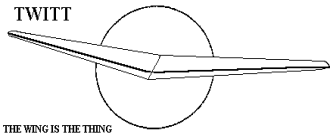
No. 355 JANUARY 2016

T.W.I.T.T. NEWSLETTER

Mitchell U-2 Flying Wing. See page 6 inside for more information on this design.
Source: http://home.earthlink.net/~mitchellwing/images/u2/p1.jpg

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

The number after your name indicates the ending year and month of your current subscription, i.e., **1601** means this is your last issue unless renewed.



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.

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Wt/#Issues	FRG	AUSTRALIA	AFRICA
1oz/1	1.75	1.75	1.00
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TWITT gatherings are held on the third Saturday of every odd numbered 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 (#1720), east side of Gillespie or Skid Row for those flying in).

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PRESIDENT'S CORNER

I think I have a good mixture of things for you this month. There are a couple of letters with interesting links for those of you who like the look things up on the Internet and track down other ones.

The Nurflugel group had some images uploaded of Backstrom designs and other materials related to Al's aircraft. They were a little "dirty" so I used some software to try and enhance the images so they will show up better in the printed version of the newsletter.

As I noted last month, I would continue with the material from Jim Marske talking about his designs that were influenced by Backstrom. This month I cover the Pioneer II series and next month should finish up with the Pioneer III and an extensive summary of the designs.

Lastly I pulled a thread from the Mitchell U-2 group since it was a new builder asking some very basic questions about building this aircraft. TWITT member Norm Masters provided some good information as a starting point so I will follow this for the next several months to see how it progresses. One other responder offered to help but also thought there were other designs that would be safer, so we will see how that part of the discussion goes.

LETTERS TO THE EDITOR

Dear Andy!

A Merry Christmas to all and a good start into 2016!

A year full of adventure and new experience comes to an end. A year with good and bad things.

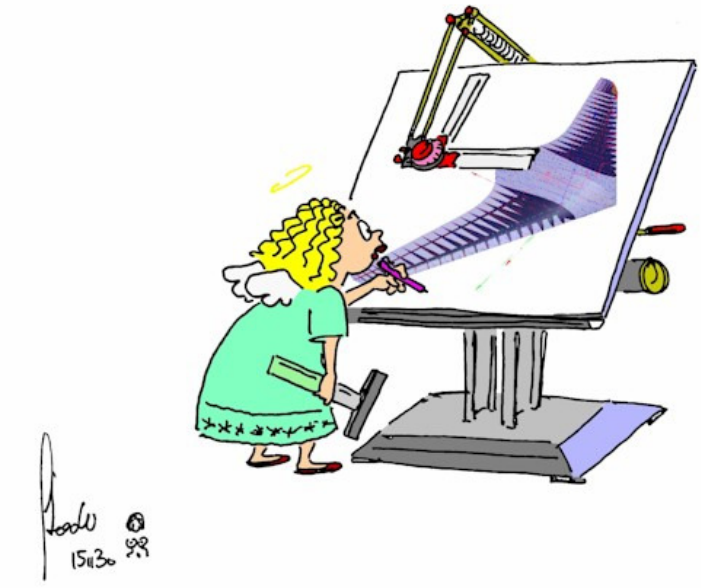
We are all looking forward to meet our loved ones and celebrate Christmas.

For the next year we hope good things are progressing and we may be part of activities to make the world better.

And, maybe, have some time for the flying wings hobby...

With kind regards

Reinhold Stadler



(ed. – We always get these fabulous images from Reinhold every year but after the December issue has been sent to the printer. No matter the timing they are always worth sharing.)

Enjoy...
https://www.warhistoryonline.com/military-vehicle-news/us-navy-x-47b-stealth-aircraft.html?src=fba&type=wca&page=who

Best regards

Doug Russell-White

130710-N-LE576-002 A U.S. Navy X-47B Unmanned Combat Air System makes an arrested landing aboard the aircraft carrier USS George H.W. Bush (CVN 77) as the ship conducts flight operations in the Atlantic Ocean off the coast of Virginia on July 10, 2013. The successful landing marks the first time a tail-less, unmanned autonomous aircraft landed on a modern aircraft carrier. DoD photo by Capt. Jane E. Campbell, U.S. Navy. (Released)

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http://edition.cnn.com/videos/us/2015/12/21/orig-wingboard-airplane-extreme-sport-future-of-adventure.cnn/video/playlists/future-of-adventure/

Doug Holverson

(ed. – This is a short video showing this concept in a radio controlled version. It doesn't explain it all but is very interesting.)

(ed. – This also came in from Doug.)

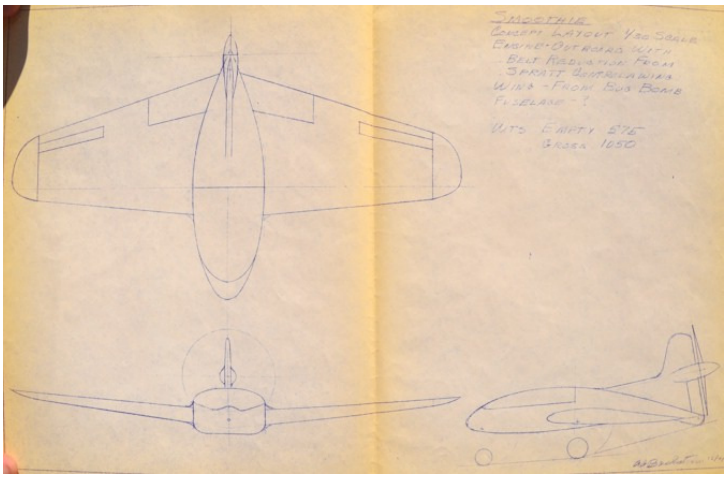
Looks like something from one of those "Luft '46" alternate 'verses.

http://www.darpa.mil/news-events/2015-12-28

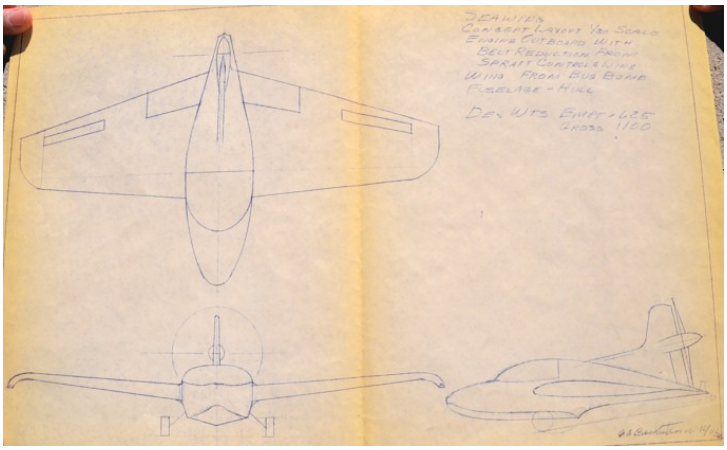
Image Caption: *DARPA has awarded Phase 3 of Tern to a team led by the Northrop Grumman Corporation. DARPA plans to build a full-scale demonstrator system of a medium-altitude, long-endurance unmanned air system (UAS) designed to*

use forward-deployed small ships as mobile launch and recovery sites.

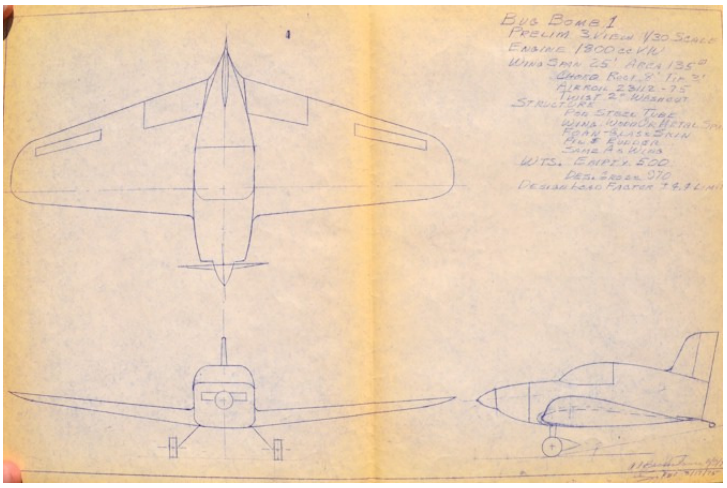
(ed. – Last month I printed Jim Marske's comments on Al Backstrom's flying plank series. Coincidentally, Dennis Olcott just uploaded a number of diagrams and specification information to the Nurflugel Yahoo group covering other Backstrom designs. I have downloaded a few and cleaned them up a little so they would reproduce here for our group.)



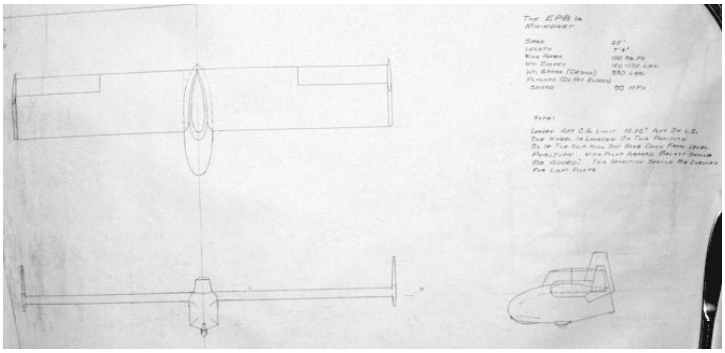
Smoothie – December 1974



Sea Wing – December 1974



Bug Bomb 1 – November 1974



EPB 1A Mini Midget 3-View

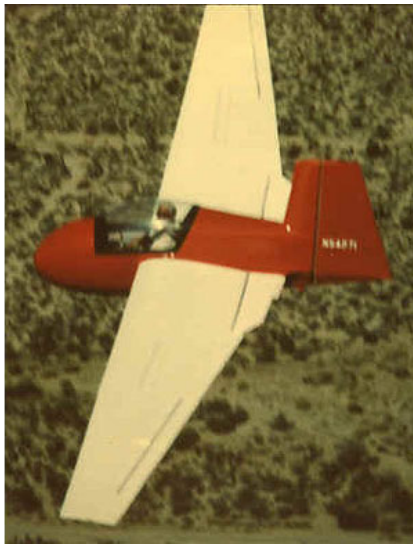
(ed. – Jim Marske also included some information on his initial flying wing designs when he sent in the Backstrom material. So here is part of those comments.)

PIONEER 1:

Valuable lessons were learned with the XM-1 project but it was time to move on to a new format.

Through 1964 to 1968 a new flying wing design took shape called the Pioneer 1. This sailplane had a 40 foot (12.2 m) wingspan but differed in that it had a swept forward tapered planform and straight leading edge. The tapered wing would provide a longer moment arm for the elevator and a wider CG range. Being swept forward, measured from the 25% chord line, the CG is moved forward which further expands the elevator moment arm length and improves dampening in pitch. A favorable side benefit is the pilot is moved further forward, ahead of the wing, for improved downward vision.

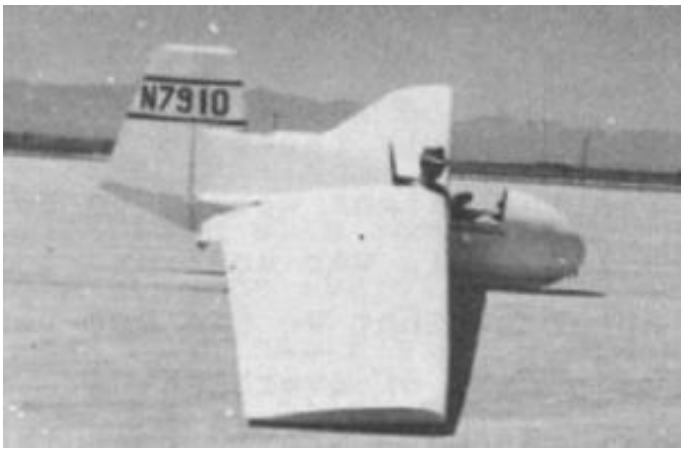
A new wing profile was developed by modifying a NACA 33012 and giving it a bit of trailing edge reflex to make it stable. This was a good choice as the CL max went from 0.85 of the Fauvel to 1.24 with the modified NACA foil. Like the XM-1 the wing contained no washout, or twist. The Pioneer 1 (below) was expected to be highly stall resistant despite the tapered wing planform.



Structure of the wing was wood and construction typical of the day. The spar was spruce and of 'I' beam cross section. Ribs were sawn from ¼" marine plywood. Wing skin was 4mm mahogany marine plywood. The fuselage framework was made of welded steel tube. Nose fairing and upper aft deck was molded fiberglass. The wood rudder construction was typical of the wing. The fin and rudder was one piece. The fin acted as an aerodynamic counter balance for the large all flying rudder.
Glide path was controlled by under surface flaps hinged at 45% chord. Under surface flaps on the XM-1 were found effective at high speed but they lost their effectiveness at low speed. It was difficult to put the glider down exactly where you wanted it due to a strong floating in ground effect. So they were doubled the size over the XM-1.

To attack the adverse yaw problem, the narrow tip chord of the tapered wing, would reduce the energy to roll into a turn. The original plan was to install differential ailerons but, as an experiment, we decided to play with roll spoilers. The roll spoilers were affective but had several unfavorable side effects. Roll rate was proportional to the 'g' loading. Secondly, at high speed the roll spoilers produced drag proportional to the square of the airspeed. Needless to say, this was not a good roll solution.

The elevator with its longer moment arm required only half the deflection of that of the XM-1. There was no noticeable loss of lift if the stick were to be suddenly moved aft.



The landing flaps, despite their large size, were not effective when in ground affect. The glider could not be put down on the desired landing spot. Dropping the nose only increased the speed without any loss in altitude.

Tow hook installation was similar to that used on the XM-1. Center of Gravity tow hooks were located on either side of the fuselage a short distance under the wings leading edge. They proved effective for both aero tow and ground towing operations. One auto tow on El Mirage Dry Lake, using hard wire, the Pioneer 1 achieved a release altitude of 2,800 feet (854 meters). Height was limited by the weight of the towing wire.

After flying the P-1 for several months the wing tips were extended to 46 feet (14m) and the roll spoilers modified, made longer with a narrower chord. The intention of this change was to increase the roll rate and reduce drag at high speed. The new roll spoiler was an improvement but not enough to make it

acceptable. Unfortunately, differential ailerons were never incorporated into the Pioneer 1 as originally planned.

In its final configuration the Pioneer 1A had a speed range of 32 to 160 mph (52 to 260 kph) at a wing loading of only 3.5 psf (17 kg/sq m). Maximum glide ratio went to 33 to 1.

Overall, the Pioneer 1 project was a success. Many fine flights were made with the extended wing by co-builder, Bill Daniels, in the early 1970's. Climbs in wave to 31,000 feet (9,450 m) and out-and-return flights in excess of 360 miles (583 km) were not uncommon. However, the roll spoilers were not the answer to the adverse yaw problem.

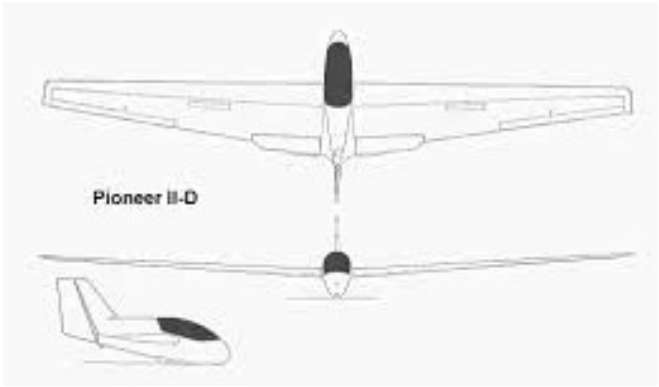
I did not mention this at the beginning of this Pioneer 1 report that we wanted to get a feel for how this flying wing would compare in performance with a current popular US sailplane. The Schweizer 1-26 was very popular in most clubs all over the country and would be a good choice to copy. So the short winged Pioneer 1 was designed around similar proportions. The fuselage was to be of steel tube, fabric cover and of 1-26 appearance. The wing was the same span and the airfoil of the same family. Our wing area was the combination of the 1-26's wing and horizontal tail to keep the playing field even. The wing tip chord dimension was kept the same while the root chord was extended to absorb the additional area. The empty weight turned out to be similar to the 1-26.

We flew the original short wing Pioneer 1 against many 1-26's. The low speed performance was nearly identical up to about 45 kts, but above that, the 1-26 fell away embarrassingly fast. It was no contest at all. This was again encouragement to continue research and development in the unswept flying wing. Like the XM-1, the glider was highly stall and spin resistant.

PIONEER 2:

The Pioneer 2, appearing in 1973, was a smaller (12.2 m) simplified version of the Pioneer 1 with a slightly higher aspect ratio of 12 Vs 10.8. Construction was an all wood wing of conventional structure and fabric covered. The fuselage was a molded fiberglass shell rather than the welded steel tube frame of the Pioneer 1.

Differential ailerons were adopted for roll control rather than roll spoilers. In flight, adverse yaw was still a concern as there were occasions when one would simply run out of rudder power. Overall, it was acceptable but additional attention was needed in this area.



The initial Pioneer 2 version used a reflexed NACA 23012 profile at the wing root and a 23010 at the tip. While this aircraft performed well at high speed it did not seem to climb well in thermals. Later versions went back to the Pioneer 1's reflexed 33012 airfoil which was a definite improvement. The Pioneer 2 now climbed well and the high-speed performance did not seem to suffer.

The lower surface flaps, which were not very effective when flying in ground effect and were replaced with upper and lower surface flaps. This was a definite improvement in glide path control but there was a small pitch bounce when opened.

Although 36 Pioneer 2's were built and flown from kits you seldom see any for sale because their owners won't part with them. It was a light and agile sailplane in flight. Some Pioneers have extended their wings from 13 meters to 14 meters and a few others to 15 meters.

In its final configuration the 'D' model was the most successful achieving a 38 to 1 glide ratio on a 15 meter wing. It climbed well and ran well. This may seem remarkable in that it has a fabric covered wood wing. If the wood wings were built accurately, air leaks sealed, and the surface finish smooth and polished, remarkable performance can be obtained despite the wings non-laminar airfoil.

(ed. – More next month.)

Mitchell U-2 Threads

Hi guys, I am an electronics engineer student, but I love planes and wanted to build one.

I have recently got my U2 plans, was studying them for sometime but couldn't get into much details.
As per the plans, I need 2 inboard and 2 outboard spars on each wing, right?..So that makes 4 inboard and 4 outboard spars in total.

And the inboard spars are bent at an angle, right?..
And I could not find the number of foam ribs in each wing.

The cockpit(fuselage) is also wooden right, unlike here on YahooGroups I saw some U2 photos with metal tube frame.

These are some questions I need answers to. Thanks in advance for your time and answers.

Uzair850

The U-2 has one spar consisting of a long 1mm plywood panel with spruce cap strips on the top and bottom with a folding joint 1/2 way between the center line and the tip. The spar was originally designed for 10 Gs but that was for a gross weight of 450 pounds. There are two 12 degree bends in the spar to match the sweep angle. As far as I know nobody has actually flown that plane at much less than 550 pounds and 600 is probably typical which gives a G rating of 7.5. The pod is plywood with a steel tube frame, as are the fuselages of most wooden airplanes.

The plane itself should weigh about 320 pounds if you follow the plans to the letter however there are a few modifications that years of service have shown to be good ideas that may drive the empty weight up close to 380. The are:
The rigid main gear beats the crap out off the spar and can crack it on a hard landing from both the bending load and torsion. The cracked spar problem only happened twice that I know of however the beating causes the D-tube skin to separate from the spar after about 200 hours. Suggested solutions are to thicken both the webbing and the D-tube shell inboard of the bend in the spar. Or just move the main gear to the pod but that also requires some more structural design work.

The spar caps are bent. This is not a problem, in fact it's a good design, but it requires several long scarf joints that waste a lot of expensive aircraft grade spruce. Wet layup carbon roving would be cheaper and lighter.

Ingres and egress require that you support your weight on rib zero. if you're not very careful you can dent the D-tube shell or even punch a hole through it. On a finished plane this requires a 3 layer thick fiberglass bandage on the outside on the D-tube spanning ribs 0 and 1. I think a 2" thick styrofoam backer to the outboard side of rib 0 would fix it.

Don't try to save money on the rudder control cable tubing. We had to pull the tubing out because the original builder used polyethylene tubing and it got brittle after 7 years of just sitting in a hangar. We redesigned it to use pulleys. Probably more expensive than high quality nylon tubing but lower friction.

The PVC bushings on the stabilator torque tubes are often to tight and can wear grooves into the torque tubes. Be sure to leave some clearance for wing flex.

The fuel tank filler caps are a long reach, making spills likely. This can make a greasy mess inside the wing. Make sure that everything back there is fuel proof. A catch reservoir on the fuel tank with a drain tube going out through the bottom of the wing would be a good idea too.

The airfoil is an old fashioned extensively laminar section. These old airfoil sections are very sensitive to surface imperfections. Watch your wire sag when you cut the nose ribs and be gentle forming the plywood D-tube. To get the best L/D you will still need to fill some waves. There's a note on the blueprint that fairings are left to the discretion of the builder. If the wing is built to high accuracy the drag of unfaired landing gear can be most of your drag so even fairly

simple spats can increase your glide a lot. An engine cowling wouldn't be a bad idea either.

Norm Masters

Your welcome to ask me anything you like, i recently finished building a u2.

I invested 1000 plus hours and it took 4 years to build. I found it to be a very difficult plane to build as there is lots left off the plans.

But ask away and i will definitely help.

Wing span very wide and little help or support ...

There is other planes safer, less build time, lower cost and lots of support with build. I got rid of my u2 shortly after finishing due to safety concerns.

Ryan Derot

AVAILABLE PLANS & REFERENCE MATERIAL

Tailless Aircraft Bibliography

My book containing several thousand annotated entries and appendices listing well over three hundred tailless designers/creators and their aircraft is no longer in print. I expect *eventually* to make available on disc a fairly comprehensive annotated and perhaps illustrated listing of pre-21st century tailless and related-interest aircraft documents in PDF format. Meanwhile, I will continue to provide information from my files to serious researchers. I'm sorry for the continuing delay, but life happens.

Serge Krauss, Jr. skrauss@ameritech.net
3114 Edgehill Road
Cleveland Hts., OH 44118 (216) 321-5743

VIDEOS AND AUDIO TAPES

(ed. – These videos are also now available on DVD, at the buyer's choice.)

VHS tape containing First Flights "Flying Wings," Discovery Channel's The Wing Will Fly, and ME-163, SWIFT flight footage, Paragliding, and other miscellaneous items (approximately 3½+ hours of material).

Cost: $8.00 postage paid
Add: $2.00 for foreign postage

VHS tape of Al Bowers' September 19, 1998 presentation on "The Horten H X Series: Ultra Light Flying Wing Sailplanes." The package includes Al's 20 pages of slides so you won't have to squint at the TV screen trying to read what he is explaining. This was an excellent presentation covering Horten history and an analysis of bell and elliptical lift distributions.

Cost: $10.00 postage paid
Add: $ 2.00 for foreign postage

VHS tape of July 15, 2000 presentation by Stefanie Brochocki on the design history of the BKB-1 (Brochocki,Kasper,Bodek) as related by her father Stefan. The second part of this program was conducted by Henry Jex on the design and flights of the radio controlled Quetzalcoatlus northropi (pterodactyl) used in the Smithsonian IMAX film. This was an Aerovironment project led by Dr. Paul MacCready.

Cost: $8.00 postage paid
Add: $2.00 for foreign postage

An Overview of Composite Design Properties, by Alex Kozloff, as presented at the TWITT Meeting 3/19/94. Includes pamphlet of charts and graphs on composite characteristics, and audio cassette tape of Alex's presentation explaining the material.

Cost: $5.00 postage paid
Add: $1.50 for foreign postage

VHS of Paul MacCready's presentation on March 21,1998, covering his experiences with flying wings and how flying wings occur in nature. Tape includes Aerovironment's "Doing More With Much Less", and the presentations by Rudy Opitz, Dez George-Falvy and Jim Marske at the 1997 Flying Wing Symposiums at Harris Hill, plus some other miscellaneous "stuff".

Cost: $8.00 postage paid in US
Add: $2.00 for foreign postage

VHS of Robert Hoey's presentation on November 20, 1999, covering his group's experimentation with radio controlled bird models being used to explore the control and performance parameters of birds. Tape comes with a complete set of the overhead slides used in the presentation.

Cost : $10.00 postage paid in US
$15.00 foreign orders

FLYING WING SALES

BLUEPRINTS – Available for the Mitchell Wing Model U-2 Superwing Experimental motor glider and the B-10 Ultralight motor glider. These two aircraft were designed by Don Mitchell and are considered by many to be the finest flying wing airplanes available. The complete drawings, which include instructions, constructions photos and a flight manual cost $250 US delivery, $280 foreign delivery, postage paid.

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