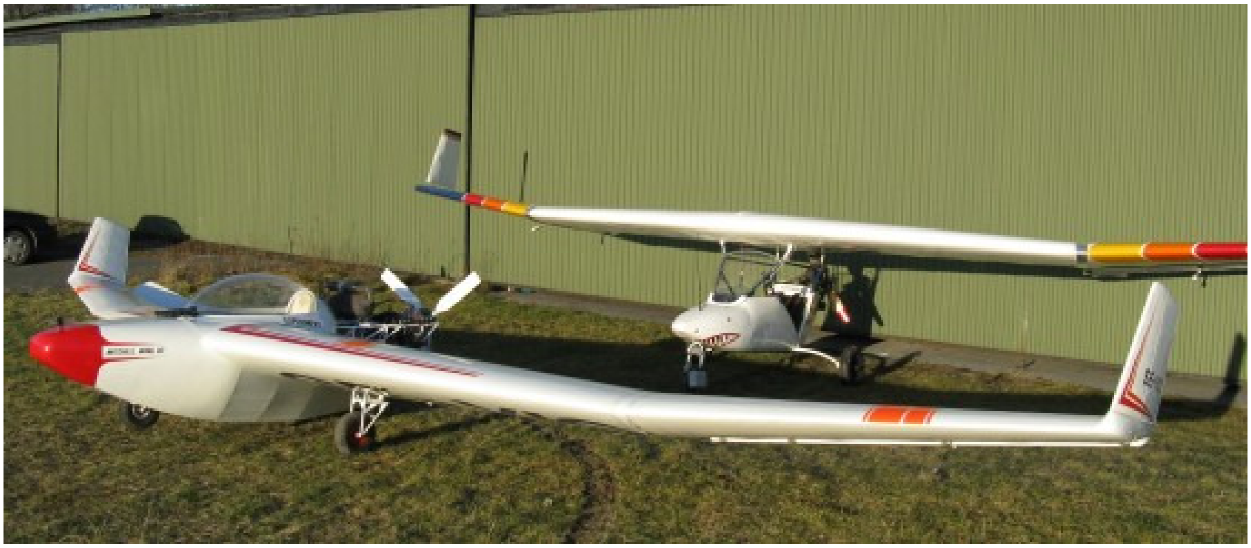
No. 367 FEBRUARY 2017

T.W.I.T.T. NEWSLETTER



Wicks Aircraft has reached an agreement with Mitchell Wing to market complete airframe kits for the Mitchell B-10 and U-2 ultralight kits. Source: http://kitplanes2.com/blog/2010/12/wicks-selling-b-10-and-u-2-airframe-kits/

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., **1702** 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. 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) 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) 447-0460 (Evenings – Pacific Time)
E-Mail: twitt@pobox.com
Internet: http://www.twitt.org
Members only section: ID – **09twitt09**
Password – **member2009**

Subscription Rates: $20 per year (US)
$30 per year (Foreign)
$23 per year US electronic
$33 per year foreign electronic

Information Packages: $3.00 ($4 foreign)
(includes one newsletter)

Single Issues of Newsletter: $1.50 each (US) PP
Multiple Back Issues of the newsletter:
$1.00 ea + bulk postage

Foreign mailings: $0.75 each plus postage

Wt/#Issues	FRG	AUSTRALIA	AFRICA
1oz/1	1.75	1.75	1.00
12oz/12	11.00	12.00	8.00
24oz/24	20.00	22.00	15.00
36oz/36	30.00	32.00	22.00
48oz/48	40.00	42.00	30.00
60oz/60	50.00	53.00	37.00

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 (#1720), east side of Gillespie or Skid Row for those flying in).

TABLE OF CONTENTS

PRESIDENT'S CORNER

Well, I am almost settled back in my home office after the move to Austin and it was easier to pull material together for this issue. My thanks to Jason Wentworth for his timely message with a lot of information on what the future might bring for flying wings doing surveys of other worlds in our solar system. As I noted to him, Al Bowers mentioned this subject during last year's ESA Western Workshop including the payload limitations that require light, collapsible craft since there are lots of other experiments on board the mother orbiter.

I have finished up the radial flow engine material from John Patten as noted last month. This was an interesting concept that I am sure has probably influenced current high by-pass ratio engines being used today. Just my guess since I am not an engineer.

I think you will be waiting with baited breath to hear more about Robert Hoppe's functional flying wing shown on page 2. I hope he will have his article available by next month so I can share the other photos he included in his message. I used one showing it in-flight so there was no doubt about his comments on its performance.

I hope everyone is getting ready for the upcoming flying season. My area of Texas is starting to show improving weather patterns so I have to get busy and get current again.

Andy

LETTERS TO THE EDITOR

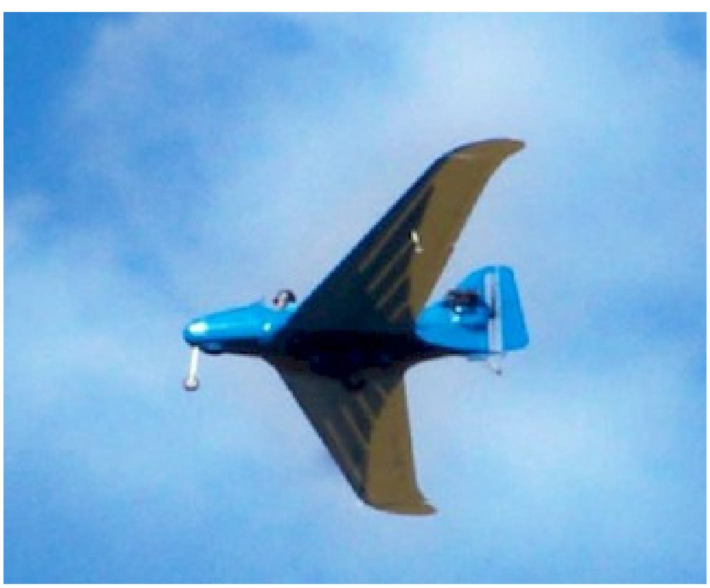
Andy

I have been working on a flying wing project for some time and finally flew it for the first time, under power, last summer. I finished it years ago as a glider which I flew briefly in a prone position. I lately finished putting an engine on it and put 23 hours on it in August and September of 2016 and am happy to report it is very solid and stable in the air and I haven't had any problems with it at all. All flights were made at my hometown airport of Sikeston, MO. Here are some specs and pictures. If you are interested I could write up a short article for TWITT.

Span	36 ft.
Wing Area	162 sq.ft.
Empty Weight	700 lbs.
Engine	Rotax 377 (35 hp @6250 rpm)
Cruise	70 mph.
Climb	300/400 ft.per.min. (rough, need more testing)

Robert Hoppe

(ed. – My thanks to Robert for offering to write more on his design and I will publish it when available. In the mean time I have included one of the photos he included in his message. I am saving the rest to go along with his article.)



Hello Andy,

It's time to start designing proposed flying wing and tailless (both swept and plank types will work fine) aerobot planetary probes, and here is why: Venus, our nearest (just ~26 million miles at its closest) planetary neighbor, has just been found to generate global-scale atmospheric waves—of the type used on Earth for wave soaring—that persist for days! Here is the news report on this discovery:

Planetary aerobot probe designers should be cheered by this
(see: http://spaceflightnow.com/2017/01/22/japanese-spacecraft-spots-planet-spanning-wave-on-venus/); Japan's Akatsuki Venus orbiter discovered a 6,000 mile-long (10,000 kilometer-long) wave feature in the planet's atmosphere, which lasted for at least *four days* and remained over—and was caused by—Aphrodite Terra, an Africa-size highland region on the planet. On Earth, such atmospheric waves (they were also observed on Mars as far back as the USA's Mariner 9 Mars orbiter mission, which ended in October 1972; the characteristic wave clouds were seen downwind from the gigantic Tharsis volcanoes) have enabled sailplanes to climb over 50,000 high, and altitudes of 100,000 feet are possible
(see: http://en.wikipedia.org/wiki/Perlan_Project).
Also:

Long-duration waves in the atmospheres of Venus and other worlds (even Saturn's moon Titan can probably generate them in its atmosphere) would enable sensor-equipped, sailplane-like instrumented aerobots to sample planetary and satellite atmospheres over enormous altitude ranges as much as desired, without any onboard propulsion (an optional onboard electrically-driven propeller would enable such an aerobot to fly elsewhere if desired). Tailless (swept flying wing or straight-winged "plank"-type) gliders would be the easiest to fold and package inside aeroshell heat shields. In addition:

Their unfolding & deployment sequences (following aeroshell separation from the main spacecraft [or from the "cruise stage," if a dedicated spacecraft wasn't used], atmospheric entry, parachute deployment, and aeroshell forward heat shield jettison) would be simpler and more reliable than those of "regular-configuration" gliders, whose fuselages would require more hinge points—each one of which is a potential failure point—than tailless swept-wing or plank-type tailless gliders (whose very short, “stub” or pod fuselages wouldn’t require any folding, hinged joints at all). As well:

Since space probe designers are conservative, tending to stick with what has been proved to work reliably on earlier probes, such tailless aerobots—if they deploy reliably and work well, which they should—could become the *de facto* standard, baseline designs for planetary and satellite atmosphere probe craft. As well as taking *in situ* measurements of atmospheric composition, temperature, pressure, winds, and other parameters, such aerobots could also photograph the surfaces of their destination worlds at higher resolutions than could be obtained from orbit (and from viewing angles that would be inaccessible to orbiting spacecraft). Magnetometer, gravimeter, spectrometer, and surface radiation emission readings could also be taken in higher detail from an aerobot than from an orbiter. For example:

On Mars, a powered aerobot—using an electric- or hydrazine engine-driven propeller for propulsion (in the 1970s, such missions were studied and found to be feasible)—could fly down the immense Valles Marineris (it’s Mars’ “Grand, GRAND Canyon,” being over 2,500 miles long, 120 miles wide, and up to 4 miles deep!) and/or around the huge volcanoes that jut up to 13.6 miles into the Martian sky, taking measurements and close-up, geologically useful photographs. (Technically, the correct term is “*areologically* useful,“ since it’s on Mars rather than on the Earth, but very, very few planetary scientists are so pedantic—“Martian geology” is good enough for them, and for me. Likewise, virtually none of them use “Cytherean” to refer to surface or atmospheric features of Venus, even though it’s the correct term; “Venusian” and—it’s less commonly used—“Venerian” are perfectly useful adjectives.) As well:

Due to its weaker gravity, about 3/8 of ours at its surface, Mars’ atmospheric density (although its surface atmospheric pressure is less than 1% of Earth’s!) falls off much more slowly with increasing height than on our more massive Earth, so flying at great heights above Mars is less difficult. This is also why all Martian aircraft designs look like sailplanes or powered sailplanes, because the air there “*starts* thin and *stays* thin as you go up.” As well as being scientifically useful (and visually awe-inspiring!) in their own right, such aerobot-obtained surface images and data would also help mission planners select the best landing sites for future Mars landers and rovers, and—one day (which will be quite soon, if SpaceX founder Elon Musk has his way)—for human visitors (and settlers) going to the Red Planet.

Jason Wentworth

(ed. – This closes out the material started last month. This was included in the package send to us by John Patten, but there is no way to determine who wrote it since it refers to things said by Heuvel versus it being told by Heuvel.)

ADVANCED VTOL DESIGN USES NEW RADIAL FLOW ENGINE

An advanced VTOL design powered by a patented radial flow gas turbine engine could provide total yaw control by the use of the inertial properties of the engine eliminating the need of a vertical stabilizer and rudder and requires no aerodynamic reaction surfaces or thrust vectoring.

The circular planform of the vehicle acting in concert with the torque inducing capabilities of the two counter-rotating engine rotors enable t he aircraft to make heading changes of essentially no limit along a given flight track at all flight speeds in very little time and with little or no "G" forces. Aerodynamically, this is possible because of the minimal change of the lift-drag profile as viewed from any aspect along the horizontal. Rapid target acquisition in aerial combat is the main goal of this system.

The radial flow engine powered circular aircraft was developed by Norman L. Heuvel of Kent, Wash. a pilot with Delta Airlines with a background education in physics. He holds U.S. (4,193,568) and Canadian (No.1,074,134), (No. 1,086,513), (No. 1,092,37I) patents and has continued to improve both the engine and vehicle designs. A high-bypass ratio engine version and vehicle planform and engine inlet. changes are the most notable improvements since the patents here granted in 1980.

Heuvel has worked with consultants Gordon C. Oates, professor of Aeronautics and Astronautics at the University of Washington and Robert O. Bullock of Airesearch Mfg. Co. of Arizona in analyzing the radial flow engine concept. Oates (deceased Nov '86) calculated the performance and sizing of the engine and developed the theory of counter-rotating compressor blades noting the possibility of significantly higher diffusion factors than found in axial flow engines. Bullock wrote an encouraging critique on the engine with special emphasis internal blade aerodynamics. *(See comments by Oates at the end of this article.)*

An Oct '87 report from the Flight Dynamics Laboratory, Technology Assessment Office at Wright Patterson Air Force Base, Ohio indicates that the concept is considered to be technically feasible. However, the report also states, "At the present time there is no known Air Force need or requirement which could embody the subject concept". The report also estimated the development costs at several hundreds of millions of dollars.

Heuvel cites the Rockwell International X-31 project to explore the tactical use of high agility as an indication that the need does now exist. Due to the unique geometry of the engine and the fact that it delivers essentially "area" thrust as opposed Lo "point" thrust, he envisions many new aerodynamic design possibilities particularly with regard to lift engines thereby justifying the development cost.

The disc-shaped planform is very similar to the Gruman "Hawkeye" radome and the Boeing AWACS radome which establishes some measure of precedence. The domed canopy is partially surrounded by the engine inlet scoop which is fitted with transparent blow-in doors that co-function as windows for on improved pilot visibility. The remainder of the inlet located immediately in front of and below the domed canopy consists of a semi-annulus shaped scoop to insure even air distribution to the engine compressor face. The fuel tank is shaped and located at the bottom center of t he vehicle for several reasons. First, the center of gravity of the vehicle will not change appreciably during fuel usage, secondly, the overall mass of the vehicle will be concentrated for the optimum operation of the yaw control system, (minimizing adverse inertial properties), thirdly, the shape tends to stabilize the torroidal vortex formed by the engine exhaust during low altitude hovering, finally, the aerodynamic drag of this shape will partially compensate for the high drag of the vehicles upper surface components reducing probable pitch-up tendencies.

Vehicle pitch and roll control is accomplished with differential elevons located on both the upper and lower surface at a suitable distance aft of the CG. These panels may also co-function as high drag devices or speed brakes, and an alternate method of yaw control in cruise flight.

The gyroscopic stability provided by the engine rotors is directly proportional to engine RPM and is thus at a maximum during take-off, landing and hover when aerodynamic control surfaces are least effective. This effect diminishes with reduced thrust requirements and does not adversely counteract. attitude control inputs to any significant degree during any phase of flight. Slightly positive stability with vehicle controllability is therefore maintained during all times of engine rotation.

Pilot visibility at the cost of increased aerodynamic drag is the primary design tradeoff of the vehicle. The alternative is to "sink the pilot into the vehicle and condemn him to scan the horizon from an airborne manhole", according to Heuvel.

The domed canopy of the present design is very generous to accommodate an average six-foot pilot and all associated avionics and flight equipment. "In fact, with the exception of the planform radius, almost every dimension, including the radius distance to the compressor face is based on the pilot", he says.

The radial flow engine is easily the most crucial component of the proposed concept. In principle it operates on the same thermodynamic cycle like all gas turbine engines. However, the radial geometry introduces some novel restrictions and advantages as compared to conventional "axial flow engines". The centrifugal force field set up by the internal blade elements acts parallel to and in cooperation with the mass flow rather than 90 degrees to it thereby lessening blade tip losses in both the compressor and the turbine. Further, since each blade row in the compressor is moving and providing a work input unencumbered by stator blading the compression ratio is substantially higher than would be expected from a conventional pair of blade rows under the same conditions of flow Mach number and blade speed. The turbine being largely the antithesis of the compressor benefits in a line manner.

The high by-pass version of the engine particularly provides favorable rotor and turbine cooling capabilities. The aft fan design allows ambient air cooling of the outer portion of the rotors and provides a conductive routing of by-passed combustion air to cool the turbine.

In Heuvel's opinion the major difficultly of the engine design is containment of the high-pressure gases between the two rotors. The flattening effect of centrifugal force acting in conjunction with 'speed-staged' ball bearings offers the best solution at this time, he says. Other difficulties include the internal drag penalty of the high ratio of surface area to nozzle area and the undetermined performance of blade aerodynamics operating in a flow field of a constant velocity gradient as measured from blade hub to tip.

Bullock recommends further study of the blade aerodynamics to identify and solve problems likely to be encountered in the trans-sonic region of engine operation.

Department of Aeronautics and Astronautics
University of Washington
Seattle, Washington

July 19, 1977

Mr. John Graybeal
Seattle, Washington

Dear John:

I have included here some comments concerning the dimensional aspects of the Heuvel engine. I've been in touch with Norm concerning the calculation of various areas, etc., and the concepts indicated herein will be incorporated in his drawings. Hopefully these comments are in a useful form, but please let me know if I can be of further assistance.

Sincerely,

Gordon C. Oates, Professor
Aeronautics & Astronautics

Some Comments Concerning the Dimensional Aspects of the Heuvel Engine

The radial geometry introduces some novel restrictions and advantages as compared to conventional "axial flow engines". In particular we note:

COMPRESSOR

The radial geometry here tends to introduce an outwardly increasing cross-sectional area unless the compressor sidewalls are contracted very sharply. To some extent this must be the case because the increase in air density with passage through the compressor introduces a requirement for a contracting cross-sectional area. This requirement may be reduced by allowing the flow (radial) Mach number to reduce as the radius increases. Such a design does, in fact, have some benefits. Thus, by allowing the Mach number to reduce, the resulting increased flow area allows the use of blades of manageable height. The higher Mach number in the early stages allows an acceptable compression ratio per stage (where the blade velocities are lowest), and the high blade velocities at the latter stages allow good compression ratios in spite of the low flow Mach numbers. It is to be noted that because each row is moving, and hence providing a work input, the compression ratio per pair of blade rows is substantially higher than would be expected from a conventional pair of blade rows under the same conditions of flow Mach number and blade speed

COMBUSTOR

The radial geometry here offers a distinct advantage. The naturally increasing cross-sectional area tends to counter the tendency of the flow Mach number to increase with heat addition. As a result the combustor pressure losses (which are proportional to the Mach number squared) should be reduced, as compared to those of conventional combustors.

TURBINE

Turbines must have an increasing cross-sectional area, and here again the radial geometry helps. Thus, whereas in conventional turbines severe sidewall expansion is required for high work output turbines, this requirement is much reduced by the naturally increasing cross-sectional area of the radial geometry.

MITCHELL WING THREADS

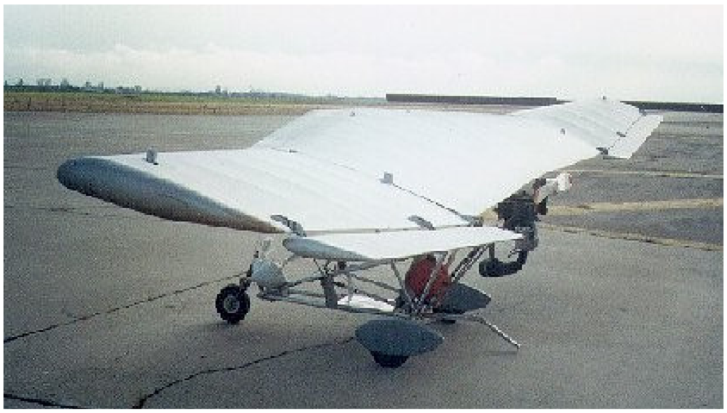
Hi Friends,

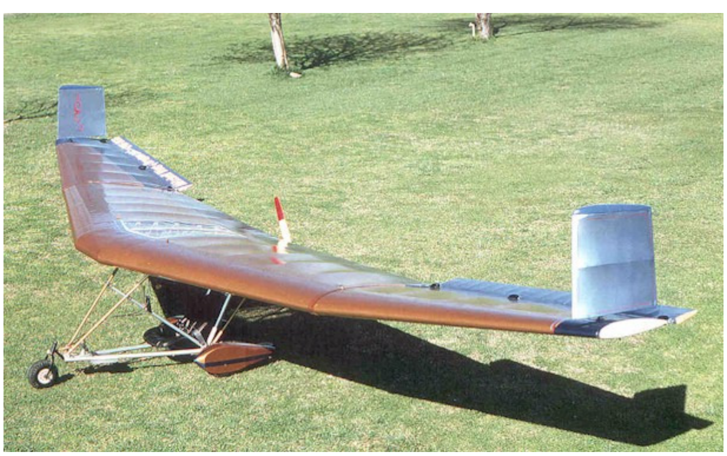
I am currently building a MW B10 in France. It's slowly go ahead but it doesn't stop...I would like to mount outboard rudders.,-it looks little more aesthetic.. May someone of you fellow builders/pilots put on some pics, photocopy of plan, about the supports of the rudders of the U2 MW with the specific materials, ribs reinforcements.... I thank you very much for your replies

Bluesky

C. Bouzerand

(ed. – Here is the only B-10 picture I could find that didn't include outboard rudders although it may be they just weren't installed. The second picture almost appears to be the same aircraft but with the rudders added. I have also included a picture of Richard Avalon's version of the B-10.)





Greetings,

Having owned an A-10, a B-10, and a Mitchell T-10, I too think it's a good idea to mount the rudders on the tips. I'd suggest you copy the design of either the A-10 or the T-10 (they are the same) and go with that. The advantage is your wings will fold without the need to remove the rudders.

Since the Mitchell Wing company is back in business you may be able to order the hinges from them saving you the time of building them. Your going to have to also fabricate the spots on your wing that are used to hold the folded sections to the wing while folded but it would be an easy thing to do. I don't have any photos but the Mitchell Wing company should be able to provide a photo of the wing folded and unfolded to give you an idea of what I'm talking about.

Camden Blue

Give us a call we'll be happy to help!
www.mitchellwings.com

Greeting, I am very happy to read your fast reply .I have thought about your solution and you fully confirm my first idea, I have visited your new page of Mitchell wing company: Glad to see it back !(I am sorry I didn't pay any attention about before...).The idea you suggested is confirmed by the pages of a MW A10 restoration I put in my favorites sometimes ago. I will contact the company soon, Thanks again. Thanks a lot.

Claude Bouzerand

AVAILABLE PLANS & REFERENCE MATERIAL

Coming Soon: <u>Tailless Aircraft Bibliography</u>
Edition 1-g

Edition 1-f, which is sold out, contained over 5600 annotated tailless aircraft and related listings: reports, papers, books, articles, patents, etc. of 1867 - present, listed chronologically and supported by introductory material, 3 Appendices, and other helpful information. Historical overview. Information on sources, location and acquisition of material. Alphabetical listing of 370 creators of tailless and related aircraft, including dates and configurations. More. Only a limited number printed. Not cross referenced: 342 pages. It was spiral bound in plain black vinyl. By far the largest ever of its kind - a unique source of hardcore information.

But don't despair, Edition 1-g is in the works and will be bigger and better than ever. It will also include a very extensive listing of the relevant U.S.

patents, which may be the most comprehensive one ever put together. A publication date has not been set yet, so check back here once in a while.

Prices: To Be Announced

Serge Krauss, Jr. skrauss@earthlink.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 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 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 $140, postage paid. Add $15 for foreign shipping.

U.S. Pacific (559) 834-9107
8104 S. Cherry Avenue mitchellwing@earthlink.net
San Bruno, CA 93725 http://home.earthlink.net/~mitchellwing/

COMPANION AVIATION PUBLICATIONS

EXPERIMENTAL SOARING ASSOCIATION

The purpose of ESA is to foster progress in sailplane design and construction, which will produce the highest return in performance and safety for a given investment by the builder. They encourage innovation and builder cooperation as a means of achieving their goal. Membership Dues: (payable in U.S. currency)

United States	$20 /yr
Canada (Air Mail)	$25 /yr
All Other Countries (Air Mail)	$35 /yr
Electronic	$10 /yr
U.S. Students	Free if full time student as defined by SSA)

Make checks payable to: Experimental Soaring Association, & mail to Murry Rozansky, Treasurer, 23165 Smith Road, Chatsworth, CA 91311.