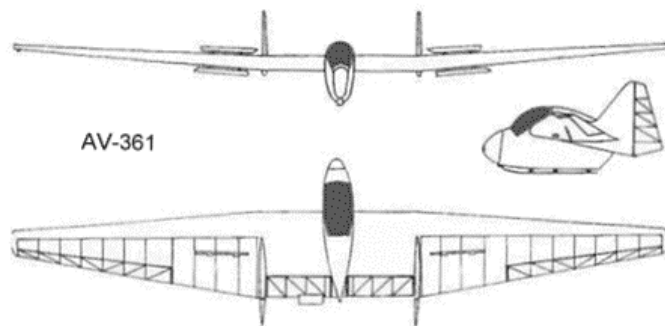
I have gotten interested in the Fauvel Flying Wings. I have the info pack on the AV-361 from Falconar Avia. This is the only place to get plans for any of the Fauvel sailplanes.



ABOVE: German built AV-461

I have been in contact with Jean Molveau (molveau@airpress.fr). He is writing a book about the flying wings of Fauvel. I have tried to find a listing on any Fauvel wings registered in the U.S. for him but have had no luck. Do you have any info on registration?

Ronald F. Clemenson
rclemens@hflenz.com



(ed. – This is one of the messages I added to the new website page. He subsequently came across www.landings.com, but like me looking for BKB aircraft, he didn't have much luck getting an answer to his question. So if anyone has some information, please contact him, or us if you don't have e-mail so we can pass it along.)

TWITT:

I am a fairly new member and have not been able to attend meetings for some time now, but have been enjoying the Newsletter. I have designed and built a tailless model with a span of approximately five feet with winglets. Our first attempts to fly it was not successful, but since then have made modifications and hope it will fly soon.

My question to you or any member is how to determine the CG range. I have not been able to find any info on the subject in any of the books I have purchased. Can it be computed or must it be determined by flight check? Do you know of any literature that I could read the subject to any length?

On a second subject, look up the Insitu Group in Bingen, Washington on their Aerosonde project on the internet, you will find it very interesting.

John Binikos
bikoda2@worldnet.att.net

(ed. – I passed this along to Bruce Carmichael, who came back with this simple method for finding the CG:



“Model builders find the location in a non-mathematical way. On the planform of the wing they draw a spanwise line from the centerline to the tip at the half chord point. They then place the length of the tip chord in line with and ahead of the root chord. Then they place the length of the root chord behind and in line with the tip chord. Connect the forward end of the tip chord ahead of the root to the aft end of the root chord behind the tip. Where this line intersects the half chord line is the spanwise location of the wing aerodynamic center. The aerodynamic center lies at the quarter chord of this chord. C. G. should be at least 5% of the mean chord ahead of the quarter chord and further if you have a fuselage sticking out in front.”

I would like to thank Bruce for providing this simple method that everyone can use.

I have included one of the photos that John sent along with his question so you can see just what he is trying to put in the air.)

TWITT:

Thanks for the renewal reminder. Also, thanks for video taping the Al Bowers BWB presentation. Kudos to him for doing an excellent job with this subject. For those of us that don't live near by, this is a very effective way to stay involved. Almost like being there.

I am including photos that I took of a very derelict Burnelli CBY-3 Loadmaster at the New England Air Museum. I know that it isn't a pure flying wing per say, but I think it fits in with the blended wing discussions of late. It actually had a service life of about 7 years. The empennage was nowhere to be found.

I found a website,

www.adrageous.com/burgessdunne/index.html

that has excellent photos of a newly constructed Burgess Dunne flying wing biplane by one B.D. MacKeracher. It's worth checking out and maybe could be worked into a future TWITT newsletter. This wing was so stable that the pilot could walk out on the wing while in flight without concern. This was pre WW I. This was also the first military aircraft evaluated by both the British and American Armies.

Thanks again for all the good work. There's more to it than most folks realize.

Paul Spatrisano

(ed. – I have included a couple of the pictures you sent to help our members identify with the design.



I checked out the Burgess Dunne site and that was one heck of a building project. I will try to contact Mr. MacKeracher to see if there is something we can include in the newsletter without infringing on any copyrights.



Thanks for the comments on the newsletter. You are right about it taking more than most would think. The biggest problem many months is finding enough material to fill the pages with relevant information. The same goes for the website, but at least there I can search the internet and find new things on my own. I have really enjoyed doing the website and, it has actually helped me with my job when I needed to evaluate my employer's site. I got the job done quicker and with much better results.)

MARSKE UPDATE

(ed. - Last month we printed the first installment of a Marske Update from Serge Krauss, covering his visits to the Marske shop during October and the first half of his "Reflections on the Pioneer Series". I held out his opening "Monarch Notes" for inclusion in this issue with more invited material on Jim Marske's lightweight "Monarch" flying wing. Last month's installment included Pioneer IA, II-D, and III-A sailplane planviews and brief discussions of Pioneer aerodynamics, performance, and developments, including an overview of comparative data on new airfoil developments for the Pioneer series. With some interesting, little-known history, Serge now concludes his "Reflections on the Marske Pioneer Series.")

October 25, 2000

A previously overlooked letter in an old Soaring magazine reminded me this Summer of why the Pioneer has not enjoyed the popularity it deserves in the U.S. For those unfamiliar with the Pioneer's history, a truly tragic misrepresentation of the Pioneer II, with apparently permanent consequences, occurred with publication in Soaring 7/74 of Rick Apgar's article, "Flying the Pioneer II". This uncomplimentary article, based on experiences with a spurious aircraft presented to Apgar as a true Marske Pioneer, led to unfounded prejudice, ridicule and suspicion that has lasted in some quarters of the soaring community to this day. I asked Jim Marske to comment.

This is what ensued. First, Jim Marske was invited to submit a rebuttal – which he did. Unfortunately, it never appeared in print, a friend at Soaring asking him a year later why he had never sent it. Meanwhile two Canadian

builders wrote in Soaring Mail that their newly completed Pioneer exceeded their expectations and was a "real performer", staying with a refinished Slingsby 18-meter "Skylark" 3F placarded at 36:1. On a subsequent trip through Canada, Jim learned that the Pioneer, well built but with rough ('orange peeled') paint, had actually outperformed the Slingsby. To quote Jim, "I personally inspected this Skylark, and it was very clean indeed. Its owner was not happy when the 12.8 meter P2B out flew his big bird."

Years later, Bob Michener brought to Jim his newly purchased "Pioneer", asking why it required full up elevator to avoid nosing over. The plane, N4SS, turned out to be the very same plane tested by Apgar and reviewed in his article. Examination of the roughly finished aircraft quickly revealed that the builder had replaced the cambered, reflexed wing specified in the plans with one of nearly symmetrical section. Maximum lift was greatly reduced, stability was questionable, and drag was unacceptably high at any reasonable lift. Other changes had also been made by the builder, who apparently felt that he was thus flying something closer to an Me-163, an aircraft for which he had a strong affinity. Since for flying wings, **The Wing IS The Thing**, this was anything BUT a Pioneer. However, maintaining the Marske wing planform and fuselage shape made it a "Pioneer" in the builder's estimation, and the aircraft had apparently been "flown widely in Texas, New Mexico, and Arizona as a valid Marske design."

Rather than destroying N4SS, Jim Marske converted the wing back to a modified 33012 airfoil (he mentioned sawing out a 20-foot long dart in the lower plywood skin, parallel to the spar at the 25%-chord point, cranking camber into the D-tube, and rejoining the skin (!). Ribs were cut at the rear spar to incorporate reflex). This and other changes to return the plane to Pioneer specs resulted in good flying qualities and performance. Over the years they added the swept vertical stabilizer and performed other detail clean-up (sealing the canopy reduced sink rate by 20%). In a letter published in Soaring 8/89, Michener outlined this story and exhorted Soaring to make available to SSA members a "letter of record to Soaring Magazine" from Rick Apgar, stating that he had acted in good faith, but had "since become aware of the misrepresentation." Michener referred to "20 years of insidious, virulent prejudice that never surfaced for objective refutation." From what I've heard, I don't view this as hyperbole.

Perhaps some good came from this, in that Bob Michener and Jim Marske were able to use N4SS as an experimental test bed for modifications and revisions leading ultimately to the Pioneer IID specs. However, the original harm was never fully rectified. Interestingly, I am told that Dick Johnson has declined to test a Marske Pioneer for Soaring, saying that he only reviews factory aircraft. So while Soaring has given Jim some good exposure since the Apgar article, the one direct refutation of its misinformation will not be possible.

So why dwell on the Pioneer? An attractive, well-proportioned, but inexpensive sailplane with quite respectable performance, its potential remains dramatic.

Who wouldn't be impressed by the promise of a 35+:1 sailplane refitted with a higher-A/R, 15-meter glass wing of 55% higher airfoil-section L/D max? Optimization of the wing-fuselage combination is subtly difficult but rewarding. None of this has been lost on Jim Marske, who has been quietly exploring the possibilities.

Incidentally, I am not an employee of Marske Flying Wings. Through admiration for his work and at the instigation of Wil Foshag, I sought out the creator of the Pioneer series several years ago at Group Genesis, finding him to be a dynamic source of ideas on flying-wing development and a tireless pursuer of the tailless ideal. I have tried to furnish periodic TWITT updates ever since. Marske Flying Wings is a unique enterprise overseen by Mat Redsell, himself an exceptional individual of many talents. Enthusiastic to learn and see the art advanced, I help out a little when I can.

As the Monarch continues to find favor (everyone seems to love flying it), I hope that the exciting designs on the Marske drawing board make it into the air. They will be much more than "flights of fancy". The P-3 is well along, almost all glass fuselage parts and quite a few wing parts having been produced from completed molds. While it has deferred some to a current Monarch construction run, it should still fly next summer. I can't wait.

MONARCH NOTES

October 25, 2000

Much of the Marske shop's recent efforts have been directed toward continuing development and production of the Monarch, a unique craft born under Marske's hand in the early 1970's. The Monarch is best understood through the excellent Marske internet site set up by Mat Redsell. In short, it is a very light, open, slightly forward-swept, high-winged, tailless sailplane that is most often launched via auto tow. Commonly released at between 800 and 1200 feet, it soars on the weakest of thermals, when other gliders cannot. I am impressed with its low weight of 180-190 lbs (down from nearly 250 in the original and soon to be under 155 in a new carbon-fiber version), which easily brings it under 100 Kg. The "G" has a more tapered, higher A/R wing and some evolutionary aerodynamic and structural refinements, including a tiny aileron-mounted adverse-yaw damper (tried earlier on Mat's 'F' model) that actuates with up-aileron, minimizing the need for rudder. Cruising marginally faster and with a slightly lower sink rate than the "F", the "G" has probably surpassed the advertised L/D max of 22. Low sink rate and high maneuverability have allowed saves from as low as 200 ft., and flat-land cross-countries have been performed at altitudes below 1500' AGL when heavier ships were unable to leave the airport area. Mat is still carefully moving the c.g. aft and finding even better performance. Jim Marske's 8½ -hour flight in the old "E" at Elmira a couple years ago suggests that the Monarch is also a real threat to soaring records for its class. Mat Redsell has a

Monarch article in this month's Soaring, and a second feature article is expected in the December issue of Kitplanes.

UPDATE

November 22, 2000

Several things have happened during the past month. First, Mat Redsell concluded c.g. experiments on the Monarch G to his satisfaction. With 9 or 10 enthusiastic helpers, Marske Flying Wings transitioned smoothly and on schedule to its new location, where work has resumed. Clean and freshly renovated, the new shop has better climate control, slightly more work space, and a nice office area. I have devoted some time to comparisons and projections of Pioneer family sailplane performance for various wings employing the old 33012 and new Marske airfoils. Applying my pocket calculator (no spreadsheet!) to Jim Marske's airfoil data and what appears to be a conservative fuselage/fin drag coefficient, I computed and graphed L/D curves indicating remarkable performance in agreement with Jim's own Pioneer-4 figures. Potential for even a stock-planview Pioneer IID with the new airfoil is startling. While discussing results and speculation, Jim showed me an even newer (2 day old) airfoil with even better performance; the guy never stops! Finally, I was able to learn something of carbon lay-ups, while helping out a little on the new carbon Monarch during my visit this week. Learning is grand.

For those of you on-line, go to:

<http://continuo.com/marske/workshops.htm>

for a lot more information on all of the Marske designs. This site will also tell you about the workshops he conducts from time to time for builders. They have been highly recommended by a number of people who have attended past workshops.

For those of you not on-line, try this more conventional address: Marske Flying Wings, c/o Marion Industrial Center, 3007 Harding Highway East, Marion, OH, 43302. 740-223-3550

GENESIS 2

(ed. – The following information was extracted from the advertisement in Soaring magazine and is provided for anyone wanting more information on this sailplane.)

Genesis 2, a high performance, Standard Class sailplane, has been carefully crafted to provide an unparalleled level of performance, comfort and safety. Extensive computer simulations, flight testing, and refinements have resulted in a totally new wing airfoil capable of achieving extremely high performance levels while retaining desirable handling characteristics.

Standard equipment includes: Roncz 72S airfoil; automatic control connections; carbon rod wing spar

caps; JAR-22 design standards; integrated wing tank water ballast (52 gal.); internal pushrod sealing; upper surface double height speed brakes; radio antenna in vertical fin, and; main wheel hydraulic disk brake.

For current price and delivery information, please contact Sales and Management Office of Group Genesis USA, 130 Yellow Rose, Alta, WY 83422, (307) 353-8403, fax (307) 353-8433, groupgen@aol.com or www.groupgenesis.com.

JIM MARSKE SAYS -

(ed. – Jim published this on the Nurflugel mailing list just at the right time. It fit into this month's newsletter discussion by Serge and Jerry's letter. Thanks to Jim for letting us print it again here.)

There seems to be a bit of confusion concerning adding anything forward of the CG in unswept flying wings. Jerry Nolan and I talked about this a bit when he was in my shop at Marske Flying Wings. Sounds like Don is a fearful of just what I meant. In this case I am glad he has brought this concern forward so we can solve the problem. We had two Monarch accidents in the past 25 years. Luckily no one was killed. Both Monarch builders changed the design of their wingtips. Each one constructed heavily curled down tips so that they would act as tip skids as well as an air fence to keep lower surface air from spilling off the bottom of the tip. Clever idea, right? You are delaying the tip stall to very high angles of attack. Still sounds like a good idea. Problem is the wingtips are in front of the cg (and center of lift). So the center section at the fuselage stalls first and the wing tips last. Result is the wingtips, which are lifting ahead of the cg, rotate the aircraft up into an even higher angle of attack. If you are in a turn during this process it will set you up for a spin. I have watched a video tape of this accident many times. A 15-degree bank to the left at very low flying speed and slowly developed into a steeper left turn and the nose falling down into the beginning of a spin. After half a turn it recovered back to level flight. About 75 meters of altitude was lost from a beginning altitude of 200 meters. The aircraft flew straight, but very slowly, for 150 meters then began making another slow left turn. The exact events occurred as mentioned above. The aircraft self recovered after half a turn but this time there was no altitude left for a pull up. The pilot had a broken ankle and a broken upper leg.

We have tried to spin several different Monarchs, without the curled down wingtips, even in far aft cg location without success. It will not spin. The cg was moved back to 27% and it would not spin. Normal cg range is 21% to 25%. The high-performance Genesis sailplane, one of my more recent designs, has a small horizontal tailplane on the top of the rudder. We can get it to stall and fall into an incipient spin, but will not do more than a 3/4 turn. The nose will pitch down on it's own, and the wing is flying again – even with full up elevator held in

at all times. This seems to occur on the above mentioned Monarch flights also.

The straight and slightly swept forward type flying wing are the safest and most forgiving type of aircraft I have ever flown and that includes all conventional tailed aircraft, powered and unpowered. I would not have spent 50 years of my life developing the unswept flying wing had it not had special flying qualities. And that includes, very high performance, safe flying qualities, less mass, low cost and fast build time.

(ed. - Jim then added the following after I contacted him about the printing the above material.)

The turned down wing tip style only applies to swept forward wings with no washout. I suspect the turned down wingtip, which is similar to the style found on some Cessna 150's, would be acceptable on straight flying wings without affecting spin characteristics.

Another fascinating break through is recent progress in flying wing airfoils. Thanks to computer software we now have a few very good stable laminar airfoils for use in flying wings. It is possible now to build a small plank type sailplane with a 40 ft span and AR of 10 that will have a 40 to 1 glide ratio.

Another problem recently solved is elimination of adverse yaw. If I had any beef against flying wings it was it's annoying high aileron adverse yaw. Sweptback wings and plank type wings, where non-differential elevons are used, have very high adverse yaw problems. Using a tapered wing with a swept forward leading edge, Pioneer II type, permits the use of differential ailerons which reduce adverse yaw somewhat. I was discussing this problem with Mat Redsell last year when he mentioned the magic word, 'servo tab'. So we added a servo tab to the outboard end of the aileron (2" x 12") at the trailing edge. When the aileron is deflected upwards, say 30 degrees, the tab also deflects upwards another 30 degrees making a total of 60 degrees. When the aileron is deflected 0 to 15 degrees, the tab remains at 0 degrees relative to the aileron. This not only reduced the adverse yaw but totally eliminated it. We can make coordinated turns without touching the rudder. Karl Streideick, after soaring the Monarch 'F' called it an Ercoupe. On the new Monarch 'G' we built the servo tab into the aileron. There is no noticeable increase in stick force due to the servo tab.

We are now in the process of building an all carbon Monarch. We have made a 12g main wingspar that weighs only 4.5 pounds ! Thanks to the Graphite carbon rod, strong, light and inexpensive structures are now possible. Calculated empty weight for the completed Carbon Monarch is 145 pounds. There is no real reason to build such a light glider except to qualify under FAA's Part 103 ruling to be able to manufacture completed aircraft.

A.R. WEYL COMPILATION

These items contain A.R. Weyl's historic articles from Aircraft Engineering and The Aeroplane, ca. 1944-1948.

- "Tailless Aircraft and Flying Wings"; Aircraft Engineering; 12/44, 1/45, 2/45.
- "Stability of Tailless Aeroplanes"; Aircraft Engineering; 3/45, 4/45.
- "Tailless Aeroplane Control Systems"; Aircraft Engineering; 5/45, 8/45.
- "Wing Tips for Tailless Aeroplanes"; Aircraft Engineering; 9/45.
- "High-Lift Devices and Tailless Aeroplanes"; Aircraft Engineering; 10/45, 11/45.
- "Stalling Phenomena and the Tailless Aeroplane"; The Aeroplane; 4/25/47, 5/9/47, 6/13/47, 6/27/47, 7/11/47, 8/1/47, 8/12/47.
- "The Biology of the Flying Saucer - The Story of Low Aspect Ratio Aircraft"; The Aeroplane; 2/13/48, 3/5/48, 3/19/48, 4/2/48.

These total about a 112-page book. Each set is photocopied from my master copies of the Cleveland Public Library's originals and spiral bound in black vinyl. The copy quality is good for second generation copies. The originals are becoming unfortunately ever more brittle due to their age; so opportunities to view and copy them will become rarer. Taken together, these articles

constitute the most scholarly and extensive individual contribution to literature on the history and principles of tailless flight up to its time. Well documented (citing hundreds of refs.) and illustrated, they remain a monument to Mr. Weyl's erudition, only a few foreign and wartime efforts (e.g. German developments like the Me-163) having escaped his keen eye for historical and technical significance.

If anyone would like copies they may contact Serge Krauss at skrauss@Earthlink.net or the address/phone number located in his bibliography ad in the classified section.

Prices (postage included): \$19.00 (U.S.), \$22.00 (Europe), \$24.00 (Australia/Asia).

SERGE NEEDS YOUR HELP

Serge continues updating his **Tailless Aircraft Bibliography** with information acquired over the past few months. Input from European friends/members has been especially helpful in expanding the French and Belgian content, but more information on 1999-2000 European publications would be gratefully accepted! If you have anything that fits into this category, please contact Serge and see if you can be of any help. This is a tremendous work and needs to be kept current with any and all information available on tailless aircraft.

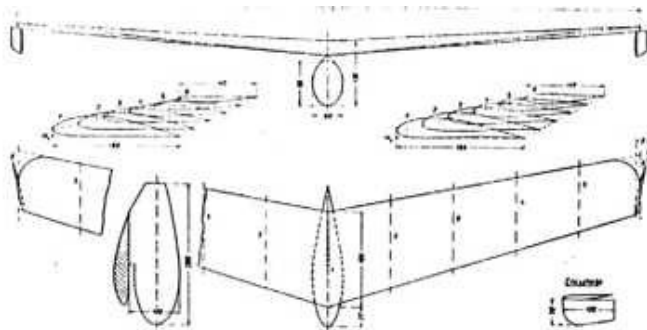


FIG. 5.—Wind-tunnel models for the development of the earlier Storch types of Lippisch (β = angle of slanting of the wing-tip disks). The aerofoil sections shown left belong to aerofoil type '1, those shown on the right to aerofoil type 2.

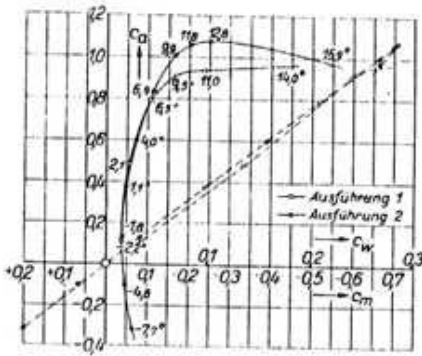


FIG. 6.—Wind-tunnel test of Storch I without wing tip disks. The moment coefficient c_m ($= -c_m$) is referred to the leading edge at the centre of the wing. Note the differences between the two aerofoil systems shown in Fig. 5. Ausführung = type; referring to aerofoil types in Fig. 5.

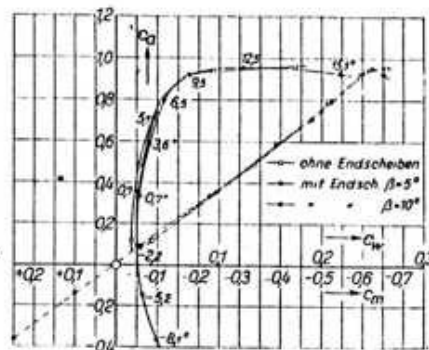


FIG. 7.—Wind-tunnel tests of Storch I with and without wing tip disks and under different angles of slanting β . Ohne and mit Endschiben = with and without wing tip disks. $c_m = -c_m$, $c_w = c_d$.