No. 121 JULY 1996

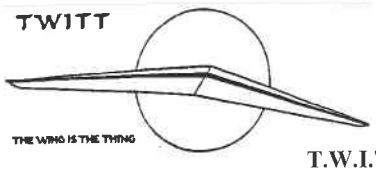
T.W.I.T.T. NEWSLETTER

10th ANNIVERSARY GALA CELEBRATION

T.W.I.T.T.
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., **9607** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, July 20, 1996, beginning at 1330 hrs at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - East side of Gillespie).



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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60oz/60	21.75	30.25	21.75

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

I can't believe it has been 10 years (as of last month's newsletter issue) since TWITT first became as an idea and dream of three or four aviation "nuts". It has been both a bumpy and a smooth ride over the years as the initial group struggled to keep it going and produce a newsletter. They did manage to make it grow and in the process got some worldwide attention bringing in members from both the European and Pacific regions.

A decade of newsletters and programs is something to celebrate so we will be having a party at the July meeting. If you haven't been to a meeting in a while, please try to come out for this one, partly for the birthday party and mostly because we have a very good program (see the next page).

I must apologize for not getting on top of the library listing and newsletter index since my last column. I have been busy getting my last kid into college in Arizona and it seems to be a never ending process, both financially and physically. I will get on it this month and try to have some information next month (promise).

I will do my soapbox duties again for the SHA Labor Day Workshops at Tehachapi over what else but the Labor Day weekend. There are some preliminary activities on Friday with the formal workshops being conducted on Saturday and Sunday. Saturday evening there is an auction of anything that has to do with aviation which has been donated for the cause. Sunday night features the big barbecue type dinner and Monday's event is an association meeting as well as the final wind-down of the flying. You should try to spend at least one day at this event sharing your ideas and seeking new ideas from others who are interested in building sport aviation type aircraft.

Now for my other soapbox. Here we are into the middle of summer and I still haven't seen any photos or had any stories about how all those winter projects turned out. This goes for you modellers and full size guys alike. Please help us share your experiences with other members so they don't have to re-invent the wheel trying to learn something you already know. So break out those cameras and pens and go to work.

Andy

JULY 20, 1996 PROGRAM

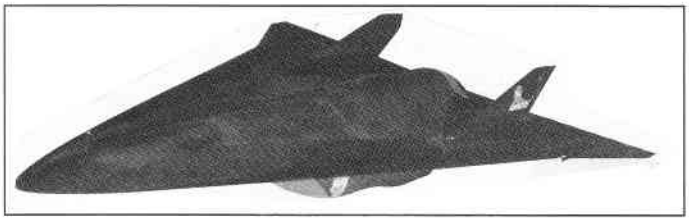
COME JOIN US FOR A PARTY

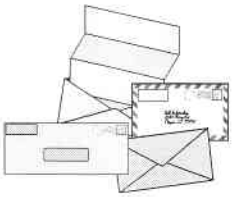
The program this month will feature **Bruce Hinds**, one of the Northrop B-2 test pilots. His presentation will give us an overview of the B-2 program, some of the technical data surrounding the aircraft and a couple of short videos. He has also indicated he will field our questions, so this will be your chance to quiz an expert on what makes a good flying wing.

Bruce has over 12,000 hours of flying time gathered over a 31 year career as an Air Force pilot and development project manager for private aerospace companies. He has flown at least 68 different types of aircraft ranging from single seat fighters to multi-engined cargo and bomber aircraft. His resume indicates he has been involved in many of the Air Force's unique projects like the C-5 Minuteman Airborne Launch (an alternative to having missiles in silos by rolling them out the back of a C-5 and then igniting the missile during a controlled descent) and the C-130 Fulton Air Recovery System (snatching people off the ground by capturing a cable suspended from a balloon and connected to a special suit that carried the person).

We are also expecting a visit by Brig. Gen. Robert Cardenas who was one of the Air Force test pilots for the XB-49 and a previous TWITT speaker. He has indicated the meeting would also be attended by Jim Logsdon who is a well known aviation historian. He is currently working with the Flight Test Historical Foundation in putting together a museum at Edwards Air Force Base featuring milestone aircraft and pilots through models and placards. It is our understanding that he may be agreeable to answering some questions about his experiences and other historical issues.

Don't forget this will be our Tenth Anniversary party and we will be having cake and ice cream to mark this milestone in our aviation history.





LETTERS TO THE EDITOR

June 1, 1996

TWITT:

Concering my money, I hope it arrived. My next U.S. visit is planned for November.

In regards to Newsletter 119, here is your desired translation.

Radienreinrassiges N1 - A Radius is a Radius - Reinrassig means Pedigree (if it is a dog), Throughbred (if it is a horse) and Arian (if it is a German). So I think we best stick to horses and call it a Radiusthroughbred N1!!!

Aug der Basis von 5 Radian - Based on 5 Radii

Ausgehend von der fliegenden Sichel - Based on the flying Sickle

des Hollanders aus Arnhem - Of the Dutch man from Arhem (I think even they did not know his name)

Des Flegenden Hollanders in Sichelform - Of the flying Dutchman in the form of a sickle.

The text in the upper right hand corner means:

Stabilisierender Teil - Stabilizing Part
Uebergang - Transient Part
Tragender Teil - Lifting Part

Hoping this is your questions resolved and announcing soon some news about Swiss-TWITTS.

Sincerely yours,

Thomas Bircher

(ed. - First let me thank you for your subscription renewal. It is always nice to hear from you and we will be looking forward to more news on what is happening with flying wings in Switzerland.

Also thanks for the translation items. By now you have seen the June Newsletter and found that Gunther Rudat also sent us about the same words, but I do notice it seems difficult to bring it over into a smooth English flow of words.

A side note for Gunther - I haven't forgotten your videos, but there have been some problems with the copying equipment that will be overcome presently. The tapes will be air mailed to you to expedite delivery.)

June 10, 1996

TWITT:

Here is my check to replace the one that got lost.

My interest in flying wings is mainly in radio controlled models. I currently have two flyable, a

Wind Freak and a Genesis, both gliders. Late last fall I finished a semi scale Cutlass and a Klingberg Sport Wing. We ran out of weather before I had a chance to test them.

At present I am building a new fuselage for my Robbe Vampit to covert it to a powered model.

Back in 1938 my dad started building a series of free flight tailless gas models which flew very well. This is where my interest in flying wings started.

Sincerely,

Bud Manning

(ed. - Thanks for the renewal, and I hope you are finding enough material geared toward the modeller in the newsletters. I guess we should also thank your dad for getting you interested in flying wings to the point you wanted to stick with it and join TWITT.

The Genesis is produced by a company right down the street from the TWITT hanger, whose late owner was also a member of TWITT. The company is now run by his wife and I believe they still offer the Genesis in their catalog if anyone is interested.)

June 1996

TWITT:

I have started construction on my third flying wing in the last eight years. All of them have been designed for slope soaring. I know of only the basics of flying wing design, and I think it is time for me to learn a little more theory.

Enclosed is a check for $27 for a years subscription (I am not sure how much to send due to the fact I have a year old add for TWITT. If this is too much money, just send me some back issues, thanks.

Here is the top and side view of my design which is based upon a 1939 German experimental aircraft. I use this sweptback/sweptforward wing platform on all my designs. I chose an undercamber airfoil for slow flying and good thermal characteristics. The height of the fuselage is over 12" therefore not a real penetrator. I am very interested at this time on control surfaces, if you have any back articles please send them to me. This plane is about 85% complete.

Wingspan	82"
Wing Area	880 sq. in.
Airfoil	Undercamber-Reflexed
Construction	Balsa

Michael St. John
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Long Beach, CA 90807
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(ed. Thanks for your new subscription, and by now you should have received some back issues from the extra money. We are glad to have you aboard, and hope you will find the information you are looking for in the newsletters.

If you have some specific questions about control surfaces, or would like to make a proposal on how you think one might work better, please submit it to us for publication. This is the best way to get information that is relevant to your needs as some of our members will offer their expertise.)

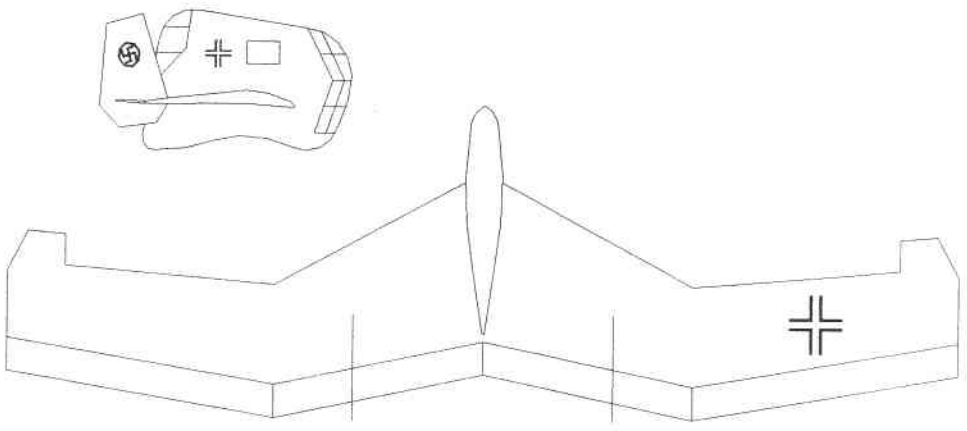
BOOK REVIEW

Dear Andy,

I recently completed my review of Bruce Carmichael's book Personal Aircraft Drag Reduction. I am attaching the text file to this message in the hopes that you will want to publish it in the TWITT Newsletter.

Regards,

Marc



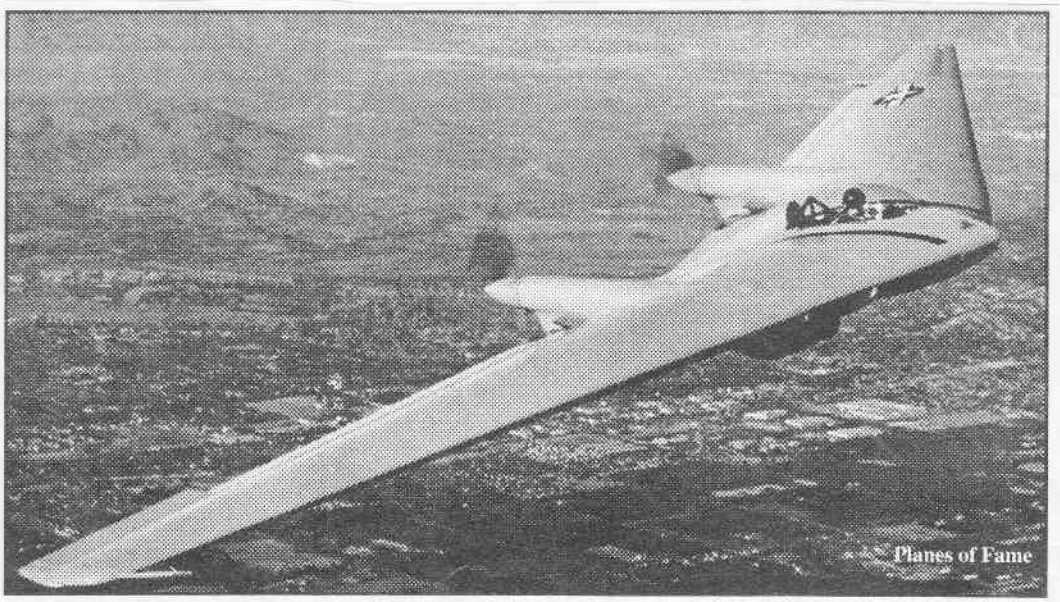
Personal Aircraft Drag Reduction

by Bruce H. Carmichael

(Published by the author, 34795 Camino Capistrano, Capistrano Beach, California 92624, USA: 1995) 195pp, 195 illus., 26 tables, refs Photocopy, 1/c, Velobound. $25 post paid in USA, $28 Canada, $33 Western Europe, $35 elsewhere.

Reviewed by F. Marc de Piolenc [mdep@thegroup.net]

This reviewer has spent a good deal of time searching for a better title for this book, since limiting its application to personal aircraft seems to deny its much wider usefulness. This compendium of aerodynamic design guidance (and rare, sometimes unique data) by a widely recognized authority in the field deserves a more sweeping title.



THE UNIQUE N9M flying wing from The Air Museum Planes of Fame

(Source: Pacific Flyer Aviation News, Section B, June 1996, page B15, photo by Chuck Stewart.)

True, it does emphasize low-subsonic Mach numbers and low to medium Reynolds numbers, and discussion of powerplant installation drag is limited to air-cooled piston engines, but the sophistication of some of the aerodynamic drag reduction techniques is well beyond the skill of most personal aircraft builders. This book is (with the exception of one acknowledged omission) a design manual for the ultimate low speed, high efficiency airplane, if the designer chooses to use it that way. It is in any case much more than a set of cookbook recipes for a cheap weekend flier. A military contractor working on a long endurance, high altitude reconnaissance air-plane will find material useful to him, as will designers of pylon racers, CAFE competitors and others who are fighting installed-power restrictions or seeking the ultimate in aerodynamic performance.

The organization of the book reflects the author's cognomen of "Mister Low Speed Aerodynamics," his long standing interest in laminar flow design and his determination to apply to flight articles concepts thought by many to be laboratory curiosities.

Beginning with a historical review of research aimed at enhancing external laminar flow completed by an interpretation of trends in this field, the author goes on to offer examples of actual, flying aircraft incorporating drag reduction techniques that he advocates. There follows a section entitled "Drag Concepts" explaining the various tools available to the designer for measuring, comparing and estimating drag. While the rest of the book emphasizes reduction of parasite drag, this section necessarily considers the contribution of induced drag to the total drag of an airplane, both to give a complete picture and to give the reader an idea of the relative gains from reducing one or the other type of drag.

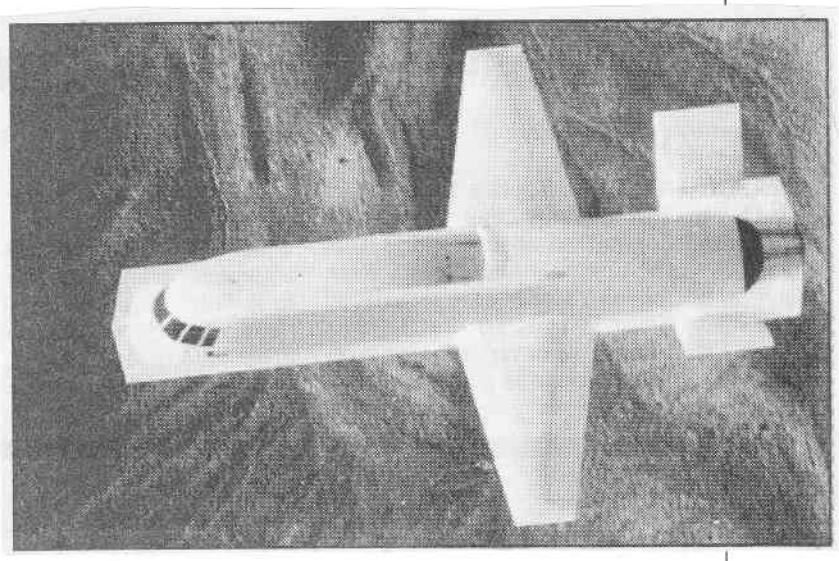
"Some Performance Considerations" defines a Universal Performance Function, considers the effect of drag reduction on the top speed of both propeller- and turbojet-driven airplanes and considers the "climb-out problem."

This is followed by a compendium of laminar flow `wing experimental data, prefaced with a discussion of the significance of Reynolds number and a comparison of theoretical airfoil drag prediction to wind tunnel results. This section covers only "natural" laminar flow, achieved by shaping the airfoil section for the longest possible "run" of favorable pressure gradient. The following, brief section covers all-laminar wings, where laminar flow is maintained artificially by suction. The author then briefly discusses the influence of three-dimensional effects on wing performance and the design of high lift devices. A wing optimization study then compares the minimum drag area of a reference aircraft with flaps and without flaps.

The section that follows contains data unique to this book. It concerns low drag bodies suitable for use as aircraft fuselages, and capable of achieving long runs of laminar flow. Again, theoretical considerations are followed by masses of experimental data on low-drag bodies culled from the author's extensive work in this field. Surprisingly, the effect of body shapes on static aerodynamic stability is also considered in two sub-sections on body yawing and pitching moments. All-

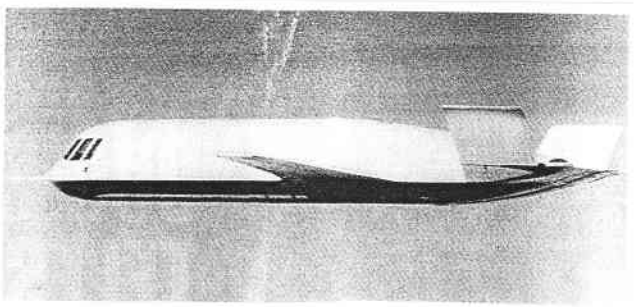
laminar bodies using suction to stabilize the laminar boundary layer are briefly considered. The section ends with a body drag optimization study based purely on natural laminar flow.

Tail surfaces are considered next, primarily from the point of view of minimizing control surface profile and parasite drag. Trim drag (the induced drag of the stabilizer or fin) is considered here only briefly. The thrust of the section is to guide the reader to a stabilizer design of minimum surface area and thickness.



ABOVE & BELOW: Tacit Blue early prototype used for stealth technology research. It's 55' long with a span of 48'. Air Force file photo.

The author then delves fearlessly into an area of aerodynamic design with a high voodoo content - component interference drag. Drawing on his own experience, Carmichael assigns it firmly to the parasite drag category, contradicting some eminent authorities. Having defined the source of the drag, he justifies his assertion by reference to experimental data and lists the many successful remedies applied. He also discusses one obscure and intriguing example of favorable wing-body interference.



The next section, on cooling drag, is perhaps the most frustrating to the reader. On the one hand, the author claims that a large portion (10%-30%) of engine power is consumed in keeping the engine cool, as against the 2-4% theoretically required, suggesting that great gains could be made in this area. He then disclaims experi-ence in abating cooling drag and offers a brief discus-sion of inlet and exit design, a cursory discussion of internal flow losses, and eleven references. The author's discussion centers on air-cooled engines with conventional cooling arrangements, but some of the references include treatment of liquid-cooled engines and the use of exhaust-driven ejectors to induce cooling air flow.

"Practical Problems and Solutions" covers the problems that face constructors attempting to realize long runs of natural laminar flow in real aircraft. It is as satisfying, despite its brevity, as the preceding section was frustrating. Here the author's rare combination of theoretical understanding and practical experience combine to make a rare treat for the reader. After the usual discouraging exposition of the influence of waviness on flow transition on a flat plate, he presents the results of flight experiments at Northrop that clearly showed that real flows over actual airfoils are less sensitive to waviness than flat-plate data would indicate. What is more, the trend with increasing Reynolds number shows allowable waviness decreasing less quickly than for flat plates. Both findings provide solid encouragement to builders. More valuable and equally encouraging data on steps and gaps put natural laminar flow design squarely inside the realm of practical construction, even - with great care - on metal wings.

"Adverse Influences in Flight" discusses the influence of tractor propeller slipstream, noise and vibration, atmospheric turbulence, icing, rain and insect contamination on the performance of laminar light aircraft.

"Refinement through Flight Test" picks up where most design texts leave off. Answered here is the question of what to do when a new airplane's performance does not meet expectations. As one might expect of a long-time soaring pilot, the flight test methods presented emphasize zero-propeller-thrust (engine running) glide tests and gliding tests with the cooling system sealed. Also covered are flow visualization tests using tufts or oil films. The references in this section are especially numerous, varied and useful. The techniques are well within the reach of serious and careful amateurs.

In "Conceptual Laminar Flow Design," all the foregoing considerations are reviewed and their influences on design considered. Two aircraft - one actual (Ed Lesher's Teal) and one conceptual (Lars Gietz's Vmax Probe, currently under construction) - are used for illustration. The author presents a full drag "buildup" (estimate) for Gietz's machine, then compares it with actual figures from the Teal, taking into account differences in design and design goals.

The final section is not about laminar flow at all. It concerns Fabio Goldschmied's ingenious and

controversial proposals for large suction bodies that achieve staggeringly low drag with fully developed turbulent flow. On such bodies suction actually increases skin friction drag, but also lowers the pressure drag of the body. (At higher suction flows, the "drag" becomes negative, i.e. the flow control system becomes a wake-ingesting propulsion.) The Griffith airfoils get a similar, illuminating discussion.

Summing up impressions of this book, disappointment in the cursory treatment of cooling drag is balanced by relief at the author's reluctance to pontificate outside his avowed fields of competence. This book, plus selected references, should provide an alert designer having a basic knowledge of aerodynamics with a solid "core curriculum" in high efficiency, low speed airplane aerodynamic design. What is deeply regrettable is the crudeness of the book's typesetting, page layout and printing. The text is output on a dot matrix printer in a two-pass, blocky sans serif face that is very difficult to read. The illustrations are pasted in, not scanned. The line drawings, most of them prepared or replotted by the author, are clear and well organized. Unfortunately, photos and heavy solids are not halftoned, making many photos unreadable (e.g. tuft and oil film flow visualization photos). The book is "printed" on a high speed electrostatic copier and velo-bound. One could reasonably ask for better quality than this, as desktop publishing equipment and software are now within easy reach of most. In particular, an adhesive binding that could open and lie flat would have been welcome, and would have added nothing to the cost of the book while enhancing its readability.

Considered only as a compilation of research data, this book is a bargain when its price is compared with the cost of finding the data. It would be difficult to assign a dollar value to the author's lucid exposition of theoretical concepts, his insights into the data, his well-organized and well-labeled plots and graphs, and his care in making the book "amateur-friendly" by avoiding the use of formulas. Fortunately, we don't have to, as these features can be considered free supplements to an excellent compendium.

(ed. - The timing here is just great since there was a biography of Bruce in the May 1996 issue of Sailplane Builder, by Janice Hagen-Armstrong. I have taken portions of it to give our readers a better understanding of Bruce's credentials for writing such a book.)

Bruce attended and graduated from the University of Michigan with a degree in Aeronautical Engineering. Following graduation he went to work at aircraft companies first on the east coast and then later heading west. While on the east coast he was employed by Chance Vought Aircraft where he worked on the XF-7U1, a tailless, twin jet fighter which was the first plane to achieve .9 mach in level controlled flight. When Vought moved to Texas so did Bruce. While there he met Wally Wiberg and took some flying lessons from him and Al Backstrom. He also became acquainted with Gus Raspet at a 1949 sailplane contest, which would prove to be a key connection later.

Bruce left Texas for Akron, Ohio, taking a position with Goodyear Aircraft where he worked on the Drake Amphibian, a navy missile, and a tow target. It was at this time that Raspet invited Bruce to join his research staff in Mississippi. While at Starkville he participated in aerodynamic flight research using war surplus TG-3 sailplanes. (ed. - I believe Bruce also had some exposure to the Horten flying wing that was also being tested by Raspet.) This work in boundary layer control resulted in Bruce heading west and beginning work with Dr. Pfenniger at North Base, Muroc, CA on jet aircraft.
Bruce worked on the F-94A doing suction boundary layer control research, and some work on wind tunnels.

At this point Bruce deviated from airplanes for a while by working on things that traveled underwater (fluid dynamics). He applied his aeronautical engineering principles of drag reduction to things like torpedoes and sonar housings. (ed. - As Bruce demonstrated during a talk for TWITT, laminar flow is laminar flow whether it is air or water.)

Bruce's last 27 years of working for a living were with North American Rockwell from which he retired in 1989.

He is the President of the Sailplane Homebuilders Association (SHA) and is extremely active in the organization. He has been a strong supporter of TWITT ever since its founding 10 years ago and has been a fountain of knowledge for many of its members. Along with his book on drag reduction, he has started on another technical book on the aerodynamics-dynamics of model aircraft.

LIBRARY ADDITIONS

From Alex Kozloff comes this piece:

"Semi-tailless Aircraft", Aerospace Engineering, May 1996, pp. 25-29, from information provided by Brian J. Tipton and Dudley E. Smith, School of Aerospace and Mechanical Engineering, University of Oklahoma.

This is an analysis of "scissor-tail" aircraft configuration based on the BV-208.P3 aircraft designed by Dr. Ing. Richard Vogt during the later half of WWII. The scissor-tail configuration results from moving the conventional tail surfaces out to the trailing edge of the wing tips with a boom type structure as a fairing for the junction.

The article discusses the various theories of this application and has numerous charts and graphs of the potential performance figures.

From Chris Tuffli comes these pieces from unknown sources:

"Revealed Stealth Demonstrator". A short article on the Tacit Blue experimental aircraft that was recently de-classified by the Air Force. It was built by Northrop and flown in the early 1980s as a test bed for stealth technologies and materials. Although the aircraft and its mission were later dumped by the Air Force, the information gathered during some 135 test flights were of great value in designing the B-2 and F-22. (Also included was another similar, but smaller article from The San Diego Union Tribune, May 1, 1996.

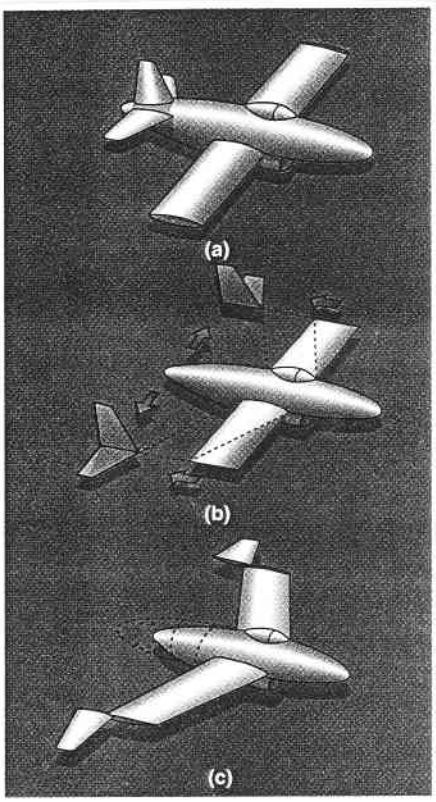


Figure 1. Transformation to "scissor-tail" configuration.

"The Plane That Learns". A short article on a 23' long subsonic model of a Mach 5 "waverider", an airplane that rides its shockwave like a surfer riding a crest. It is wedged-shaped with a blended wing and body (sounds like a flying wing). Control at both high and low speeds for this type aircraft is one of the major problems and is being solved through the use a system based on neural-net computers. This net will learn as it goes and adapt the controls to overcome problems during flight. This research could be used to help damaged aircraft land safely since it would compensate for inoperative controls.

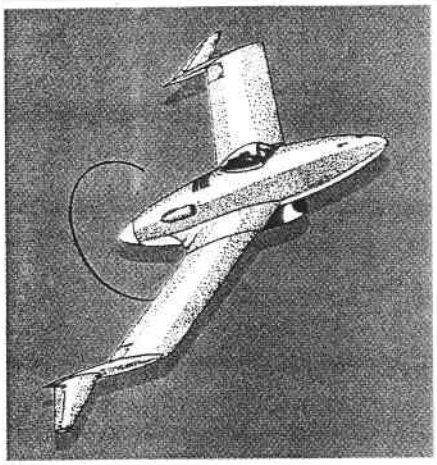


Figure 6. BV-208.P3 isometric view.

"Autonomous Flight:. Picture and trailer on the Darkstar reconnaissance drone built by the Lockheed-Martin Skunk Works. The shape has been shown in previous newsletters, but it is basically a flying wing with a strake type fuselage.

AVAILABLE PLANS & REFERENCE MATERIAL

Tailless Aircraft Bibliography

by Serge Krauss

4th Edition: An extensive collection of about 2600 tailless and over 750 related-interest listings. Over 15 pages of tailless design dates, listing works of over 250 creators of tailless aircraft, and the location of thousands of works and technical drawings for the Ho 229 (IX), Me 163, & Me 262.

Cost: $23 (Domestic)
$32 (European destinations)
$35 (Asia/Australia destinations)

Order from: Serge Krauss
3114 Edgehill Road
Cleveland Hts., OH 44118

Tailless Tale, by Dr. Ing. Ferdinando Gale'

Consists of 268 pages filled with line drawings, tables and a corresponding English text. It is directed towards modelers, but contains information suitable for amateur full size builders. Price is $38, postage and handling included (also applies to Canada and Mexico).

You might also want to purchase his new book **Structural Dimensioning of Radioguided Aeromodels,** priced at $18.00.

On The Wing...the book, by Bill and Bunny Kuhlman

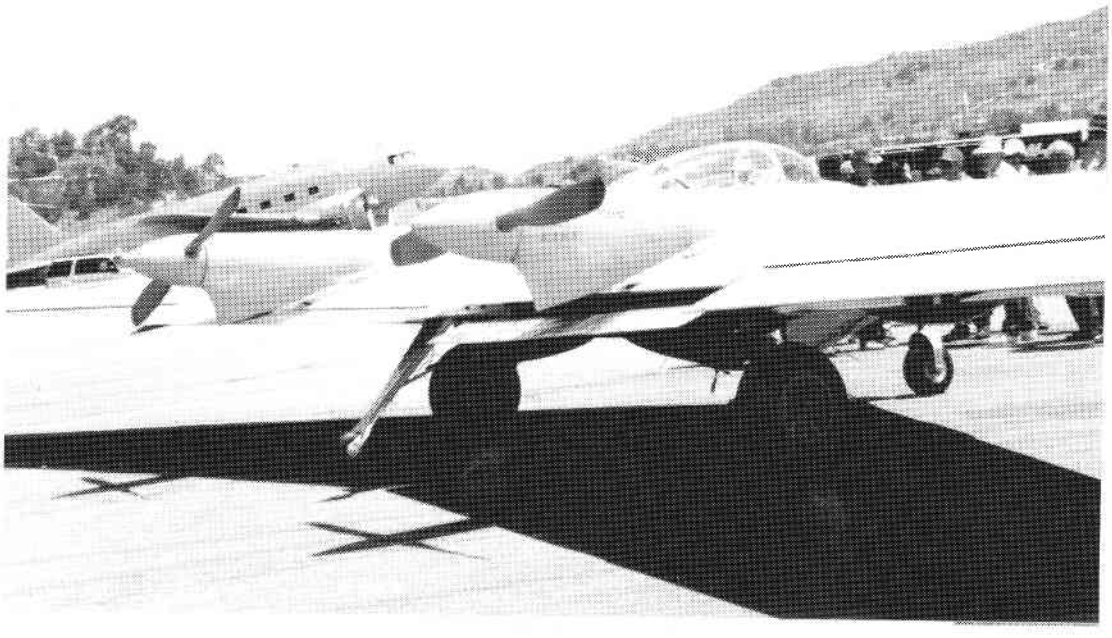
(B^2) is a compilation of their monthly column that appears in RCSD. Many of the areas have been expanded and it includes coding for several computer programs to determine twist and stability. Priced at US$28.00.

All these are available from B^2 Streamlines, P.O. Box 976, Olalla, WA 98359-0976, or (206) 857-7249 after 4pm Pacific Time. Orders shipped elsewhere will be sent surface mail unless an additional $10 is included to cover air mail postage. Washington residents must add 7.5% sales tax.

Personal Aircraft Drag Reduction, by Bruce Carmichael. This 207 page, soft cover, 8½ x 11" book starts with a

ABOVE: Right front view of the N9M while on display at Gillespie Field. Note the location and shape of the engine cooling inlet and the extreme forward position of the nose gear. Photo by Bob Fronius.

BELOW: View of N9M from the right rear showing the height and location from center-line of the engine pods, the tail skid to prevent over-rotation on takeoff, and the length and spread of the main gear. Photo by Bob Fronius.



ABOVE: Front view of Les King's The Primer as seen at the Vintage Sailplane Association meet at Tehachapi, CA. The extensive use of foam can be seem as well as the strake type nose extension.

BELOW: The Primer from an end view. The elevons are folded back up over the top of the wing and give a better idea of the wing's thickness.