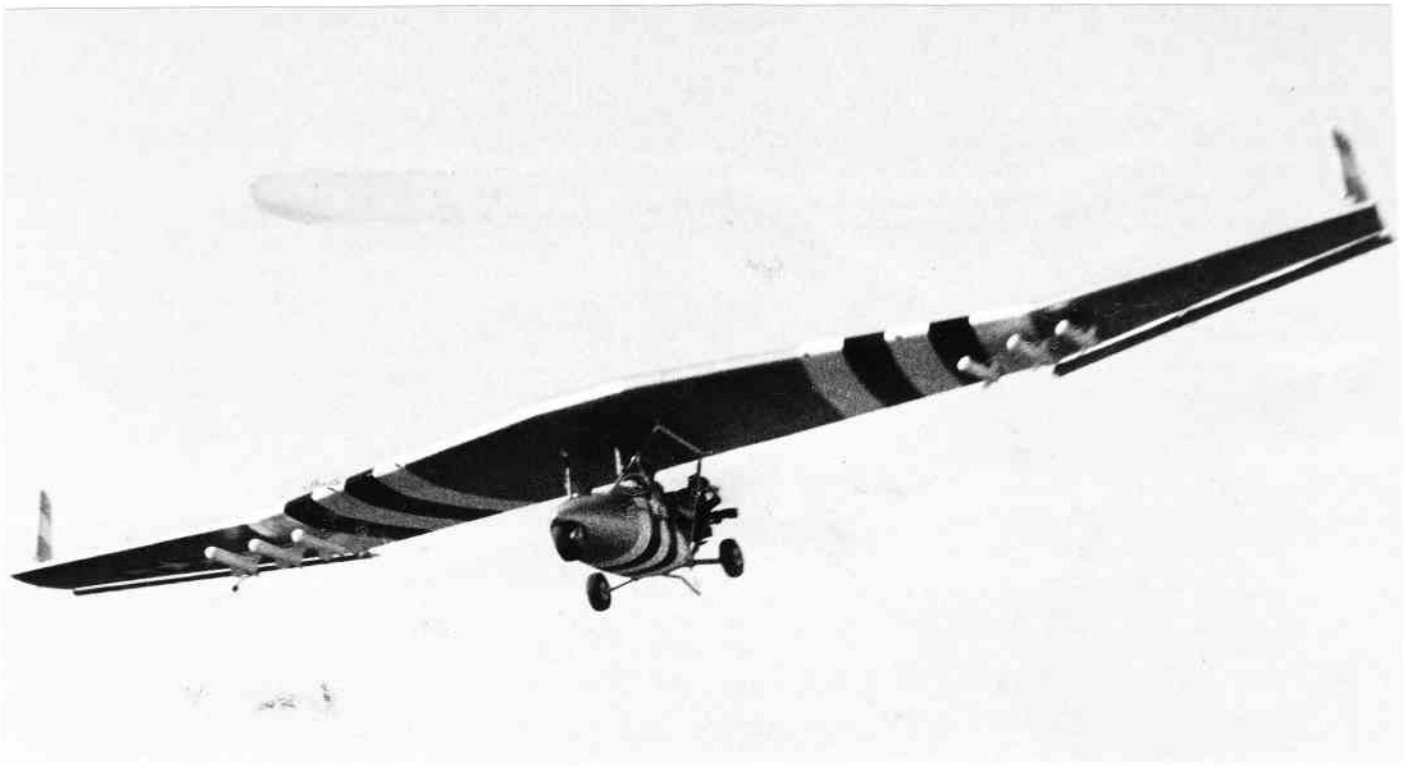
No. 70 APRIL 1992

T.W.I.T.T. NEWSLETTER



ARMED AND DANGEROUS MITCHELL B-10, POWERED BY 22 hp , 250 cc ZENOAH.
PHOTO COURTESY OF RICHARD AVALON, SAN BRUNO, CA.

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., **9204** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, April 18, 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.

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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

I would like to thank all of you who attended last month's meeting. There were over 30 people there to listen to Don Mitchell enlighten us on his perspective of aviation history. A number of those in attendance were from the Los Angeles area, with one becoming a new member and several others requesting information packages.

This month's newsletter includes a few more pictures and/or diagrams than we have had in the past. Some members have expressed a desire for more of this type coverage, along with sufficient written material to provide new and interesting flying wing concepts. We hope this meets with the general membership's approval.

Also in this newsletter is Ed Lockhart's logo submission, which I think is the last one we know is coming. I will plan on putting together a composite of all the logos in the May issue so that your favorite can be voted for. Once that is done we can determine the best way to get it reproduced and out to those members who want them.

For those of you dyed in the wool Don Mitchell fans, he has indicated he is willing to talk about various subjects related to his flying wing projects at future meetings. This has become possible since he now lives in Tehachapi, and it is possible for him to make it to the meetings on a regular basis. We will all be looking forward to this.

Next month's newsletter will also contain the year-end financial statements for TWITT. We had planned them for this month, but the amount of material in joined wings seemed to take precedence over the financial information. Suffice it to say we are financially sound with a growing membership.

That's all for now.

Andy

APRIL PROGRAM

As of publication date, our featured speaker for this month's meeting is tentatively set for **Dr. Joe Katz**, Professor of Aerodynamics at San Diego State University. Dr. Katz has spoken before our group in the past and proved to be very interesting. He will be covering his progress on computational fluid dynamics, so all you technical types come and get your questions answered. If you have to come some distance for the meeting and want to be assured Dr. Katz will indeed be there, please call Andy, Bob or Phil during the week before the meeting to confirm.

MINUTES OF THE MARCH 21, 1992 MEETING

Andy opened the meeting with a few announcements, like we would be having a raffle this month, and an overview of the day's program. He then asked if our visitors would introduce themselves. Bob Barbour, a friend of Bruce Carmichael's, was a military pilot who worked for Chance Vought among other things and is now building a two place motor glider. Bud Mears and Bill Barlow were also with us.

Andy then introduced Ernie Jones who is originally from Yakima, WA where he soloed in 1946. He had a video tape of a FBO from Yakima named Charlie McAllister who has been in business since 1926 at the same location. He is 88 years old and still going strong running his operation. Ernie's tape included footage of Charlie being interviewed by the local PBS station and then some of his own tape talking with Charlie while preparing to depart in his Skyhawk.

The tape also included footage of the Boeing Field museum which has an extensive collection of all types of aircraft. One of these was Charlie's Yakima Clipper sailplane which he built and flew in the local area for several years. It looked similar to some Bowlus models but was a design he had gotten out of Popular Mechanics. The video was several years old, but the museum had a lot of aircraft, and Ernie indicated there was still space for expansion so figures more airplanes are in it today. Ernie and the group chatted about some of the various aircraft as they passed by the lens, but you had to be there to appreciate it.

After Ernie completed his presentation, Budd Love gave us an update on his progress with the HIAM aircraft. Budd started by saying he had received a phone call from someone looking for a aeronautical structures engineer that could help him get FAA approval of a box that rides on top of a helicopter. Mission Research Corp. has taken up Budd's cause and are planning on paying him to design his own airplane. They have submitted a White Paper proposal to the Air Force and are waiting to see if there is any interest. Once this happens formal design and mission capability proposals will be developed and HIAM will be on its way to becoming a reality. Budd is very optimistic that further work will be done.

Andy then introduced Don Mitchell, our main speaker for the day. Don indicated he was going to talk about a number of different subjects including CG-4A wing construction and his own flying wing concepts.

(Ed. Note: These minutes will be reduced to cover only new areas that Don did not present at the SHA workshop in order to save space. As usual, if anyone wants to hear the whole talk, tapes are available for $4.)

Don began with a little background on some of the early development of the Boeing company, including the model 88. He mentioned that when United was first running passenger flights the four passengers would watch the pilot come out to the airplane with a parachute on, whereas, they had none. Apparently the airline finally got the word that this wasn't a good idea for public relations.

Don graduated from the Boeing School in 1936 and then went to work for United as a radio operator out of Oakland. He obviously survived those early days of "crude" aviation to go on and meet Hawley Bowlus. After working for Hawley for nothing for a while, he asked Don to come live in the shop and work full time.

During this time with Hawley they worked on the scale prototype for a troop transport with twin booms. It was this aircraft that Don converted into a flying wing by removing the booms, installing his external control surfaces, and putting split drag rudders at the tips. He and Hawley flew it a number of times working out some minor problems, but did not go any further with the project. The

Don Mitchell & "Stealth" model.

airframe was eventually taken back by the Army and destroyed.

Don related their experiences with the full size prototype of the Bowlus troop glider and how it was constructed. It turned out to be a 20,000# glider that was towed by a B-17. Unfortunately, on one of the flight the military test pilot started an oscillation through the B-17's wake and got the glider into an almost flat spin. Hawley and Harry Perl were able to get out, but several people were not so lucky, including DuPont whose chute didn't open in time.

They then got a contract to build three test aircraft. They had all metal spars with wood ribs in front of it. They used the Chrysler cyclo-weld process of gluing wood to metal (this was in 1944). The glider concept started loosing its appeal to the military and the project was eventually canceled.

In 1940 he started building a 50' flying wing with swept leading edges and external control surfaces. He did this to overcome the necessity of putting a lot of twist in the wing to gain stability. He modified the Junkers approach to control surfaces, but he inverted the airfoil. This works due to the fact that they become separate aerodynamic surfaces and work well together as the angle of attack changes. It didn't fly as well as he would have liked, partly because of the 30% symmetrical airfoil he used.

Don went to building conventional gliders for the next few years (the Nimbus series). During this time he worked for Timm Aircraft and got involved with coordinating the construction of CG-4A cargo glider wings. He had some interesting comments on how the various manufacturers build the wings (these were furniture companies not aircraft plants). He described some of the construction techniques Timm was using to build the spars out of laminated cap strips. He also commented that the aircraft were built to only last several years, since the military didn't plan for them to last very long during the war (planned obsolescence).

When he finally got back to flying wings he built the Osprey which he flew about 4 times from auto tow. However, before anymore testing could be done the aircraft burned up in a building fire.

About 16 years ago, Dr. Long asked Don if a flying plank could be converted into a good hang glider. Don told him about the only thing you could do with a plank was burn it up. Dr. Long finally came back with some money and Don built the original hang glider wing. Don uses the distance the leading edge is behind the trailing edge to determine the amount of sweep back. This results in less sweep on bigger wings.

He built it to fold in the middle for easier transport. The spar also had a hole in it at the center section so the pilot could put his head through it and fly in a prone position. The only problem was the hole wasn't big enough to allow for a helmet the Dr. wanted to wear, so Don had to change the pilot position so his head would stick up above the wing.

Don set the glider up so that the control stick would lock in a detent for takeoff so the pilot could use weight shift for pitch and twist grips for aileron and rudder until safely airborne. The control stick would then be used until time for a landing, and then locked back

into the detent.

Don put small landing gear on the wing to make it easier for ground handling, but the Dr. would land on them. Fortunately, they were easy to fix, but Don got tired of replacing them all the time.

The "Stealth" during build-up.

The wheels were made of a rubbery type foam cut to about 6" wide. He would then hot-wire a hole for a PVC tube to act as a guide for the axle. This was supported on the ends by plywood glued to the foam. These turned out to be excellent wheels for the type of handling the wings got.

Don has tried to standardize sweep back of his wings. The spar line, which is set at 30% is swept between 9 - 13 degrees depending on the span. This seems to work well for him so he keeps using this combination.

He commented that he was not a fan of Horten wings since they used so much twist and were very hard to fly (according to a conversation he had with Rudy Opitz). Don doesn't agree with the control surface arrangement that has controls as part of the wing. They have a tendency for them to float up as the angle of attack increases. This is why Don uses the external control surfaces.

Don talked a little about the work of Dr. Lippisch and his development of external control surfaces. Don feels that Lippisch's ideas were probably well ahead of their time when it came to flying wings. For instance the German 163 was an excellent flying machine once the rocket engine ran out of fuel. Don said he would like to find someone with some money so he could build a 163 with a jet engine since it flew so nice.

Currently, Don is working on various versions of his Stealth II. By changing pods on the 40' wing it can be a hang glider, ultra-light, micro-light, or regular glider. It can be configured for bicycle or tricycle gear, and powered or unpowered. It uses a symmetrical airfoil with Irv Culver's twist theory and it seems to working very well. He is also playing with a 16' model of this wing which can be seen in the accompanying pictures.

Commenting on the external surfaces, Don said that according to NACA the hinge line for the surface should be a the leading edge to ensure the size of the gap does not change with surface movement. However, he has found that placing the hinge line further back and allowing the gap to change size has not had any adverse impact on flying characteristics or control effectiveness. There is always the possibility of flutter, so Don counter balances all the surfaces except the rudders, and highly recommends it.

To avoid adverse yaw, he twists the external surfaces 10 to 12 degrees which causes the down surface to be almost streamlined during a turn. The surfaces move about 30 degrees up and 7-8 down. Although the NACA reports had a percentage formula for gap width, Don uses a uniform gap the entire length of the surface. The size of the gap changes with deflection due to the twist, but he has not found this to be a problem.

Don's design philosophy is to keep the aircraft as simple as possible, safe and cheap. The difference between the ideal machine and

one that gets the job done is so small it is not worth the additional effort for the average builder. He uses wood because it is easy to work with and is good for ultra lights. He has found that a good combination is red PVC foam under a wood surface. The bond between the foam and wood prevents the wood from getting moisture from the inside so deterioration is slowed down.

When designing an aircraft first you have to figure out what it is going to be used for. Secondly, are you going to factory build it or have the homebuilder put it together. Don decides how to craft something based on who is going to be doing to work. Many times the whole project is a series of compromises that will allow the greatest number of people to complete the project.

Don talked a little about control system strength and rigidity. Making them strong is not much of a problem, but achieving rigidity with cable type systems is difficult since there is a lot of slop developed by the time you get through all of the pulleys and bellcranks. If there are going to be high surface loads this may not be an acceptable situation, so designing to functional purpose becomes important.

Don was asked to comment on the Hughes Spruce Goose. He explained a little bit about how some of the components were constructed, which included some very unique methods for laminating curved parts and attaching the outer skins to the bulkheads. He also told us some about a Hughes racer and some the strange things he asked the designers and builders to do during construction.

Andy thanked Don for a most interesting presentation, and then held the raffle as a wrap-up for the meeting. The certificate for a T-shirt with a choice of pictures was won by your's truly, and one of our guests won a flashlight and battery set.

That's all folks.

LETTERS TO THE EDITOR

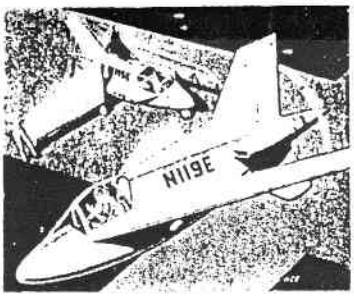
2/1/92

TWITT:

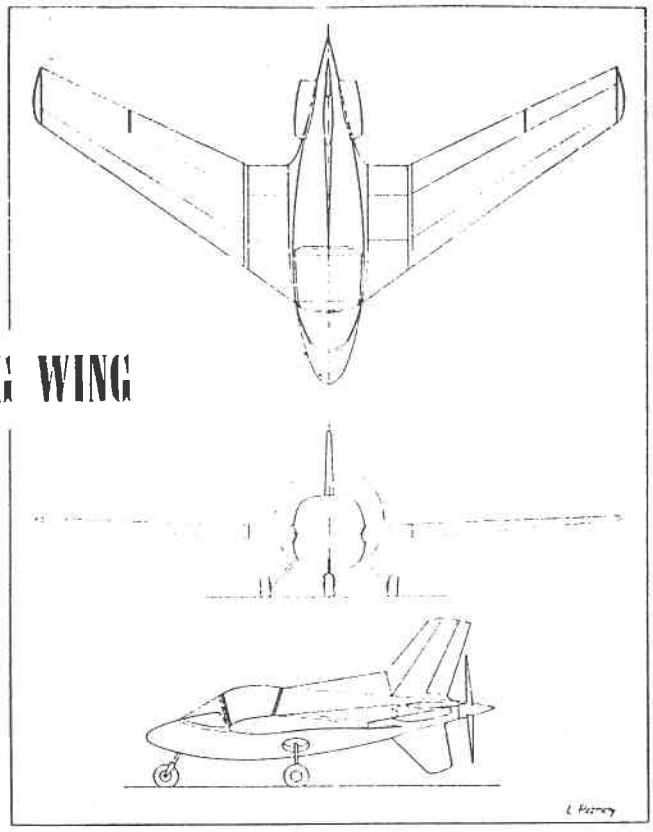
Here is an article that might be of interest to someone at a meeting or through the newsletter.

It is from EAA A/C File #3 Design Vol. 1, probably from about '62-'63. There is nothing about copyright mentioned. Maybe L. Pazmany would be interested in revising or expanding on it.

The only thing I question is the laminar flow over 100% of the chord - possible even with control surface discontinuities?



Drawing by Geo. Collinge



AN EXPERIMENTAL PUSHER FLYING WING

by Ladislao Pazmany, EAA 2431

Also, what do you think of Ray Borst's stab thinning? Would it increase hinge moments, significantly?

PS: Ray Borst taught at San Diego State - if he is still around he would be a good speaker.

Take Care,

Larry Nicholson

(Ed. Note: Thanks for the material, Larry. Due to limited room we are only publishing the diagram of Pazmany's Pusher Flying Wing, and will use "Reducing Control Surface Drag" as filler in this or a later issue. If anyone is interested in the two page design proposal by Pazmany, please send us a self addressed stamped envelope and we will send you copies. Pazmany emphasized that this was presented as an idea and that it needs further evaluation. It might be just the thing for you adventurous types who are looking for an unusual model.)

2/26/92

TWITT:

I have been meaning to write to TWITT for a while but getting a new business started has consumed most of my time. I want to thank those members who made the comments about my low wing design. Their comments sent me back to the drawing board and the new configuration is starting to gel. When I get something definite, I will send some drawings and info for the members to chew on.

I am the member Karl Sanders sent you the AIAA report for. He wrote to me and offered his opinions and cited three reports. It is very difficult to get such info out here in the wilds of Colorado so I appreciate his contribution greatly.

My interest in joined wings is based on the enclosed article and my long time desire to design a two place sailplane that doesn't have the dimensions of a B-25. Soaring is dying in this country. Our sailplanes are being sold off to Europeans because flyers are not interested and sailplane owners are leaving. I believe that the PROCESS of soaring is a chief cause of this situation. I think my situation is typical. If I want to go soaring, I have to drive 70+ miles to the nearest airport that allows sailplane operations. Then, if I had a plane, I'd have to have a gang of bodies around to help me unload my 2 place sailplane and assemble it because it has a 50'+ wingspan and weighs over 700#. Then I'd have to go through the hassles of getting my monster out to be towed aloft. I did it for a while and swore never to go through it again.

I believe the only way to go is self powered, I don't like to fly alone and all the self powered planes are single place. The joined wing configuration (according to the article) seemed to fill my soaring needs perfectly. It is reasonably sized for one or two man operation. It can be powered simply and cleanly. According to the article, it should have good L/D for level soaring (penetration) and with front and rear extended it should have excellent thermalling qualities.

Karl criticizes the concept in his letter to TWITT. I respect his experience and intelligence but I also thing this might be a good opportunity to get a forum going on this configuration. I am enclosing a couple of sketches to help stir the pot a bit.

The Mark 1 design allows the owner the flexibility of a small (22' span) cross country charger or by adding wing extensions a fairly compact (for two place) sailplane.

The Mark 2 is designed primarily for soaring although its 32' wing span is less than that of some contemporary light planes.

You will notice a difference between the left and right wing junctions on the Mark 2 drawing. I have made a 15" span balsa glider with the left wing junction and it flies well.

I'd appreciate any comments any of the members might like to make.

Sincerely,
Jim Loyd

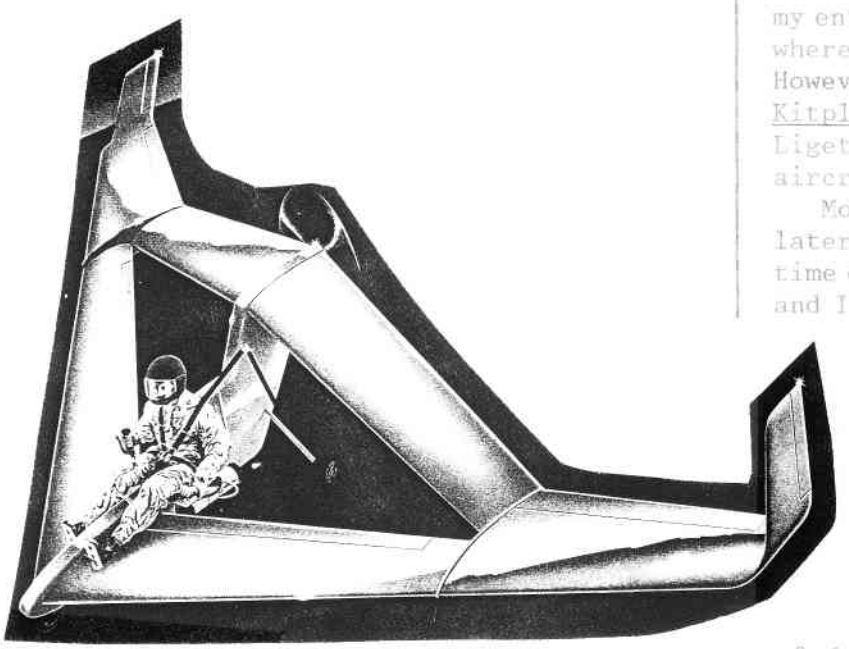
(Ed. Note: The article Jim is referring to is "Joined Wing - Modernizing An Old Concept," by Chuck Bulot, as published in the March 1983 issue of Homebuilt Aircraft, pages 21-23. It discusses the ideas of Dr. Julian Wolkovitch through a question and answer session with the doctor. We have also received a marketing brochure for TRIDENT joined wing ultralight which has been worked on by Dr. Wolkovitch.

Information on the TRIDENT can be obtained from Summit Aircraft Corp., P.O. Box 884, Denton, TX 76201.

If you are interested in a copy of the article, send a SASE and we will send you a copy.

As indicated on the March cover, we have

included Jim's concept drawings on page 10, and we hope it sparks some comments from the neophyte and experienced designers out there.)



Summit Aircraft TRIDENT

3/16/92

TWITT:

Received my first issue of the TWITT newsletter as a full fledged member a couple of days ago. I was quite startled to see what appeared to be my 1982 Sailplane Design Entry in the Sailplane Homebuilders Association, first ever, design competition on the front cover. Reading on I discovered that Mr. Jim Loyd was given credit for the concept. Research will show that the concept has been around for many years and, hopefully, this letter will set the record straight.

The enclosed diagrams and specifications are those of the design I submitted to Bruce Carmichael back in 1982 and were subsequently published in a booklet entitled "The Homebuilt Sailplane Design Contest" by the Soaring Society of America. The judging was in two stages. The first stage included a technical review of each design and the second was the final judging based on the finished product. Of the near 100 entries, only 18 were judged good enough to continue on to the second stage. The Centauri was one of the few that was allowed to continue. You may recall that Burt Rutan won that competition with the Solitaire.

About four years later the Ligetti brothers of Australia built a design very similar to my entry. The aircraft was brought to Oshkosh where it was flown quite successfully. However, in talking with Dave Martin, of Kitplanes Magazine, he indicated that the Ligetti's had made some modifications to the aircraft and it was subsequently destroyed.

Model testing of my design indicated some lateral stability problems. However, at the time other priorities entered into the picture and I have not returned to the project since.

I have done some extensive reading on the subject of joined wing aircraft. Many of the more prominent designers and theoreticians are of the opinion that the concept, although interesting from a structural standpoint, has absolutely no advantage over conventional wing-first/tail-last configurations.

Structurally, the joined wing concept offers some advantages. Weight reduction of the structure is the first to come to mind, however, it requires that both the main wing and the forward canard be of the same span. This eliminates some of that weight reduction advantage. Because of the basic triangular form of the configuration, a great deal of rigidity is gained and it may result in a lighter airframe overall. However, being basically a canard configuration, its overall performance figures are reduced when designed for use as a high performance sailplane. The Ligetti's showed the design has certain advantages as a powered aircraft requiring relatively low power to achieve fairly decent speed characteristics. Their aircraft required only 22 hp to achieve speeds in excess of 100 mph.

Joined wing aircraft have been around for many years. The inherent problems associated with the concept have all but eliminated it as a viable solution related to mass aerial transportation. It may be that some day someone will find a joined wing configuration that will be the answer.

Sincerely,

Dick Harrington
Editor, SHApTalk

(Ed. Note: In defense of Jim, we are sure the design he submitted was not intended to present a new concept, but rather his idea of a joined

wing configuration that would solve his particular problems.

The short message on the cover asked for comments on his proposal and we are pleased that you took the time to provide us with this historical look at joined wing design. We are surprised that Bruce did not remember the concept from the SHA contest and comment on it at the last meeting. Maybe this month we will hear from him. The Centauri three-view and specifications are on page 11.

As you can see from the copy of the TRIDENT concept elsewhere in this issue, there as some who think joined wings have a place in at least the pleasure aviation market. Perhaps your prediction of greater commercial use might come true if these initial projects have some success.)

3/18/92

TWITT: (Bob Fronius)

It was pleasant talking with you the other evening. It sounds like the members of TWITT are very active aviation enthusiasts.

Enclosed please find a check for $17 as payment for membership and an information pack and back issue.

As I mentioned in our conversation, I am actively looking for a set of plans for the ICARUS II or EASY RIDER (or any of the numerous copies). I have built two Avid Flyers and am quite serious about evaluating the ICARUS for my next project. I would greatly appreciate it if you would mention me to your son Doug, and have him call or write with any information on the availability of a set of plans.

Again, thank you for telling your son about my wanting to locate a set of ICARUS plans.

Sincerely,

Bill Spencer
95 Frisco Trail
Sedona, AZ 86336
(602) 284-0223

(Ed. Note: Welcome to the TWITT, Bill. Bob says that Icarus II plans are available from him through the TWITT P.O. Box for $10 plus $1.75 second class postage. Since our membership is so diverse, there is probably someone who has a set of Easy Rider plans they may be willing to part with or have copied. We wish you luck in your search and hope you will send us any results you obtain once your evaluation is complete.)

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 PUBLICATIONS

Karl Sanders provided the following information from the International Aerospace Abstracts, Vol. 29, No. 18, Sep 15, 1989:

A89-42488 Flying wings (2nd revised and enlarged edition) (Letaluchschie kryl'la/2nd revised and enlarge edition/), Igor K. Kostenko, Moscow, 1988 105 p. 7 refs in Russian.

The history of the development of tailless aircraft of the flying wing type is reviewed with emphasis on the work of Soviet scientists and designers in this field. The aerodynamics and flight dynamics of aircraft and gliders based on the flying wing design are discussed in a popular manner. Data on the current Soviet-made and foreign models of flying wings are presented.

Microfiche available from:

Technical Information Service - AIAA, Inc.
555 W. 57th Street
New York, NY 10019
(212) 247-6500
FAX (212) 582-4861

Price: $4 + $2.50 (mail) = $6.50

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 "P" 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

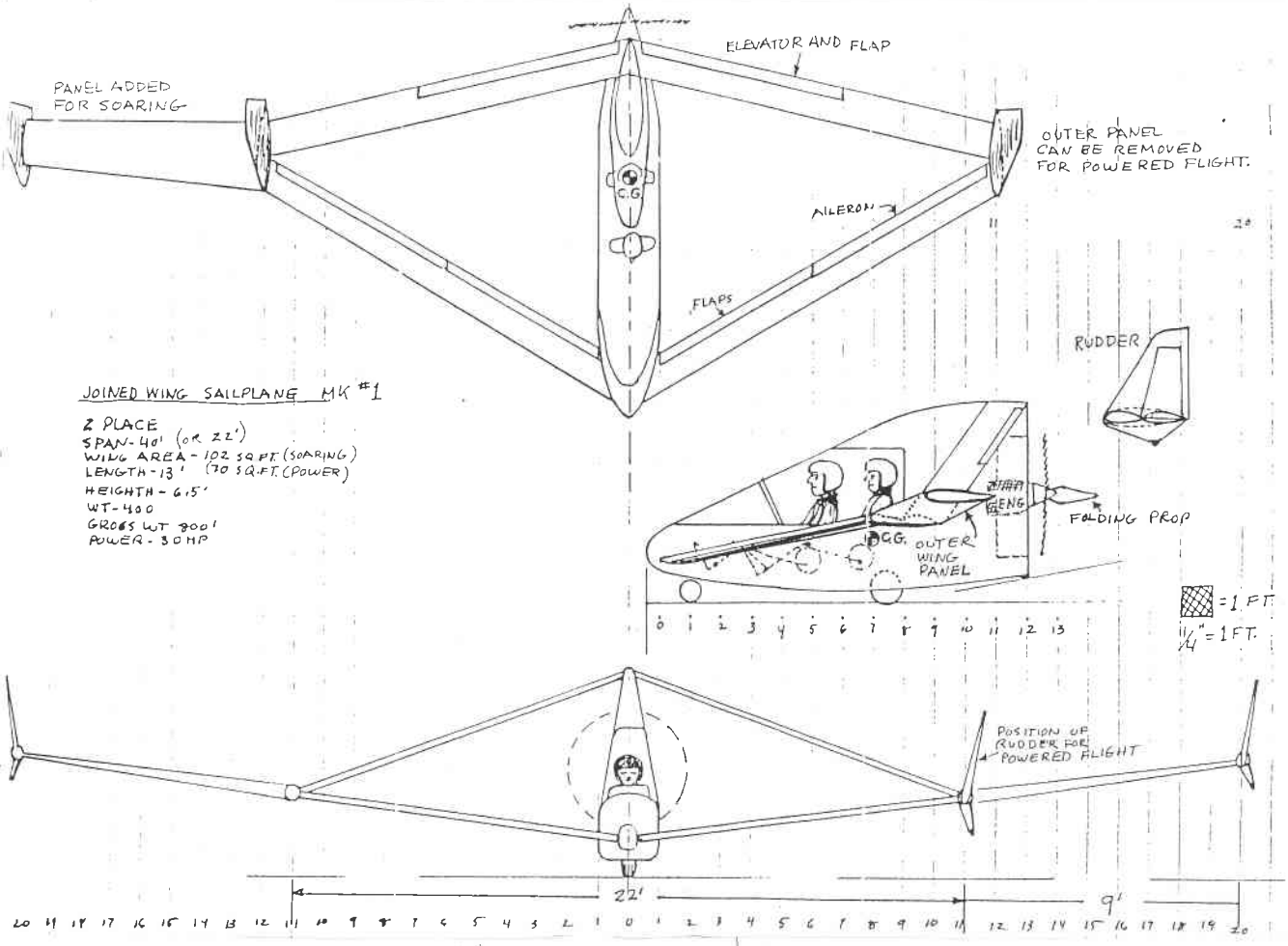
The Klingberg Wing 100 kit, an upgrade of the original Klingberg Wing is now available. It has many new features which supposedly make it more stable and a good thermaller. They are available directly from:

Future Flight
1256 Prescott Avenue
Sunnyvale, CA 94089
(408) 735-8260
Suggested Retail $219.95

Tower Hobbies also offers it for $149.99. Call 1-800-637-4989.

The original Klingberg Wing is still available from Omni Models at: 1-800-747-6664, $42.99.

Logo design submitted by Ed Lockhart

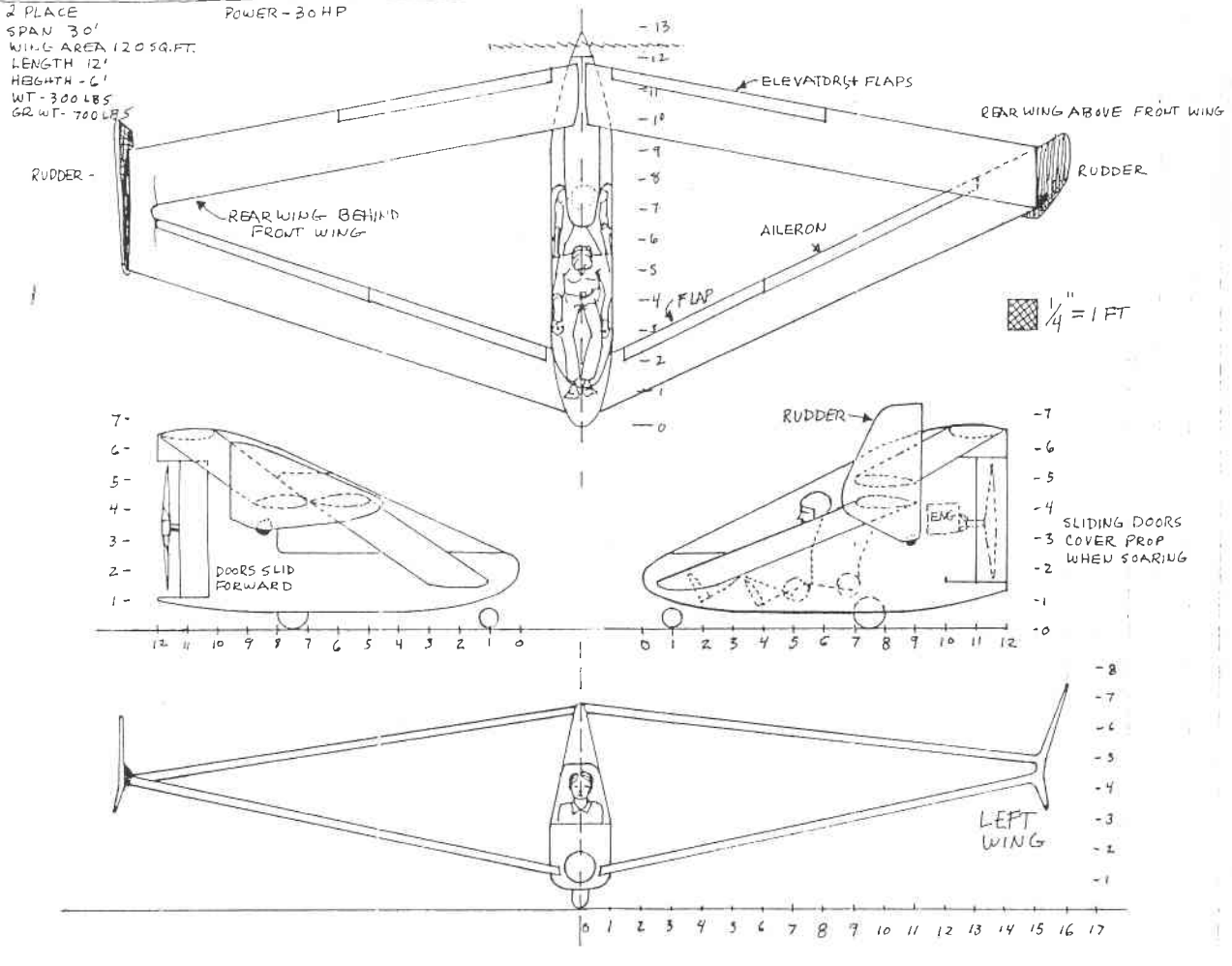


JOINED WING SAILPLANE MK #1

2 PLACE
SPAN- 40' (OR 22')
WING AREA - 102 SQ FT. (SOARING)
LENGTH - 13' (70 SQ.FT. (POWER)
HEIGHTH - 6.5'
WT - 400
GROSS WT 800'
POWER - 30 HP

JOINED WING SAILPLANE MK #2

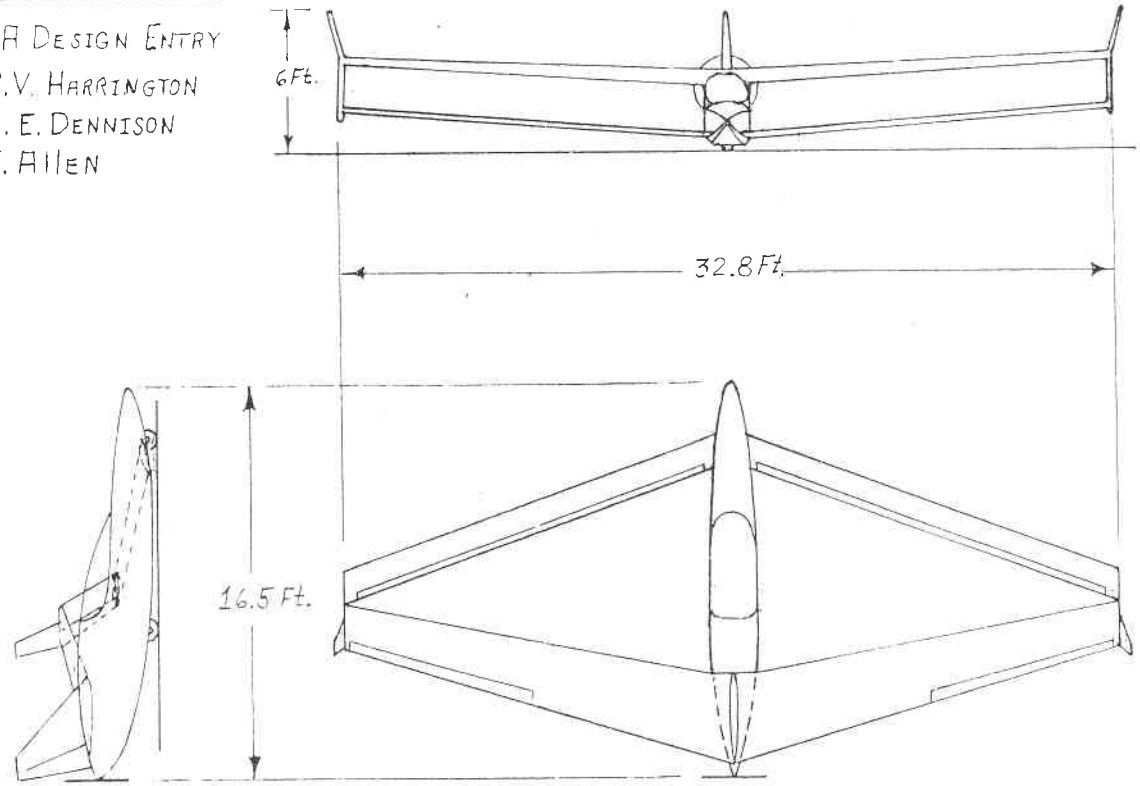
2 PLACE
SPAN 30'
WING AREA 120 SQ.FT.
LENGTH 12'
HEIGHTH - 6'
WT - 300 LBS
GR WT - 700 LBS
POWER - 30 HP



HDA1 CENTAURI

SSA DESIGN ENTRY

by: R.V. HARRINGTON
R.E. DENNISON
J. ALLEN



SPECIFICATIONS

General

Configuration	Modified Canard
Span	32'9.75"
Length	16'6"
Height to top of rudder	6'0"
Empty weight	313 lbs
Gross weight	550 lbs
Total lifting surface area	127.4 ft^2
Maximum loading	4.32 lbs/ft^2
Gross weight (170 lb pilot)	500 lbs
Normal loading	3.92 lbs/ft^2
L/D @ 500 lbs G.W.	25.1

Lifting Surfaces	Wing	Canard
Span	32.81 ft	32.81 ft
Aspect ratio	12.9	24.5
Area	83.43 ft^2	43.97 ft^2
Root chord	3.8675 ft	1.333 ft
Tip chord	1.8333 ft	1.333 ft
Mean aerodynamic chord	2.875 ft	1.333 ft
Airfoil section (Wortman)	FX67-K-170/17	FX74-CL6-140
Incidence angle	0^0	$+1^0$
Dihedral angle	$+2.5^0$	$+4^0$
Sweep angle (25% chord line)	12^0 fwd	20^0 rear

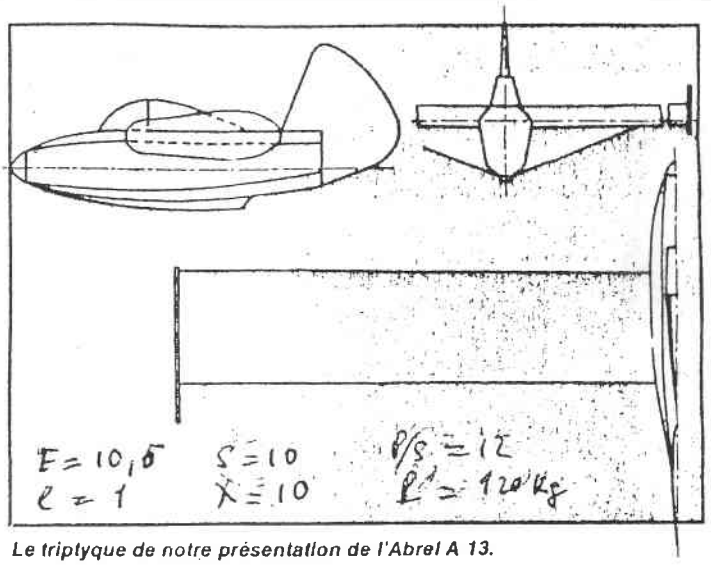
Canard Damping factor .0476

Vertical Surfaces

	Main Fin	TipPlates	Winglets
Area	9.2 ft^2	3.17 ft^2	0.793 ft^2
Lower chord	3.8 ft	1.33 ft	1.19 ft
Upper chord	1.5 ft	1.833 ft	0.385 ft
Airfoil	NACA 0009	NACA 0009	Witcomb

Moveable surfaces	Ailerons	Elevators	Rudders	Brakes
Area	*4.25 ft^2	*4.25 ft^2	2.6 ft^2	*1.58 ft^2
Hinge line	80% chord	80% chord	70% chord	80% chord
Deflection	$+20^0$ -10^0	$+20^0$ - 10^0	$+20^0$	$+20^0$
Span	*8.875 ft	15.698 ft	3.3 ft	2.56 ft

(note) * each side



Le triptyque de notre présentation de l'Abrel A 13.

French Abrial 13 "Buse" omitted from last month's newsletter.