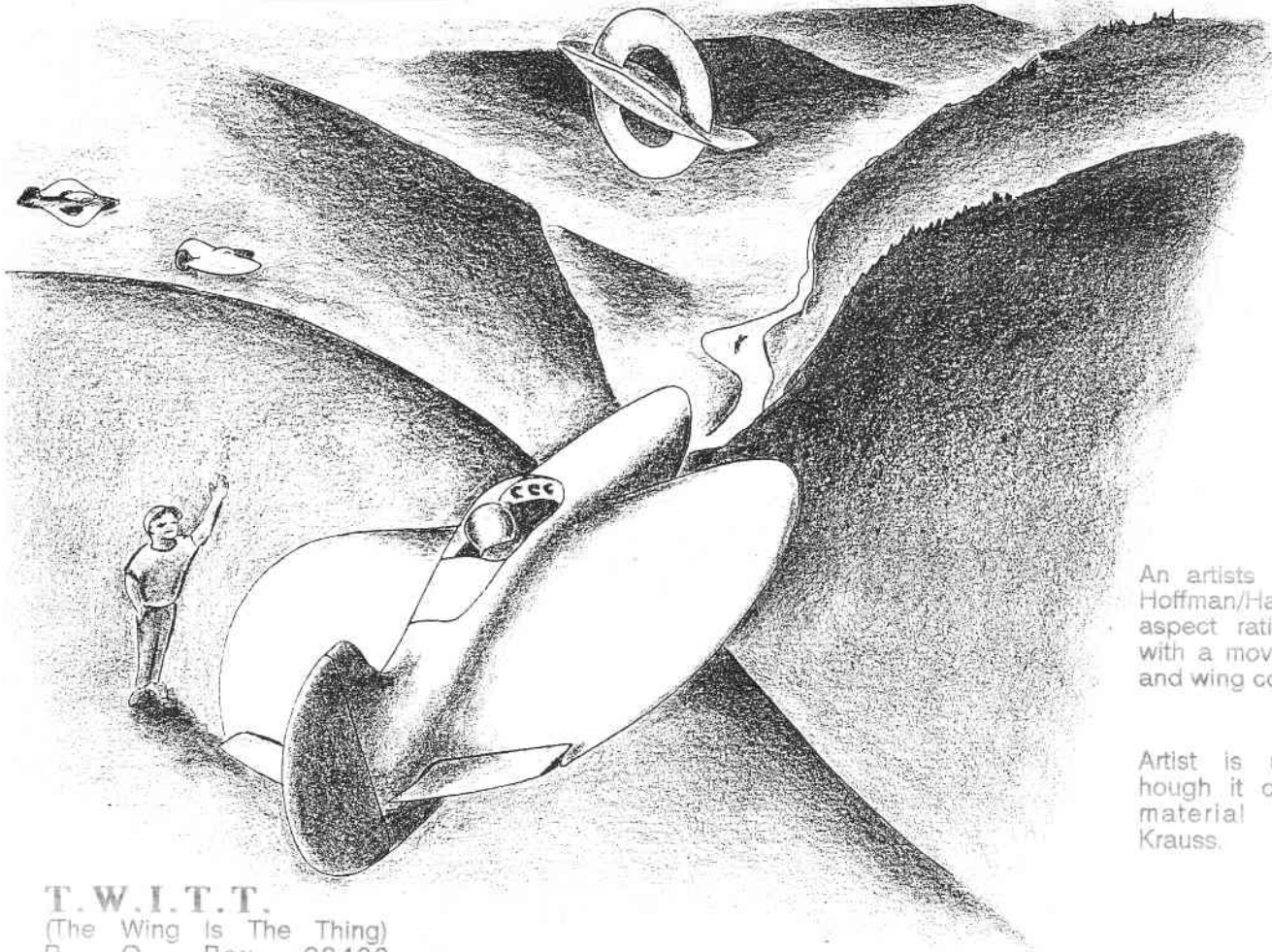


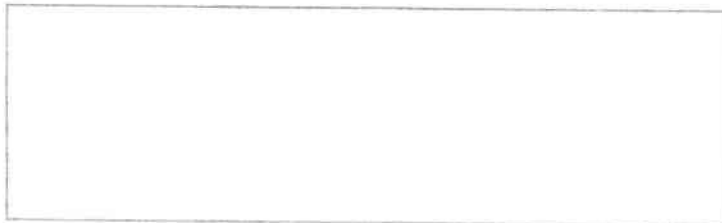
# T.W.I.T.T. NEWSLETTER



An artists rendition of a Hoffman/Hatfield type low aspect ratio flying wing with a move rounded tail and wing configuration.

Artist is unknown, although it came with the material from Serge Krauss.

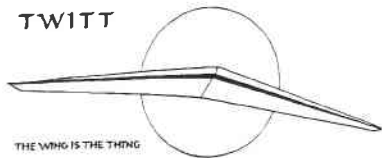
**T.W.I.T.T.**  
(The Wing Is The Thing)  
P. O. Box 20430  
El Cajon, CA 92021



The number to the right of your name indicates the last issue of your current subscription, e.g., 9402 means this is your last issue unless renewed.

Next TWITT meeting: Saturday, March 19, 1994, beginning at 1330 hrs at hanger A-4, Gillespie Field, El Cajon, Calif. (First hanger row on Joe Crosson Drive - East side of Gillespie.)

TWITT



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

**T.W.I.T.T.** is a non-profit organization whose mem-

bership 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:**

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

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

**Mailing address: P.O. Box 20430  
El Cajon, CA 92021**

- (619) 596-2518 (10am-5:30pm, PST)
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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**



**As** you can see from the comments in the minutes, attendance at the first meeting was less than I had expected. Please let us know what you, the members, would like to see at the meetings that would help increase participation.

You will see a notice later on in the newsletter calling for a special election for the position of Vice President. Bob Chase has been nominated for this position, and we are happy he has accepted the nomination. It would be nice if we could have a good turnout for the March meeting to show our support for Bob. It will only take a majority of those present to complete the election.

For those of you who might be interested in the video of the SWIFT, we can make it available to you for \$8.00, postage paid. The video will also include the First Flights coverage of the Northrop wings, The Wing Will Fly, and the Discovery Channel's Wings presentation on the ME-163. Depending on the tape remaining, it will be filled with bits and pieces of other flying wing stuff we have on hand.

Take a look at your mailing label and see if you are coming due for renewal. We generally go at least one month beyond the expiration month, however, it would sure help if you paid on, or ahead of, time. It makes bookkeeping easier. If you see red around your expiration date, you probably won't see another issue until we receive a renewal. If you miss some issues, let us know and we will back date your subscription to your original date and send you the back issues.

I sure appreciate all the material you have been sending it lately. Most of it is finding its way into the newsletter so it can be shared with other members. Please keep it up, no matter how large or small the item. If you can create an original piece on your latest project, please don't hesitate, since I'm sure others would like to know what is being attempted, and what problems have been encountered.

I guess that is all there is for this month's worth. I hope you are all getting ready for the new flying season.

Andy

## MARCH PROGRAM

At press time, Bob has lined up TWITT member Alex Kozloff, of Kozloff Enterprises, to come down from Irvine to talk with us about construction materials. (More details will be available in the next issue.)

We will also have an interesting video clip to show you on paragliding, and perhaps show some of the material from the 1993 SHA Western Workshop, if I can find the time to get some editing done.

## MINUTES OF THE JANUARY 15, 1994 MEETING



Andy opened the meeting with a wonderment as to where all our regular members were. The turnout was much less than expected, with the number of guest equalling the number of members present.

There didn't seem to be any logical explanation for this occurrence since the program was announced two months in advance as well as in this month's issue. Obviously the switch to having programs every other month has done very little to increase attendance.

**(Ed. Note: If attendance at the meetings is a result of TWITT not moving toward the development and building of an actual flying wing, then we need to know that from our Southern California members. We also need to know what it will take to get more active participation at the meetings so we can honestly tell our prospective speakers that we can provide them with a respectable sized audience. Please drop us a note with your feelings on the subject so the Board of Directors can work out a better plan for the coming year.)**

Andy announced Bruce Carmichael had learned that Reg Todhunter, a long-time TWITT member from Australia, passed away on January 10, 1994. He had been sick for some time, and was unable to even talk with Bob and June during their traditional New Year's call to the land down under. Reg was a constant contributor to the TWITT library and was always looking for the perfect flying wing.

Bob Chase received a new book for Christmas covering some of the history represented at the Smithsonian. One article included information on what happened to the Voyager when it lost its winglets during takeoff for the around the world flight. Since both tips eventually came off, the increase in drag came out to only about 1.5% which equated to approximately 15-16 gallons of gas over the entire flight. Bob will pass this information along to Eugene Rudat in France, who has been

looking for more data on wing tip shapes.

Bob also took his paper airplane show to his grandson's kindergarten class. He prepared some of the his more conventional type planes for the kids so they only had to do the final trimming. From the pictures, it looked like they all had a good time with the flying.

Bob then told the group about the latest exploits of his friend, Steve Marley, and his progress in getting a ME 163 styled ultralight into the air. It is powered by a 582 Rotax placed in the nose, with a multi-bladed prop. This combination made the weight and balance easier to control, along with putting it on a tail-dragging type of landing gear.

The wing is based on his work with Don Mitchell and uses many of Don's ideas. It is about ready for test flying, but the weather in Oshkosh, WI, has been holding things back. We are to expect a short article, and perhaps some pictures, once the plane has achieved its first flights.

Bob Archer asked if anyone had watched the WINGS marathon on the Discovery channel on New Years day. One of the hour long programs was on the ME 163. Andy mentioned that he had it recorded and was including it in the video tape when people ordered the First Flights video on the Northrop aircraft.

Andy told the group that Kevin Renshaw and Serge Krauss had both sent us a lot of material on a number of subjects, including the new Genesis project, and some Northrop aircraft. These things will be placed in the newsletter at space permits (ed. - see the Letters section for the exact nature of the material).

A short video was shown that covered the SWIFT which was shown on The Next Step on the Discovery Channel just recently. It has some very nice inflight shots showing the stability of the aircraft, including trying to force it into a spin. We will retain this footage and add it to any orders for some of the material we have in the tape library.

With the preliminaries out of the way, Andy introduced Chuck Sisto, our main speaker for the day, who would be talking about Waldo Waterman's flying wing aerocar program in which he had some involvement.

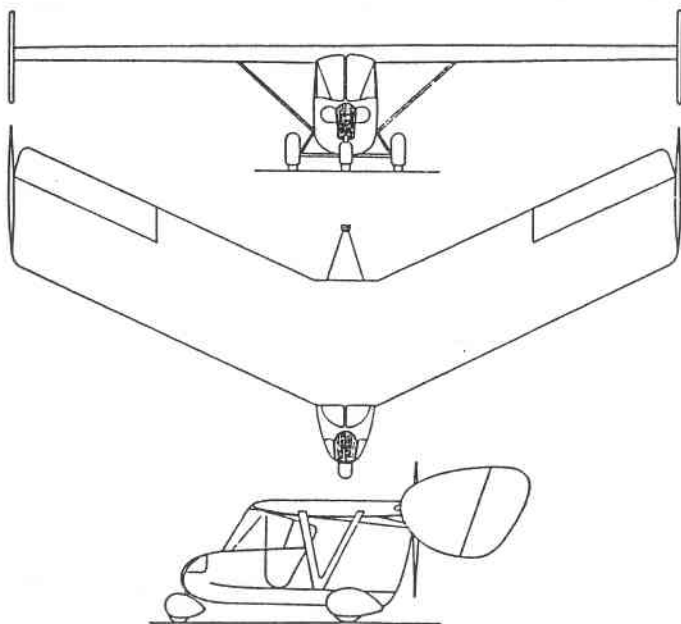
Chuck began by telling us he had been with Waterman for about two months, mostly working in the factory. When the time came to fly the first prototype, he was selected, eventually accumulated about 9-10 hours in the aircraft.

The initial test flights were really designed to show interested parties that they had a car, not necessarily an airplane. Some spin tests were done, but Chuck didn't elaborate on the results.

The Studebaker company had asked Waterman to provide three Arrowbiles at the Cleveland Air Races. Chuck was to take the prototype cross country from Santa Monica, California, with his first leg stopping at Yuma, Arizona. By the time he reached Yuma he had become convinced that he wasn't going to get much further. Having only about 1500 hours total time, he wasn't sure why he felt that way, but

just knew the plane wouldn't reach Ohio.

Before taking off on the second leg, the other Arrowbile's pilot asked Chuck to take along his baggage trunk, since Chuck had more room in his plane. This turned out to be the wrong thing to do, especially considering the location of heavy trunk.



**ABOVE:** Three-view of the Waldo Waterman Arrowbile in the configuration flown by Chuck Sisto.

Chuck tried several takeoffs, but couldn't get the nose up for liftoff. The combination of soft sand and a high thrust line was making it difficult to raise the nose.

Some young lad who had been helping Chuck get the plane back to the starting point each time came up with a suggestion that eventually got him off the ground. The solution was to build a sand pile a ways down the runway to act as a launching ramp. To make sure the nose wheel wouldn't dig into the soft sand, they used a wheel barrow to transport water to wet down the sand and make it harder. (Ah, the inventiveness of youth.)

About 30 minutes after leaving Yuma for Tucson, the Studebaker engine began to boil over. There was no place to land, and while he was trying to figure out what to do, the drive belt mechanism for the propeller broke loose, solving the overheat problem. It was almost a total disaster, since the part that broke began bouncing around between the V-belts which prevented it from puncturing the two gas tanks that were on either side of the engine.

He found a gravel covered patch to put the plane down in, but as he was applying what brakes it had, the left wheel hit a large rock that kept the gear from going any further forward. This resulted in enough damage that the Arrowbile couldn't be flown out, even if

the drive system were fixed.

Andy asked how the glide performance was once the engine was shut down. Chuck commented that he has had a lot of experience with helicopters, and he recalls the Arrowbile glided just about as well as a power-off copter.

While he was spending his time getting the plane trucked back to Santa Monica, the second one had made it to Wink, Texas. However, on takeoff the next day, after a night of heavy rains, the wheel pants filled up with the muddy clay from the runway. Just after liftoff, one wheel pant loosened, spun around the axle several times, and then broke off and went back through the pusher propeller. Fortunately, he was only about 15' in the air and was able to get it back down without injury.

With all of these problems, the third plane was shipped back to Southbend, Indiana, to the Studebaker plant and eventually flown at the air races.

Andy asked Chuck about how the plane flew once in the air. He commented that it seemed to fly okay, but you had to remember it was almost 60 years ago and he didn't know a lot about what was really happening with the plane. It was rather heavy due to the cast iron block of the engine and the Austin transmission, and seemed somewhat reluctant to get off the ground.

Due to the weight, the maximum altitude probably was about 4000' so the route of flight became critical. From Santa Monica he had followed the valleys down over Palm Springs and El Centro to get into Yuma since there was no way to get the plane over even some of the lower mountain ranges.

One interesting thing that did happen with the Arrowbile involved the movie "Your A Sweetheart." The plane was supposed to be used to transport Alice Faye and Don Murray from the Newark airport to Central Park in New York so Faye could be there in time open in a Broadway play. The actual trip was never made since the movie shots were done in Griffith Park in Los Angeles.

The Arrowbile wasn't much of a car, either. It was prone to constant breakdowns, mainly due to the weight of the major components compared to the light construction of the airframe/autobody.

The Arrowbile had a steering wheel type control that hung from the ceiling. This was used for both flying and driving. It also had two push-pull controls on the panel that controlled the wingtip fins. Chuck ask Waterman what they were used for, and he was told not to worry about them since he wouldn't need to use them. The aircraft was turned with differential ailerons, since it did not have any rudder pedals.

Andy and Bruce asked about converting the Arrowbile from one mode to the other. The system worked by pulling the lower pins on the wing struts and bringing them down to form legs like on a sawhorse (two struts came down from the wing to a common point on the fuselage/

autobody). This provided the necessary support when a lever was used to move the fore and aft wing pins. Chuck indicated he had never seen less than two men do the conversion, and some experienced crews could do it in about two minutes.

There was some general discussion about the drive mechanism and how fast it drove the propeller versus the engine speed. Unfortunately, Chuck could not recall the RPM ranges for the two functions.

Chuck closed with the observation that one of the main pictures shown of the Arrowbile has the caption "Waldo Waterman, designer and builder of the 'Arrowbiles', with the dark gray and white NR-262Y." In actuality, the person standing next to the aircraft is Chuck, lending credibility to his contention that some of the people who wrote about the Arrowbile didn't know the true facts, therefore, ended up with some misrepresentations of it.

After thanking Chuck for coming down from Santa Paula to talk to us, Andy closed the meeting.

*(Ed. Note: If anyone is interested in more information about this aircraft, the TWITT library has the following:*

*"Vintage Literature - Project for a Low Priced Airplane - Part III," by Dennis Parks, Library/Archives Director, Vintage Airplane, August 1993, pp. 5-8.*

*"Waterman Arrowbile," author and publication unknown, pp. 132-138.*

*September 15, 1972 letter from Waterman to Al Backstrom answering some questions about conversion to an amphibian.)*

**LETTERS TO THE EDITOR**



1/24/94

TWITT:

**I** hope the events of this past week have not shaken you folks up too much.

I would like to have been out there for the presentation by Chuck Sisto, of the Waldo Waterman Arrowbile, or is that Aerobile. Could I get a transcript of the program along with copies of any handouts.

What are the strong points of this design along with its weaknesses? Are plans available for this machine?

Thanks for your time,

Phil McCoy

*(Ed. Note: Well Phil, as you can see from the minutes there weren't many answers to your questions. The minutes cover most of what was said concerning the Arrowbile, however, the*

*audio tape does have some other material on non-flying wing experiences as related by Chuck. If, after reading the minutes, you decide you would like to hear the whole thing, send us \$4 and I will send you a copy of the tape.*

*Chuck did not have any handouts. However, the TWITT library had the material cited in the minutes, and I will send that off to you in the next several days.*

*I don't think there are any plans available, and of course, Waterman passed away a number of years ago.*

*If you find you want more information, drop us an line and we will put the word out to the membership and see if anyone else can be of help.)*

1/20/94

TWITT:

**I** have been looking for years (over 25) for information of flying autos.

Flying wings are my "love." Flying autos are "joy." Flying amphib autos are my goal!!

I drive a 1964 German built "Amphicar", so when I built a "Waterman's" Arrowbile, about 9' long, I placed a 14" scale balsa amphicar below it. I call it "A.B.C." (Air-Boat-Car).

In my senior years now I build much slower, and collect all I can.

I have subscribed to the "Roadable Aircraft Magazine."

Thanks (from "Gene The Marine")

Eugene Turner

*(Ed. Note: Thanks for the letter. I will send you a copy of the Waterman material cited in the minutes in case you don't already have it in your collection.*

*I would be nice if you could write to Phil McCoy and let him know about how to subscribe to the magazine, and whether you think it is worth the money. Maybe we can show him the benefits of belonging to an organization like TWITT.)*

1/3/94

TWITT:

**I** do not recall where I heard of you. I am very interested in pure flying wing aircraft and appreciate any new sources of information on these devices. Would you send me a sample of your newsletter? If it is interesting, I will subscribe, but bucks are currently too short to risk a sight unseen subscription.

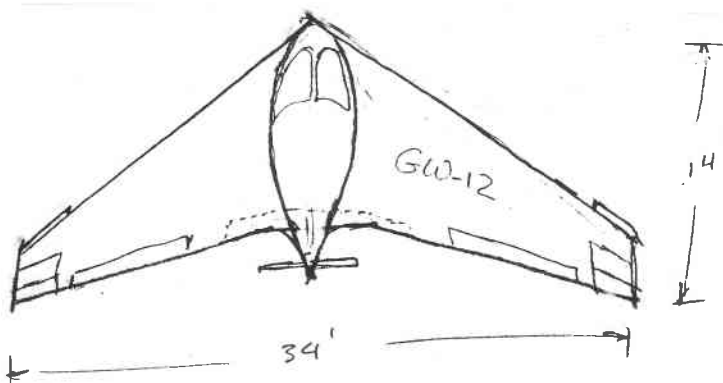
If you are looking for writers, I could send a couple of trial articles for your review.

Sincerely,

Greg Warner  
 10 Pendleton Lane  
 Londonderry, NH 03053  
 (603) 432-8949 (home)

(Ed. Note: Bob has sent him an information package that included a newsletter. If any of our members are in his general area, you might give him a call and tell him what you think you are getting for your subscription.

His letter included the pencil sketch shown below, so it looks like he is into some serious flying wing design concepts.)



12/30/93

TWITT:

I am an Australian flying wing enthusiast with a big problem in getting "accurate" drawings and photo references for the following wings so that I can make scale model radio control models of them. They are:

1. Horten Ho229 V3 - as in the Smithsonian Museum. I need 3-views of this (must be accurate).
2. Horten Ho IV Glider - also in the Smithsonian. Need 3-views and photos of cockpit and landing gear.
3. Raiders of the Lost Ark Flying Wing - I really want to make this design fly, although being fictitious it has sound aerodynamics and "is" based on a Northrop Corp. prototype. The 3-view is by "Anonymous" and is terrible - so I need a good one.

If anyone in your club has built any of these, has information, etc., please let me know and tell me how much it will cost for copies.

I look forward to your reply soon.

Yours sincerely,

Michael Brennan  
 7 Uranna Street  
 O'Sullivan Beach  
 SA 5166 Australia

(Ed. Note: Michael is not a member yet, but he sent along several sheets of material on the Raiders flying wing. I have printed the better of the pages hoping the picture will come out reasonably well. (See page 6.)

If anyone out there can help him with accurate drawings or scale plans for any of these aircraft, we would appreciate you contacting him and making arrangements for sending copies. Thanks, in advance, to anyone who helps him out.)

1/22/94

TWITT:

Here is another flying wing model that you might be interested in. It is from the August 1952 issue of AIR TRAILS, and the winter 1979 issue of AIR TRAILS CLASSIC FLYING MODELS.

The article has interesting information on lift, drag, and stability with design variations. The closest full size airplane I can remember seeing is the Jackrabbit at Mojave. He had much drag, mostly induced for the power, and had a hard time flying.

Take care,

Larry Nicholson

Also included in his letter was an advertisement for the following book:

Chance Vought V-173 and XF5U-1 Flying Pancakes. Photographs, line drawings, flight operation instruction chart, model kit reviews, cutaways, cross sections, take-off and climb chart, specs. and a full history of the Flying Pancakes through all areas of development. Sftbd., 8½ x 11', 34 pgs, 104 b&w ill.

Available from: Zenith Books, P.O. Box 1, Osceola, WI 54020, and priced at \$7.95 (probably some postage and handling also necessary).

(Ed. Note: Thanks, Larry, for the article and information on the Flying Pancake. I have put some of the drawings on page 8 since it looks like something some of our modelling members might be able to put together fairly quickly. If you modellers are intrigued by this, send us a \$1.00 and we will send you a copy of the three page article and drawings that are fully 1/3 size to make it easier for a blowup copy.)

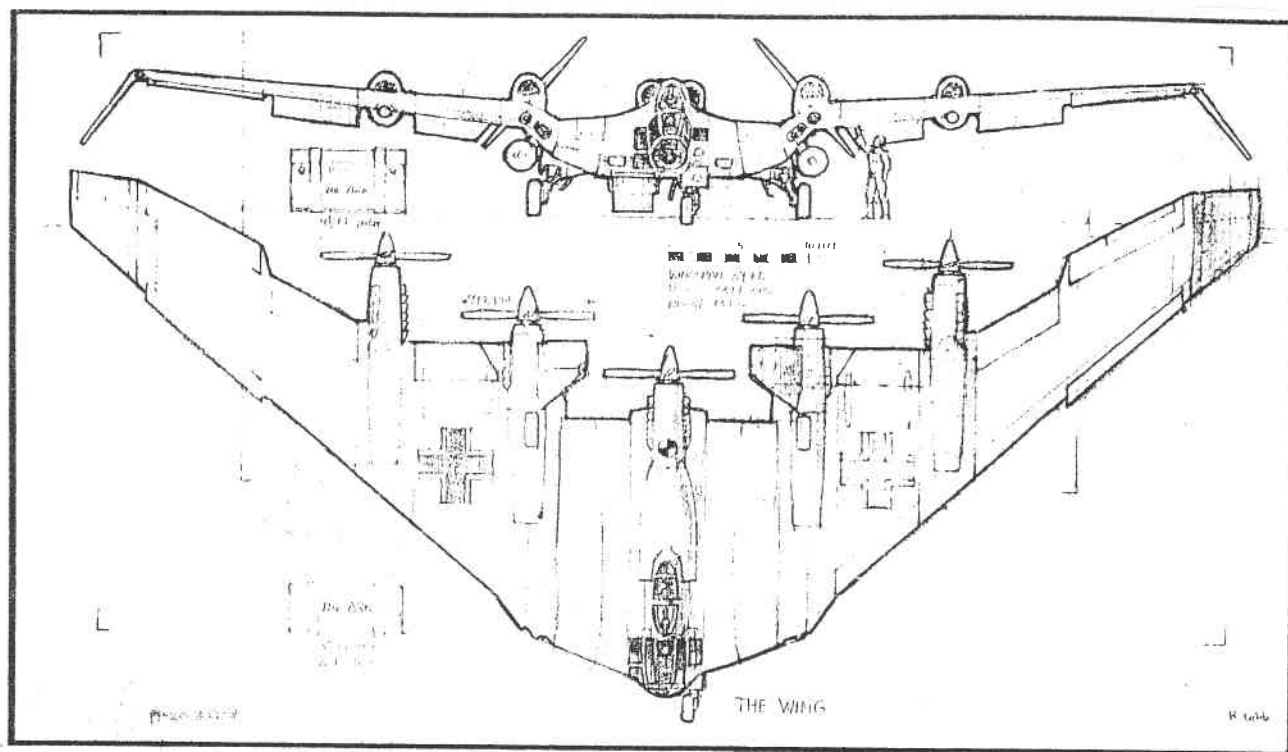
TWITT:

I'll subscribe to this newsletter, although I am interested in getting as many of your back issues as possible. Can you help?

I own 3 Mitchell wings, with two rolling cage and engines, and one foot launch cage. I am interested in the modifications to assemble down tubes to the B-10.

My grading of the wings indicate one is next





"Early"—Diagram drawing by Ron Cobb.



The futuristic Flying Wing was chosen by director Steven Spielberg to represent the ominous and advanced state of aeronautics in Hitler's Germany. Production designer Norman Reynolds used a Northrop Corporation prototype of the Flying Wing and drawings by Ron Cobb to design for Raiders of the Lost Ark this strange plane that has no tail and no fuselage. The plane was built in England by Vickers Aircraft Company and painted at EMI Elstree Studios in London. In order to ship the elaborate prop to Tunisia for filming, it had to be disassembled and sent in parts, then rebuilt on location. In the film, the Flying Wing is in Egypt (the Tunisian location) for the top secret mission of transporting the sacred Ark of the Covenant. But before the Ark is even aboard the plane, a series of dramatic events results in the fiery destruction of the Flying Wing.

to perfect except for one bent axle and one shattered outboard wing panel needing repairs to the ribs and recovering.

The other one I'd like to recover using a new method, with sewn dacron and aluminum ribs so as to be removable as a whole unit and roll-reefed (as sailboat mast sails) for better portability to foot launch sites!! What do you think?

I also own an Easy Rider UFM I'd like to recover and a Wizard I'd like to sell.

Enjoy for flights' and safe landings,

Pete Olson  
4965 Great Lakes Drive  
Va. Beach, VA 23462

(Ed. Note: It sounds like you have a good "fleet" of aircraft to keep you busy and flying. I presume the Bob has already sent off the required information for ordering back issues. If not, you can get it from the information on page one, assuming you have decided to join and are receiving the newsletter.

Perhaps one of our members could help Pete with his B-10 request by providing information or the location of any necessary drawings, etc.)

-----  
12/30/93

TWITT:

I found I had made a small error in the material I mailed out in such haste yesterday. I just caught it tonight and made corrections. Here is a new page 4 with - I hope! - everything correct this time. I also added a postscript concerning something more that I'd like explained by one of the TWITT aerodynamics experts.

I threw in a few items yesterday without explanation, flying out the door in time to get to the Post Office a couple of minutes before closing...in a blizzard. Anyway, I doubt that much or any of the Hatfield stuff is copyable, but at least you know what kind of thing he has created.

Well, last day of break's here already. Then it's back to whatever it is I think I'm trying to do in the inner city schools. So I'm off to rest. Hope you had a good holiday season and find some of what I sent interesting.

My Best,

Serge Krauss

(Ed. Note: First of all, I would like to thank Serge for his time and efforts in putting this material together. The article is six pages long and looks like it should be presented all at one time, versus in two segments. I plan on publishing it in the March issue since there will be no minutes, and besides, it will reduce

the amount of typing I need to do because it will be printed as sent.

I can sympathize with the going back to work routine. Sometimes it is hard to see if I am making even a dent in a particular backlog at work, or whether what I have done makes a difference to someone. If your teaching is as thorough as your bibliography and the material you sent us, keep up the good work.

However, I thought I would present the postscript this month to start people thinking and see what kind of response we can get. It is taken slightly out of context, but the general discussion beforehand had been on low aspect ratio wings. His lead-in to this subject was: "Edwin Sward's letter (Nov.) on circular wings led me to explore the potential of circular, annular, and other low-aspect-ratio gliders ( $A/R \leq 2.0$ ), an area universally neglected due to their known shortcomings in glide."

His postscript reads as follows:

"I've noticed that much early data seems conservative in its performance figures, probably because it was done at low Reynolds numbers. For comparison, Marske says that his Eppler program shows a 70% increase in L/D for an increase in  $R_N$  from 500,000 to 2 million and 100% for 3 million. While this laminar stuff is impressive beyond anything I'd heard before, even my older literature (Diehl) shows reductions of 15%-30% in profile drag when going from 500,000 to 7 million, a significant boost to (L/D)max in low-A/R wings. Would any of the resident aerodynamicists care to clarify just how much aircraft performance (profile drag or L/D) is affected by  $R_N$ ? Meeting discussion topic?"

---

## AVAILABLE PLANS & REFERENCE MATERIAL

**FOR SALE**

### Tailless Aircraft Bibliography

by Serge Krauss

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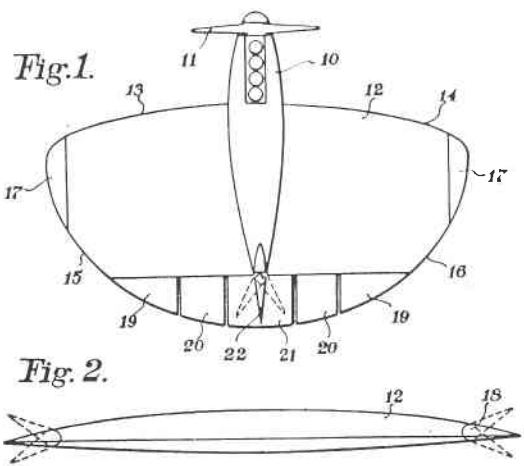
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(Continued on page 9.)



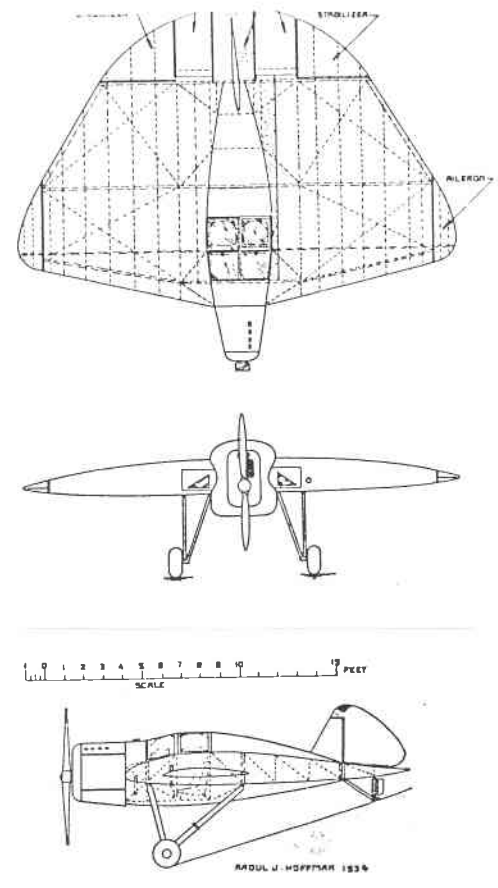
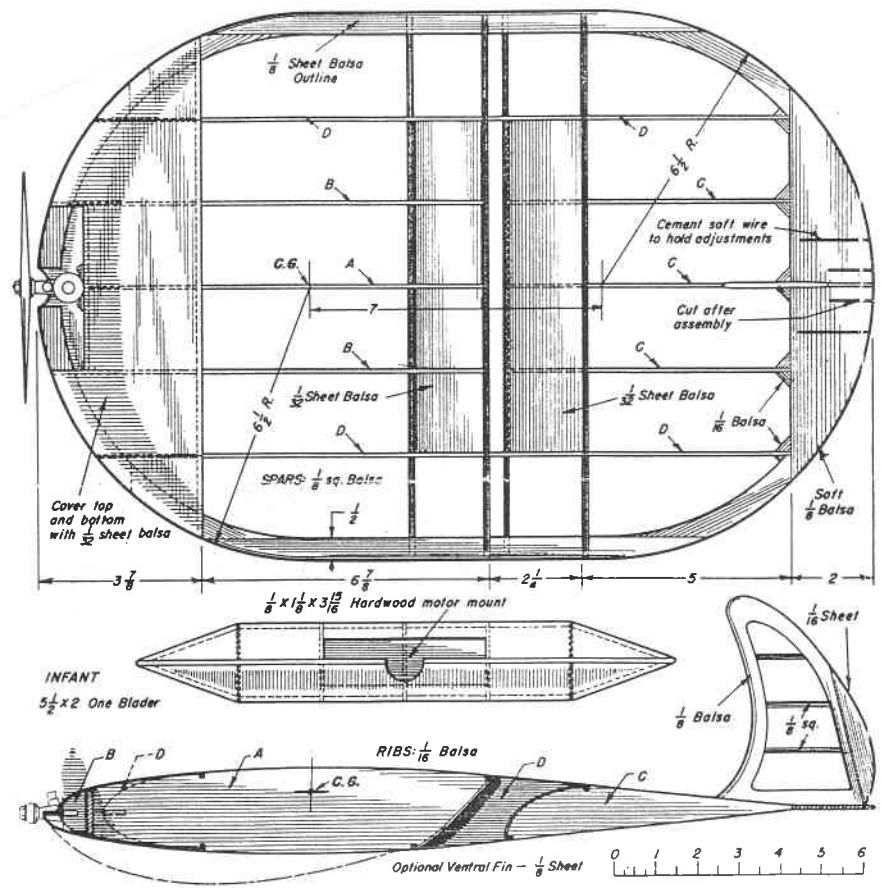
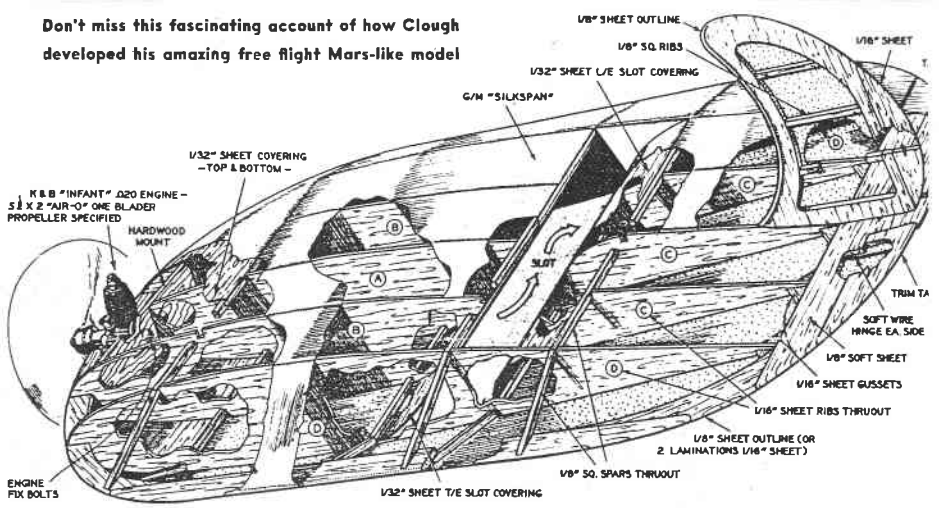
This page contains semi-construction type sketches of the FLYING SAUCER, from an article written by Roy L. Clough, Jr., and published in the magazines cited by Larry Nicholson in his letter on page 5.

The remaining three-view and Fig. 1 & 2 are of R. J. Hoffman designs, and appear to have originated from a magazine published in November of 1934, but the copies sent by Serge Krauss did not have enough information to determine the name.

R. J. HOFFMAN  
AIRCRAFT  
Filed Sept. 18, 1933



Don't miss this fascinating account of how Clough developed his amazing free flight Mars-like model




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**NOTICE OF SPECIAL ELECTION**

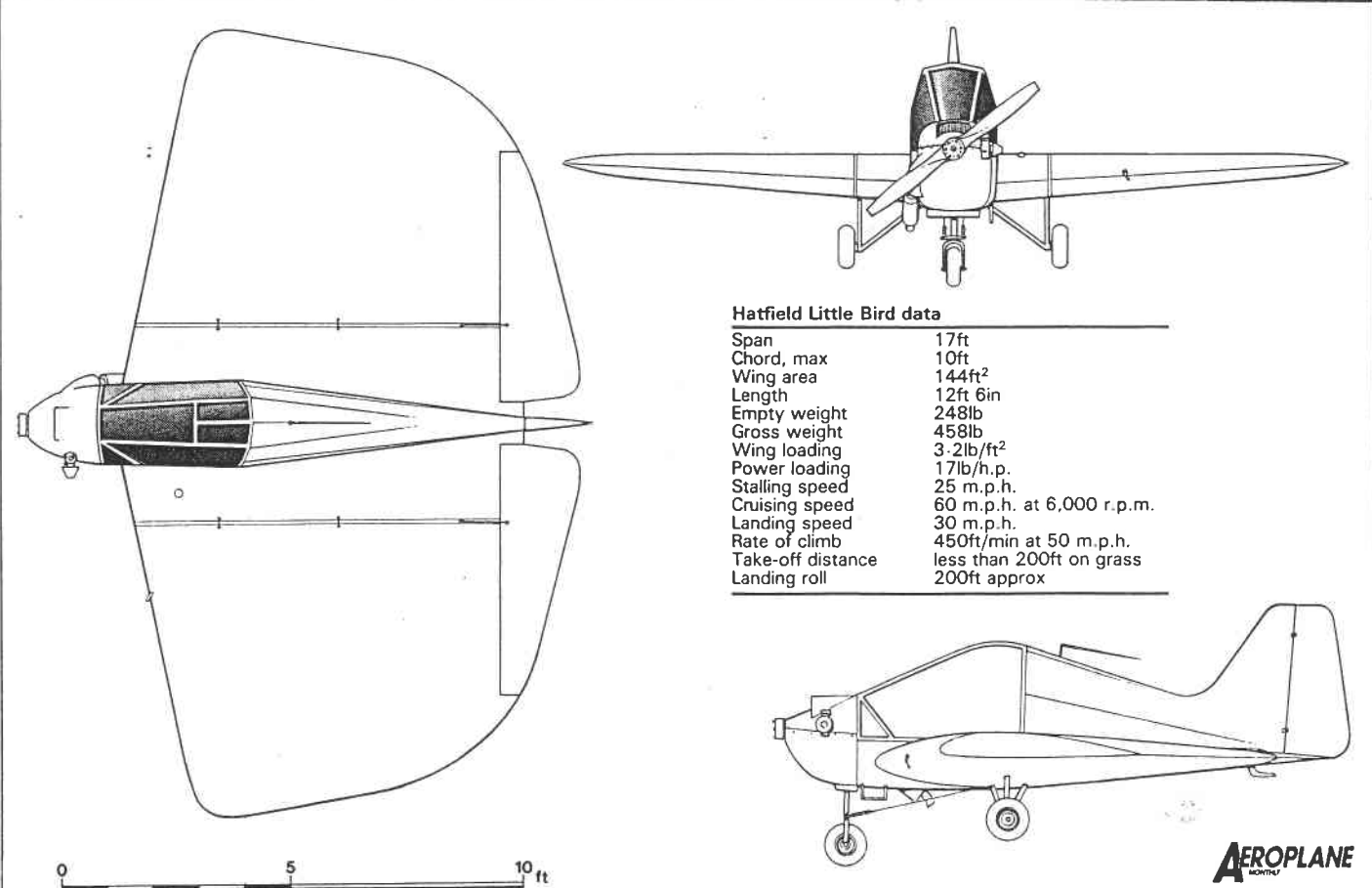
On March 19, 1994, a special election will be held at the headquarters for TWITT, Hanger A-4, Gillespie Field, El Cajon, California, for the position of Vice President.

The nominee for this position is Bob Chase.

Other nominations will be taken by mail or from the floor on the day of the election. However, the nominee must consent to accepting the position if elected.

The election will be conducted by voice vote, with a vote by a majority of the membership present at the election necessary to carry the motion.

BELOW: This item came with the material from Serge Krauss as an illustration for some of the material he presents in his paper to be published next month.



**Hatfield Little Bird data**

|                   |                           |
|-------------------|---------------------------|
| Span              | 17ft                      |
| Chord, max        | 10ft                      |
| Wing area         | 144ft <sup>2</sup>        |
| Length            | 12ft 6in                  |
| Empty weight      | 248lb                     |
| Gross weight      | 458lb                     |
| Wing loading      | 3.2lb/ft <sup>2</sup>     |
| Power loading     | 17lb/h.p.                 |
| Stalling speed    | 25 m.p.h.                 |
| Cruising speed    | 60 m.p.h. at 6,000 r.p.m. |
| Landing speed     | 30 m.p.h.                 |
| Rate of climb     | 450ft/min at 50 m.p.h.    |
| Take-off distance | less than 200ft on grass  |
| Landing roll      | 200ft approx              |

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BELOW (TOP): Article sent in by Bob Eastgate of Los Angeles, with the comment the we could be seeing more of these in the future, what with the new technologies.

BELOW (BOTTOM): Variable camber, flaired tip, fan-tailed flying wing, on the wing over the slopes of a national park. Original photo by Frank Oberle (Ed. found it on one of the bulletin boards at work).

## Solar-Powered Pathfinder Soars on First Test Flight

EDWARDS AFB, Calif. — The solar-powered Pathfinder unmanned aerial vehicle (UAV) recently conducted a flawless first test flight on solar power at Edwards Air Force Base.

The aircraft reached its maximum-allowed altitude of about 200 ft during the 41-min flight as it traveled six times around a 1.2-mile racetrack course. Its speed was about 16 mph, and at least 60 percent of the power needed to stay aloft was provided by solar cells arrayed on the aircraft's wing surface, according to Ray Morgan, a vice president of AeroVironment Inc., who remotely piloted the test flight. Remaining power was supplied by batteries.

"Everything worked very well and we're very happy with the results — we have lots of test data," Morgan said. This was the first time the UAV has flown with a significant portion of its power supplied by solar cells. An earlier version of the aircraft flew on batteries in 1983.

The Pathfinder aircraft development is sponsored by the Ballistic Missile Defense Organization with technical management provided by Lawrence Livermore National Laboratory.

Pathfinder is an all-wing aircraft, 100 ft long and 8 ft wide, powered by eight electric-motor-driven propellers. It weighs only 430 lb.

□ Charles T. Troy

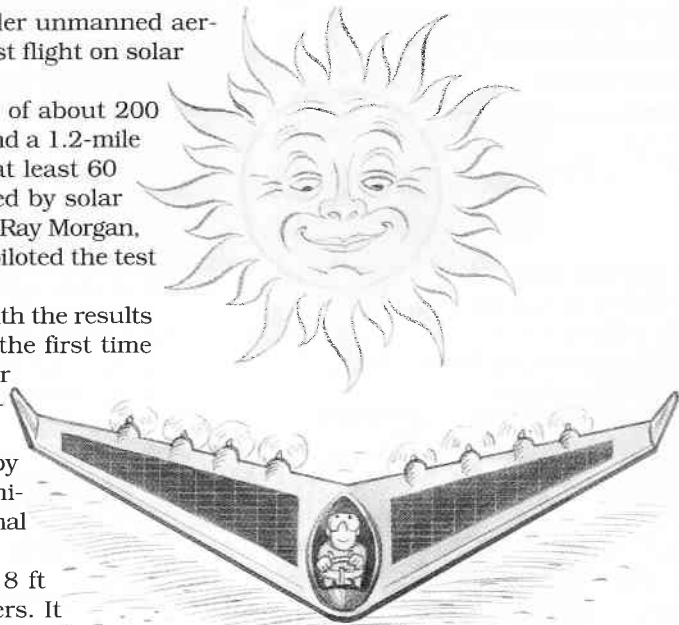


ILLUSTRATION BY GIL EISNER

