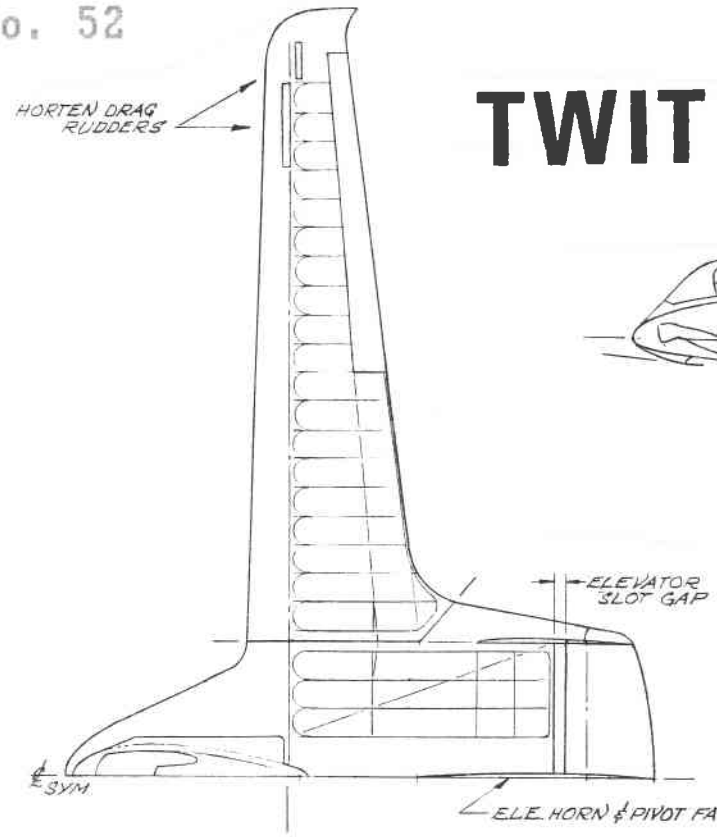
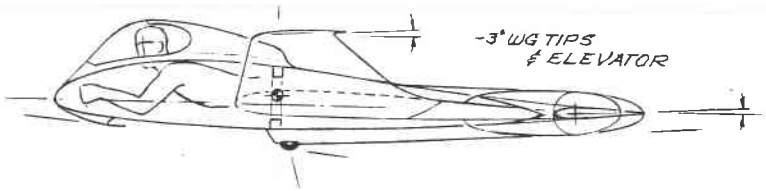
No. 52

OCTOBER 1990

TWITT NEWSLETTER

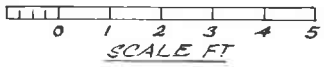




STRAIGHT BLENDED WING MK III
BY G. Blumenthal 10/1/90

SPECS:

SPAN	29.6 FT.
AREA (TOTAL)	119.4 SQ FT.
ASPECT RATIO	7.39 (TOT)
LENGTH	11.5 FT.



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

The number to the right of your name indicates the last issue of your current subscription, e.g., 9010 means this is your last issue unless renewed.

Subscription rates are $15 per year for U.S. mailings and $19 per year for foreign mailings due to higher postage rates.

Next TWITT meeting: Saturday, October 20, 1990 beginning at 1330 hrs at hanger A-4, Gillespie Field, El Cajon, Calif. (First hanger row on Joe Crosson Dr.)

PRESIDENT'S CORNER

Last month's meeting saw a good gathering of the young and the old to look at the works of Hawley Bowlus, especially the nicely re-restored Baby Bowlus of Wayne Spani. The meeting was short, as you can see from the minutes, but it seemed everyone enjoyed it.

There were probably enough members present to have an election, however, no slate of officers was put before the membership. With a good turnout this month we will get this piece of business out of the way.

The Board of Directors has been kicking around the idea of closing down the June through August meetings, as we do during the Christmas season, and just publish the newsletter. If we do this it will require a small change in the Bylaws, which can be taken care of at any regular meeting. This would also allow us to put more technical information in the newsletter since there would be no pages taken up by the minutes. Hopefully, this would be the result of our getting into the TWITT library and finding some of the good stuff for you. It would also relieve Bob of having to put programs together at a time when many people are on vacation.

As you can see in the Letters to the Editor section we now have a member in South Africa, courtesy of Peter Selinger. We have also received our second subscription request from Italy and a new one in the U.K., so we are really getting around in Europe. I hope this international flavor continues since it give us a much broader spectrum of flying wing development. Welcome to all out new members, no matter where you live.

Those of you who managed to get up to Tehachapi were treated to some very good workshops and a couple of evening sessions. Bernie Gross had the only flying wing and there were only a few flyable versions of homebuilt sailplanes, but it didn't seem to really matter. Looking at some of the ships submitted for the SHA contest there may be more wings at the next one, either the east or west coast event. We might start thinking of trying to have a small nurflugal meet in conjunction with one or both of the SHA gatherings. I would like everyone to think about it and give us some feedback. If we do this it will take some coordination with SHA well in advance so flying wing material can be built into their program. Let us know your thoughts.

You, the membership, have been quite generous with your contributions when renewing subscriptions. I would like to sincerely thank all of you since it continues to give us some financial breathing room to do a few more things for the entire membership. Along with money, we could sure use some more equipment for both the meetings and the eventual construction process. If anyone knows of someone who has a video projector of some type it sure would help for meetings. If there are some extra tools anyone has lying around that could be put exclusively to TWITT use, please bring them into a meeting sometime. I am trying to look towards the future when, hopefully, this all come together.

If any of you happen to get your newsletter in pieces due to a problem with the postal system, please return the shreds to us and we will gladly send you a new copy. I mention this since it has happened several times now but we cannot afford to put the newsletter inside any kind of cover without significantly raising the subscription rate. It doesn't happen often enough to justify a change.

I can't think of anything else to throw at you this month. I hope you are enjoying the newsletter, which should look slightly different this month due to some new word processing software. We keep trying to upgrade it in both presentation and content, but if you have any suggestions, let us hear from you.

Andy

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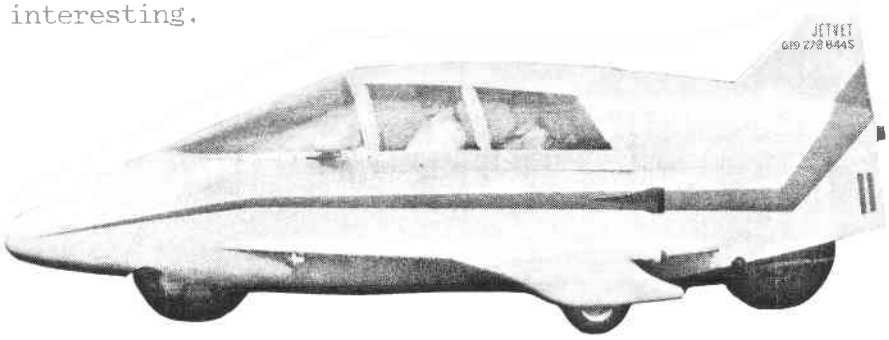
OCTOBER PROGRAM

Bob has put together a double header for you this month: something for the designers and fliers; and something for the techies interested in almost anything.

First on the program will be Don Westergren to make a presentation on how models are used to determine the flight characteristics of full scale aircraft, i.e. longitudinal stability, center of gravity location, etc. Don has made many large scale models (you can't forget his Voyager) and is an expert in this field. He gave this presentation to the local EAA chapter recently and I heard it was a big success. I am sure there will be question and answer period along with the program, so come and find out all those things you have been wondering about.

The second part of the program is a little afield from flying, although the end product looks like an airplane. Arnold Thierens will present his JETVET project (see picture below)

and discuss some of the details surrounding it. Arnold is looking to form a club of people interested in building a kit at cost as a proof of concept before final marketing begins. His letter to prospective club members indicates it can be built for less than $2500 and kit components can be obtained as building progresses. I am sure some of this building techniques can be used by those who are interested in building a "real" flying machine, so his comments should be quite interesting.



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LETTERS TO THE EDITOR

TWITT 7 June 1990

At the University of Pretoria we are currently developing a new foot-launchable glider which will be of flying wing configuration. Mr. Peter Selinger of West Germany referred us to your organization, and mentioned that you published a monthly newsletter. We would very much like to subscribe to your newsletter, and thus we enclose a bankers draft for $19.

Yours Sincerely,
Charles Crosby
Department of Mechanical Engineering
University of Pretoria
Hatfield Pretoria 0002
South Africa

(Ed. Note: Welcome Charles. We are glad to see the word of TWITT is spreading through our members. If you are interested in any back issues they are $1.00 US each (mailed). Perhaps Peter can inform you of which ones have information you would be especially interested in to prevent having to get all 51 previous issues. Also, please keep us informed of how your project is going, and any pictures, drawings, etc. would be appreciated by the other members. We are looking forward to hearing more from you.)

TWITT September 9, 1990

I've sent with this letter a check for my subscription renewal and a little extra for the general fund. I expect to see you this Saturday and I will pick up my newsletter then, if you haven't already sent it.

I've got a video from Rollin Klingberg on his model and full size wing and I'll be bringing a copy soon.

I am also working on a flying model that I will be building and flying soon.

See you soon,
Mark Motley

Dear Bob: 26 August 90

Thanks for you note and TWITT. I've already posted, by printed paper airmail, a copy of **Tailless News**.

You'll see we are mainly devoted to contest free-flight tailless models and especially aimed at keeping our one major English Tailless Contest - the Lady Shelley Cup - at the National Championships alive. The contest establishment here has been anxious to cut us out for a number of years.

I use full-size material - and indeed non-contest model like Al's (Backstrom) because I think there's always something to be learned - and as many of our readers are getting a bit long in the tooth interesting reading is more important than contest inspiration.

We don't take subscriptions - most of the printing is done for free anyway - because I can't promise more than the next issue. I'll be happy to send you a copy as and when we do one for free - and hope that if you come across anything of tailless model interest that you don't publish in TWITT you'll send it. I already send copies to Al Backstrom, as you know, Barnaby Wainfain, Ken Sykora, Daniel Walton and Bill Darkow who enrolled me for TWITT.

One of our readers has just re-printed three of the back issues for me - but he hasn't made the best job of it - and he's printed one side only - which makes for a hefty posting job. Bill Darkow has a full set of copies back to Number 6 - the first five were late 60's early 70's - and if he would copy for you it would probably be the best way

to get them. Al Backstrom's go back to Number 10, I believe.

You are welcome to copy any of our stuff.

Best Wishes,
John Pool
8 Sycamore Road
Barlby, Selby
North Yorkshire ENGLAND
YO8 7XB

(Ed. Note: Welcome to TWITT, John. Most of the people you mentioned are TWITT members, so hopefully we won't have much problem getting copies of back issues. Those of you who have copies let us know which ones you can provide and we will coordinate it so there are no unnecessary duplications. For you John, we have a large number of modelers in TWITT so we print most of the more interesting model items we come across, and Bob will keep you in mind if for some reason we elect not to put something in the newsletter. Hopefully, you will also find something of interest in the full size stuff to make into models.)

Bob Fronius:

At Tehachapi, I enjoyed your slide presentation and your congenial attitude, and I gratefully appreciate the information about TWITT. It is reassuring to find other people who share my fascination for tailless sailplanes.

Count me as a new member, and send me all the back issues of the newsletter.

Herb Hilchey
2383 Cedar
Long Beach, CA 90806

(Ed. Note: Bob substituted one of his historic slide presentations for one of the SHA seminar speakers when he was unable to make his sessions. I heard nothing but good words, like those above, about Bob's impromptu show. This goes to show there are a lot more people out there who believe in the flying wing concept; we just have to find them.)

TWITT September 28, 1990

Thanks much for sending the TWITT back issues; I trust that my check has arrived by now. I am really enjoying the newsletters, not only learning about a few sources and types of which I was unaware, but getting acquainted with members through the minutes and correspondence. The challenge now is to find a way to include some of the oft-occurring original information in my listings. Incidentally, if TWITT members wish their tailless efforts documented in the appendix to a future addition of my bibliography (design and flight dates, configuration, etc.), they should let me know.

I used the number listed in recent TWITT newsletters to contact David Murray of the N9M restoration project. Perhaps readers would be interested in a status report. If my notes are accurate, the center section is complete, except for skin. The left wing is 80% skinned, and the right wing is "framed", but not yet skinned. Plywood skin is soaked and shaped on an accurate mold before installation. Flaps are complete, and work has begun on elevons. The plane is being restored to flying condition with the intention of flying it. Mr. Murray was interested to hear of the existence of TWITT, but asked that I not mention an estimated flight date.

Big news for some of us enthusiasts is the two-hour Discovery Channel special on this project. Entitled "The Wing Will Fly", it is scheduled for airing in January of 1991 and will include historic films as well as interviews with John Meyers, Gen LeMay, and others. Presumably there will be a B-2 tie-in. Mr. Murray mentioned that several hours worth of videotape were shot and that included among Discovery Channel visitors was their president. Apparently this is a major project for them. It is good that something like this is being done while Northrop flying wing personnel are still available (I once met one who raises horses in S.W. Colorado!). Get out those VCR's!

Sincerely,
Serge Krauss

(Ed. Note: Thanks for the information on the N9M project. Hopefully TWITTers in the Southern California area will get in touch with Mr. Murray and possibly give him a hand. We certainly will get in touch with him as the project nears completion and see if he will come down for a meeting. Also see Serge's other letter reproduced as we received it. The item mentioned have been added to the TWITT library.)

(See the letters from Serge Krauss and Ed Gabriel printed elsewhere in this issue as they were received from them. It was much easier than retyping them just for the sake of formatting. For you members who send us longer letters with some technical data, it would be helpful if you could put it into columns no wider than 3 3/4". If you can't, don't let is stop you from sending it anyway, since we appreciate any news of what's going on out there.)

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MINUTES OF THE SEPTEMBER 21, 1990 MEETING

Andy opened the meeting by asking if we had any visitors. Carl Gwastney introduced himself as a friend of Bob's, and it turns out Carl's first TG-2 ride was in the one sitting there in the hanger. Not only did we have Wayne Spani, the Baby Bowlus owner, but also his father Wayne and his son Wayne, so the Spani's were three generations strong. Andy announced that the raffle prizes would be Bowlus T-Shirts put out by SHA. Andy also announced that there would be an Aerospace Museum Open House on September 29-30 at the Gillespie Field hanger which would feature all types of vintage aircraft and automobiles. He then gave the usual sales pitch for TWITT hats which are $8 a piece.

Frank Allen told the group about his Paper Bowlus project, Model #16. (Pictures of this project are included elsewhere in this issue, courtesy of **The Fly Paper**, a monthly publication of The Chula Vista Model & Radio Control Club). The aircraft is standard wood construction, but gets its Paper name from the fact that brown paper is used to cover the ribs (Doug Fronius will bring his copy of one back to the hanger for viewing). Frank invited anyone who wanted to see more of the project to come to the museum reception area and ask for him.

Bruce Carmichael gave a brief recap of the SHA gathering at Tehachapi. He highly recommended that those who didn't attend this year to save Labor Day weekend next year for this event. Not only is there a lot to learn from the presentations, but the gathering of old timers reveals pieces of gliding history you can't find in any books. For the techies, there was a destruction demonstration on a carbon-fiber and foam spar mockup where it was taken to the compression failure point. The strain gage showed 68,000 lbs before the carbon spar cap buckled under compression (tension had no visible affect on the other cap). This type of building technique is being researched in the realm of the home builder so they can achieve the weight savings possible with carbon construction.

Bruce described two of the seminars offered on both days that covered the subject of self launching sailplanes. The two speakers were diametrically opposed on the subject, with Irv Culver saying keep it simple by putting the engine in a streamlined pod where the propeller can be hidden in its wake during gliding flight. Of course, this configuration requires almost twice the power plant in order to get off the ground and climb. The other speaker owned a Woodstock with a retracting propeller and engine that is working well. He also showed the results of studies on the trade offs between deploying only the propeller and the propeller/engine combination. There was a demonstration of a truck bed mounted winch that has been used primarily for hang glider launching. It was used to launch a Bernie Gross' Marske Pioneer and a Carbon Dragon ultra-light. They are a commercial product if anyone is interested, but we only have the gentleman's name, Chris Gagliano of San Antonio Texas, and not his address.

Doug Fronius then gave us a tour of the Bowlus items he has accumulated over the years and had hanging around in the hanger. One set of wings looked like Bowlus' but in fact were Grunau Baby II wings which was designed in Germany during the 1930s. These wings were built in San Diego with imported metric wood for use on a Baby Grunau which was never completed. The wings were taken to Hawley Bowlus to put on the leading edge skins, who also copied the design and converted it to English dimensions. Along with the conversion he also made some construction technique changes to come up with the Baby Bowlus design. The Grunau wings were eventually sold to Johnny Robinson who put them on his famous JR-5.

The set of Baby Bowlus wings on the hanger wall were built in 1951 for a glider with N-number N1951, which was the same year Wayne Spani's Baby was built. Doug has all the pieces to the aircraft including a demolished fuselage. Doug also has the complete airframe for number N90841, but it is disrepair from having sat out in the open for many years at Fremont. Drawings and construction manual for the Baby are available through the SHA. There is also a set of wings for the Bowlus Bumblebee motorglider, a certified aircraft which

came out after WWII. It looks like an oversized Baby since the pilots sit beside each other.

Bob then took the floor and put on a slide show of Bowlus related activity over the years. Dick Benbough, the Bowlus historian was also available to answer questions about what was being seen or any other facets of Bowlus aircraft he happens to have come across during his research. (Since it is hard to relate the slides and narrative without the slides, the following will only cover the highlights which are pertinent.)

One of the interesting construction problems that occurred in the early planes involved the way in which the pods were put together. Concrete molds were made to lay up the veneer, but the way the molds were formed ended up making the cockpit opening narrower after aircraft number three.

Wayne Spani gave a description on how he came to find his Baby Bowlus and the fact that the previous owner had kept it so well preserved meant only obtaining a new certification and license before it was flyable again. He then told us about his decision to return the glider to as near its original colors and translucent wing covering. He did find some structural work that needed to be done (and he had been flying it this way) before beginning the recovering. Unfortunetly, the pod had been fiberglassed on the exterior so the original wood grain finish has not been achieved.

Wayne indicated the plane was sensitive in the pitch mode and it took a little getting used too. The ailerons, although big and powerful looking, were of little real help in the roll axis, with the rudder doing most of the work. The spoilers he called a joke, since they are very small compared to the wing area and have little to no affect on glide path control. Overall, he said the plane is a whole lot of fun to fly, with a top speed of 65 mph, which means it is hard to find a compatible tow plane.

After Wayne finished going through the slides, Ed Wojack showed a series of slides taken at Elsinore and Torrey Pines during the late fifties and early sixties. There was some real nostalgia in them (at least for the editor), and everyone seemed to enjoy trying to determine who or what we were looking at.

Upon completion of the slide show we had the raffle drawing. Bob Fronius won the first T-shirt and George Arauz, a guest and potential new TWITT, won the other. With the drawing out of the way the meeting was adjourned so everyone could take a better look at Wayne's Baby Bowlus he had set up in the entrance to the hanger.

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ADDITION TO TWITT LIBRARY

The following book was donated to the library by Bob Fronius.

Aircraft Material and Processes, George F. Titterton, Pitman Publishing Corporation, New York, 1937.

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AVAILABLE PLANS/REFERENCE MATERIAL

Tailless Aircraft Bibliography
by Serge Krauss
Cost: $20
Order from: Serge Krauss
3114 Edgehill Road
Cleveland Hts., OH 44118

Horten H1c construction drawings with full size airfoil layout. 30 sheets 24" x 36" with specification manual. Price: $115.

Horten Newsletter
Cost: $5 per year for US/$7.50 foreign
Order from:

Flight Engineering and Developments
2453 Liberty Church Road
Temple, GA 30179
(404) 562-3512

FLYING WING SAILPLANE PLANS AND KITS: Two time-proven, 13m homebuilt designs suitable for the novice pilot. Build either the MONARCH "F" ULTRALIGHT (19 to 1), or the PIONEER II-D (35 to 1) sailplane. Info packs $8 each, or $15 for both. Marske Aircraft Corp., 130 Crestwood Drive, Michigan City, IN 46360

The following was found in the **Los Angeles Times** newspaper on about May 4th or 5th. Hopefully someone from TWITT will be able to provide some help.

RESTORING '40s Northrop N9MB Flying Wing, need experienced volunteer woodworkers. Saturday work only. Call David Murray at (818) 369-8056 for details.

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Edward A. Gabriel
1504 Mic-O-Say Dr.
Blue Springs, MO 64015

Sept. 8, 1988

Bob Fronius
TWITT
P.O. Box 20430
El Cajon, CA 92021

Dear Bob,

I am enclosing my check for $18.00 for all past issues of the TWITT newsletter except issues #3 and #26 which I have. Also I have paid the annual dues starting with the August 1988 issue.

I am redesigning and building a Mitchell U-2 to JAR 22 structural criteria and to FAA Glider Criteria. There are several areas that appear to be less than adequate, structurally - particularly the spar shear web. During the Fall/Winter months I will be conducting spar section tests at the University of Kansas to confirm shear web allowable stresses.

I have had the U-2 airfoils analysed by the Eppler code and find very poor aero characteristics with flow separation indicated by lift curve departure from linearity and high drag above C_l=0.80. I will be willing to share my findings of these problems in the TWITT newsletter as time and progress allows.

Do you or your other flying wing enthusiasts out there know of a reflexed airfoil about 19% t/c (or one about 15 or 17% t/c which I could expand to 19% t/c) with max t/c located about 35 to 37% chord, which I could utilize? I would have an aerodynamic analysis done by the Eppler code, if there were no reliable aerodynamic data available. I had thought possibly I will write to Dr. Eppler to ask if he has any suitable airfoils for my purpose. I am stuck with the 19% t/c at this point because I have built most of the wing spar.

I am also increasing the wing span by 4 ft to 38 ft for an 18% aspect ratio increase. Also trying to clean it up aerodynamically. Most important in this respect would be a single main landing gear wheel enclosed in the fuselage instead of the wing mounted tricycle landing gear.

If there have been any U-2s flying out there I would be glad to hear from anyone about their experience. The designer has refused to answer my queries about performance tests, structural tests, design criteria or to comment on my findings from engineering analysis.

About my background: I have been an aeronautical engineer for 28 years, working in aerodynamics, structures and loads in the following organizations: FAA, ICAO and Boeing Vertol. Have a B.S. in AeroEng'rg & M.S. in Air Transport Eng'rg. Long standing member of AIAA, EAA, SSA and SHA. Have Private Pilot license with ASEL and glider rating.

Sincerely,

Ed Gabriel

Ed Gabriel

September 10, 1990

Dear Andy,

'thought I'd better clear up some "loose ends" before the current barrage of work takes me out of commission, especially since the 9/90 TWITT arrived today.

First, I notice that you dug up some Fauvel info. I'm sympathetic to Al Backstrom's desire for Fauvel information; it doesn't seem the easiest stuff to obtain. Unfortunately, having sent him some early AV.10 information from contemporary periodicals (mostly French), I realized that I'd overlooked an obvious English-language source on the Fauvel AV.10: NACA TM No. 794 of 5/36. Entitled "Chief Characteristics and Advantages of Tailless Airplanes", it's a translation of a 1935 work by A. Dufaure de Lajarte, and contains several pages of text on early Fauvel designs, particularly the AV.10, including a page of wind-tunnel model scale drawings. I have included excerpts in this package, and will furnish them to Mr. Backstrom, if he hasn't already read them. Meanwhile, I'd appreciate information on construction dates and flight dates of Fauvel (and other) designs not yet recorded in the expanded appendix to my bibliography.

Incidentally, contrary to what I've heard from some TWITT friends, I've often found tailless aircraft literature in the original language to be the best. Original sources have their advantages, and drawings, curves, specs, and mathematics need little translation. It is also surprising how much you can glean from a foreign text, once you learn the key words and phrases from context.

It was unclear to me whether you need information on both Fauvel texts you printed, so I'll comment on both. The AV.361 info is from Janes. The AV.10 text is a translated excerpt (minus 3 sets of curves) from the notable Fauvel article published in L'Aeronautique, 9,10/36, pp.178-184,205-213, whose title roughly translates as "The Problems of Tailless Aircraft and Fauvel's Flying-Wing Solution". This article seems to be a definitive statement on Fauvel's early work. I'll use your translation as a sort of "Rosetta Stone" to better understand these French articles. If you do know the source of the translation, would you let me in on it? Also, from what documents did the Fauvel and Wortmann profiles and the AV.3 drawings come?

Also included for the library are some really nice drawings of the Westland-Hill Pterodactyl Mks. IB, IV, and V, from The Book of Westland (ca.1943-44?) and furnished to me by Mr. Edward Sharratt of London, Ontario. Perhaps they will reproduce for the newsletter sometime. The XFG-1 specs and 36" wind-tunnel model drawings are from NACA MR No. L5K21 (wartime Rept. L738) and might augment a file with Kevin Renshaw's contribution in the 8/90 newsletter. The SNECMA C-450 drawings are there because I like them. I hesitate to contribute, due to lack of information on your library holdings, but am guessing that you don't have these. The bibliography indicates which items I can furnish...if anyone's interested.

Included too is the promised current supplement to my original tailless aircraft bibliography. Some 200 more hours of work have resulted in Version 1b, which has about 250 more (1750 total) tailless and 25 more (526) related interest entries, a 60% increase in the appendix listing tailless acft. creators and dates (to 174), and a lot of subtle annotative and cross-referential improvements. It lists more books, patents, and early articles, and almost all tailless items ever to appear in Janes, among other things. Cost remains $20.00 (and well worth it). Although the current 25-page supplement can't reflect anywhere near all changes to the original, it includes all additional listings and major revisions. A continually updated printout only, it is available for $5.00 in the U.S.

Finally, enclosed is $33.00 toward the purchase of all TWITT back issues through 2/90. That's it from the wilds of Cleve-berg - until another fit of normalcy sets in.

Cordially,

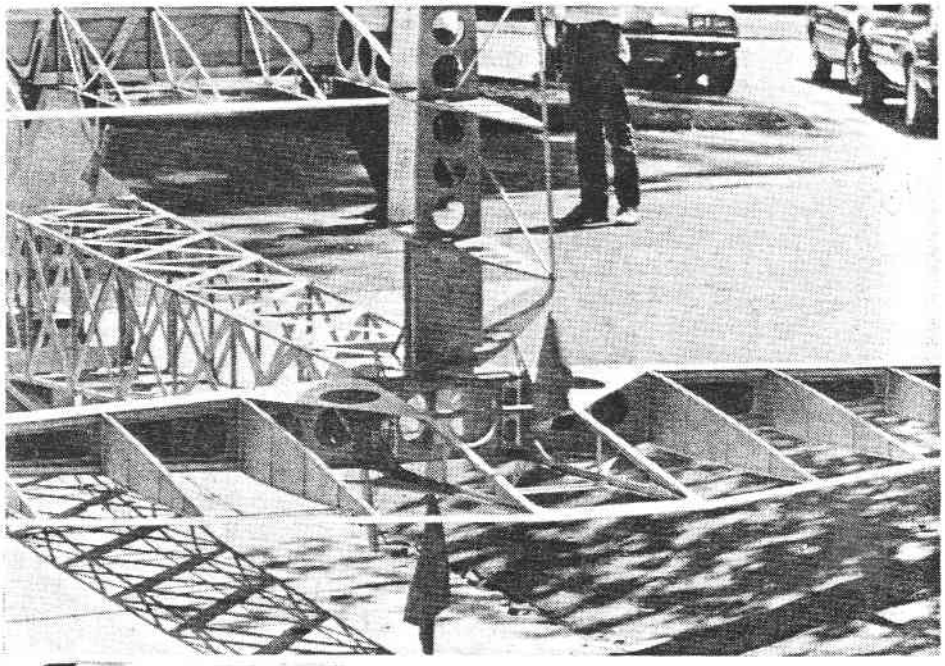
Serge Krauss

FULL SCALE "BOWLUS" UPDATE

Frank gave me a call early this month to say that this would be the first time the various pieces would all be attached (except for the wings). As you can see all of the major components have been fabricated and covering will be under way soon.

This shot is to give a size reference to the fuselage length. The wing pylon acts as a headrest for the pilot.

(Extracted from The Fly Paper, a monthly publications of the Chula Vista Model & Radio Control Club.)



Close up of the tail surfaces show the lightening holes and where the paper is applied across the ribs.

The aircraft uses full flying stab and rudder, all pivot points are hi-grade steel. The wood parts are all fabricated from authentic aircraft grade woods. Light weight and loving craftsmanship evident throughout.

Close-up of the center wing section and wing pylon area.

Frank and Bob donate their time for this effort and the Aerospace Museum pays for the wood and other materials. The aircraft will be test flown prior to it's being placed on display upstairs.

All photos were taken outside the back entrance to the museum bt the editor.

THIS ARTICLE WAS PUBLISHED IN AIR TRAILS - JUNE 1943 AND IN AN AIRTRAILS ANNUAL 1944. ITS THE EARLIEST ARTICLE IN MY COLLECTION WITH A MEASURE OF THEORY AND PRACTICE. Perhaps the later Whirlding is a comment on the value of the slotted elevon – or was perhaps just a lighter way. John Pool.

FLYING WINGS

By Henry Cole

FLYING WINGS REPRESENT THE THEORETICAL ULTIMATE IN AIRCRAFT DESIGN. USE THESE IDEAS, AVAILABLE AFTER A YEAR OF RESEARCH, TO DEVELOP PRACTICAL MODELS.

THE absence of fuselage and tail surfaces makes the flying wing aerodynamically and structurally superior to conventional types of aircraft. Nevertheless, despite these advantages, there have been few successful tailless designs—and yet birds prove that high performance is attainable.

The most well-known among man-made tailless airplanes are Waterman's Arrowbile and, more recently, the Northrop Flying Wing. The development of these planes and the remarkable flights of the birds indicate that further experiment will pay great dividends.

Presented in this article are three basic designs which were developed through glider experiments and bird observation. The many problems which come up in building a tailless model will be discussed so that the reader will have an insight into tailless design and avoid many of the pitfalls of experimentation.

Design No. 1 was selected from a number of balsa test gliders because it showed the greatest stability and could be made to circle very tightly without spiraling in. This enables the model to stay in the slightest updraft and ride the wind like the birds, a great advantage over normal craft. After thorough glider tests, the design was scaled up to Class A size and powered with an Elf single. The symmetrical Davis section and slotted wing tips were the key points of the design.

Test flights verified the stability of the design, but two defects were brought out: (1) the streamlined airfoil induced excessive speeds; (2) the tractor arrangement increased the prop shortage. The model as it stands would make an excellent speed job, but for endurance purposes it is out of the question. The model could be slowed down by building it larger and decreasing the wing loading, or by using a high-lift wing with washout.

Design No. 2 shows the changes which were made to produce a slower model. The use of a high-lift section insured a high positive pressure, but also induced a diving moment. Rather than turn up the ailerons to excessive angles for control, the diving moment was compensated for by varying the airfoil section and by incorporating a slight washout. Note that the forward section is the very-high-lift Davis No. 5 which gradually changes to a Clark Y near the tips. This produces a moment which counteracts the airfoil diving tendencies. (The principle is analogous to the lifting stabilizer.) With this arrangement the center of gravity must be moved back, and a high-aspect ratio must be used to minimize the center pressure movement in any one section. The slight washout is built in by making the dihedral break at a five-degree angle.

Two models of this design were built and flown, one a rubber job, and the other an Elf-powered gas model. For the length of motor, the rubber model turned in remarkable performance, averaging over a minute and thirty seconds. Approximately thirty flights were made with the gas model, and although it was much slower than Design No. 1, it was still too fast. The model made a number of good flights, but was far from consistent, a defect which may be attributed to structural weakness of the high-aspect ratio wing. The wings could actually be seen to flutter in flight and on one occasion broke in midair. However, tests were encouraging on the whole, and the model showed tendencies toward a fast climb and exceptional glide. A larger model with a low wing loading should turn the trick. The one weakness of the model was its slow stalling angle. A slot like that used on No. 1 would eliminate this undesirable characteristic and add much to the stability of the design.

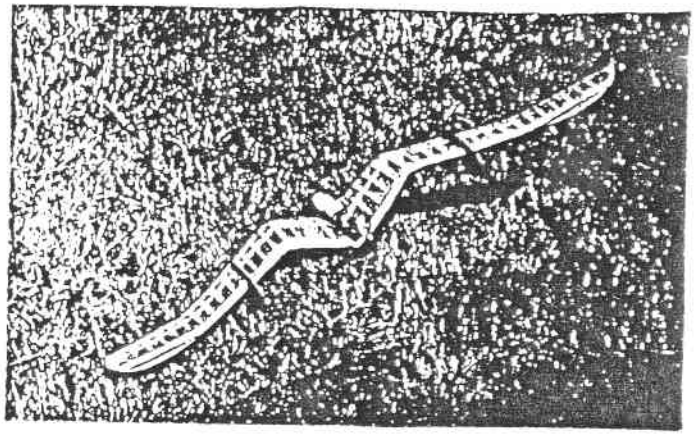
Design No. 3 came directly from the birds. Through careful study of the seagull and the albatross, several new principles were discovered: (1) the flexible slotted-tip aileron, (2) the dihedral-chord relationship. The flexible tip aileron when used in connection with gull dihedral increases lateral stability by decreasing the pressure at the tips in the side slip. The spring adjustment is quite sensitive and is not advised for everyday flying. The ailerons should, instead, be locked at the proper setting. The dihedral-chord relationship on the model increases lateral and longitudinal stability. In simple terms it is the ratio of the chord to the height above the center line. Note how the chord is largest at the high point and decreases progressively in the lower sections. The albatross section used was developed through observation of the albatross as applied to the Davis airfoil formulas. Tests indicate that it is a stable section and possesses a higher lift than other stable sections of the same thickness. It has many of the characteristics of some of the N. A. C. A.'s far more us five-numbered series.

This page thanks to Dave Baker

At present the model has been tested only with the high start. With two strands of $^3/_{16}$" rubber twenty-five feet long and seventy-five feet of towline, the model shoots skyward at a fast rate, releases and sets into a slow, steady glide. The whole flight is exceptionally smooth and the model soars with all the grace of a bird. The consistency of the flights indicates that the design will make a good gas model. (The plans show the top view drawn flat for construction.)

The elements of tailless design are based primarily on three factors.

Longitudinal stability is mainly dependent upon the type of airfoil used. With stable sections a very consistent model can be produced with only small amounts of sweepback and washout. Note how little sweepback was necessary on No. 3. Some good stable sections are: N. A. C. A. M—6, U. S. A. 27, and the albatross section presented first in this article. With high-lift sections more sweepback and washout must be used in connection with high-aspect ratios. Good sections are Clark Y, Eiffel 400 and Davis No. 5. Variation of the airfoil as used on No. 2 is best when using high-lift sections.



The rubber version of this design produced flights of over a minute and a half. It proved slightly tricky as a gas job; the wings were found too weak.

On all tailless models a small amount of washout is necessary. Adjustable tip ailerons are the best way to get this effect, for the framework often twists with the tightening of the covering and any built-in washout is lost. The most effective way to get longitudinal stability is with a large slotted aileron as used on Design No. 3. Small deflections give the desired effect and have the advantage of low drag.

The exact position of the center of gravity is best determined by experiment. Many glide tests should be made, first with a low wing loading and later with a high wing loading. Any radical changes with the C. G. should be noted and their cause determined. ☞ 7

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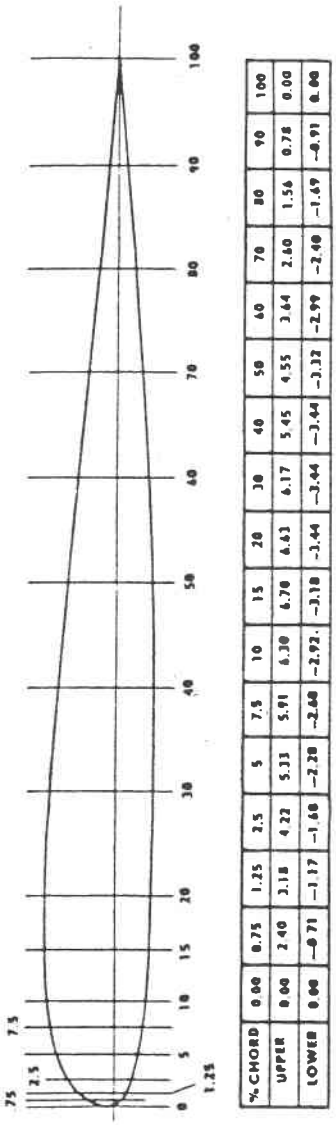

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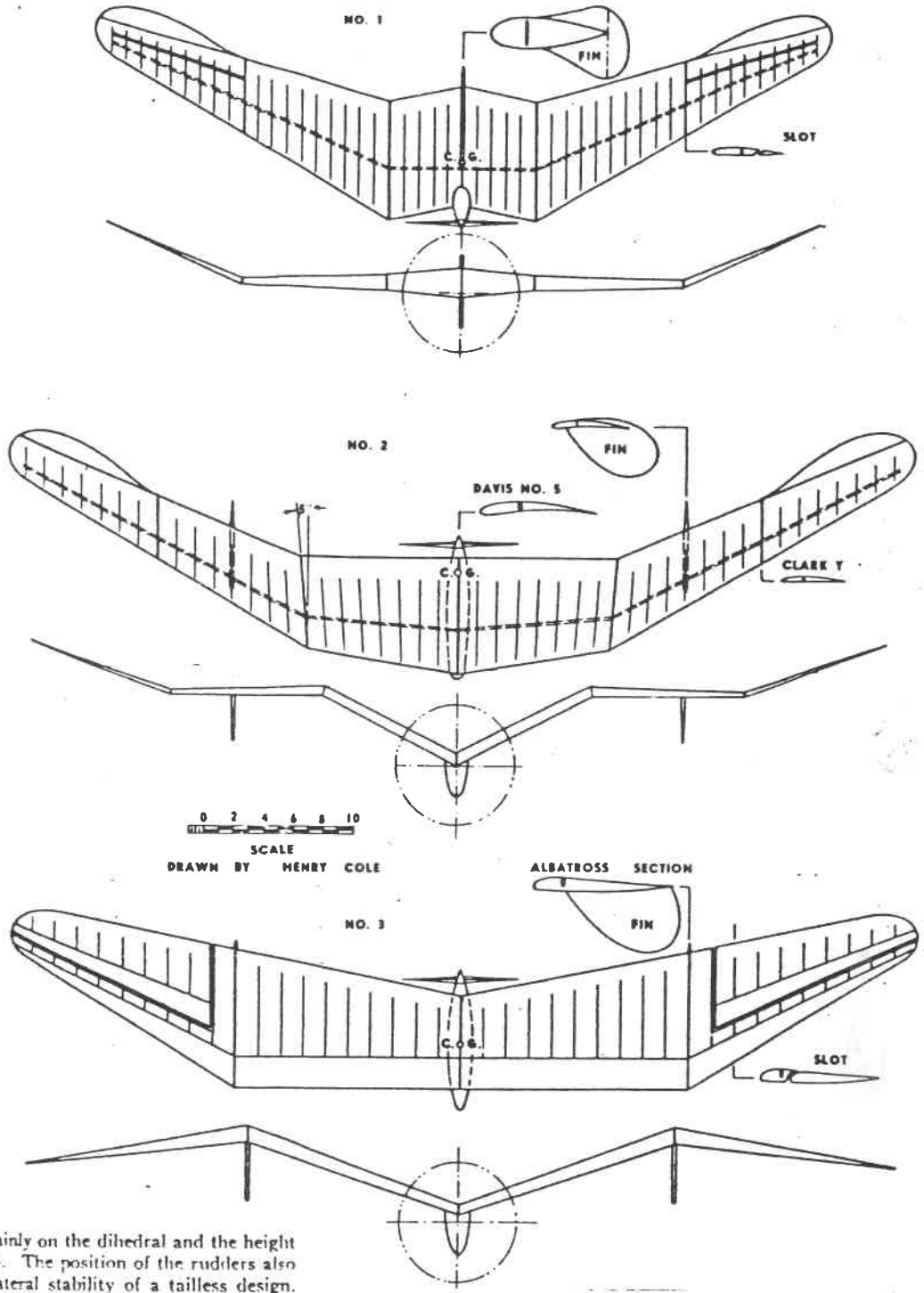
UPPER	0.00	2.40	3.18	4.22	5.33	5.91	6.30	6.70	6.63	6.17	5.45	4.55	3.64	2.60	1.56	0.78	0.00
LOWER	0.00	−0.71	−1.17	−1.68	−2.28	−2.68	−2.92	−3.18	−3.44	−3.84	−3.44	−3.32	−2.99	−2.40	−1.69	−0.91	0.00



Lateral stability is dependent mainly on the dihedral and the height of the center of lift above the C. G. The position of the rudders also has a pronounced effect on the lateral stability of a tailless design. Note that on all three designs rudders at the tips have been avoided because it was found that they have a detrimental effect upon spiral and lateral stability. In deciding upon the dihedral, the importance of keeping the center of lateral area low should be considered, for it determines the spiral characteristics of the airplane. In addition, excessive dihedral induces the plane to rock, causing great loss in efficiency.

Design No. 3 is a perfect example of keeping the C. L. A. low and yet incorporating sufficient lateral stability. The dihedral-chord relationship builds up a high pressure at the peak and the gull tips keep the C. L. A. low. The result is a stable model with smooth flying characteristics.

Directional control is one of the greatest problems of tailless models. Since the rudders must be placed close to the C. G., the directional moments are small unless billboard-sized rudders are used. The best solution is to place the rudders where they will be most effective without changing the lateral stability. In the case of a tractor (Design No. 1), the rudder should be placed directly in the slipstream with most of the area below the wing. In the case of pushers, the rudders must be placed outboard on the wing. It was found that the area above the wing has practically no effect, so the rudders should be placed entirely underneath the wing. The most effective place is at the points of high pressure. On No. 2 the rudder is placed on the flat section of the dihedral. The ideal setup is on No. 3, where the fin is at the high-pressure point at the peak.

Possibly sufficient directional control can be obtained by using extreme sweepback and depressed tips as on the Northrop, but the loss of lift due to sweepback is not worth the little extra drag of auxiliary rudders. The position of the C. G. is important for directional control; the most trouble will be experienced with tailless models using high-lift airfoils which require that the C. G. be moved back.

To present a complete and absolutely accurate report on a highly experimental type like the tailless design would not be possible at this time. The three designs and the discussion on stability should serve as a guide to the inexperienced designer. The increase in performance from Design No. 1 to Design No. 3 indicates that the basic

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This page thanks to John Godden

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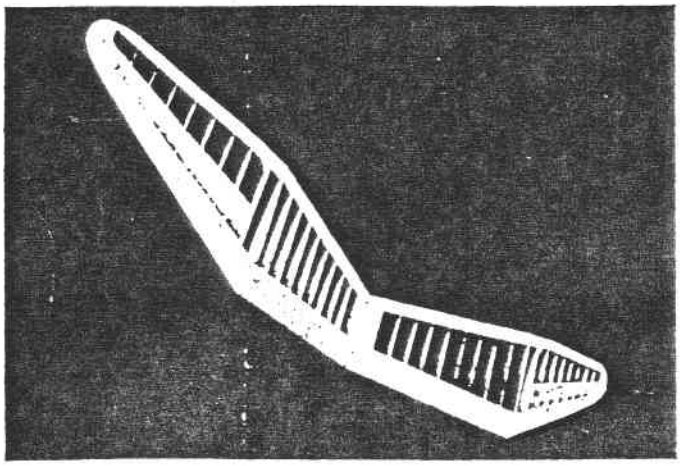
ideas are sound and will eventually lead to models as efficient as the birds.

Model builders should have no illusions about developing a super contest model of this type under the present AMA rules. Conventional models are allowed a large stabilizer upon which no loading penalty is placed. Consequently, the surface loading required is twenty-five percent less on conventional models. Therefore, it is suggested that for comparison tailless models should be built with a six-ounce-per-square-foot wing loading. All of the designs presented should be scaled up for contest flying.

At present the tailless design does have two fields of possibility in competition, as a towline glider and in control-line speed contests. It is hard to understand why it has not been developed in these fields before, for the tailless design presents the ideal setup for soaring, the ideal setup for speed. The following recommendations can be made: No. 1 for speed; No. 2 for powered endurance models; No. 3 for towline and high-start gliders. Remember that No. 2 should be scaled up and the wing loading kept to 6 oz./sq. ft.

A complete explanation about adjustments would be too lengthy; it is advised that the builder experiment with small gliders before building the larger models. In short, the procedure is to turn the ailerons slightly up and add weight to the nose until a smooth glide is obtained. The ship is then power-flown and stalls, dives, or turns are ironed out with thrust adjustments. For towline gliders, the rudders are set for the desired turn and the towline hook is set to one side so that the model tows straight. The high-start glider should be tried by all model builders. With a well-stretched line, the model starts out at tremendous speed and climbs high overhead before releasing—and all of this without running or cranking the motor.

The next time you see a bird soaring high overhead, watch its slow, majestic flight and see how truly remarkable it is. Essentially a tailless model, the bird is the perfect flying machine, representing the goal which we seek.



No. 3 design is recommended by the designer as adaptable for towline or hy-start gliders. Slotted aileron was found to greatly increase the model's stability.

BILL DARROW SENT THE POEM. RATHER SUMS UP THE STATE OF TAILLESS LITERATURE.

THE BLIND MEN & THE ELEPHANT
A Hindoo Fable

It was six men of Indostan,
To learning much inclined,
Who went to see the Elephant
(Tho' all of them were blind),
That each by observation
Might satisfy his mind.

The First approached the Elephant
And happening to fall
Against its broad and sturdy side,
At once began to bawl:
"God Bless Me! But the Elephant
Is very like a wall!"

The Second, feeling of the tusk,
Cried, "Ho! What have we here,
So very round & smooth & sharp?
To me tis mighty clear.
This wonder of an Elephant
Is very like a spear!"

The Third approached the animal,
And happening to take
The squirming trunk within his hands,
Thus boldly up and spake:
"I see," quoth he, "the Elephant
Is very like a snake!"

The fourth reached out an eager hand,
And felt about the knee.
"What most this wondrous beast is like
Is mighty plain," quoth he;
"'Tis clear enough the Elephant
Is very like a tree!"

The fifth who chanced to touch the ear,
Said: "E'en the blindest man
Can tell what this resembles most;
Deny the fact who can,
This marvel of an Elephant
Is very like a fan!"

The sixth no sooner had begun
About the beast to grope,
Than, seizing on the swinging tail
That fell within his scope,
"I see," quoth he, "the Elephant
Is very like a rope!"

And so these men of Indostan
Disputed loud and long.
Each in his own opinion
Exceeding stiff and strong.
Tho' each was partly in the right,
And all were in the wrong!

- John Godfrey Saxe

This page thanks to John Godden

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