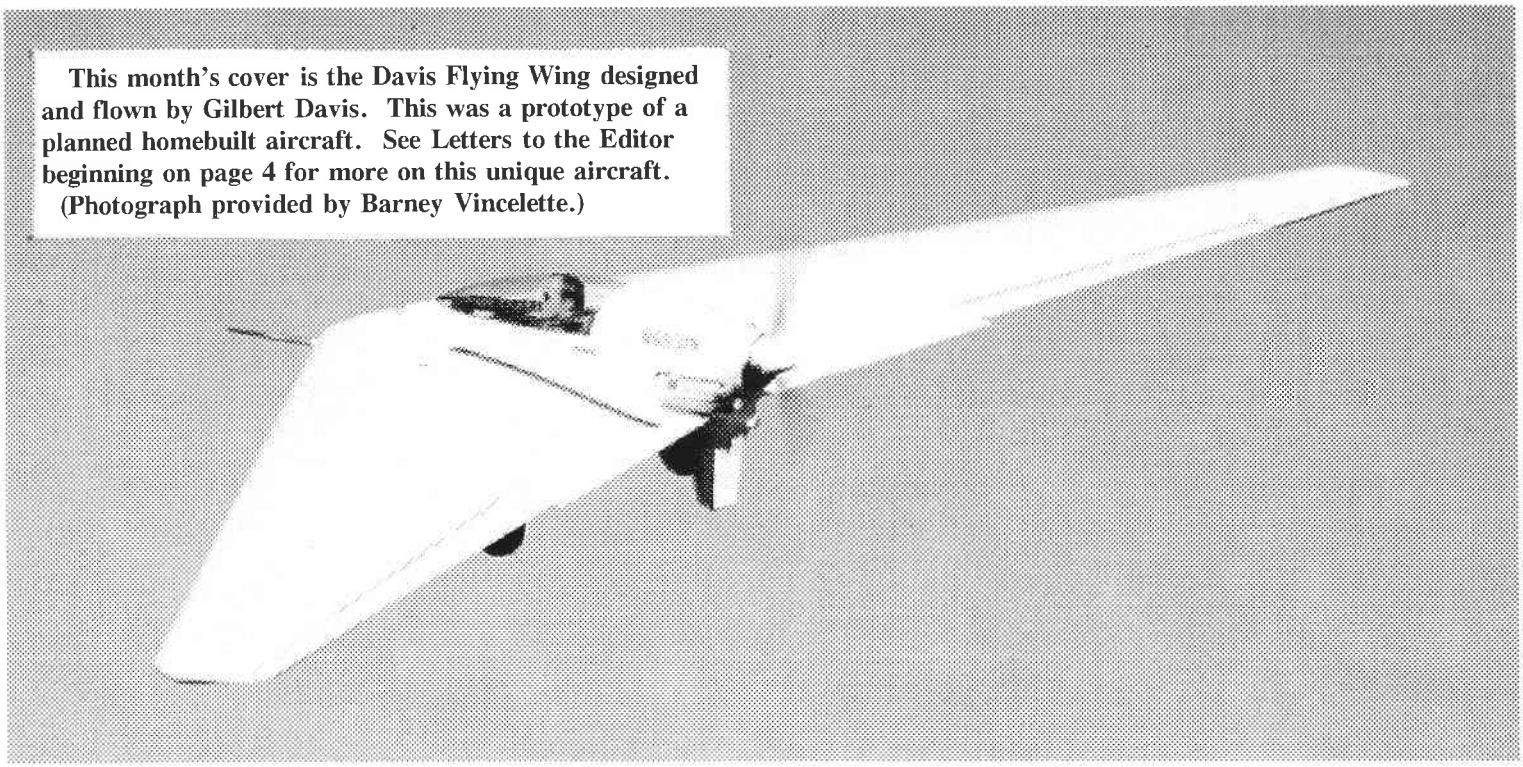
No. 102 DECEMBER 1994

# T.W.I.T.T. NEWSLETTER



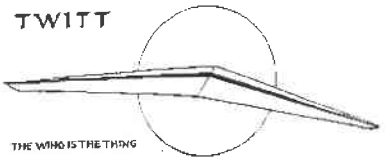
This month's cover is the Davis Flying Wing designed and flown by Gilbert Davis. This was a prototype of a planned homebuilt aircraft. See Letters to the Editor beginning on page 4 for more on this unique aircraft. (Photograph provided by Barney Vincelette.)

**T.W.I.T.T.**
The Wing Is The Thing
P.O. Box 20430
El Cajon, CA 92021

MERRY CHRISTMAS!

The number to the right of your name indicates the last issue of your current subscription, e.g., **9412** means this is your last issue unless renewed.

**Next TWITT meeting: Saturday, January 21, 1995, beginning at 1330 hrs at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - East side of Gillespie).**




**THE WING IS THE THING (T.W.I.T.T.)**

**T.W.I.T.T.** is a non-profit organization whose membership seeks to promote the research and development of flying wings and other tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis. T.W.I.T.T. is affiliated with The Hunsaker Foundation which is dedicated to furthering education and research in a variety of disciplines.

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

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**Meetings are held on the third Saturday of every other month (beginning with January), at 1:30 PM, at Hanger A-4, Gillespie Field, El Cajon, California (first row of hangers on the south end of Joe Crosson Drive, east side of Gillespie).**

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## PRESIDENT'S CORNER

I apologize for the newsletter being a little late this month, but I had to go away on a business trip and there just wasn't enough time to get it out before my departure.

I hope it finds you well on your way to finishing your Christmas shopping, and that you are getting all those "flying things" you need from your loved ones. This is a good time of the year to justify that little extra expense for the new radio or engine your pet project just can't live without.

The TWITT library now has a copy of Tailless Aircraft in Theory and Practice, by Karl Nickel and Michael Wohlfahrt, as translated by Capt. E.M. Brown RN, published by the AIAA. There are some interesting line drawings of flying wing type aircraft (or proposed designs) that I will try to incorporate into the newsletter from time to time, mainly to peak your interest in perhaps purchasing the book. Karl Nickel has been a TWITT member for a number of years.

Just a reminder to those of you who have subscriptions coming due for renewal. Don't forget that the fee has gone up to $18 per year for U.S. members and $22 US for our foreign members. We don't anticipate the proposed rise in postage rates to affect the price at this time, but the situation will be reevaluated sometime next year to determine how much it is impacting us financially.

I would like to thank Dominique Veillard for the excellent half-tones he made for this month's issue. He went to a lot of effort to get them just right rather than simply throwing them in a machine at giving us a one shot result. Hopefully, we will be able to use him again in the future, depending on his schedule and our publication dates.

I have taken some extra time this month to try some different type styles to "jazz" up the newsletter a little bit more without sacrificing its content. Things were just getting a little monotonous, so we'll see how it looks.

All of us here at TWITT central wish all of our members a joyous holiday season and a very happy new year.

Andy

# MINUTES OF THE NOVEMBER 19, 1994 MEETING

Andy opened the meeting by thanking everyone for enduring the cold hanger for the day. He announced there were hot beverages and cookies in the rear to help with the cold, as well as magazines and periodicals. He then asked for everyone to introduce themselves to the group and just briefly relate why they were there.

During these introductions we found two people who were interested in joined wing technology and wanted to build either models or full size aircraft using this design. One of our guests was Dr. Shawn Carlson, Executive Director/Physicist, Society for Amateur Scientists. This is a new non-profit organization whose purpose is to get people who have a passion for science but don't have the opportunities because they don't happen to be Ph.D.s and get them doing front line science through an underwriting program working with world class experts in their field.

Bob Fronius announced that everyone was invited to the Annual John Street Aeronutical Society gathering on New Year's Eve (after 8:00pm) and Day. After breakfast on New Year's Day, the flittering, diving and inverted flying will commence. Bomb drop, spot landing and distance from the center of a 25' circle will be observed. There will be a special salute to Doc Sloan, only if his cannon downs anything. All persons present will be official judges, but the host (Bob) will make the final decision (and is willing to be bribed with cash, checks or plastic, or tawny port). In the event of Bob's demise before this illustrious event, it will become a wake, and a vulture will prevail.

*(ed. - This is a fun event for those of you who like to build wild and crazy things that might actually fly. This year's theme is aircraft the flap to fly, but anything is eligible for the contest. You must bring your own building supplies, or you can pre-build your creation and come to compete. If you are interested, call Bob at one of the numbers on page 1.)*

Andy then showed a short video on the very impressive space shuttle launch project carried out by the University High School (Orange County, FL) science class.

The floor was then turned over to Karl Sanders who opened with some remarks on his experiences as an aeronautical engineer before the began taking questions from the audience.

Karl has written several articles on flying wings, some of which were not positive about flying wings, but they also weren't negative as to the possibilities for tailless aircraft. *(ed. - Karl has been a constant contributor to the TWITT library, most of the information being directly related to the positive aspects of tailless technology, although he may believe a tailed airplane may have inherent advantages for many applications.)*

Until his retirement about four years ago, he was an advance or preliminary design engineer for over 48 years. Much of this work was trying to come up with an aircraft to meet certain mission requirements. This is not always possible to do with flying wings due to the limited amount of cargo space available unless the airframe is made exceeding large.

Karl worked for Alexander Lippisch during the 1942-44 period doing design engineering on some of his more bizarre creations.

After the war, Karl moved to Argentina where he met Dr. Reimar Horten. He helped Horten build the first tailless glider in Argentina through the government sponsored aircraft company.

Bob Chase asked Karl about the pros and cons of forward swept wings as opposed to having a flying wing with aft sweep. The swepted back configuration allows for more control of the aerodynamic center and CG, while providing some pitch dampening effects (forward sweep also gives the dampening, whereas a plank style does not).

Bob indicated he had some experience with swepted back wings with tip rudders that proved less than satisfactory. Karl explained the rudders may have been necessary due to the lack of a fuselage and fin to act as a weather cock. The use of both tip rudders and ailerons working simultaneously also have the effect of canceling each other out, which could account for some poor performance qualities.

Bob Fronius passed around an old drawing of a side-by-side, swepted-back flying wing with tip rudders designed by Hawley Bowlus for everyone to see as an example of what was being discussed.

Ed Lockhart asked about whether you should use wash-out or wash-in on a swept-forward wing. Karl responded that you have to look at the entire configuration before coming to a conclusion about whether to use wash-in, or perhaps no twist, on the forward swepted wing. This type of wing already has a tendency to stall at the root section, rather than the tips, so it is a difficult question to answer without a specific configuration to analyze.

Paul Stahlhuth showed Karl a picture of the swept-forward RC model he designed and talked about at the last meeting. Paul indicated he had built the wings without any type of twist and they had been flying successfully in that configuration. Karl commented that the tail surface incorporated in Paul's design gave him a short couple horizontal surface which was not a bad idea. It has the effect of moving the aerodynamic center slightly aft. Karl also mentioned that the dihedral was necessary in the forward swepted wing to provide some directional stability, which is what Paul had done with his models.

In looking at the model, Karl said he liked the idea of a quasi independent horizontal surface since he is a proponent of small forces on long moment arms. This is a very efficient way of accomplishing controllability, and the longer the moment arm that smaller the surface needs to be to achieve the same results.

Apparently Lippisch had experimented with some bungee launched delta shaped flying models as part of a German Army project during the war. What they found was that high angles of sweep back did not provide the stability of lower angles, but no further work was done at that time to determine the degrees of controllability each type could achieve.

Karl went on to explain why he felt the swepted-back wing had advantages over the forward swept type. These advantages included better gust relief due to the bending causing a change in the airflow sweep line making the leading edge lower than the trailing edge. This is not twist, but just geometry that changes the lift distribution. It also assumes the wing is not extremely stiff and has some flexibility within the structure. Forward sweep works in the opposite way, therefore, is not a good in this aspect.

In some cases sweeping the leading edge or the entire wing backwards is done more to control the CG of the aircraft than to improve the performance. Examples of this are the DC-2 and DC-3 with their swepted leading edge (an after thought in the design) and straight trailing edge.

Dominique Veillard asked about which type wing produces the worst cases of dutch roll. Karl commented that it is about the same for both types.

Swepted-back wings also tend to be heavier due to the increase in wing length that affect the bending moments. This leads to building a structure to resist the bending, which means more material and, therefore, more weight.

Karl went on to explain that in designing a flying wing you have to ask what is the purpose, or what do you want to achieve, and what kind of airplane, powered or unpowered, do you want. The glider is the simplest type to plan since you don't have to match wing area to a power requirement. Sinking speed and glide angle become the primary considerations for the glider.

For gliders, the comparison between conventional and flying wing types tends to show that there is no significant advantage to the tailless design in L/D. This is due to the ultimate values for the lift coefficients that produce the minimum glide angles. However, the tailless aircraft carries with it other problems, like a restrictive range of CG adjustment.

This CG range problem really comes into play when you start looking at powered commercial aircraft that must carry large payloads. The internal volume of the wing is not sufficient, unless you make it extremely large, to carry cost effective loads over the distances typically flown by the airlines.

Conventional aircraft, with their long tail and moment arm control surfaces, also provide some additional controllability aspect not available in a tailless design. In cases of extreme flight path divergence (wind shear, etc.) the small moment arm of a trailing edge control may not be sufficient to pull the G loads necessary to get the aircraft out of this type of condition.

Karl went on to talk briefly about canards in relation to delta wing shapes. In some instances this combination can result in a lighter weight aircraft due to the lower bending forces imposed by the canard versus a conventional tail surface. Of course, there are some disadvantages to canard designs, so it goes back to his original comment about what is the intended purpose of the aircraft.

As an illustration of his comment on designing for a purpose, Karl related how he arrived at a flying wing design to accomplish the around the world flight made by Burt Rutan's Voyager. He had an aspect ratio of about 9.5 versus approximately 15 for the Voyager, but the wing only held one pilot which was probably not feasible for this long of a flight. He did end up having to use two engines in order to get the heavy wing off the ground and up to cruise altitude, just like the Voyager, but he didn't explain whether his configuration allowed for shutting down one when the weight was reduced later in the flight. Of course, all of this was speculation, since the aircraft was never built.

Bill Chana asked about what Karl knew about the Navy's now defunct A-12 program, a delta-shaped flying wing to replace the A-6 ground attack aircraft. Although Karl had worked a little on the project, he did not know why the particular configuration was chosen. He did go back to his original theme of some operational requirements can override the aerodynamics of an aircraft. In this case, perhaps the need for stealth was a controlling factor in the A-12's design parameters.
*(ed. - According to a brief bit in the November 1994 Pacific Flyer Aviation News, the mockup of the A-12 has been donated to the Heritage Aviation Association in Fort Worth, TX. The association says it plans to display the full-scale model at the Aviation Heritage Museum, to be located at Alliance Airport.)*

Karl went on to discuss a little about the joined wing concept, since there were at least two people in the audience interested in it. This type of aircraft is basically a bi-plane with a stiff structure and joined tips. Bill and Karl both felt there were some distinct disadvantages in this concept since the upper wing has to conform, or live, with the structural deflections of the lower wing. Again, the end use for the aircraft could dictate this type of configuration as Boeing found when they were looking for a better way to carry an anti-sub (AWACS type) radar (buried in the upper wing) without all the parasite drag associated with the big rotating disk.

One of the biggest disadvantages to joined wing designs may be the way in which fuel has

to be stored and used and its result to the CG during a flight. This can be overcome with proper fuel sequencing, but may not be appropriate for the average sunday flier with low experience.

There was some general discussion about the stalling characteristics of a joined wing design, particularly at high angles of attack. In this situation the lower wing's wash would have a tendency to block out the rear, upper wing with less than desirable results. The point was then made that by having the engine mounted high on the vertical in front of the rear wing the propeller wash would help overcome some of this problem. In a seaplane application it would also keep the engine out of the water spray.

Bob Chase took us back to the forward sweep wing by relating he had solved some of the wing drop during stalls by putting part of the vertical fin below the wing. This kept it in cleaner air during the stall, and Karl commented that the F-8 fighter took advantages of this same principle.

One of the missions well suited for a flying wing is that of high altitude reconnaissance work. Here, large spans are an advantage in this application. The oblige wing is now being experimented with as an alternative for missions such as this.

The question was asked as to why the canard configuration was abandoned relatively early in the evolution of the airplane. Karl summized that it was due to the better gust dampening affects of an aft mounted tail surface versus the forward canard. The conventional aircraft's wing is almost entirely at the CG so it is not adversely affected by the gust, and then the rear tail surface takes care of any divergence. The canard, however, starts a larger pitching movement as it goes through the gust which the wing may not be able to fully overcome.

Karl talked a little bit about some of the new problems facing pilots today, one of which is the fly-by-wire systems that can make an unstable aircraft feel like it is flying quite normally. However, when there is a software glitch or some other hardware failure things can go wrong in hurry at put a heavy task on the pilot to maintain control. *(ed. - One of TWITT's original ideas was to have a stability augmentation system for the flying wing, but have a manual means of quickly shifting the CG forward if there should be a failure of the system so that the pilot could retain control of the aircraft.)*

One of the problems with a flying wing in the commercial arena is its lack of flexibility to adapt to new roles. Karl gave the example of trying to reconfigure the B-2 to carry cargo or more bombs than it was originally designed for. This would be hard to do since there is not much that can be done to expand the internal volume of the airframe. However, take a B-52 and you can add a section of fuselage to expand the bomb load or make it into a cargo carrier. This is probably one of the reasons why we are not seeing Jack Northrop's vision of commercial airlines using flying wings.

This was the last area of discussion during the regular portion of the meeting. Andy thanked Karl for his taking the time to come down from Los Angeles and provide us with his insights on flying wing designs. With that done, the meeting was adjourned.

# LETTERS TO THE EDITOR

11/29/94

TWITT:

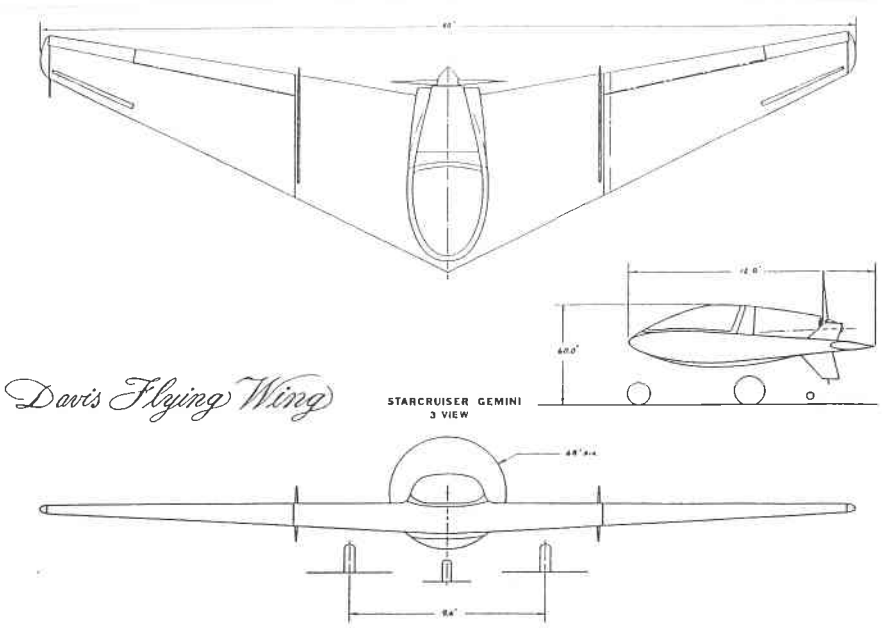
In 1946, in Hawthorne, California, the giant XB-35 having well neigh deafened anyone neat it with its 12,000 hp engines took position to begin its takeoff for its first flight. Jack Northrop had issued an order that all non-essential personnel remain indoors for their safety. But word of its taking the runway flashed through the plant and all the engineers, scientists and craftsmen who created it mobbed the side of the runway. As the takeoff began, the sound of the engines was drowned out by the wild cheering that could be heard across the countryside.

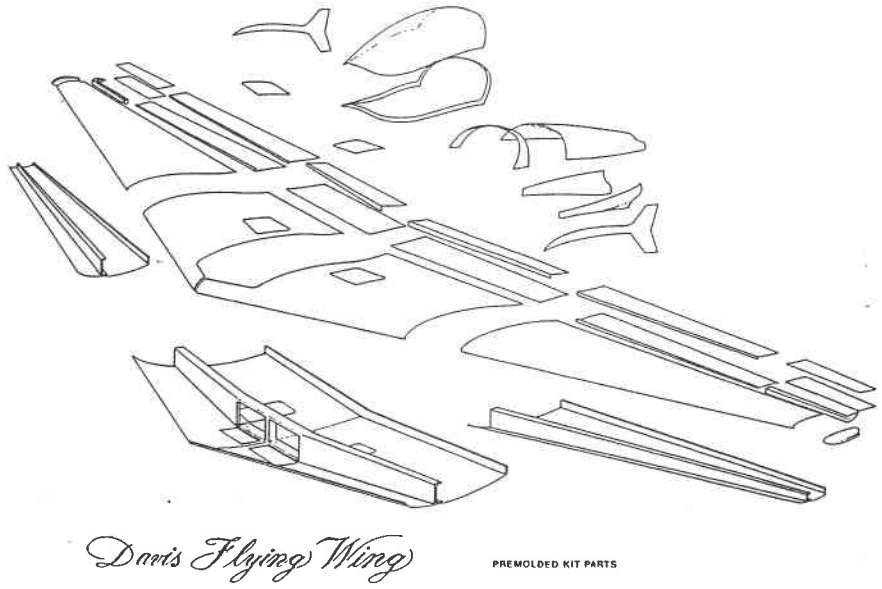
We all know that shortly after the XB-35 became the YB-49, the personal malice of the Secretary of the Air Force brought about the orders to vandalize every YB-49 that could be found.

The YB-49 was more that an engineering achievement whose influence can still be felt in air and space craft. It was a cultural miracle of Western Civilization that stood apart, as do Finland's "Futuro" houses stand apart in architecture, Raphael's paintings stand above the visual arts, Mahler's Symphonie of a Thousands is far beyond music. Not only is the extermination of the YB-49 an injustice to human kind, but should a civilization from some distant planet make contact with us, it would be wrong to deprive them of the beauty such a form has to offer.

For the rest of us, the eternal form of this flying wing need not be lost to eternity from where it obviously came just because it changes configuration and becomes available to all who want to build it in a smaller size that could carry two or three people.

In 1987, in Boise, Idaho, Gilbert Davis successfully flew a single seat flying wing that he had built using engineering records, plans and assistance from the Northrop engineers. This "proof of concept" wing flew with the utmost maneuverability and efficiency. But, because it was only a temporary test ship intended for donation to the EAA museum in




the resources available to him.

Over the last few years I have been corresponding with him as he goes through cycles of depression that are an inevitable medical part of extreme chronic pain. He said that he will never be able to complete the "Starship Gemini" under such conditions, but he could be interested in someone else taking over and completing it. I have suggested to him and I wish to suggest to TWITT, in particular to experienced composite designers, that his plans be taken and slightly adjusted to a set of plans that people could purchase and use to build such flying wings from scratch.

While I believe Mr. Davis should be paid a royalty every time a set of plans is sold, I think it should be very clear that our reason for making available the flying wing is not charity or pity for what has happened to Mr. Davis, but rather because it is the best flying wing for private ownership ever designed. I sincerely hope some of us in TWITT can bring it about; I think Mr. Davis would agree to it.

Respectfully yours,

Barney Vincelette

| | |
|---|---|
| Span | 40' |
| Length | 12' |
| Height | 5' |
| Empty Wt. | 980# |
| Useful Load | 2,020# |
| Norm. Gr. Wt. | 2,000# |
| Max. Gr. Wt. | 3,000# |
| Fuel Cap. | 90 gal. |
| Engine | Lycoming O-320 |
| Propeller | Wood, fixed pitch |
| Max Speed | 185 mph |
| Stall Speed | 52 mph |
| Cruise Speed | 172 mph |
| Rate of Climb | 1,300 ft/min |
| Range 55% | 1,800 mi |
| Range 75% | 1,500 mi |
| Ceiling | 24,000' |

Oskosh, after which a ship would be offered in kit form to carry two or three people, it used a two stroke Kawasaki engine and a belt drive to the propeller. One day the belt broke at too low an altitude for a successful forced landing and in the crash Mr. Davis was crippled by a broken back.

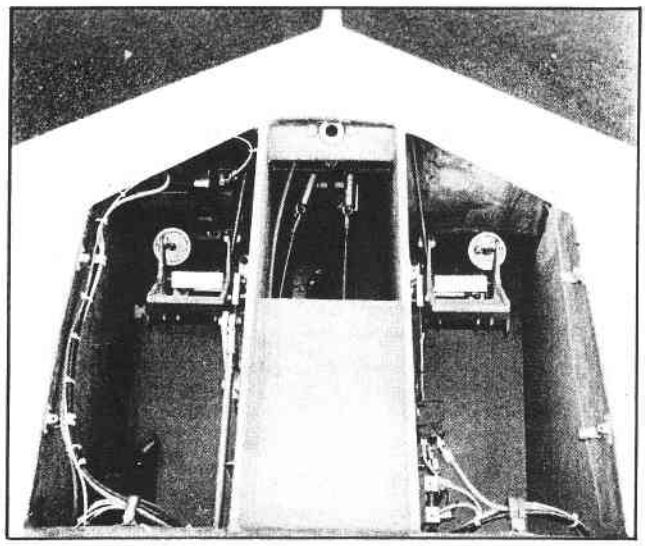
Since then several operations have been attempted to stop scar tissue from growing against his spinal cord and inflicting chronic pain. However, he still suffers from cycle of crippling clinical depression, and as much as he wants the two seat wing to fly (powered by a more dependable Lycoming O-320 engine) he cannot do it by himself. He has designed the "Starship Gemini" to be built from pre-molded composite parts, but the factory facilities needed to do it this way are beyond

*(ed. - This is an unusual request from a member, however, what he is proposing has some merit that warrants further investigation.*

*Barney and I talked about it on the phone one evening, and I felt the biggest issue was one of product liability on the part of the engineers that helped modify the existing plans into a more builder friendly design. If this obstacle could be overcome, I believe we have the engineering talent within TWITT to come up with a set of plans that would allow the average homebuilder to construct this type of aircraft.*

*If there are any members who would be interested in exploring the possibilities this proposal presents, please contact us by phone or letter so we can determine if it worth perusing. Obviously, this would be a purely voluntary effort on everyones part, but there*

*has been no specific timeframe established that would create a pressure situation in meeting publishing deadlines.*



**Easy maintenance access**

*I have published some of the material Barney included with his letter so you can see where the project was when the crash occurred. I hope that this might be something TWITT can do to further the expansion of flying wings within the general aviation community as sport planes.)*

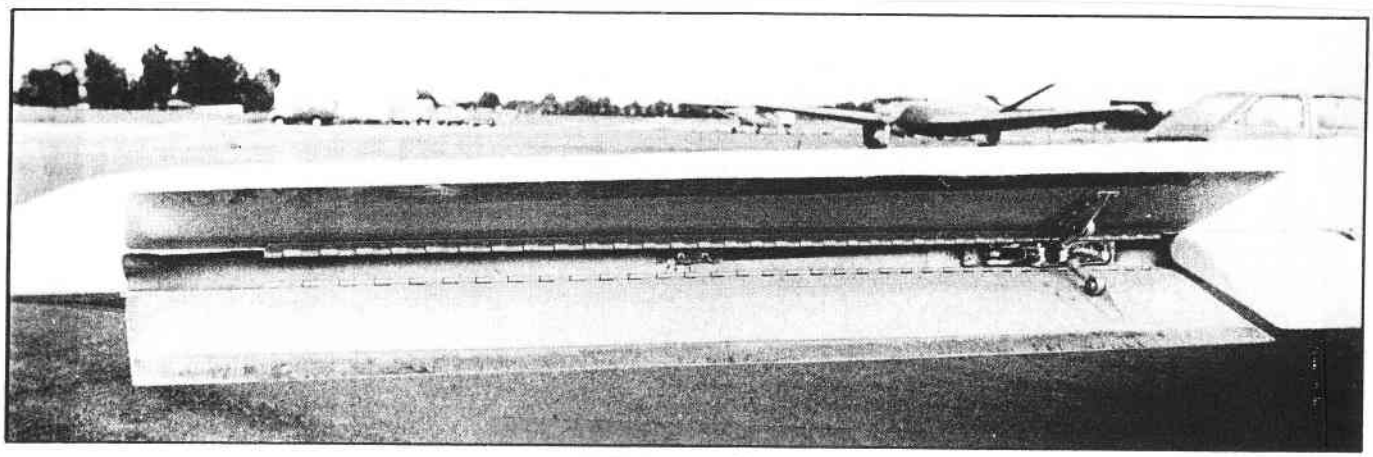
11/16/94

TWITT:

Enclosed please find my check in the amount of $18 for membership renewal *(ed. - everyone please take note that this is the current membership fee).*

I would like to offer TWITT some items I have before they become damaged due to improper storage. First, I have a complete set of blueprints for the Kasper BKB 1A and Bekas swept-wing sailplanes, which I purchased from Witold Kasper in the late '70s. Also, I have a new, unused set of plans for the Easy Riser, a rigid-wing biplane tailless hang glider that was popular in the mid 1970's (derived from T. Kiceniuk's Icarus series); I built and successfully flew 3 of these, each of better quality than its predecessor. These plans must NOT be used to build an actual aircraft, since there was some evidence of instability under certain conditions (we were able to solve this problem through careful construction and minor modifications). I would be happy to discuss my experiences with the Easy Riser if anyone is interested. Additionally, I have a series of plans for some successful tailless RC model airplanes which I will include in the package.

Last year I did a design study on an original design plank planform which might be suitable for a 2-place cross country airplane; I have included a couple of copies of a concept drawing of the final design, which I subsequently decided not to pursue. I wrote Al Backstrom several times and he provided me with some very useful input as well as his approval of my concept. I really believe that such a design could satisfy a need for an efficient airplane that could be simple to construct (or to manufacture in kit form!).



**Split drag rudders**

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# Season's Greetings

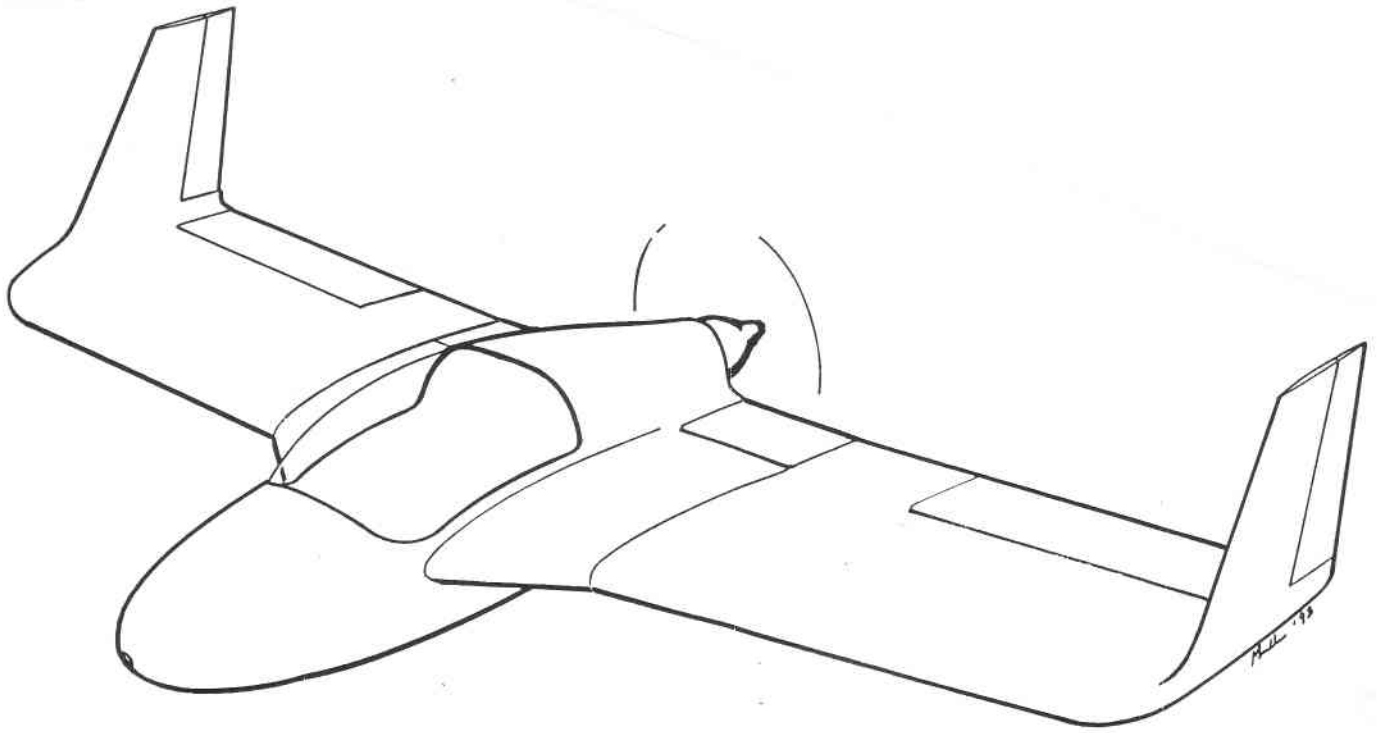
Currently I have decided to go back to my first love, which is soaring; I have begun the construction of what I hope will be a very high performance 15-meter sailplane with a partner, Rob Sjostedt. This is to be an all carbon-fiber aircraft constructed exclusively from

molds. Progress on the first major component (the horizontal stab) is well under way, so this is no "pipe-dream" project.

Some day I'll make a meeting down there!

Good Flying,

Bill Hinote



*(ed. - First let me say we would be happy to receive the items mentioned in your letter, and would make sure they are properly stored. We will abide by any restrictions you place, such as not using them to build an aircraft, but would like to be able to allow members to see, and/or use, any of the better ideas that may be available from the plans.*

*As you can see, I have reduced your drawing down to make it fit the newsletter's format a little better, but I think everyone can get a good idea of where you were going with this project. We would be happy to hear and see more about it when you have the time.*

*Bill included his business card of Griffon Aircraft Co., P.O. Box 390, San Luis Obispo, CA 93406, which we would assume may eventually produce one of the designs he has discussed above.*

*I will get the items you requested in your other note off to you in the near future and I know you will enjoy them.)*

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11/18/94

Dear Mr. Sanders
c/o TWITT:

I was very sad to read your letter in TWITT this month because I feel that there is a lot of disinformation or misunderstandings in the air.

This spring I informed the two Argentinean aerospace magazines from which I got the addresses that there had happened a great honor for Dr. Horten, the British Gold Medal. In the same time, the medal was presented to the family in the British Embassy in Buenos Aires. The information I had is from Great Britain in the year 1993, and is from their leaflet of the history of this award and the medallists before. Dr. Horten is not listed in the table of former medallists. The only reason to understand the wrong information is that the magazine did it because the son of Dr. Horten himself received the medal in May 1994 in the British Emabassy in Argentina, accompanied by other members of the Horten family.

The other point is that the table with dates of the Argentinean Horten designs is not complete and contains wrong information. The Urubu never was a hangglider; it's a side-by-side sailplane. The real hanggliders H X and b Piernifero with 10 and 15 meter spans I have also missed seeing. Also the Horten H Ib, the H XVI, both flown, are not listed. The world's completest information of all Horten designs is to be found in the book Nurflügel written

by Dr. Horten himself and I in 1983. I know there are some gaps in it, especially in those things that happened in the years before the end of WW II. We couldn't get those closed up to the date the book had been printed. Perhaps one day we (together with friends) will be able to publish a supplement, "Nurflügel Vol 2" or so. We will see.

Please don't worry about my response. Thank you very much for your interests in the Horten history shown in your effort to put together all information available. As I don't understand the Spanish language I cannot read the originals from Argentina, so your engagement helps me very much.

Yours sincerely,

Peter F. Selinger
Stuttgart-Sillenbuch, Germany

*(ed. - It does appear that there is some confusion information about the British Medal award to Dr. Horten as to when and where it was presented. If anyone else out there has access to some British publications that might tell the real story, we would appreciate hearing from you.*

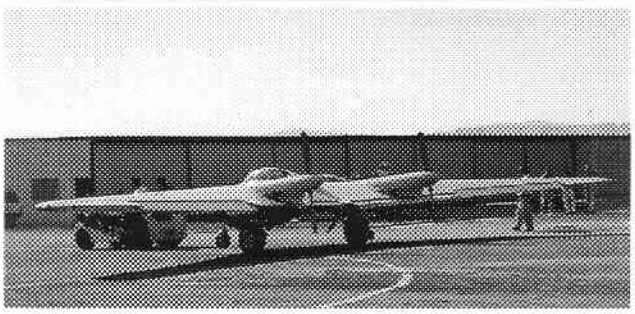
*I know Karl put together the table from the information he had available, and I tried to make sure I transcribed it correctly while putting in into the newsletter. I hope that nothing was done wrong during this procedure, and, if so, I apologize to both Karl and Peter.)*

## THE N9MB FLYS AGAIN

*(ed. - The following material was extracted from an article by Wayman Dunlap published in the December 1994 Pacific Flyer Aviation News. By the way, he titled the article "The Wing Is The Thing".)*

On November 11, 1994, a restored Northrop N9MB took to the air at the Chino, CA airport, powered by its experimental Franklin XO-540-7 eight cylinder supercharged engines, and piloted by Don Lykins, Planes of Fame museum chairman. This initial test/demonstration flight lasted approximately 40 minutes. *(ed. - This event was covered by the press and our own TWITTers Bob Fronius and June Wiberg. The pictures included in this issue were taken by Bob.)*

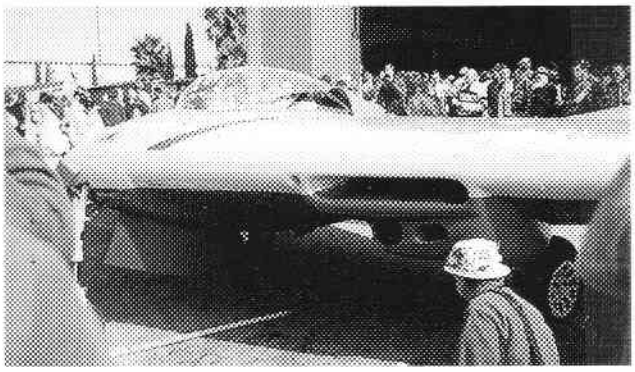
Maneuvers during the flight were kept simple and it went without incident until Lykins flew down the runway for the crowd's benefit, then reduced the power to the two Hamilton Standard 2 B-20s and started losing RPMs. Although he thought he was loosing power, the problem was later determined to be the propeller governor on one engine going to the low RPM stop. He was able to successfully land it (as can be seen from the picture below of a deadstick landing).



**ABOVE: N9M being towed out to the flight line at Chino Airport for the first public flight.**

Also attending the event, along with a large crowd of aviation enthusiasts, were Jack Northrop's son, John, and Northrop's granddaughter Janet, and other members of the Northrop family.

Although it looks small, the N9M has a 60' wingspan, a length of 19.5', and a height of 8.5'. It only holds 50 gallons of fuel so its endurance is limited to 1.5 hours, and has a maximum speed of 320 mph with a ceiling of 21,500'.



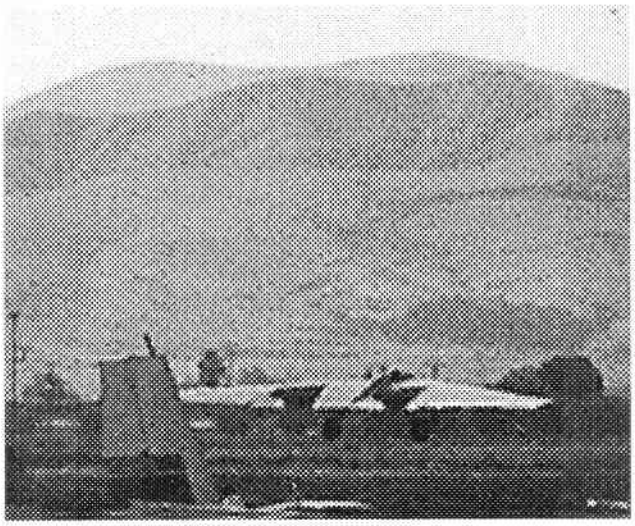
**ABOVE: View from left front showing the one-piece canopy and nose-wheel position.**

Lykins reported that the flying wing flew well, though it did tend to dutch roll and hunt a bit. However, he wasn't sure if those problems weren't pilot induced. It was flown in clean and gear-down configurations to test landing gear and flap operation. It was made intentionally a bit nose heavy at first, but retracting the gear did get rid of a lot of up trim. The CG may be put back a bit in gradual increments as the flight test program progresses.

It was in 1982, that Lykins announced that a crew of museum volunteers would undertake the extremely difficult task of restoring the aircraft to flying condition. They estimated it would take about 2-3 years, however, the project ended up taking nearly thirteen years due to the complexity of the experimental airplane. The crew had to essentially reverse engineer the entire project since there were many changes to the airframe that had not been very well documented over the years.

Another problem was the lack of experienced aircraft woodworkers to rebuild the various structures. Pregwood, a special laminate now available only in Germany, had to be imported to replicate load-bearing sections of the

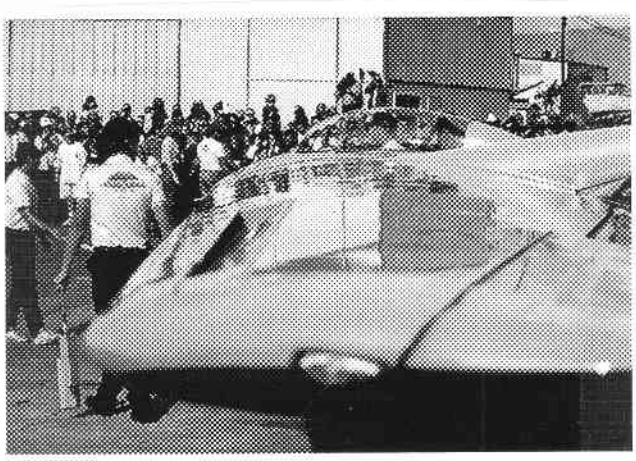
**ABOVE: The left main gear using a P-51 wheel assembly, and the air intake for the Franklin experimental engine.**



**ABOVE: This is a blownup section of the picture showing the deadstick landing at Chino. If you look closely you can see the right propeller in a stopped position.**

wooden structure. A number of companies provided special parts, and a few even wound up overhauling parts they had originally produced for the flying wing program in the 1940s.

Although it was the restoration of a proven design, Lykins reported that he intends to put the aircraft through a full performance flight test program to re-validate the genius of Jack Northrop's original concept. The aircraft will be kept on display at the Planes of Fame museum on the Chino airport, although they hope to have it flown to various airshows.



**ABOVE: Looking down the left wing showing the slotted leading edge, the size of the trailing edge split drag rudders, angle of the drive shaft cowlings, and the relative position of the pilot.**

## *AVAILABLE PLANS & REFERENCE MATERIAL*

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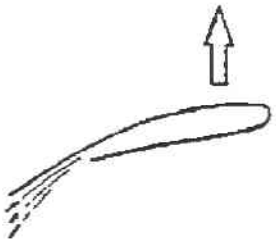

**THE HIAM AIRPLANE NEEDS YOUR HELP**

**For** those interested in assisting Budd Love with the future development of his High Internal Air Mass (HIAM) project, he would be glad to hear from you. This concept has some potential to include design of a Horten type flying wing utilizing HIAM technology. (See Dec '92 newsletter, page 4.)

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

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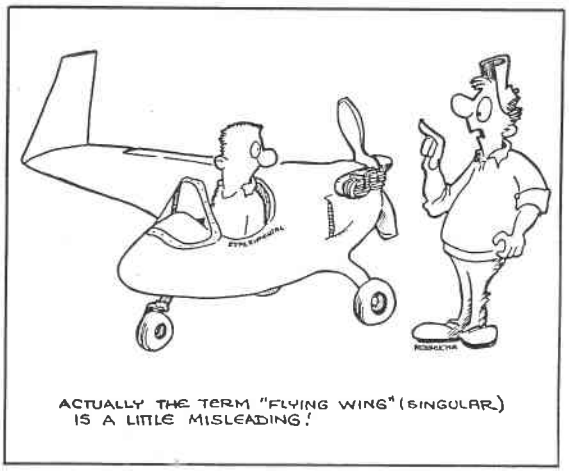


ABOVE: "Air Toons" cartoon from the pages of the December 1994 Pacific Flyer Aviation News.

BELOW: Drawing of the (only slightly swept) Kasper-wing with rigid wing. Source: Tailless Aircraft in Theory and Practice, p.288.