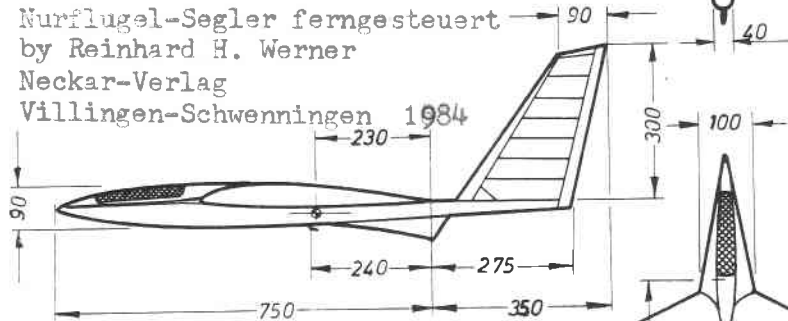


T.W.I.T.T. NEWSLETTER

From: Nurflügel-Segler ferngesteuert
by Reinhard H. Werner
Neckar-Verlag
Villingen-Schwenningen 1984



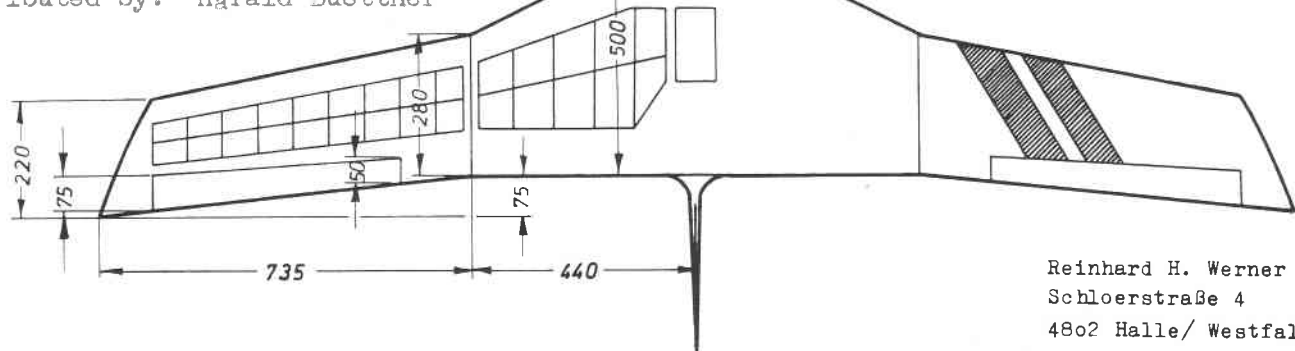
C o b r a

RC-Nurflügelsegler von Reinhard Werner

Spannweite : 2350 mm
Fläche : 66 dm²
Gewicht : 1500 g

E 374, im Außenflügel Strak auf E 635
-4° Schränkung im Außenflügel

Contributed by: Harald Buettner



Reinhard H. Werner
Schloerstraße 4
4802 Halle/ Westfalen

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., **9202** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, February 15, 1992
beginning at 1330 hrs at hanger A-4, Gillespie
Field, El Cajon, Calif. (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 types of tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis. T.W.I.T.T. is an affiliate of The Hunsaker Foundation which is dedicated to furthering education and research in a variety of disciplines.

T.W.I.T.T. Officers:

President, Andy Kecskes (619) 589-1898
 Vice Pres., Dave Pio (619) 789-1650
 Secretary, Phillip Burgers (619) 563-5465
 Treasurer, Bob Fronius (619) 224-1497

Editor (Acting), Andy Kecskes

The T.W.I.T.T. office is located at Hanger A-4, Gillespie Field, El Cajon, California.

Mailing address: P.O. Box 20430
 El Cajon, CA 92021
 (619) 224-1497

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Meetings are held on the third Saturday of each month, 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

WELL, the year is not off to the booming start we would all like to see, but I am sure it will get better over the next few months. Attendance at last month's meeting was kind of sparse, and I am sure part of it was due to the topic and the fact there was no noted speaker.

I know I have asked in the past, but it is time to remind those of you in Southern California that we sure could use some help in finding good speakers. For those of you who work in the aerospace industry (I know there aren't many left), see if one of your engineers or designers would be interested in joining us for an afternoon and cover some topic of interest. There are many areas we have not covered, many of which are applicable to flying wings as well as conventional aircraft. PLEASE beat the bushes a little and see what you can come up with in the next few months.

Someone out there paid us \$15 in cash at the November meeting, and in the confusion your name didn't get written down. Hopefully, you are still getting the newsletter and will let us know who you are so we can update your membership.

I am still pleased to see that people want copies of Don Mitchell's tapes from the Tehachapi meeting. We will keep these as a permanent part of the TWITT library so new members can avail themselves of this interesting talk by a leader in flying wing technology for the home builder.

I have been surprised that there wasn't more response to the series of treatises by Karl Sanders and others. They have provided some valuable information to the membership, and I was hoping it would stimulate some of you

to share your experience or knowledge with us. Please let us know if you have a favorite reference book, computer program, etc., that could be of value to others.

Since we have such a diverse membership, Bob thought that maybe some of you old-timers out there might be able to help him with a project. He is looking for information and/or pictures of flight activity from the Point Loma area (San Diego, CA) during the period 1929-30, including any flights by Hawley Bowlus. If you don't have pictures, but were an eye witness and could provide some detailed information that would also be great. A group of local aviation pioneers, Bob included, is trying to get a National Monument established on the soaring sites at Point Loma. So far it has been a real battle with the city, and any additional information would help prove their case.

That's all for now.

Andy

FEBRUARY PROGRAM

The February program will be a two parter this month. We were not sure at press time which part would be first, but they are:

1) A video of 1/4 scale Reno Style pylon racing. These aircraft have minimum of 100" wing spans and must be stand-off replicas of aircraft that have actually raced at Reno. Our member, Harald Buettner, is currently building a set of molds for a clients 1/4 scale Bearcat that will be powered by a 35 hp engine and designed for just this type of racing. For those interested, there will be another race meet on April 23-26, 1992, at Marana, Arizona, which is between Tucson and Phoenix.

2) Frankie Clemens will be given us a talk on women and air racing, specially the Pacific Air Race. Frankie soloed in 1977 and has participated in five races, along with working in some type of official capacity in every race since 1978. These races require a great deal of planning and expert execution for the two person crews and their aircraft. Frankie will tell us some of the ins & outs of this type of racing. This might be a good time to bring your wife, girl friend, significant other, so she can see how she fits into the aviation world that you love so much.

So come join us for a "Day At the Races."

MINUTES OF THE JANUARY 18, 1992 MEETING



Andy opened the meeting by welcoming everyone to the first meeting of the new year. With the small group it was decided to keep things somewhat informal, with several members being given an opportunity to update the group on their pet projects.

Bob talk a little about the history behind the builder of the ASW-24 model that has been gracing the hanger lately. Jean Marc Vevey, who is also a hang glider enthusiast, has been flying the real thing in France for some time now and give Bob the model when he was visiting San Diego. The ASW-24 has a span of 78'9" and an estimated L/D of 57:1.

First to take the floor was Budd Love, who told us that he may have found a source of financing for his HIAM aircraft. He has been approached by a company that supports various types of projects if they feel it has some commercial application. In Budd's case they also see some military interest in the end product.

Budd was to have a meeting with Mission Research Corp. during the next week, at which time the project would be discussed in more detail. Budd felt very good about this group compared to others that have expressed any interest. They seem to know what it will take to get the HIAM off the drawing board and are willing to support a long-term effort. They are also willing to put up the money rather than Budd having to put up a substantial deposit as many of the venture capitalists have required.

We all wish Budd good luck in the upcoming meeting, and hope this group will become as enthusiastic as Budd about HIAM.

Tuto Figueroa then took the floor to explain a little about his upcoming presentation to the AIAA branch at the University of San Diego. He is going to talk about aero thermodynamics that the HIAM type aircraft would have.

Tuto will be discussing the types of engines and configurations that are needed to produce the amounts of airflow through the wing to provide the boundary layer control. This would be applied to a combination aerodynamic and mechanical flap to produce increased lift capability. Part of the concept appears to

be how to also channel the fan airflow along with the core engine high pressure air to meet whatever mission requirements the particular aircraft is designed for.

Some of this information looks like it could be useful to Budd in supplementing what he has already designed around a core engine for his concept aircraft.

Tuto went on to explain a little about the various types of propulsion systems and how they use energy. To the aerodynamicist propellers and fans are all the same other than the amount of compression they provide depending on the number of stages.

Jerry Blumenthal was asked to explain a little about any progress he was making in completing his scale model of the Rattler. I seems he has been working on other projects, including one for Bob on producing drawings for a scale model of the "Lil Dogie," but is about ready to get back to his own model.

Jerry offered the following in: "An Open Letter to Messrs. Bruce Carmichael and Karl Sanders Regarding 'Rattler.'"

Dear Bruce: I did indeed misunderstand your suggestion that the design would perform without a twisted wing (neg. 4 degrees). Of course, the forward section would then require a positive incidence to maintain the forward CG position for stability. I thank you none the less for the input.

Dear Karl: I appreciate your suggestion that a variable incidence wing would facilitate stability experiments, but must hasten to explain that such an arrangement on this model would necessitate unporting the outboard "wing" sections from the inboard (and forward) section. Secondly, a flow fence would be required between these sections to minimize drag. The pivot arrangement and the flow fences would complicate an otherwise clean and simple design especially since my stability model indicates that no decalage is necessary between the sections of the wing. The wing twist seems to be all that is needed for stability. I am sure that the model I'm designing will vindicate my theses.

Thank you both for your comments.

Jerry reiterated that his stability model has shown the forward and aft portion of the wing can be built on the same chord plain and only require twist at the tips. He has been thinking about putting drag rudders at the tips for differential control, as well as simultaneous deployment for drag control.

Bob took over the program at this point and explained how he had come to have all the

pictures of Mitchell's wings and Hawley Bowlus' early aircraft. It is a classic example of one small error compounding into an even bigger one thanks to the U.S. Postal Service.

When Don Mitchell was a young fellow he went to work for Hawley Bowlus for no pay, but just to learn how to build gliders and have a roof over his head. During this time he had his dream of building a flying wing.

This came to be realized when he took one of Bowlus' prototypes for an Army troop glider, removed the boom tail assemblies, and added his distinctive trailing edge, inverted airfoil control surfaces to make it into a flying wing. This aircraft was flown until the Army finally came back to Bowlus to claim their property, which they then destroyed.

After a short break Bob presented his slide show which has been covered in the September 1991 Newsletter from the perspective of Don Mitchell (tapes available for \$4).

At the completion of the slides, the meeting was adjourned.

LETTERS TO THE EDITOR

January 21, 1992



TWITT:

Enclosed is \$8 for two of Don Mitchell's tapes of his talk at Tehachapi concerning his flying wing development process. One for me, and one I will pass on to member Roger Waterbury. We have discovered that we have similar military backgrounds.

As magnificent as Peter King's logo submission is (August 1991), I feel that animal rights groups may strongly object to what they may perceive as a helpless bird, flapping about and terrorized in his cage, while being buzzed by a Northrop YB-49. Anti-war groups may object to the YB-49. Ah, what to do?

The logo submitted by Richard Avalon in the October 1991 TWITT Newsletter seems clean and clear and not likely to raise many objections, except for those that just like to object.

My sense of aviation history, developed over half a century, and my reference library, remind me that there are one hell of a lot of flying wing designs, and finding one to suit all is nearly impossible.

My two flying wing projects continue, but a busy schedule does not allow me much time to work on them. I look forward to the time when I can again visit with Don Mitchell, Bob Fronius, and some other TWITT friends.

Best Regards,
Gil Metcalf

(Ed. Note: Thanks for the comments on some of the logo submissions. I think we will look to the March issue for a vote on everyone's favorite. However, before we can proceed with placing an order we need some feedback on how many members are interested in having one or two, etc. so this information will also be requested on the ballot. So go back through your newsletters and make your decision early.)

January 21, 1992

TWITT:

Enclosed are \$2 for your membership application and flyer, including one back issue.

I am very interested in flying wings and have gotten into the hobby of RC flying so as to learn how to fly them. If I had known of your organization I would probably have saved myself a lot of time and money pursuing dead ends.

Where I fly (Kite Hill in Laguna Niguel, CA) there are few people who say anything good about wings so it is with great interest that I am looking forward to your letter & membership.

Thanks,
Jeff Savage
26431 Smoketree Ln.
San Juan Capistrano, CA 92675

(Ed. Note: Jeff won't see this unless he orders back issues to see what he has missed the past several years. If we have any other members in his general area who are into RC flying wings and could give him a helping hand, how about dropping him a note and see about getting together.)

January 22, 1992

TWITT Wing-Tip Vortex

Occasionally on a calm morning, while walking through the woods, one may get a whiff of tobacco smoke, or perfume that has persisted in a vortex, left by someone who is long gone, at the time of detection. Similarly, vortices, shed by the tips of large aircraft may upset light planes quite some time after the large planes are long gone. Those who study such things tell us that an aircraft may find that tip losses account for more than half of the total loss, or drag of the entire aircraft. Many complex design concepts (diffuser tips, twist or wash-out, taper, section change, etc.) are employed by designers to try to diminish this loss or drag, but another problem pertains to all these. What is right for one speed is wrong for all others, if a rigid wing is employed. The right angle of attack for landing, for example, means that in a dive the tips may press down, sometimes to such a degree that they may break off.

Birds avoid this by several neat tricks. Some suggest that every feather is held by a variable musculature, but I doubt this, since a bird's wing is almost devoid of the required bulk, and has only the required feather sockets. Like a cat's tail or a dog's back, a bird can fluff after a bath, for example, but the wing feathers move collectively and not individually, except the allulla (the bird's wing slot that probably was the prehistoric thumb). They can alter the angle of attack, and employ variable geometry, as hawks do when they "stoop" and so reduce area by elbow-joint flexing, or they may stretch the wing to the maximum area, as for landing, but it is very unlikely that individual feathers can be controlled, other than collectively. Tip losses are minimized by taper, and aspect ratio, or by multiple slots, but the greatest saving is through a flexible wing that is self adjusting.

If we rule out variable geometry as too complex (though some still try it), we may still get some goodies from the birds and bats if we do as they do and place the spar forward, and let the ribs twist it, and also use ribs that can flex a bit. If we can get all the dimensions right, it seems that we might get the proper loading at all speeds, and the span loading might diminish to zero at the tips at all speeds. Old "gummy flugel," indeed!

I am working on a 1/3 scale model of this

concept, and hope to fly it soon. The large (full scale) bird should follow soon, but meanwhile, I'd like help on single thickness airfoils. Please, if any of you can work a computer program on very thin sections, please tell me how to do it. Or if there is a known study on bird/bat airfoils, please tell me. I need help.

Thanks,
Syd Hall
13983 Gracie Road
Nevada City, CA 95959-9624

(Ed. Note: Well Syd, here's your letter for everyone to read and contemplate. I know there has to be someone out there who can help with the computer program side by either putting in information and giving you some results, or perhaps providing a copy for your own use if it is feasible. How about guys, can you help Syd with this one.)

December 30, 1991

TWITT

Please renew my membership for '92. I'm working intensively on flying wings (ultra-light) operated in ground effect over water. You may publish my address & phone number for any who wish to correspond.

Keep the ideas coming!

Eldon Runkel
7801 Payne
Dearborn, MI 48126
(313) 945-8875

P.S. - I am also a Technical Writer in search of employment. (See attached resume.)

(Ed. Note: Sorry this didn't make it into the January Newsletter. We hope you have found a good job by now, but just in case here are a few items from your resume for someone who might be interested:

- Extensive engineering support background in automotive and aerospace fields.
- Two years of liaison function between engineering, manufacturing, logistics and launch integration for McDonnell Douglas.
- Five years writing military vehicle specifications, engineering releases and technical studies.
- Worked for: McDonnell Douglas Space

Systems Co.; Borg Warner Corp.; Ford Motor Co.; Fruehauf Corp.; and LTV Aerospace Corp.

When you have time how about giving us some information on your flying wing projects so we can share some of the things that are common to wing design with the other members.

Good luck in the job search.)

January 20, 1992

Karl Sanders sent us a copy of "Design Synthesis and Optimization of Joined Wing Transports," AIAA Paper #90-3197 written by John Gallman, Ilan Kroo, and Stephen Smith. This was in response to a member that had inquired about joined wing aircraft "how to," etc. He also had the following comments:

In my humble opinion: a wretched idea! - perhaps worth looking at for a drone/RPV design.

Most of these ideas are theoretically interesting, but of little/questionable value. Once you build such a mousetrap you've had it - you can't modify it, e.g., increase span or tail area, etc.

And, as you can guess, the whole idea is not new. The well known Focke-Wolf aerodynamicist, Hans Multhopp (about 20 years ago as advisor to GE's staff) came up (ca. 1942) with a night-fighter design joining a swept back wing to a swept forward horizontal tail. And, in 1919 Reinhold Platz (Anthony Fokker's - the Dutch maverick's welder/chief designer) built a sail-wing (flexwing) on that same principle. I believe there's a picture in Weyl's book FOKKER, THE CREATIVE YEARS (fantastic reading!!).

(Ed. Note: We would like to thank Karl for the submission and comments. We are not sure who made the inquiry, but I am sure this will solicit a response asking for the paper which Karl has asked by pass along. We have included one of the pages in this newsletter with the thought that it might wet someone else's appetite for this type of aircraft.)

Karl also included an article titled "Oblique-Flying-Wing Supersonic Transport Airplane" published in NASA Tech Briefs, January 1992.

Karl indicated reproduction was okay, so we have included it in this newsletter. Someone else had also given Bob the actual page from the magazine. Thanks to both of you for the contribution.

The package Karl sent also had some pages from a book published by Schiffer Military History, West Chester, PA., titled The Horten Flying Wing In World War II - The History & Development of the Ho 229, by H.P. Dabrowski as translated by David Johnston. Karl comments that it has excellent photos and is 52 pages long. He also included some material on the Horten IV which appears to be narrative pilot report from a document called "Wings of the Weird and Wonderful." We will try to publish some of the more interesting comments as room permits in future newsletters.

January 23, 1992

TWITT

I am a new member, and I heard about TWITT from Bill and Bunny Kuhlman (B²). I am a 25 year old college student, and I first became aware of 'wings when I saw the PY-49's vain attempt to destroy the Martian fighting machines in the 1950s film adaptation of H.G. Wells's War of the Worlds. To my six year old eyes, the YB-49 looked every bit as un-earthly as the fighting machines.

Since then, I have read every book I can find on tailless aircraft, especially the elegant designs produced by the Horten brothers. At present, my main interest is in flying wing R/C sailplanes of both swept and plank-type planforms.

I am trying to contact a gentlemen name Kirk Kreigh, who in 1977 was a member of the Dover Mosquitos, a now defunct R/C soaring club in Dover, Delaware. On June 26th of that year he took first place in the Jr-Sr. Unlimited category in a duration/spot landing contest held by the club. His design was a large plank flying wing that was completely devoid of vertical surfaces or a fuselage pod. The contest results were printed in the November 1977 Model Aviation News, in the "S.O.A.R. Subjects" feature by James Gray. In the photo of the winners, Kirk Kreigh is in the center of the front row.

I have tried to contact him through the A.M.A., the National Soaring Society, the League of Silent Flight, and several individuals, all without success. If an TWITT members know where I can find Kirk Kreigh, I would really appreciate it if they would contact me. I would like to purchase a copy of the plans for his 'wing. It looks like it would be a good thermal soarer, and since it

placed first in its category, it must have been a pretty good design.

I would be much obligated to you for your help.

Sincerely Yours,

Jason Westworth

3081 N.W. 4th Terrace

Miami, FL 33125

(Ed. Note: First, we would like to welcome Jason as a new member. I hope we will hear more from you in the future, especially as you try new model wings and find solutions or problems that would help others.

From the picture Jason included with his letter, Kirk's wing looked to have a 12-15' span, with a slightly tapered leading edge, straight trailing edge, and large spoilers. If Kirk stayed in R/C soaring, there may be some of our members who have run across him in one of their clubs. Please drop Jason a note if you have had any contact with Kirk.)

AVAILABLE PLANS & REFERENCE MATERIAL

FOR SALE

Tailless Aircraft

Bibliography

by Serge Krauss

Cost: \$20

Order from: Serge Krauss

3114 Edgehill Road

Cleveland Hts., OH 44118

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.

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130 Crestwood Drive

Michigan City, IN 46360

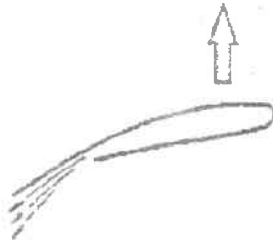
MODEL WINGS

The cover of the July 1991 issue of RCModeler features a flying wing called the "Stealthbat" offered by Wing Manufacturer. There was no price listed, but they can be contacted at:

306 E. Simmons
Galesburg IL 61401
(309) 342-3009
Catalog: \$4.00

Omni Models carries the Future Flight Klingberg Wing kit for \$39.99 (item #FTF4000). They can be contacted at:

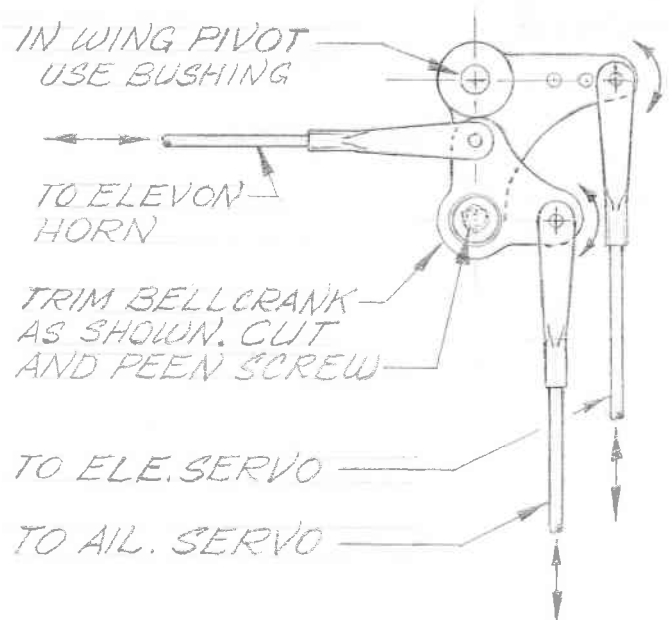
P.O. Box 1601
Bloomington IL 61702
1-800-747-6664 or (309) 663-5798
Shipping: \$5.00



THE HIAM AIRPLANE
NEEDS YOUR HELP

For those of you who would be interested in assisting Budd Love with some aspect of his High Internal Air Mass (HIAM) project, he would be glad to hear from you. This concept has great potential for the future of air transportation.

Contact: AIRLOVE, LTD.
6423 Campina Place
La Jolla CA 92037
(619) 459-1489



THIN IN-WING MIXER
USE DU-BRO BELLCRANKS
& BUSHINGS. ONE UNIT IN
EACH WING. MOUNT FIRM

This mixer was designed by Jerry Blumenthal for the combined elevator/aileron system on his scale model of the Rattler. It was designed to be slim so it would fit inside the airfoil just in front of the control surface. This was necessary since the interior of the fuselage would make it difficult to place a conventional mixer.

**A Monthly Publication for the
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\$19 Bulk/Third Class, or \$26 First Class

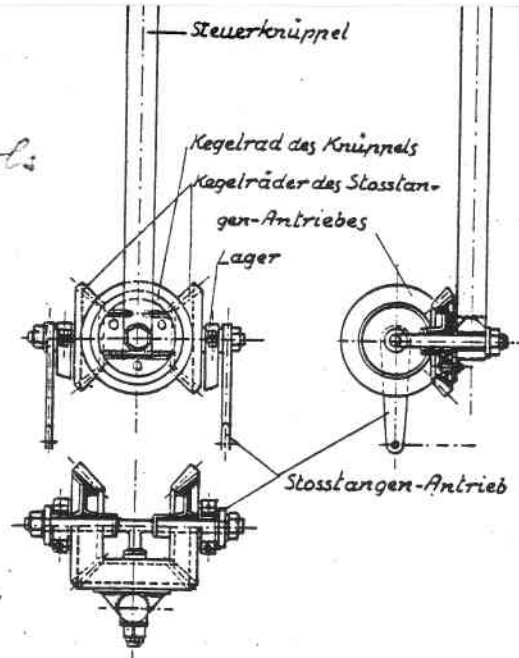
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R/C Soaring Digest

P.O. Box 6680
Concord, CA
94524



bevel gear type
Tailless flight controls
(Leppisch)



37. Kegelradsteuerung für ein schwanzloses Flugzeug.

Contributed by:

Karl Sanders

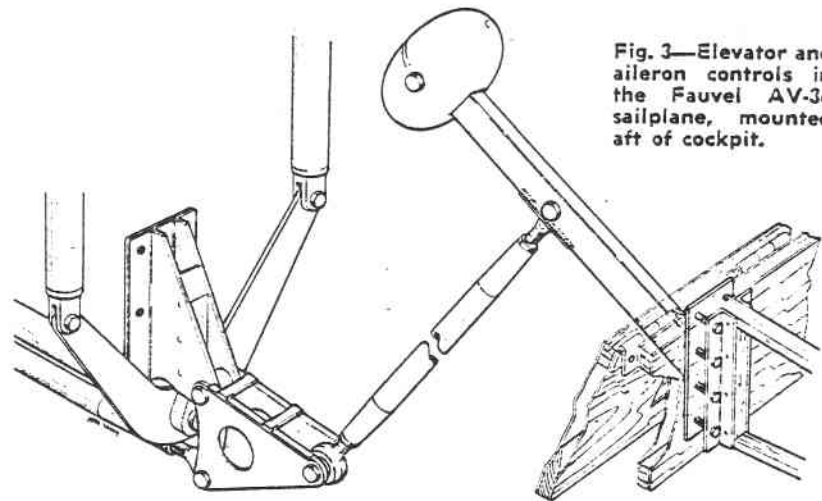


Fig. 3—Elevator and aileron controls in the Fauvel AV-36 sailplane, mounted aft of cockpit.

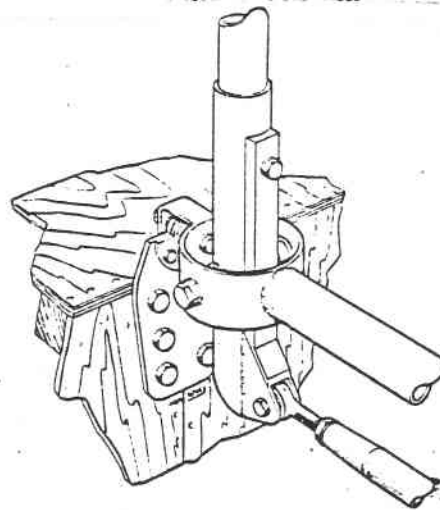


Fig. 4—Control stick mounting in the Fauvel AV-36 sailplane.

Oblique-Flying-Wing Supersonic Transport Airplane

A previously abandoned design concept is reintroduced.

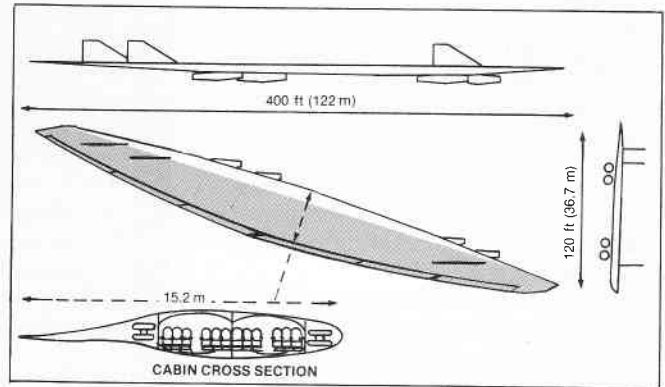
Ames Research Center, Moffett Field, California

An oblique-flying-wing supersonic airplane for the transport of passengers and cargo has been proposed as a possible alternative to the B747B (or equivalent). The oblique-flying-wing concept was first proposed in 1957 by Dr. R. T. Jones but was abandoned because of then-insoluble problems of stability and control. Since that time, the technology of artificial stabilization has advanced sufficiently to warrant reintroduction of the concept.

In the baseline configuration (see figure), the airplane would accommodate 462 passengers and 16 cabin crewmembers. The interior would resemble that of a wide-body aircraft, with an average aisle height of 1.91 m. Windows would be installed in the leading edge, and emergency exits would be located in the leading- and trailing-edge sides of the passenger cabin. The cockpit would be located at left end of the cabin for a pilot and a copilot. The pilot would have good visibility during approach and climb.

The wing would have an elliptic planform with a nearly elliptic spanwise thickness-to-chord distribution, resulting in minimum wave drag for a given volume. The wing would be curved upward slightly to obtain an elliptic spanwise lift distribution. The wing can be swept from 35° at takeoff to 72° in cruise to achieve the maximum lift-to-drag ratio for any speed from mach 0.2 to mach 2.0. To achieve the required lift with minimal drag and a nearly level cabin floor, during cruise, the center of gravity would be shifted to the required position by a fuel trim system. The airplane would have a conventional monocoque and honeycomb structure incorporating the aluminum alloy

The **Oblique Flying Wing** would transport passengers and cargo as fast as twice the speed of sound at the same cost as current subsonic transports. It could fly at the same holding speeds as those of present supersonic transports but require only half the takeoff distance.



RR.58-AU2GN (or equivalent) developed for the Concorde. By limiting the speed to mach 2, one would reduce the equilibrium skin temperature from 130°C to 100°C, thereby increasing the life of the airframe over that of the Concorde.

To increase yaw control in case of the failure of one engine and to minimize the wave drag and wing stress, the engines would be podded in four nacelles. The nacelles could be pivoted over a 35° range and would be distributed optimally along the span. In view of the limitations of the artificial-stability-and-control system, the nacelles would have to be placed as far forward as possible. Four 250-kN engines of conventional design would be used. The undercarriage would include six legs with four tires each.

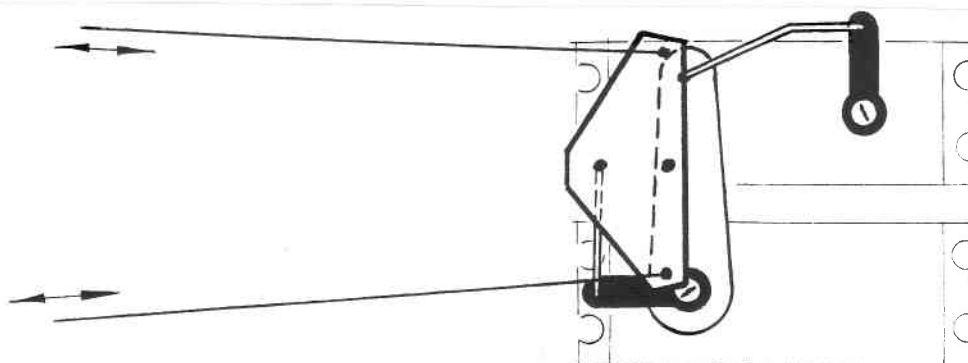
The maximum takeoff weight would be 20 percent less than that of the B747. The aircraft would operate from conventional runways within the FAR 36 stage 3 noise requirements. The oblique-flying wing can also operate overland at the boomless supersonic cruise mach number of 1.2. Stability and control around the roll and pitch

axes would be provided by a 10-percent-multisegmented trailing-edge flap. Segmenting the trailing-edge flap would increase the reliability of the system and enable the control of roll. Such a flap system could help to smooth out any gusts and allow the use of a more-cambered wing and a higher design lift. The artificial-stability-and-control system for this flap would include a standard proportional/integral/derivative controller that would relate the angle of pitch and its first and second derivatives with respect to time to an optimum flap deflection.

This work was done by Alexander J. M. Van der Velden of Stanford University for Ames Research Center. Further information may be found in NASA CR-177529 [N89-25233], "The Conceptual Design of a Mach 2 Oblique Flying Wing Supersonic Transport."

Copies may be purchased [prepayment required] from the National Technical Information Service, Springfield, Virginia 22161, Telephone No. (703) 487-4650. Rush orders may be placed for an extra fee by calling (800) 336-4700. ARC-12525

Reprinted from NASA Tech Briefs, January 1992.
Contributed by: Karl Sanders.



Mechanischer Mixer von Frank Wilde, Chester
Verhältnis Höhe / Quer hinreichend variabel

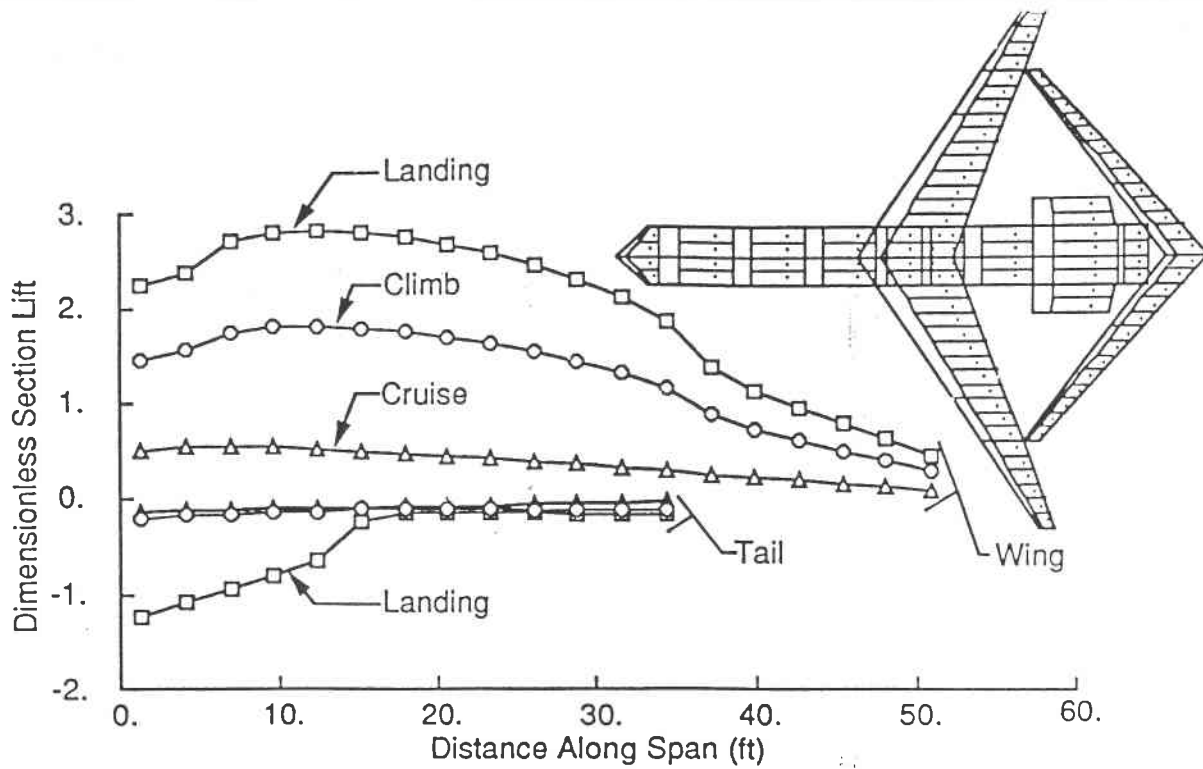


Figure 1: Wing and tail lift distributions for a typical joined wing that is trimmed for climb, cruise, and landing approach.

Extracted from: AIAA Paper 90-3197
 "Design Synthesis and Optimization
 of Joined-Wing Transports"

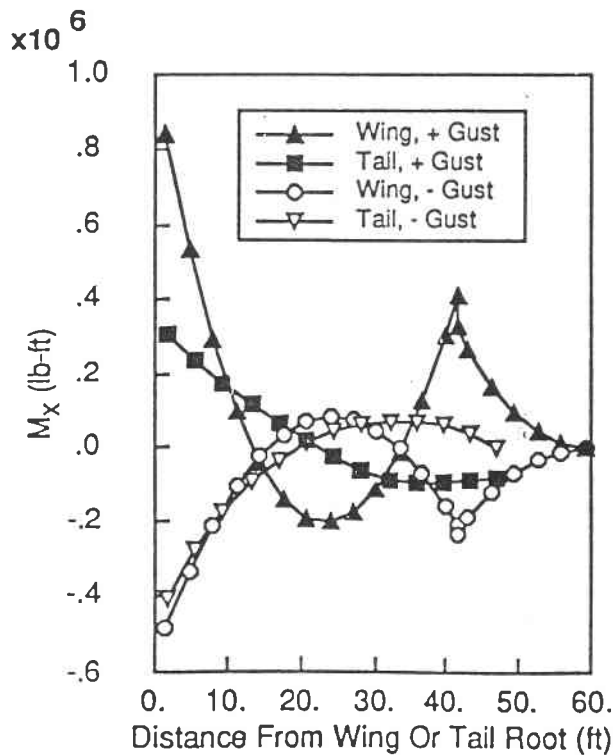


Figure 2: In-plane, or M_x bending moment distributions for a typical joined wing subjected to both positive and negative gust loads.

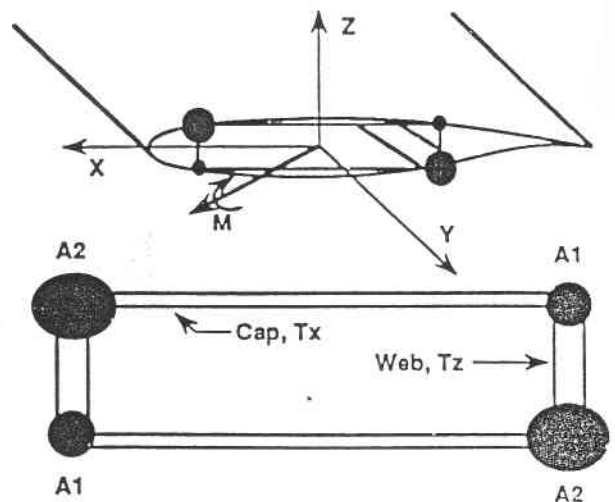


Figure 3: Structural box model with skins, stringers, and the resultant bending moment.