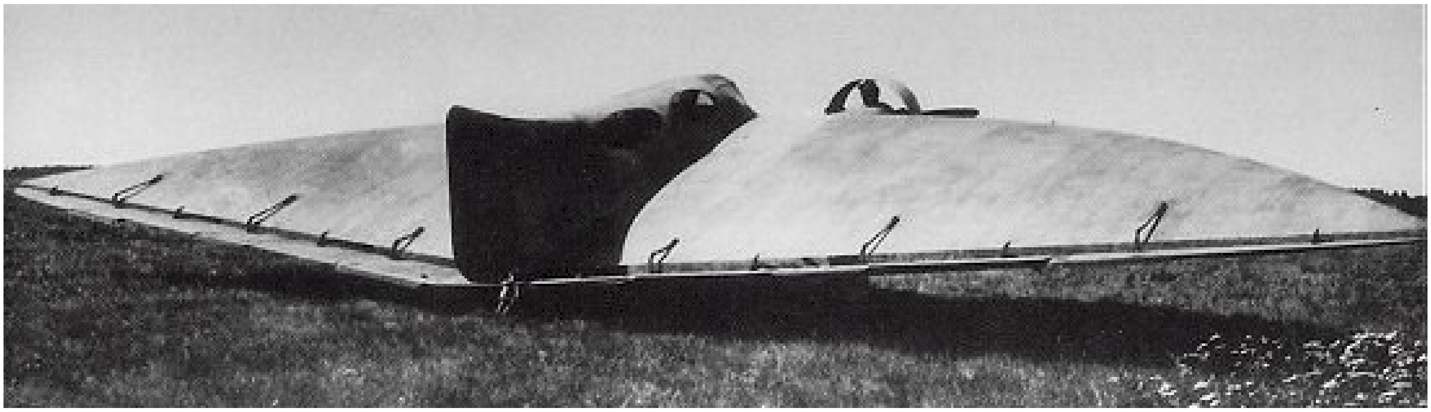
No. 354 DECEMBER 2015

T.W.I.T.T. NEWSLETTER



One of Cheranovsky's prototypes showing it's oddly shaped wing. See page 2 for more on some unusual designs. Source: http://www.dailykos.com/story/2015/12/3/1451848/-Flying-Wings-and-Things

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., **1512** 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.

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

President: Andy Kecskes (619) 980-9831
Treasurer:
Editor: Andy Kecskes
Archivist: Gavin Slater

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) 589-1898 (Evenings – Pacific Time)
E-Mail: twitt@pobox.com
Internet: http://www.twitt.org
Members only section: ID – **20issues10**
Password – **twittmbr**

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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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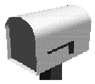
PRESIDENT'S CORNER

Not a lot going on this month or much to tell you about in the world of flying wings. There hasn't been much coming out of Europe either so don't know if this is a function of the flying weather shutting down or a lack of interest in these designs.

I found it interesting that no one took me up on the offer to produce CDs of the newsletter back issues for your own archives. I thought some of you who do not use a computer very much would take the opportunity to obtain color copies of the newsletters since the black and white printed versions often leave some of the details less than obvious. The offer is permanent so if sometime in the future you decide on getting a disk it will contain all the issues to that date.

Since I have the room I will again make my plea for newsletter material. It can be short or long on any subject matter covering some phase of flying wings or tailless aircraft. This could be from your personal experience, like a project, it can be about full size or model aircraft, or it could be a new proposal that needs to be discussed in an open forum.

HAPPY HOLIDAYS
and
NEW YEAR



LETTERS TO THE EDITOR

I am looking for the Backstrom EPB-1 plans. I was told that maybe TWITT has a copy of them. Could you advise me on this?

Thank you. Best regards.

Rafael Angel

I have a set. The controls page is completely useless. The rest is ok. The VSA should be able to sell you a set. If not, maybe I can help.

Looking for study/research, or to build?

Dennis Olcott

The VSA don't sell the plans anymore, therefore your help would be greatly appreciated.

At first, I'd want to study them for research purpose, then I'll decide if I build it.

Rafael

(ed. – Just so everyone knows, we do not have any plans for Al Backstrom's designs.)

My name is Alessandro Pia, I am Italian. I am a glider pilot and ultralight. I am an amateur builder (my last building is a Corby Starlet).

Kindly if you can tell me if you have a copy of the construction plans of the FACET OPAL if it requires paying.

I await your response. Best regards

Pia Alessandro

(ed. – As far as I know there are no plans for this design unless Scott Winton made any and they area now in the hands of his brother. If anyone knows of plans I would be interested in knowing.)

(ed. – Here are a couple of items from the Nurflugel e-mail exchanges.)

A tailless article at the DailyKos.

http://www.dailykos.com/story/2015/12/3/1451848/-Flying-Wings-and-Things

Doug Halverson

And then there was John William Dunne making and flying model arrow-shaped flying wing gliders in 1902 … so maybe it wasn't the Germans that we have to thank. Who was really first? In whichever field you start this quest you soon discover that there are many answers and few of these pioneers knew much about their contemporaries. Without modern communication, much was achieved in splendid isolation. Anyway, I will plump for Dunne. Any other bids? Perhaps Leonardo?

Chris Bryant

There was a great article last year about Starling Burgess in Air & Space. Along all the other things he did he also built Dunne 'wings under license. http://www.airspacemag.com/history-of-flight/most-talented-aviation-pioneer-youve-never-heard-180950149/?no-ist=&page=1

Norm Masters

Earlier than Leonardo Da Vinci. Both China and Japan had early hang gliders well before Christ. I remember reading about "men flying like birds and faster than a man running...". Bamboo and coated silk craft which were considered white or black magic.

Bruno De Michelis

I have always been a J.W. Dunne fan. While not as systematic and knowledgeable about aero-dynamics as the Wrights, he did happen upon a geometry that led to stable flight, where the plane reacted to upsets by righting itself. His airfoils (defined as flying surfaces) were oblique wrappings of cylinders and cones. He even traded letters with his friend H.G. Wells on this. His first successful manned glider flew 7/07 and his first powered "hops" occurred in late 1908. His powered craft were flying in 1910, before he demonstrated controlled and hands-off powered flight and descent in front of Griffith Brewer and Orville Wright on 12/20/10, flying his craft as a novice, while writing all of his moves on a sheet of paper.

The problems with assessing priority in tailless-aircraft flight involve not only verification of events, but just how close to tailless the craft is, whether or not you want powered flight, and whether it must be manned. In historic times, other craft to consider include Berblinger's glides ca. 1810, Mouilliard's uncontrolled lifting from the ground in a "plank" glider, in gusts ca. 1865, Ader's powered, but not well controlled "hops" with his comples, bird-like "Eole" in 1890 and "Avion" in 1897, and Etrich/Wels extensive experiments in the early 1900's. Among their accomplishments in Zanonia-type craft were model glider experiments in 1900-1904, a 15-m manned glider that flew in 1906, and later powered experiments that grew separate stabilizers and evolved into WW I's "Taube". They had a "hop" on 10/13/08.

Probably the most controversial is New Zealand's Robert Pearse's first powered flight in a "plank" configuration in early 1903, before the Wrights by a few months. It seems fairly well documented that he actually got off the ground for some distance at that time, but also that he was not well, if at all, in controlled flight.

Jose Weiss' Zanonia-type model experiments of 1890-1912, with a manned flight in 1909 or 1910, merit respect too.

I'm one of the guys who feel that to claim real flight, it has to be controlled. So, I'm a real Wright brothers fan and, with Chris, give the nod to J.W. Dunne for stable and practical powered tailles flight. 'just don't want to forget the other pioneers.

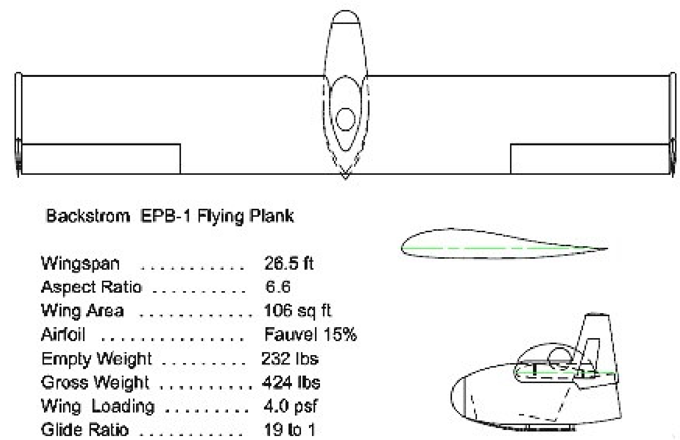
Serge Krauss

Andy, I've been sitting on this Backstrom Plank story for a while, so here it is.

Jim Marske

BACKSTROM PLANK REVISITED

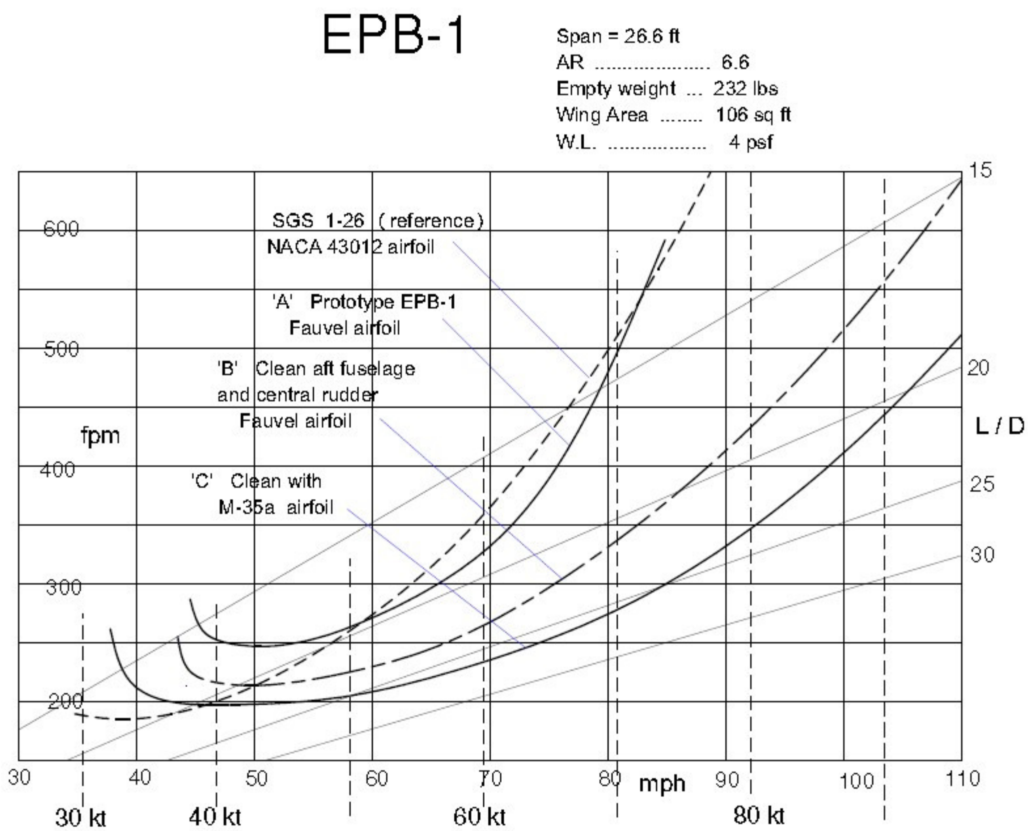
In Al's own words, "The EPB-1 is a sailplane designed in an attempt to determine the minimum size glider which will have a reasonable soaring performance." Al was encouraged by the successful development work of a Frenchman, Charles Fauvel, and his AV-36 flying wing sailplane in the mid 1900's. However, scaling down the AV-36 left Al with a wing with small area and very narrow wingtips. Looking further back into the early 1900's, another Frenchman, Arnoux, built and flew several airplanes, which featured the basic, 'Flying Plank' configuration. Running with the Plank idea, Al conceived a plank design of his own. It was to be small enough that it could be trailered in one-piece. Al wanted the performance to be similar to that of the then popular, two place war surplus trainers. A few calculations showed that a wingspan of 26 ft and aspect ratio of 6.6 would give him the desired performance.



First flights were made during August of 1954. The EPB-1 had its teething problems but they were worked out one-by-one. After smoothing and painting the aircraft performance measurements were made at Mississippi State University under the direction of August Raspet. Maximum L/D was measured at 19.8 to 1 at 60 mph. Minimum sink was 240 fpm at 50 mph. Tuft studies on the wing and fuselage juncture were carried out exposing high drag and separation areas. Further modifications, based on these tuft studies, were anticipated but were never realized. A list of these changes were listed in Al Backstrom's flight test report published by Mississippi State College in 1956. To reiterate a few of Al's items he listed in his report that needed changing:

A. Canopy. A smooth fitting juncture at the forward end of the canopy is required.
B. Extending the rear end of the canopy to the trailing edge to reduce the pressure gradient.
C. A wing fairing fillet should be added to the wings upper surface as far forward as possible.
D. Add fillets to the lower side of the wing intersection.
E. Extend the fillets aft the trailing edge to further reduce drag.

F. Round off the bottom of the fuselage and landing skid.
G. Eliminate the forward section of the tip fin plate and round off the wing tip.



With the help of computer software and making some judgments from my experience on my early XM-1 Plank I did a comparison study on Al's Little Plank. As a baseline I copied Mississippi State's polar and presented it here. See flight polar curve 'A' for original performance.

FLIGHT POLAR CURVE 'B'

The highest drag item on the Little Plank was on the aft fuselage, above and below the wing. On a short wing with the highly disturbed airflow amounts to a good percentage of the span. Extending the fuselage pod to soften the steepness of the under wing truncation and adding a fairing behind the canopy would have helped considerably. Furthermore, removing the wingtip fins and replacing them with a central rudder would reduce the aircraft wetted area and some projected frontal area. A flight polar curve was plotted containing these changes. See flight polar curve 'B'. With these assumptions, and retaining the Prototypes Fauvel 15% airfoil, the glide ratio would go to 23.5 at 60 mph and the sink rate be reduced to 220 fpm.

FLIGHT POLAR CURVE 'C':

On the next study I attacked the wing's airfoil. The EPB-1's wing section was a thinned down Fauvel airfoil (15% Vs 17%) but had excessive reflex making it overly stable and unnecessarily lowering its maximum lift coefficient. It took many years to find a better airfoil but with the help of a few friends like John Roncz and Dave Lednicer, a more efficient airfoil came about. In its final configuration, now known as the M-35a, it has proven to be superior to the Fauvel in all respects. This is born out on the Pioneer 3 sailplane across the entire speed range. Plugging the airfoil data into the computer to develop the new Super Plank we see now that the sink rate is reduced to 195 fpm at 46 mph and the best L/D is 26.8 at 70 mph.

SUMMARY:

These performance figures are not impressive by today's standards but for a very small 26.5 ft one-piece glider its hard to beat. The high minimum sink rate of is due purely to its short wingspan and low aspect ratio. Increasing the aspect ratio on a fixed wingspan would improve the glide ratio and speed but the minimum sink rate would remain nearly the same.

A short wingspan has other side effects. I had heard that on one occasion the little Plank flew into the tow planes slipstream and was nearly turned over on its back. Apparently, the entire wingspan fits into the slipstream.

I am not trying to encourage others to build a Flying Plank type, rectangular planform, glider as it has flying difficulties, particularly the high aileron adverse yaw and short center of gravity range.

However, a taper winged version resembling my early short winged Pioneer 1 would be a wonderful improvement using the M-35a airfoil and produced in composite construction. I personally feel it would make a wonderful club type sailplane with a glide ratio of 34 to 1.

Jim goes on to talk about his designs:

XM-1 FLYING PLANK

Al's experiments soon led to the development of my very own version of the Flying Plank which I called the XM-1. It was a straight rectangular wing of 38 foot (11.7m) span with a fairly low aspect ratio of 8.9. Its airfoil was a thinned down Fauvel section from 17% down to 14%. The wing structure was a solid wood main spar with ribs of the typical truss type. The D-tube was skinned in fiberglass. The fuselage consisted of a fiberglass outer shell. A welded steel tube frame was bonded into the shell to carry flight and landing loads.

Initially, the XM-1 had wing tip fins with drag flap doors on the outboard side of the fin for yaw control, mimicking Backstrom's little Plank.

Method of glide path control was copied from the Fauvel AV-36 with it's under surface wing flaps thereby keeping the top of the wing aerodynamically clean. The flaps were hinged at 45% chord where the pitching moment is relatively unaffected.

No canopy was incorporated on the original version and the aft hood had an AV-36 type appearance. Tow hooks were installed on either side of the fuselage pod and a bridle tow line arrangement was used, much like that of the AV-36.

Upon completion and making a few low glides by auto tow, just like the models, the longitudinal stability and pitch response was found to be very good. However, yaw control proved to be very weak and required immediate attention. Also, the tow hook placement was too far below the aircrafts center of gravity resulting in nose pitch ups during towline surges. Larger drag doors were installed, nearly doubling its former size. The fuselage side tow hooks were raised higher on the fuselage to locate them close to the aircrafts vertical center of gravity. Several more short auto tows indicated a definite improvement with the new hook location but the yaw authority was only slightly improved.

XM-1B modification

The XM-1 was moved back into the shop for major modification. New, much larger hinged wingtip rudders replaced the door type flaps. An enclosed canopy was installed to improve airflow in the wing to fuselage juncture. The upper aft fuselage was replaced to fit the new canopy. The fuselage was extended 9" beyond the wings trailing edge incorporating small wing to fuselage fillets.

Higher auto tows were made which included a full circuit of the airfield. The aircraft was more responsive to the rudder but was barely acceptable. Airtows followed but it was very obvious that the glide performance was very poor. I estimated the glide ratio to be about 14 to 1. However, the glider was very forgiving at low speed. It could not be stalled and all controls were effective even with stick held full back. Attempted spins resulted in harmless skidding turns.

XM-1C modification

Perplexed over the poor glide performance, I suspected the large tip fins to be the blame. The tip fins were removed and endplates installed. The endplates were flush with the upper surface but extended 3" below the lower surface to act as wingtip ground skids. A single fixed fin was added to the aft end of the fuselage pod. The outboard end of the elevens were converted into split trailing edge flaps similar to that used on the B-2 Flying Wing bomber. While in the shop the leading edge D-tube was carefully contoured and refinished.

The ensuing flights demonstrated dramatic improvement in glide ratio which I estimated at 25 to 1. We now made our first soaring flight and by the end of the season we accumulated a 4 hour per flight average time. I began to realize that, despite its short 12 meter and low wing loading of 17 kg per square meter, the high speed glide was exceptionally remarkable.

XM-1D Modification

However, there were problems with the XM-1C that still needed to be weeded out. By far the greatest irritation was the persistent high adverse yaw produced by the ailerons, or elevens in this case. There was not sufficient rudder power available to counter the aileron drag. To improve yaw authority the wingtips were extended 400mm outboard of the drag rudders to get them out of the wing tip vortex. This was a definite improvement making the yaw control barely acceptable. However, the bottom line was that the high drag of the aileron was countered by high drag of the split flap drag rudders on the opposite wing. All this rolling drag was costly, especially when making tight figure eights on a short ridge in the mountains.

In addition the short moment arm between the aircraft center of gravity and the elevator meant its pitch authority was limited requiring increased elevator deflection, requiring 20 degrees up in slow flight and 15 degrees down elevator in cruising flight.

Furthermore, a sudden application of back stick caused the glider to momentarily sink as it rotated to climb attitude due to the reduction of lift in the elevator area. The consequence of large elevator deflections between low and high speed was considerable source of drag.

A characteristic of the Plank concept was that it would dip nose down whenever entering a thermal. The slower I flew and the stronger the thermal the more it would dip nose down. Normally, a 10 to 15 degree of dip would result. If no correction was made the aircraft would return to normal flight within 4 or 5 seconds. This is a normal response when you consider the airfoil is trimmed to fly at a definite angle of attack. When a thermal is encountered the relative airflow angularity is increased, say from 10 degrees to perhaps 15. The wing will immediately adjust itself to the new flow direction by dipping its nose. Once the aircraft completes its upwards acceleration due to the up-current the nose will return to its normal attitude. The beauty of this phenomenon is the g loads and stresses are reduced.

The XM-1 had gone through several iterations. From the ‘A’ through the ‘D’ model. Each modification showed a significant performance gain but the strong adverse yaw remained the nagging problem.

Summary

In retrospect, the performance for such a small, low aspect ratio sailplane was remarkable. In its final “D” configuration it had a glide ratio of 29 to 1 and an effective speed range of 40 to 120 mph (65 to 195 kph). The XM-1 remained active for the next 10 years making many fine soaring flights. However, there came a time when it is necessary to move on to a new approach.

The thinned down Fauvel airfoil was overly stable, that is, it carried a large amount of reflex which in turn reduced its CL max to only 0.83. On the plus side, with a minimum airspeed of 40 mph (65 kph) the speed at minimum sink was 42 mph (68 kph). When combined with the XM-1’s stall resistance I could work thermals low down at 45 mph (73 kph) in a steep bank without the fear of an accidental spin.

The main drive that inspired continued work on tailless wing development was its outstanding stability in pitch and its unexpected high speed performance despite its low 3.5 psf (17 kg/sq meter). Off the winch, I could always get 10% higher tows and anyone else. In addition, the aircraft was very forgiving to fly. It just would not stall. Even though I had run out of back stick, all other controls remained responsive. Furthermore, this was the only aircraft I have ever found to be stable in turns. With ailerons neutral some rudder was required to hold it in a turn. Taking foot pressure off the pedal the aircraft would roll out into straight flight. On one occasion, a cumulus cloud formed around me while climbing in a strong thermal. Using the Planks roll stability I continued circling while noting the cloud was brightest directly overhead. In a few minutes I came out the top of the cloud and found I could gain another 200 or 300 meters above the cloud. For the next hour and a half I enjoyed hopping from cloud top to cloud top. On final approach upon landing, I enjoyed dropping the landing flap followed by pushing both feet to the floor to extend both split flaps. The rate of descent had to seen to be believed.

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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