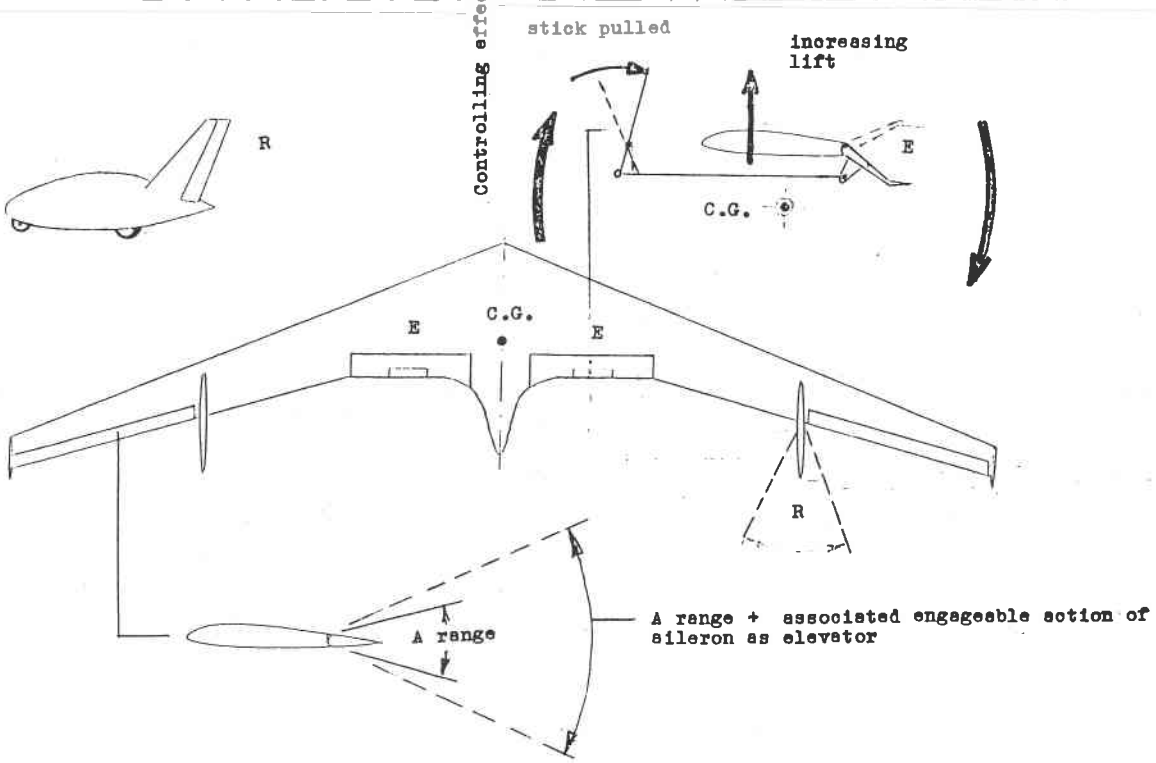
T.W.I.T.T. NEWSLETTER



From "Polish Flying Experience with Taillless Gliders," by Adam Zientek, Technical Soaring, April 1992. See Page 7 for more.

FIGURE 9. SZD-20x. Controlling.

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., **9206** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, June 20, 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:
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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.

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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

First of all I would like to thank all of you who have sent in your vote for the logo. So far there is one distinct leader (you'll find out which one next month) with two others trailing somewhat. Personally, I was surprised as to which one seems to be the favorite.

I would like to thank Kevin Renshaw for going to "a lot of trouble" to locate and talk with Tom Blakeny. It looks as though I can really pick the right person for a job. Hopefully, we will also see Tom join our group, as well as provide us with some information on his aircraft.

On the more serious side, the Vintage get together at Hemet on Memorial Day had a good turnout of historic and vintage birds. Unfortunately for some, a vicious hail storm moved through a Friday and did substantial damage to a number of fabric covered planes sitting out on the flight line (including Bob and Doug Fronius' TG-2). The storm also left a great deal of water behind, but by Sunday the place was starting to look like a dust bowl again. The flying seemed pretty good for all concerned, and it looked like everyone had a good time.

I would like to thank Julio Paredes for bring out his MiniBat for the meeting, and answering all the questions at the conclusion of the meeting. It looks like an interesting project he will be proud of once it is in the air.

Starting this month will will be publishing the first few pages of an excellent article from Technical Soaring entitled "Polish Flying Experience with Tailless Gliders." We hope you find it enjoyable and helpful in your ongoing or proposed projects.

That's all for now.

Andy

JUNE PROGRAM

Unfortunately, the program we had anticipated for the June meeting was not possible due to the speaker's non-availability.

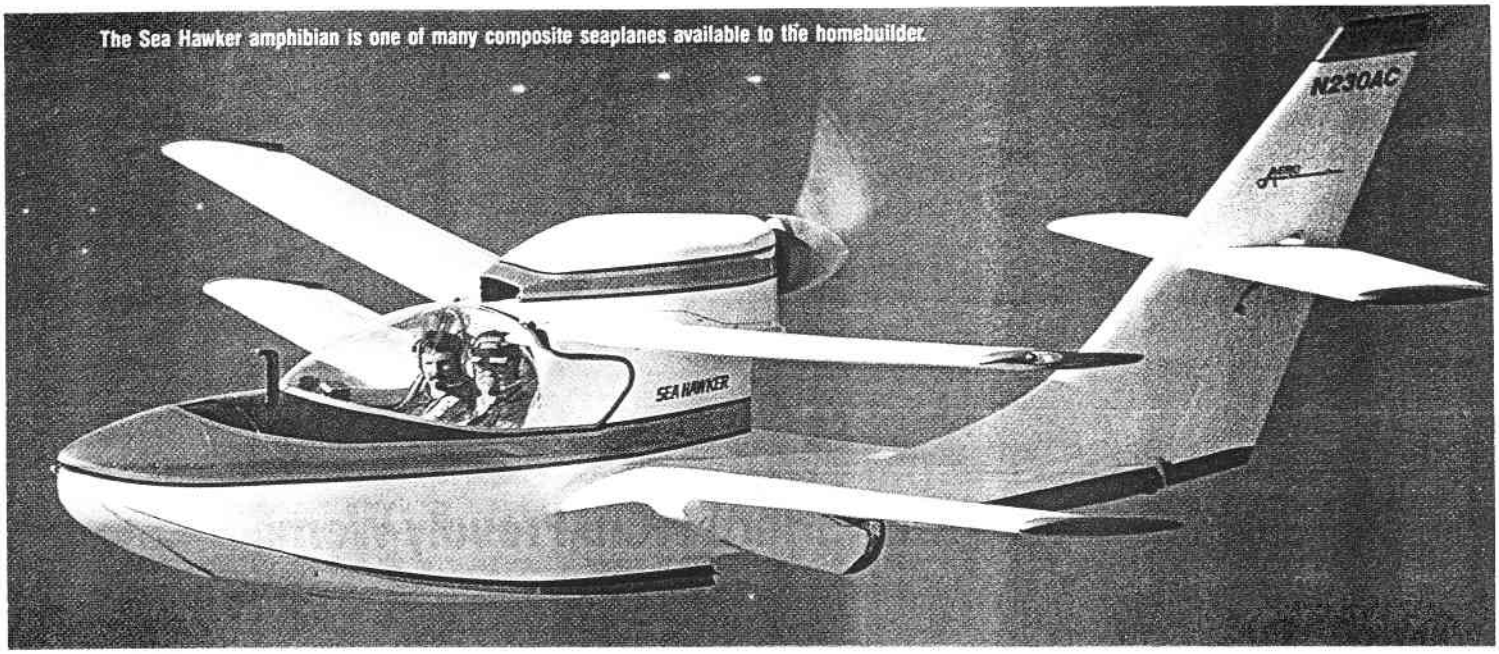
However, **Bob** has put together a good program which will include Capt. Roger Flowers, USN (Ret) bringing in his Sea Hawker biplane amphibian for a show and tell session outside the hanger.

Bob Chase will be telling us about his recent experiences in learning to fly his Trike. His comments during last months meeting indicated this should be an interesting story.

Also on the program will be Doug Fronius, who will tell us about his recent trip to Switzerland and flying a variable geometry glider. I know Doug had a good time flying around Switzerland, Germany and France, so he should have some interesting comments.

There will also be a tape of WWII footage of the CG-4A gliders during landing maneuvers, if time and audience desires/permits.

of the speakers are currently lined up for the Labor Day Sailplane Homebuilders Association's series of workshops at Tehachapi. The program



The original Sea Hawker was designed by Gary LeGare of Q-2 fame. Kevlar and various core materials are used to provide a true monocoque structure. Kits are now produced by Aero Composite Technology, Inc., RD 3, Somerset, PA 15501, (814) 445-8608.

It is powered by a Lycoming 150 hp engine, has a top speed of 160 mph, cruising range of 150 mph, and is two place side-by-side.

MINUTES OF THE MAY 16, 1992 MEETING

Andy opened the meeting with the usual round of announcements. The raffle prizes for the day were a large dual temperature thermometer and a 25' extension cord with multiple outlet plug.

Andy informed the group about the dedication of Torrey Pines Glider National Soaring Landmark which will occur on June 6. Bob and Doug were to display vintage gliders for the event, and apparently there were to be a number of old timers attending who were the pioneers of Torrey Pines.

The other get together was the Memorial Day Vintage Sailplane Association meet at Hemet-Ryan which is always a neat event for people interested in older sailplanes.

Bruce Carmichael gave us a quick run-down

will include: Pazmany on metal construction, Stornik about his designs and construction, Gustafuson on a modified S-2 with a greater wingspan, Pierson on Diamant sailplanes, Armstrong on status of a composite, light, 13m sailplane, King comparing different types of construction materials, and Buettner on composite construction molds. The Swift is supposed to be there for a flight demonstration, and they are expecting a good turnout of aircraft supplies for an auction.

Andy announced that Budd Love was going to be receiving an award from the AIAA for his outstanding design in the HIAM wing and the contribution of its theory to aerodynamics.

Andy also wanted to thank his daughter for making and contributing an engraved, wooden TWITT plague for the hanger (one of her woodshop projects).

Andy then asked the members present to vote for their favorite logo choice, in order to insure we get a good membership representation of this project.

Before starting the program, Bob had asked to have everyone present briefly introduce themselves to the group and give a little background on why they were involved in TWITT. It is amazing to see the diversity of experience within this group and the reasons why people are interested in flying wings.

During the introductions, Bob Chase indicated he had flown his Trike for a very short and eventful flight. He said it lasted about 2 minutes and he was not sure if he ever had complete control. He indicated he would give us more information next month after he has had a chance to get some dual time. There

is a possibility he might also be able to bring the Trike to meeting.

With the introductions completed, Dr. Joe Katz took the floor to discuss low speed fluid dynamics as it relates to three dimensional panel code.

He began by explaining what they are doing at San Diego State University under a NASA grant. Unfortunately, he was using a slide to show the progression of various code projects which makes it difficult to recap here.

Today's programs have the capability to analyze, in a two dimensional mode, attached, subsonic flows and get reasonably good pressure distribution results. These would be good for some types of gliders. There may be a problem with some of the friction coefficient because some of the codes don't treat this area yet.

Dr. Katz went on to discuss the region called incompressible and inviscid where the Reynolds numbers are high. This applies to many areas of general aviation flight regimes where the boundary layers are very thin. Again, he mentioned the codes for these types of airfoils is reasonably good.

He then talked briefly on the physical layout of the program which was covered by Phillip in greater detail last month. What this all means is that the average homebuilder is gaining the capability to do computer analysis on PCs with programs that have reasonable costs.

Some of the programs can now be used to analyze aircraft accidents by projecting the flight paths based on information from flight recorders and radar tape data.

Dr. Katz talked about the relationships between low speed wind tunnel tests and the computer projections for the same aircraft. Apparently, they were able to account for some of the variances in terms of interferences from the tunnel itself, therefore, giving more validity to the computer results as a basis for initial planning.

One project Dr. Katz became involved with was wind tunnel testing of a Mazda "P" race car trying out new aerodynamic shapes and ground effect. The tunnel was simply a verification test of what had been shown numerically. They found that the actual car has some different pitching moments because the boundary layer was putting more down-force on the front of the car. This was overcome with some small spoilers on the front of the car.

Another project that pointed out the good and bad sections of coding was tunnel testing of an F-18 model. They were able to get some interesting results that confirmed portions of the numeric data.

Dr. Katz then covered some airfoil design starting with boundary layers which is the viscous effect. From there he talked about laminar flows and the points at which this flow becomes disturbed into turbulent flow. He summarized by saying that the boundary layer for laminar flow will be thinner, friction will be lower, and flow separation will happen later if the flow is turbulent. Control of the laminar bubble becomes important depending on how you want to use the airfoil.

Another factor to consider is the favorable pressure distribution when talking about laminar turbulence. If the pressure gradient is favorable it delays the formation of the transition point and you get more laminar flow.

Dr. Katz concluded by emphasizing the importance of the three dimensional models that are now reaching fruitation.

At the completion of Dr. Katz's presentation, Andy conducted the raffle. Reg Finch won the extension cord and Bob Archer took the thermometer.

The indoor portion of the meeting was concluded at this point and everyone went outside to inspect Julio Paredes' MiniBat and ask him questions about it. We would like to thank Julio for bring this flying wing for all to see, and I am sure he got some good input on ways to finish it. Perhaps he even got some suggestions on how to improve some portions of the plane as he works to put it together.

A small group of the techies also got together with Dr. Katz to talk more about airfoil design and the types of things some of the new programs can predict.

LETTERS TO THE EDITOR

May '92

TWITT

What is the meaning of the dates 1792-1991 and 1782-1991 (on the logos in last month's newsletter)?

Several years ago I saw a flying wing glider, that was self launching, hanging from the rafters at the National Soaring Museum near Elmira, NY. I believe it was built and flown by some one named Mitchell. If you could shed any light on this ship, it would be appreciated.

Thank you,
Phil McCoy
6420 Hankee Road
Mantua, OH 44255

(Ed. Note: The dates on the logos were just for effect to show what could be done, and have absolutely no meaning to TWITT or the logos designer.

As for the flying wing hanging the NSM, I am told it is .)

May 21, 1992

TWITT

Enclosed is my check for renewal of the newsletter.

The article on Schrenk, et. al. was most interesting. I rarely get to include twist, sweep and taper in my introductory aero course, but will show the students this work in the fall. It might be interesting to some of your readers to know that the location of impending stall can be predicted by these methods; occurring at the span location of the highest point of the curve.

Was sorry to read that Don Mitchell feels that the only thing to do with a flying "plank" is to burn it. I have faith in the design and continue to work with a 1/3 scale R/C to see how the winglet at various alphas can improve the polar.

The first "plank" I designed and built was all metal and yet flew on 9 hp (rated) multiplied by the eta of a 35" prop (which ain't none too good). The plank is the solution to the equation:

Lambda + Taper = $$

that is, sweep plus taper may yield extra polar efficiency but if a person just wants to have fun flying then avoid the sum of the two and you will save mucho dollars.

More power to the boys who are trying to boost efficiency, but for me I just want to fly with the least amount of machine wrapped around me. Good luck to all disciplines of the flying wing.

Yours truly,
Lewis Dewart

(Ed. Note: Thank you for the additional information on predicting the stall. I am sure our techi readers out there appreciate it. The diversity of opinions on which is the "best," "most efficient," or "sleekest" type of flying wing continues to amaze me, and I hope everyone keeps playing with their ideas to the benefit of all of us.)

May 26, 1992

TWITT

A friend has a Mitchell Wing - complete and ready to fly. He's too old to use it and wants to <u>give</u> it to someone - probably wants to sell the trailer it is on.

It is A&P built - good work, epoxy glued, and a nice trailer. He is afraid of liability problems. The engine (Zenoah) and re-drive/prop is brand new - he wants to sell the power unit for $750.

What do you think? Your comments would be helpful.

Sincerely yours,
Don Santee
4510 N. 13th Ave.
Phoenix, AZ 85013

(Ed. Note: We weren't really sure if you wanted advice about taking over the aircraft yourself, or whether you were asking if the whole deal was worth some else approaching your friend with an offer. Hopefully, Bob has given you his thoughts on the matter by the time this comes out.

Perhaps some of our other members have some thoughts (how about it Don M.), or may be interested in acquiring all or part of the package. If there are any, please correspond directly with Don at the above address.)

May 20, 1992

TWITT

Just a short note to let you all know that I have contacted Tom Blakeney about his 11' flying wing model. He promises me that he is preparing an article for publication in TWITT, including photos and a 3-view. One hold up was that until he wrote the article, the wing had no name. That's been fixed now.

It was a major effort for me to find Tom. I had to walk all the way to the other end of the building we both work in!! Actually, Tom and I have worked together for the past 8 years.

I enclosed some 3-views of the Vought XF5U Flying Pancake and the V-173 prototype, just because I haven't sent in anything in a while. They are from <u>The American Fighter</u> by Enzo Angelucci & Peter Bowers.

One last note: I just got my copy of <u>Tailless Tale</u> from B^2, and it is excellent. I highly recommend to all TWITTs.

Regards,
Kevin Renshaw
Fort Worth, TX

(Ed. Note: We would all like to thank you for the extraordinary effort in getting Tom to provide us with an article on his bird. Have you shared any of your newsletters with him to the point he is thinking about joining TWITT so that we might hear more from him?

Thanks for the 3-views. They always come in handy for filler inside the newsletter or even the cover, once in a while. We have featured the Pancake in an earlier issue of the newsletter.)

May 4, 1992

TWITT

I notice my black TWITT logo doesn't have the right shape - cut it out with scissors when I was on a muscle relaxer - kinda like being drunk! Want a better one?

Enclosed is a neat cable control system for a V-tail. Got it from Don Santee.

Do you know of anyone who wants heavy metal Soviet planes? Hope some are saved (have sent

information to 34+ U.S. museums). I wonder if they would build a BRO-5 "Ruta" and how much the cost would be delivered..... Would the FAA allow it?

Take care,
Larry Nicholson

(Ed. Note: The logo Larry was referring too was a solid black version of the Northrop wing logo on page 10 of last month's issue, and was not published. To answer your question, Larry, we do not need another copy since the voting has started, but thanks anyway.

The cable control system will make good filler material in the coming months.

The reference to Soviet planes comes from a letter to Larry from Algis Jonusas in Luthuania. He is offering planes and helicopters for sale like: MIG-21, MIG-23, SU-17, SU-9, SU-27, JAK-38, B-12, MI-14, and KA-25. He indicates all are in good condition and are deliverable by container. There is also a TU-95 bomber that can be flown to its destination. He can be reached for negotiating prices at: Lankos 5-1, 3005 Kaunas, Lithuania, FAX 0127-733455.

Larry also sent along a 3-view of the BRO-5 RUTA, a 1938 vintage gull-wing configuration, aerobatic glider constructed by Br. Oskinis.)

April 24, 1992

TWITT

The newsletter is very interesting and improving with time. On page 7 of April's letter, Dick Harrington says that Mr. Legetti was killed in the machine that he brought to Oshkosh. No, the machine was a new, I think, 2 seat prototype on its first fight, and certainly had modifications in it. There was more than one machine. However, the machine may not have been the cause. I will check up and report.

I certainly appreciate Don Mitchell's lecture, and include money for the tape. His comments about the Hortens is too true.

Carl Yeager flew the Jet and said that it was a good machine to fly, but his wife said that he damaged it because it was hard to land. Charles Fauvell seems to be the only flying wing to have a normal C of A.

Don Mitchell's machines have had bad luck in Australia. A b-10 was just blown over in the back yard. A U-2's outer spar was condemned and the owner gave it to another builder who flew it; exit the second builder. I have both plans, but no space to build them, and no information on the ones which are built. I have built some of the Fauvell AV-60 wing ribs, but loss of the original wings because the airfoil was wrong is a bit too much to bear and the project is junk in my hanger.

The AV-222, whose builder was killed by a car, is still around and may be finished, but it is top secret and I know nothing officially.

I have had trouble with the Trike. I learned in it and soled in it, then bought it 3 years later. The wing had been kept in the sun and the trike was modified. Flew with a porposing motion; very forward CG. Lost in landing; during the rebuild we found damaged tires with patches on them and the plastic wheels breaking up. Fitted metal wheels and another wing; flys okay with light pilots but needs a decent prop (making one).

Page 5, Larry Nicholson, re laminar. Well, laminar is what stopped my AV-60. The airfoil stalled over several different angles and was poor. You do not need laminar, and bluntly, I and Charles Fauvell wish it had never been invented (clean laminar works, dirty doesn't).

Yours sincerely,
Al Lewis
Paddington NSW
Australia

(Ed. Note: Thanks for the comments in a number of areas. By now you should have your Mitchell tapes, and we hope you enjoyed them. It is very hard to get all the good stuff from a talk like his into the written minutes, and the tapes allow all of you hear what the rest of us did in all its glory. Requests for Don's talks at Tehachapi in '91 and at the meeting keep coming in, and hopefully we will have other programs in the future where tapes will be of interest.)

INFORMATION NEEDED

Bob Fronius, TWITT's Founder, along with some other early aviation pioneers in the San Diego area, are trying to get a National Monument established on the soaring sites at Point Loma. He is looking for information and/or pictures of flight activity from the Point Loma area during the period of 1929-30, including any flights of Hawley Bowlus. If you don't have pictures, but were an eye witness and could provide some detailed accounts of the soaring, that would be great. If you can help, contact Bob at home in the evenings, the hanger during the day, or through the TWITT post office box. Thanks for your help.

AVAILABLE PLANS & REFERENCE MATERIAL

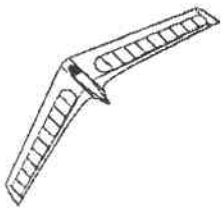
Tailless Aircraft Bibliography
by Serge Krauss
Cost: $20
Order from: Serge Krauss
3114 Edgehill Road
Cleveland Hts., OH 44118

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.

Info packs $8 each, or $15 for both.

Marske Aircraft Corp.
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 following pages are being reprinted with the permission of Technical Soaring, the technical and scientific journal of the Soaring Society of America (SSA), and Organization Scientifique et Technique Internationale du Vol a Voile (OSTIV). It was published in the April 1992 edition, Volume 16, Number 2, pp. 48-55.

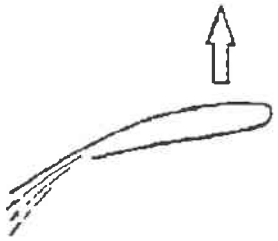
It was brought to our attention by Karl Sanders, who also offered the following comments regarding the article.

"These obsevations are not 'new,' and were previously documented in NACA and USAF reports (re: Northrop's designs), andby Dr. Karl Nickel in his book on tailless aircraft design (re: Horten's).

"There are four causes for the pitch dynamic instability:

. Low pitch dampening by the wing alone.
. Low wing moments of interia
. Pilot induced oscillations (PIOs; neuro phas lag).
. Air turbulence and gusts.

"There is one (1) cure: feedback (automatic) flight control system (FBW).



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

"Is that weight and cost wise affordable for soaring."

The article is too long for printing in the newsletter all at one time, so we will print it in two sections, June and July. We have enlarged and enhanced some of the diagrams, both for reproduction clarity and to make them easier to view and analyse. We apologize for the three photos not coming out very well, but the quality in the article made reproduction difficult.

We hope you enjoy the information about flying wing aircraft, and that the figures are helpful in some way to furthering your own projects.

If you have any questions or comments about the material in the article, please send them to us so we can share them with the membership, and perhaps get you some answers.

POLISH FLYING EXPERIENCE WITH TAILLESS GLIDERS

By Adam Zientek

Presented at the XXI OSTIV Congress, Wiener-Neustadt, Austria (1989)

SUMMARY

The tailless aircraft named "Lotnia" was the first ship designed by Polish flying pioneer Czeslaw Tanski in 1894. Then followed:

- "Dziaba" designed by Stanislaw Malinowski, 1923
- JN-1 "Zabus" designed by Jaroslaw Naleszkiewicz, 1931
- SZD-6x "Nietoperz" designed by Wladyslaw Nowakowski and Justyn Sandauer, 1951
- SZD-20x "Wampir 2" designed by Jan Dyrek, 1959
- AV-36 CR designed by Charles Fauvel. This ship was bought from Austria for comparison studies.

The regular flight test reports were available for the last three types mentioned above only, so their flying properties could be described.

SZD-6x "Nietoperz" was tested in three variants having different yaw control system arrangements. More than 50 flying hours were completed during the factory tests. Now "Nietoperz" is displayed in the museum. SZD-20x "Wampir 2" was destroyed in a flutter case accident in its 14th flight. Box

SZD types, with swept-back wings, were very sensitive in the turbulence in the wake of the towing aircraft. AV-36CR obtained a Polish C of A and is used even today by the Student Flying Club of the Technical University, Warsaw, with its straight wing, it has behaviors rather similar to that of conventional ships.

All types showed a tendency to non-damped short-period pitching oscillations in gusty conditions. This limited the thermal flying tests considerably.

Now these three tailless gliders belong to history. None of them meets the requirements for acceptable flying properties and performance.

The rapid development of conventional sailplanes has pushed the tailless concept aside. To smooth this conventional- ships domination, the idea for designing the modern tailless models like SB-13 arose.

PHOTO 1. SZD-6x

PHOTO 2. SZD-20x. Elevator deflected upwards when stick is pushed forwards!

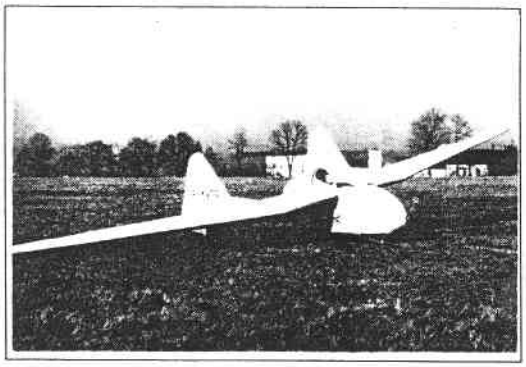


PHOTO 3. AV-36 CR

Table 1
Numerical Data

		Lotnia I	Lotnia III	Dziaba	Zabus	Nietoperz	Wampir
Span	m	8-6-110	10.8-11	6.75	17.g	12.0	15.0
Length	m	2.2	3.6-3.8	5.0	3.0	5.05	3.g
Wing area	m2	7	12	15	16.8	14.4	15
Aspect ratio				3	19	10	15
Wing profile						23012	23112
Empty mass	kg.	15-18	20-25	-	136	196	175
Load	kg.	60-65	60-65	70	75	-	-
Mas. mass	kg.	75-80	80-90	115	211	269	250
Wing loading	kg/n2	11.5	7	8	12.5	18.7	16.7
Load factor		-	-	-	-	6.5	6.5
Glide ratio		-	00.4	-	16	17.5	24.4
Min. sink	m/s	-	00.2	-	0.8	1-35	-
Never exceed speed length-			-	-	-	300	200

1. HISTORICAL INTRODUCTION

The history of tailless gliders is as old as the history of gliding itself. In the pionerr hang gliding times some of the ships use this principle, among them the original design of the Polish flying pioneer Czeslaw Tenski, the "Lotnia" (FLIER)" (Figure 1). Czeslaw Tenski was a painter but he had exceptional technical abilities. He experimented at the same time as Otto Lilienthal and was in correspondence with him. The first "Lotnia" constructed in 1894 allowed the tailless conception to be tested in practice. Later, it was equipped with a small tailplane and further changes were made to the stabilizing surfaces for better trim.

The "Dziaba" (FROGGY) (Figure 2) designed by Stefan Malinkowski, 1923, had a wing of great area and maximum profile thickness of about 50 cm (20 in.). Take off was by the pilot running. Control was by means of variation of profile camber and thickness on right and left wings separately for rolling and on both wings simultaneously for pitching. The pitching could also be adjusted by means of a forward extended "wind detector." It could also allow for dynamic soaring in gusty conditions. Stefan Malinowski declared his entry in the Gliding Competition At Bialka near Nowy Targ, but when ready for take off the glider was lifted by a strong gust and destroyed completely, so this original concept could not be flight tested.

The first tailless model on which some flight tests were performed in Poland was JN-1 "Zabus" (PIGGY) (Figure 3) designed by Jaroslaw Naleszkiewicz, 1931. This concept embodied the ideas created by Prof. A. Lippisch. JN-1 had a wing of trapezium planform, a high span of 17,9 m and high aspect ratio of 19. The aileron and elevator were located along the wing trailing edge. The rudder surfaces used also as air brakes, were installed on the wing tips; right and left were deflected independently. The closed canopy was a novelty at that time.

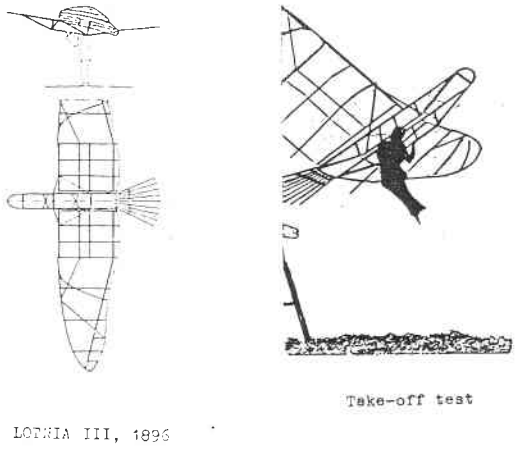


FIGURE 1. Lotnia tailless glider designed by Czeslaw Tanski.

The first flight was made in June 1932 at Deblin airfield by Captain Franciszek Jach. Bungee take off was used initially, then motor car tows. The results were, however, not satisfactory. Too high elevator sensitivity and violent stalling led to serious damage that stopped further testing.

While those tailless models did not give epochlike results, they made an interesting contribution to the history of flying wings.

The next chapter of this story was written in the early fifties by the SZD factory at Bielsko-Biala. Principal data for all types are given in Table 1.

2. SZD-6x "Nietoperz" (BAT) (Figure 4)

Description

Mid-wing arrangement. Swept forward inner wing integral with fuselage. Swept back outer wing panels. Wooden structure. Alternative yaw control arrangement were provided (Figure 5), changes from one to another requiring only a few hours.

Variant I: The glider was equipped with a normal foot actuated rudder. The other control surfaces were located on the wing trailing part namely:

- lift flap (F) on the central wing part controlled by a hand wheel,
- combined aileron/elevator surfaces AE1 and AE2 on the outer panels with different deflections in 1:2 ratio. A separate lever actuated the outer ones to 90 degree deflection as air brakes, the aileron/elevator action remaining.

Variant II: The rudder was fixed as a fin, yaw being con-

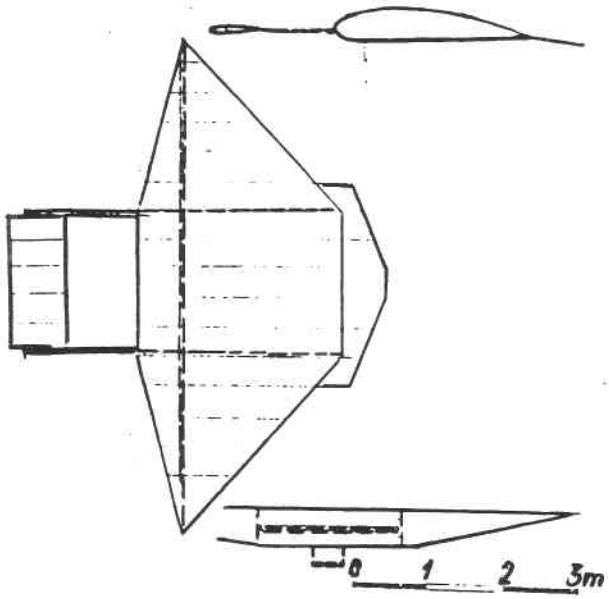


FIGURE 2. Dziaba tailless glider(designed by Stefan Malinowski) with wind sensor and control by means of profile variation, 1923.

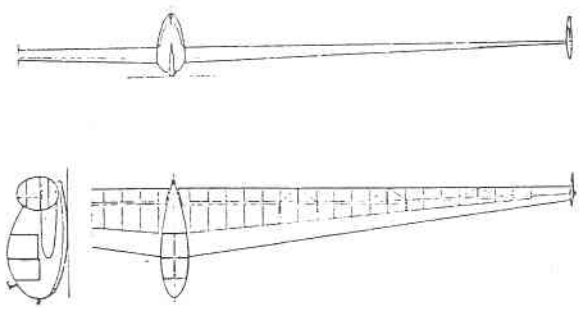


FIGURE 3. JN-1 Zabus designed by J. Naleszkiewicz, 1931.

trolled by asymmetrical (on one wing only) deflection of aileron/elevator. Pedals were operated independently to right and left. For air braking either both pedals simultaneously, or a hand lever, were used.

Variant III: As variant II, but the rudder was removed.

Flight testing

In view of the lack of experience of tailless gliders at SZD, the maiden flight of "Nietoperz" was prepared very carefully. The tests started with many short winch launches of 1-2 to 10 m of altitude covering distances up to 300 m. to determine basic flight properties before allowing aero towing. One short aero tow was then made to 2 to 3 m of altitude, at which the cable was released, simulating it being suddenly broken in normal operation. In the first proper aero tow something went wrong. When the glider entered the towing airplane turbulent wake after being initially above it, it pitched suddenly to the ground, then jumped up, lost airspeed and dove down. The fuselage front part and right wing were severely damaged. After repairs the tests were continued meeting no more problems. First, several short winch launches up to about 20m of altitude were made. Then the normal aero towing up to 2000m of altitude allowed the regular flight testing to start.

During these factory tests on variant I nearly 50 flying hours and a distance of more than 1000 km in many aero towed transportations were completed. In September 1951 the glider took part in a great Flying Show at Warsaw.

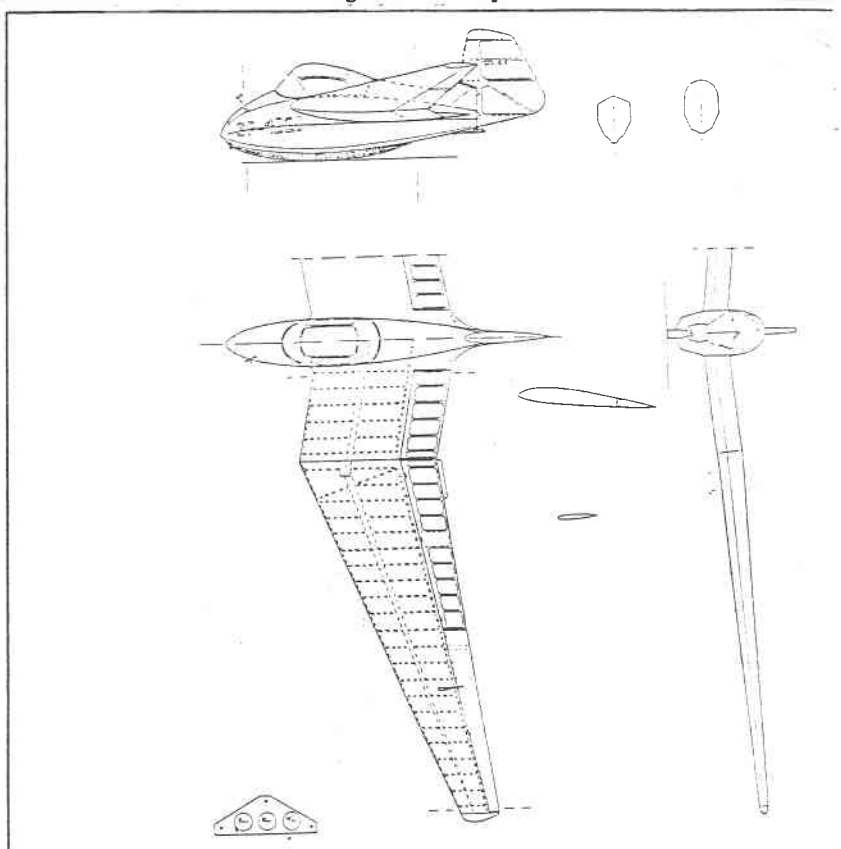


FIGURE 4. SZD-6x Nietoperz BAT designed by Wladyslaw Nowakowski and Justyn Sandauer, 1950. Maiden flight at Katowice, January 5, 1951, flown by test pilot Adam Zientek.

Variant II performed 6 wing launchings and 1 aero tow and variant III 3 aero tows.

In all the factory tests the glider was flown by one pilot only. Other pilots were allowed when all the tests had been completed.

Now the ship is in the Aviation Museum, Cracow.

Special flying behavior

Variant I:

- Unpleasant pitching on the ground run in take off and landing due to the curved skid.
- Poor scarcely noticeable flap effect.
- Very sensitive elevator producing vigorous response even for small deflections. Too sensitive in gusty conditions especially at rear c.g. location.
- Distinct short period pitching oscillation without control stick action and not noticeable without instrumentation. The estimated frequency was of about 2 Hz.
- Dangerous non-compensable tendency for nose-heavy pitching as a consequence of entering the towing airplane turbulent wake. Every entering into it led to a dive through and below this zone. It was the reason for the damage at the first aero tow. For the explanation see Figure 6.
- Positive static and dynamic longitudinal stability. The phugoid period was 11.5, 16 and 20 seconds at 75,90 and 120 km/h respectively.
- Astonishing ability to control the pitch by means of pilot's body position in cockpit (body movements forward and backwards as far as the back belts allowed). The resulted c.g. travel was about 1 cm. Unlike other gliders "Nietoperz" could be, in smooth air, controlled in aero towing with the stick free using the movements of pilot's body upper part only. It was even possible, though difficult, to fly above and below the airplane wake and to pass this zone in a dynamic way hands off, small aileron corrections being made by knocking the stick with the knee. The trimmed airspeed range obtained by the c.g. travel was 72-110 km/h. (Pilot of 75 kg).
- Poor aileron efficiency in the smooth air and unsatisfactory in gusty conditions.
- Strong negative (adverse) aileron yawing moment created problems in aero towing, especially in gusty conditions.

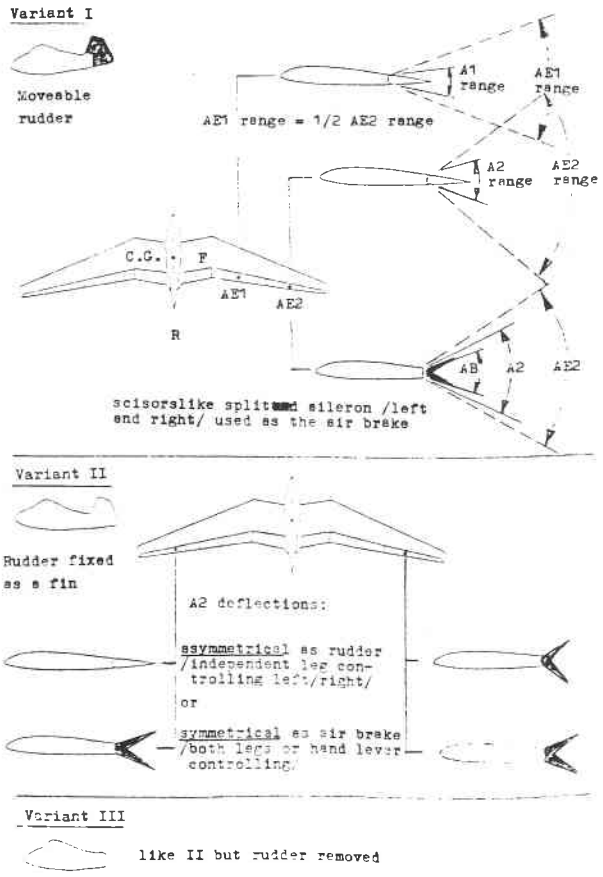


FIGURE 5. SZD-6x Control system variants.

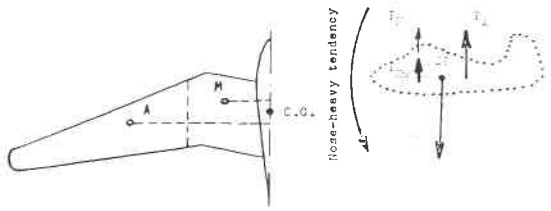


FIGURE 6. SZD-6x. Nose heavy behaviour inside the towing airplane turbulent wake as a consequence of the lift decrement on the central wing p[art being in the turbulent airflow. P_A-lift on the central wing part; P_M-full lift on the central wing part before thedisturbance; P_{MW}-lift on the central wing part decreased by the disturbance.

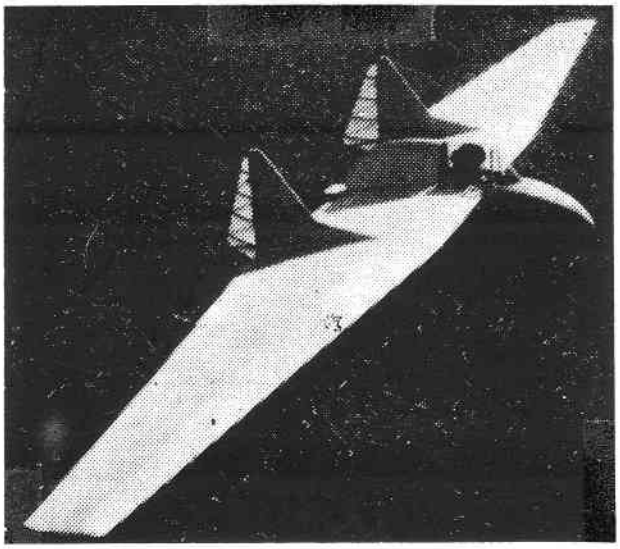
- Short-time action of aileron when not aided with rudder resulted a weak roll. With prolonged aileron deflection the bank slowly reached 20 degrees and then during about 3 seconds, the glider yawed into the direction opposite to the bank. In consequence the bank returned to zero; it then developed further in the original direction, the glider now circling that way more and more steeply until it entered a spiral dive (Figure 7).
- Precise straight flight controlled with aileron only (rudder free or locked) was difficult.
- Yawing was generally controlled with the rudder in a satisfactory way in smooth air. In gusty conditions it was unsatisfactory especially when compensation of towing cable side surgings was necessary.
- Bank reversal time, when both rudder and aileron were used, was about 4,4 sec. at 90 km/h airspeed (normal value for gliders).
- Side slip was possible up to 10 degrees bank for aileron fully and rudder partly deflected. Full rudder deflection resulted in a turn opposite to the bank.
- Considerable lateral instability with rudder free. At 100 km/h the yawing oscillations had a period of about 4 sec. associated with about +/- 30 degrees bank and about +/- 15 degrees yaw.
- Good air braking effect of slotless aileron. The control force increased in line with increasing deflection. On the ground run a slight tendency to nose up motion appeared.
- Stalling was possible with the rear c.g. limit only. The stalling speed was about 65 km/h.
- Spinning was impossible at all tested c.g. locations.
- Diving up to 210 km/h airspeed were performed. With the airbrake (split aileron AE2) the value of 190 km/h was reached. The rather high stick force made diving difficult.
- Initial airspeed necessary to perform loops was 170 km/h. Pull out stick forces were rather high. The stick movement had to be slow to avoid the pitching oscillations. When at the top of a loop the airspeed was too slow, the glider hung in the inverted position. After some time, considerably longer than for the conventional gliders, the ship pitched rapidly and unpleasantly into the normal flying attitude, then dropped nose down owing to insufficient airspeed.

Because of the low performance and flying difficulties in gusty conditions most of the thermal flying tests were useless. The maximum gain of height in a thermal was only 150 m owing to the tendency to pitching oscillation and the poor aileron efficiency making control difficult.

Variant II:

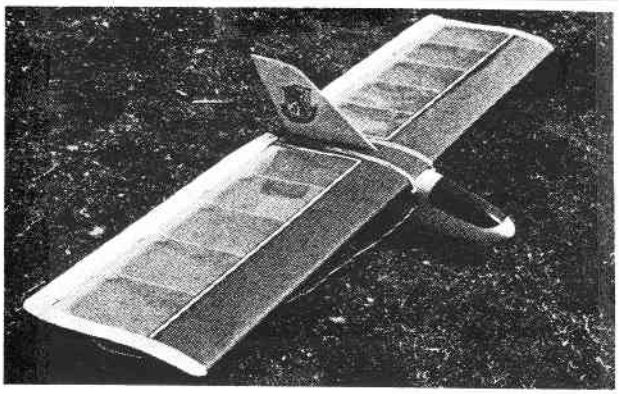
- Controllability, aerobatics included, was nearly the same as for variant I.
- Yaw control was satisfactory although difficult with the separate pedal deflections because of ergonomic reasons. The pulling leg force applied to the pedal necessary to support the closing spring was too weak and the aileron was not fully retracted.

From Modell Bauplane, 1992/1993,
Plans Handbook Catalogue de Plans,
Baden-Baden.
Contributed by Harald Buettner



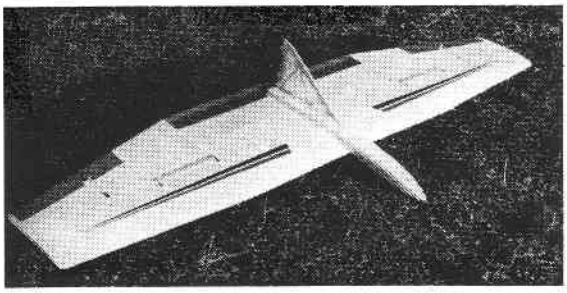
Fauvel AV-36 (in franz. Sprache)
Nurflügel

S: 3000 mm, L: 785 mm, G: 2300-2500 g, RC: 4-5 Funktionen, R: Holz, T: Holz.



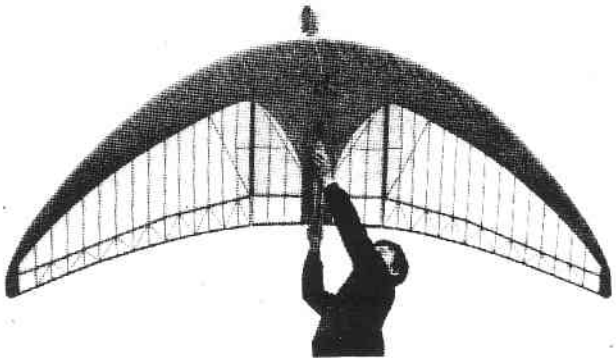
Little Plank (in engl. Sprache)
Nurflügel-Segler

C. Clemans, D. Jones, S: 1 420 mm, G. 670 g, P: S-1, (A: 0,8 ccm), RC: Quer-Höhe, R: Holz, T: Holz



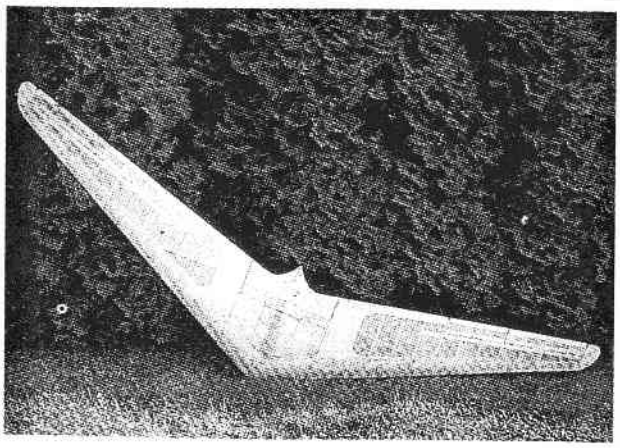
F-O-B

G. Obrecht/H. Bruns, 1974, S: 2 150 mm, L: 810 mm, G: 1 950 g, F: 23 g/dm², P: S-Schlag-Strak, RC: Seite, Höhe, Quer, Störklappen, R: Holz, T: Holz



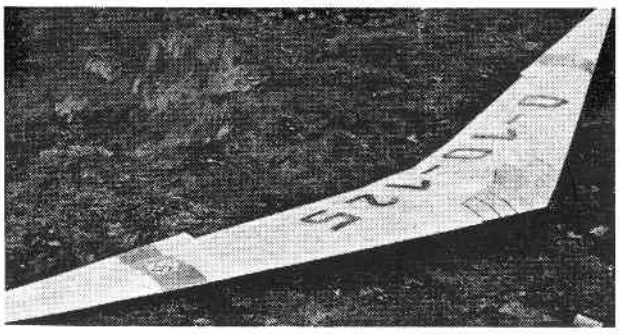
Horten Parabel
Semi-Scale Nurflügel

R. Roeser, 1989, M: 1:4, S: 3000 mm, L: 975 mm, G: o.RC 3800 g, F: o.RC 20 g/qd, P: N 60 R, RC: Seite, Höhe, Quer, R: Holz, T: Holz, B: Konzept der Gebr. Horten: Parabolisch geschwungene Nasenleiste, parabolische Tiefenverteilung der Fläche, parabolische Schränkung; Leichtwindsegel, auch als Freiflugmodell geeignet.



Wing
Anfänger-Modell

Andreas Mack, 1990, S: 2300 mm, G: 1150 g, F: 22 g/qdm, P: Strak H II 13,5 %, NACA 0010, RC: Quer/Höhe (elektronisch gemixt), R: Holz, B: Nurflügel-Modell des Horten-Typs; groß, jedoch handlich; konventionelle Holm-Rippen-Bauweise.



Horten III

Klaus Nietzer, 1972, M: 1 : 6,7, S: 3 000 mm, L: 520 mm, P: S-Schlag-Strak, RC: Quer-Höhe gemischt, R: Holz, T: Holz.