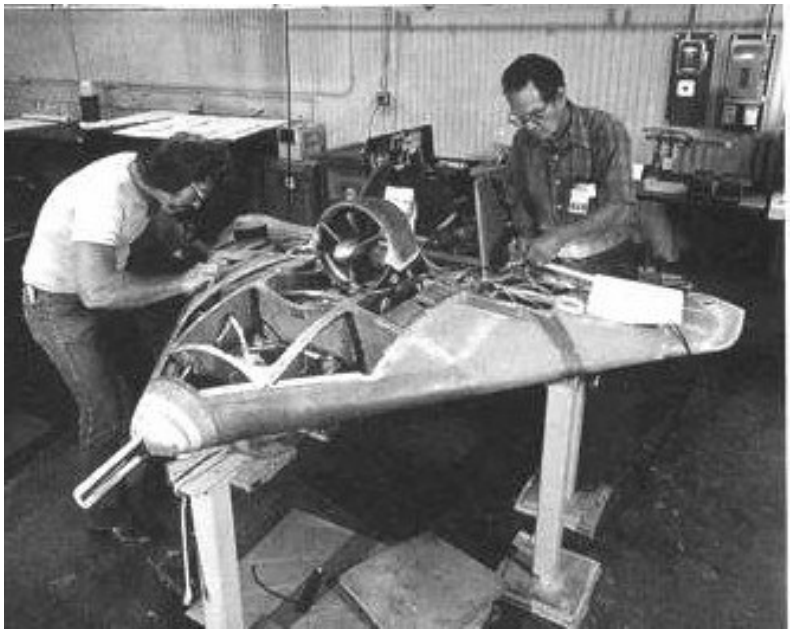
No. 183 SEPTEMBER 2001

T.W.I.T.T. NEWSLETTER

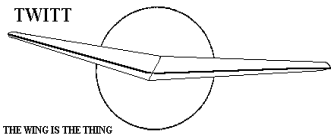


Composite materials, delta-wing design and a rotorduct propulsion system were key features of the Model 262 “Manta Ray” mini-drone by Teledyne Ryan. With 7.5 foot wing span and 25 hp piston engine driving the ducted propeller, the 160 pound delta-wing drone was easily transported by two men.

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., **0109** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, September 15, 2001, beginning at 1:30 pm at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - Southeast side of Gillespie).



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

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

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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).

TABLE OF CONTENTS

PRESIDENT'S CORNER

I just got back from the SHA Western Workshop at Tehachapi and it was great as always. The organizers do a fantastic job of bringing together the best people from all aspects of homebuilding to make informative presentations. Attendance was good and there were even a few TWITT members to be found in the various workshops. It may not be directed at flying wings, but you still need to know the ins and outs of building if you're going to put your dream project into the air. If you didn't make it this year, make sure to plan on attending during the 2002 Labor Day weekend, even for just one-day. It's well worth the time.

As you will see (depending on the order in which you read the newsletter) we weren't able to put a program together for September. This hasn't happened for a long time, but we are just running out of sources for speakers in the Southern California area. We went to the every-other-month format for that very reason and it has helped to slow down using up speakers. But there comes a time when no matter how hard you look or who you contact, there just isn't anyone available that can do a presentation of some relevance to flying wings.

We might have some interesting times ahead with the web site. The economy has taken its toll on the company that provides the Internet support to the cable company we use as our ISP. There have been several news stories that bankruptcy may be in their future. The cable company has said they will have an alternate plan, but there could be some transition problems. I will keep you informed.

Hope everyone had a fun holiday weekend.

Andy

SEPTEMBER 15, 2001 PROGRAM

We are sorry to announce that we were unable to arrange a program for September. This hasn't happened for a long time, but is always an inevitability since we have been doing programs for so long. We will continue to try and find a speaker between now and the 15th, so you can call the hanger during the day or any of us in the evening to see what came up.

For those of you who will come regardless because you like "hanger flying", we will have the PBS tape on Paul MacCready's world of interesting flying machines. This is about 55 minutes long and has a lot of really nifty little flying wings. We will also have available the tape that Dennis Karoleski sent us on a Mitchell Wing and Kasper Ultralight flying out of a small strip on the east coast. It makes for some interesting contrasts between the aircraft.

So we will be glad to see you if you decide to come, but will understand if you don't make a long drive. We will be working hard to put together a good program for you in November.

MINUTES OF THE JULY 21, 2001 MEETING

(ed. – This is a continuation of Stefanie Brochocki's presentation on the BKB-1. I have reprinted the last paragraph from last month as a point of reference.)

On a subsequent flight (May 14), tufts were installed on the section of the wing next to the fuselage. Webb reported:

> "The flight was deliberately cut short by prolonged stalls to check the behavior of the flow over the top of the wing around the fuselage which had been tufted. The flow breakaway occurred at the wing root at the trailing edge when the machine was stalled and held in the mushing position with full up elevon. Approximately the last third of the wing chord was affected. All other tufts were streaming correctly"

Could this be an example of the tuft behavior that Kasper later described? The description seems to correspond to the initial stages of what's shown in this photo, *(fig. 5)* supplied by Fred Bodek, of one of Kasper's tuft tests on the BKB. It could be speculated that, had the nose-up position been held longer increasing the angle of attack, a greater percentage of the chord ***might*** have shown a "disturbance" of the flow similar to the photo. One can only speculate also on what caused the sudden stall or whether the incident was significant.

ABOVE: The award for coming the furthest for this meeting (besides Stefanie) goes to Norm Masters of Grand Junction, Colorado. He is standing next to the sailplane historical marker on Point Loma, where the likes of Hawley Bowlus and Charles Lindberg once made early soaring flights.

Webb, in the same report, recommended the following adjustments and modifications in order to improve handling characteristics. Dave Webb's Proposed Modifications to the BKB:

1) Enlarge the rudders - to provide better directional stability at small yaw angles

- to increase the effectiveness of dive brakes

- to increase rate of entry into a turn when soaring

**** A large amount of increased rudder area should be forward of the rudder hinge to relieve pedal loads. (fig.4)*

2) Reduce elevator sensitivity by changing stick elevon gearing.

3) Aileron differential should be altered to remove excessive adverse aileron drag.

The remainder of the flying season was devoted to checking out new instrumentation, to investigating landing techniques especially on rough terrain, which seemed to be causing some porpoising.

There was a tremendous amount of paperwork generated by the BKB. For example, the documentation required for the certification process alone was astounding. The amount of correspondence generated was substantial (on file at TWITT). The really impressive document though, is the Type Record demanded by the D.O.T. for certification. It has 250+ pages of detailed calculations and drawings which required updating as modifications were made to the design.

Design changes had to be drawn and in workable form. There was also a public demand for information on the BKB. Several magazines ran stories on the BKB in

the 50's and 60's, and Stefan gave several presentations, including the substantial OSTIV paper during these years. He often was unable to be at the testing sessions because of all the demands. It was a very fortunate thing that he had such willing and capable associates to carry on this part and to report to him. Evenings and weekends were not enough time to keep up with the workload and I think that was beginning of "burn-out" for him.

There were two objectives to the testing: one to satisfy the D.O.T. of the BKB's airworthiness and acquire type certification and, the other to assess performance. It was apparent that more comprehensive and expedited testing was needed along with full time effort and attention. And referring back to those stall and tuft tests, there was a clear indication that the glider had some unusual behavior that was beyond his group's capability to thoroughly explore.

Prof. Barry Newman of McGill University, also advisor to Canadair Ltd., had developed an interest in the project. Newman wrote to Dr J.J. Cornish of Mississippi State University in 1961 requesting a testing program similar to that carried out on the Horten IV. He wrote:

"My own view of this matter is that here we have a unique sailplane which incorporates some of the improvements which Gyorgyfalvy suggested in his report on the Horten IV and that it would be a shame if the performance, stability, and general handling characteristics of the machine were not recorded for posterity."

And indeed, as it turns out, he was prophetic. MSU readily agreed to the idea, so Stefan along with George Adams and Dave Webb sought leave from Canadair for a six week testing program. The costs of tests were to be born under government contract. This is what was in the works for the glider at MSU.

The following testing and analysis was proposed:

1. Performance

a) Measurements of rates of descent (speed polar) at various speeds at minimum of 3 cg locations.
b) Measurements of profile drag.
c) Complete airflow studies.
d) Analysis of results for possible improvement.
e) Incorporation of improvements and flight confirmation.
f) Rates of descent in banked tuns.

2. Stability and behavior

a) Establishment of cg limits, stick fixed, stick free.
b) Measurements of stick forces and elevon deflections at various cg limits.
c) Measurements of pitching and yawing oscillations after disturbance.
d) Rates of roll.
e) Response to gusts (aeroelastic effects).
f) Stall investigation.
g) Tumbling characteristics.

Why this plan fell through, I can only speculate. I believe everything was in place but there seems to be some indication that the last minute cancellation of the plans had something to do with transportation and trailering. MSU was definitely ready to initiate the program, so the problem was not from that end.

I do think that this event basically signaled the beginning of the end for the Canadian testing of the BKB. In 1962-63 it was flown only 8 times to my knowledge but I can't locate any written reports of this, although Dave Webb might have some. These flights involved testing of new landing skids but time, money, and energy had basically run out.

THE SEATTLE YEARS

There are various questions that come to mind about these later years of the BKB's short existence.

What happened to cause the BKB's L/D in the high twenties to slip to 19/1? What caused it to acquire a shady and suspicious reputation? In what way did the changes initiated by Kasper affect the handling and performance characteristics? Since his modifications were frequent and sometimes reversed, the little outside written commentary is often difficult to link with any particular stage in developments of the glider.

Did the long trailer journey to Seattle affect the condition of the glider and perhaps its subsequent performance? Did the soggy Seattle climate warp the wooden structure or surface? There really are no answers, just speculation.

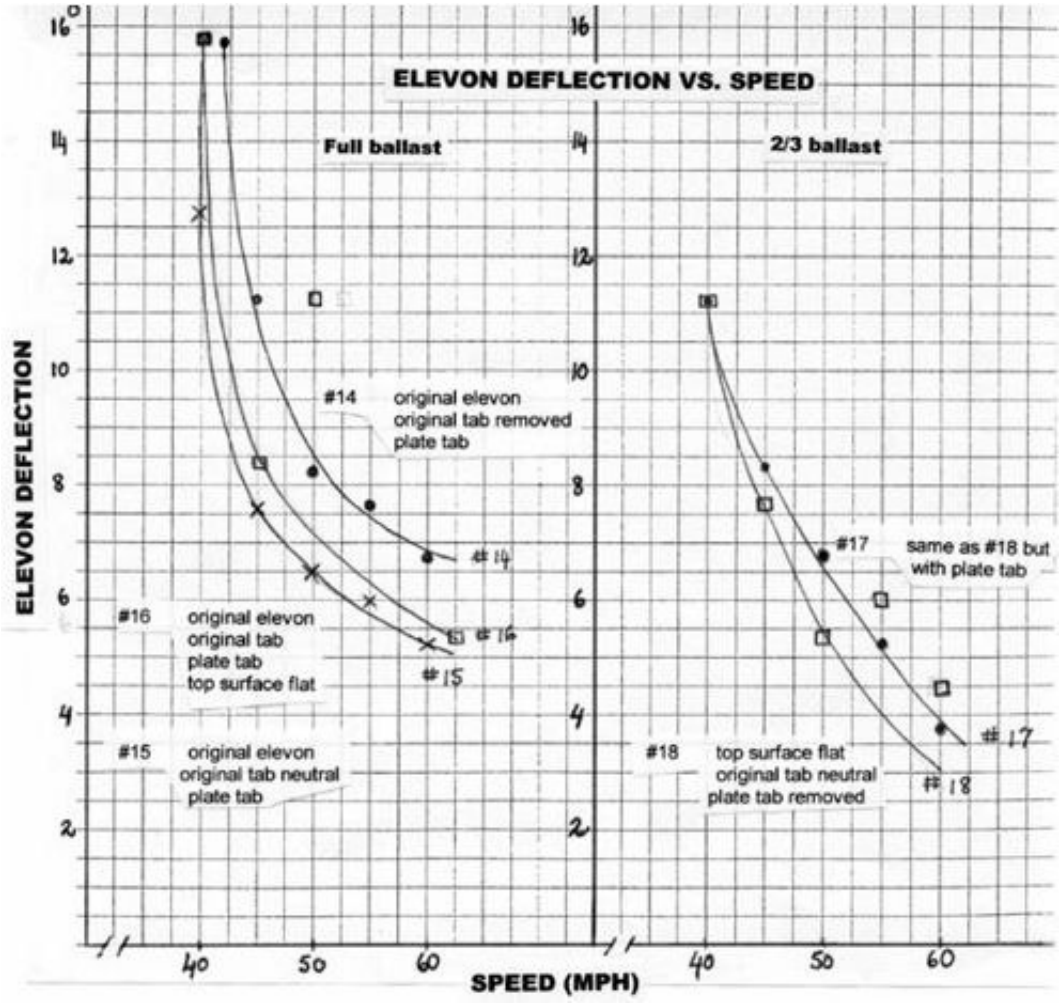
ABOVE: Stefanie illustrating a point on the wing of the BKB. Note, she is holding a small paper version of the BKB that was designed by Pat Oliver. With the right trim, it flies very well.

In 1956 the glider was moved from Kasper's basement to that of a McGill engineering professor named Edis who was a member of the Montreal Soaring Council. Construction was completed there in 1958, several months after Kasper moved to Seattle.

When in Seattle, Kasper rekindled his interest after having dropped out of the project in 1956. He wrote several times to Stefan and to Stan Rys, after the glider started testing, requesting news, and eventually demanding the use of the glider under the terms of the

trio's partnership agreement. After the transfer to the US in 1963, Al Wilson had the use of the glider for a year as Kasper didn't have a pilot's license until 1964. It appears that Al may have been the one who increased the size of the rudders as Dave Webb had suggested. Photos from that time, with Al at the controls, indicate that the size of the rudders had indeed been increased substantially. However, it doesn't appear that Dave Webb's advice to increase the area ahead of the hinge line was heeded in this modification.

Kasper, in his letters, requested drawings and test reports from Stefan and received them. When he started flying the BKB he had some difficulty catching on and wrote Stefan to tell him the glider was terrible and that it



only flew properly once he had made major alterations. He wrote to Stefan in 1965:

"Finally last year in the fall, I obtained the permission to take my graduation flight on the BKB. So I did, and I must say the experience was very bad. I will describe all the faults. Extreme sensitivity in the elevator especially in tow. Rudders impossible to move, it felt like pushing into a wall. In free flight at 60 miles the elevators were about 100 up. Stick forces pulling forward. Estimated L/D about 20. It was measured before by Al Wilson but I could not believe it until this flight."

You've seen the charts with the L/D calculations done by Marsden and some of the other test pilots, so what caused the discrepancy? The rudders, though requiring force were not impossible to move,* and Kasper had received Webb 's 1961 recommendations to increase the area of the rudders ahead of the hinge line which should have dealt with this problem. (Wilson's enlargements would explain this difficulty, as Kasper never flew with the original rudders.) Kasper also encountered difficulties operating the rudders because he didn't, as mentioned before, really understand the way the controls and mixer functioned. He was used to resting his feet on the pedals on a regular glider where the pressure differential is used to control rudder The BKB pedals demanded a different touch in level flight because forward pivotal pressure was what controlled the airbrakes and individual tip rudders.

He commented later in the same letter:

"The first flights made in spring proved the changes were right, but by this time nobody wanted to fly the glider. Because I alone flew it, and because after each flight some regulation was made, the general impression was that the plane was tricky and had limited maneuverability, as would be normal for flying wings. I alone knew different."

In an interview with Peter Bowers (Air Progress, Spring/Summer 1966) he also claimed that it had been too complicated to incorporate twist into the BKB wing during construction so the builders had cheated, using an untwisted wing, trailing the elevons higher to achieve the same effect. The article says:

"Longitudinal stability [in the BKB] is achieved in most tailless designs by combining sweepback with heavy washout at the wingtips. Since building the washout into the wing complicates the construction problem, the BKB-1 used an untwisted wing and merely trailed the elevons a bit high to achieve the same effect." This is absolutely not true; the BKB had a true 5% twist incorporated in to the full span construction. Stefan remembers very well setting the wing jigs himself for this very purpose, and of course the twist is well documented in the World's Sailplanes Vol.2, as well as Swiss-Aero Revue and others. The very detailed specifics of the twist, including calculations for each station are in the Type Record. The twist was a necessary component along with the constant chord wing

in establishing the elliptical lift distribution. All of Stefan's personal design work attempted to maintain an elliptical lift distribution as much as possible under all deflections.

There seems to be a general consensus that Kasper's additions to the end of the trailing edge of the wing, the stingers, did add more pitch stability. However, no one except Kasper flew the glider both with and without the stingers, so comparison is impossible. Stefan feels they were likely advantageous. Kasper also added fixed vertical plates ahead of the rudders that also may have enhanced the performance, and he removed all of the ballast in the nose. Thus the cg was moved as far back as possible. (Remember that earlier pilots said this caused difficulties on tow and increased pitch sensitivity.) It's important to note that Kasper's goal for the BKB was aerobatics while Stefan's was a low-cost, stable, well-performing soaring machine that was easy to assemble. These objectives are not necessarily sympathetic to each other, so the BKB's potential in soaring was not further explored or developed as a result.

TEST REPORTS FROM SEATTLE

This far, I've unearthed written reports on the BKB by only two persons other than Kasper: Dez George-Falvy and Harry C. Higgins. Dez is no stranger to flying wing aficionados, but Harry is less known outside of the Boeing circle. Both names carry a great deal of weight, but Kasper never published anything they wrote.

Harry was, before retirement, Chief of Stability and Control at Boeing, a power plane instructor, and experienced glider pilot. He has been most gracious in supplying me with a substantial amount of information.

His first flight of 20 min. in the BKB was not a happy one. He admits several extraneous negative factors influenced his first impressions. These are probably worth noting. Harry's quite open about his bias against flying wings and prior to his flight, he had talked to several persons who had also flown the BKB (or was it the Bekus?) and had unfavorable comments. He wrote a lengthy report whose highlights I'll summarize.

Flight # 1 (Harry C. Higgins, Oct. 20, 1968)

1. In smooth air, pleasant to fly, easy to spiral, very maneuverable.
2. Remarkably low sink rate considering span.
3. In rough air, unpredictable, requiring special control techniques.
4. Take-off motion erratic, unresponsive to controls.
5. Strong adverse yaw from 40 - 90 mph IAS.
6. No perceptible speed stability in form of stick force change with speed.
7. Stable in pitch (qualifies this in report).
8. Desired greater drag control in landing.
9. Downward visibility inferior to conventional gliders.

It's clear from some of Harry's comments that he had not at this time mastered the use of the rudders for directional control both during take-off and during flight. Adverse yaw need not be a problem as perfect turns and control were attainable through their use alone. Pilots unfamiliar with the mixer effect on the controls, and the use of rudder instead of aileron, always tended to have this reaction when first flying the BKB.

Take off involved unusual pitch motion but Harry found he could control this. It is interesting that the test pilots back in Ontario had no problems on ground tow except for initial flights where the towline had been attached below the wings producing nose down movement on tow. They had solved this by changing the point of attachment to slightly below the widest part of the nose. But they had kept most of the ballast in the nose. Is it possible that Witold in removing this ballast to change cg. had changed the glider's behavior in ground tow?

Harry found the aero tows were uneventful and he was able to experiment with steady changes of tow position, finding the glider amazingly stable on tow in still air.
Off tow, he found:

Flights #2, 3, & 4 (Oct. 26, 1968)

1. With some exceptions, ailerons without coordinated rudder produced zero roll rate.
2. Ailerons have no adverse effect on roll rate once mastery of roll control with rudder pedals is achieved. (Rudders were the only controls that he felt gave the pilot feel of hinge moment.)
3. Roll rate appeared nicely ratioed to pedal forces at all speeds.
4. Dynamic response in roll to rudder deflection is precisely first order.
5. He wondered why does roll control through pedals not peter out at high speed?
6. Pitch control excellent (after adapting to sensitivity), except as noted above on take-off and in rough weather.
7. Lazy eight's and loops a "delight to perform".
8. Landings critical, with limited drag control and poor visibility down and to sides.
9. Dangerous to fly without proper training. Suggested a two-seater trainer.

These reports showed that Harry had achieved control mastery on these flights. He said that he would prefer addition of a lateral control system that would give a positive steady roll-rate without use of rudder pedals. He also suggested reducing friction and changing gearing on the elevons. Kasper had already made changes in this area described in his letters, and it's impossible to ascertain what the effects of this were compared to the glider as he received it.

Dez George-Falvy also flew the BKB somewhere around this time, perhaps a bit later, the date of the flight(s) is unknown. (Dez is not well, so I've been unable to get his permission to copy his report, but I don't think he'll mind my sharing some aspects of it with you.)

Dez, in contrast to Harry, was well acquainted with flying wings. His "Performance Analysis of the Horten IV Flying Wing" is internationally known and acclaimed. He is an accomplished pilot and knew Kasper through their mutual gliding interests. When I talked to Dez last year, he was not well enough to provide any new information, but I managed to obtain a copy of his unpublished and apparently incomplete report plus the results of an interesting telephone conversation from Jim Davis. Jim was exploring vortex lift in conjunction with his kayaking

interests, and of course that led him to Kasper and then to Dez.

Observations by Dezso George-Falvy who stressed that these are estimated performance data and require further verification:

- BKB sensitive to pitch control, somewhat more so than Ho IV. Both experience sensitivity.
- BKB experiences pitch oscillations under gusty conditions but these are quickly damped requiring no corrective action by the pilot (as with Horten).
- Extremely good natured stall characteristics (as with the Horten).
- BKB: perfectly smooth flights can be made using only the rudder for lateral control and the elevator for longitudinal control. (Elevon does all in Horten).
- Amazingly good agility in maneuvers (much better than Horten).
- Effective glide path control in both aircraft that did not change the gliders' attitude when operated. (Horten unsurpassed). BKB advantage: spoiler provides good directional control when landing.
- Visibility on landing poor (prefers Horten prone position)

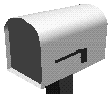
Comments:

- "The BKB shows almost comparable performance with the Horten IV, showing that it has achieved a significantly better span efficiency."
- "....performs better than a conventional design of its size".
- "....a significant step forward in the development of tailless gliders".
- "Some design features of the BKB-1 such as the constant chord wing planform and endplates seem to enhance its aerodynamic efficiency and compensate for the low aspect ratio."
- "Demonstrated that aerodynamic efficiency does not have to be sacrificed for acceptable handling qualities.

With all this good news, why wasn't everybody testing, flying, and developing the BKB?

At this point we took a stretch and snack break. Bob served up cake and ice cream. The cake's theme this year (see below) was a picture of Andy holding Bob's enlarge picture of a Horten IV, celebrating 15 years of helping spread the word on flying wings.

(ed. – Next month we will conclude with the post-break portion of Stefanie's presentation.)



LETTERS TO THE EDITOR

SGIAN DUBH

(ed. – The following was provided out of the blue by Hugh Lorimer of Scotland. You can see the full size photos by going to the Member's Projects button on the website and then the SGIAN DUBH button.)

Since the introduction of the B.C.A.R. Section "S" in 1985 there have been no new 3 axis microlights of British manufacture or design even taken to the very rigorous test stage. It is my contention that the "Authorities" can't (or won't) cope with anything new, they need a production status aircraft with "history" before they will even consider looking at it.

My first attempt at my own design was a two seat all flying canard called the "IOLAIRE" (below) this met with nothing but blocking even after all the structural stress calculations had been checked and the load testing

completed in line with B.C.A.R. Section "S" approved methodology. It has flown, and proved stable and easy to handle, both in the air and on the ground, however an approved flight test program cannot be conducted without a TEST CERTIFICATE.

When I began to think about the design for a single seat microlight I went back to my aeromodeling roots (when I designed and raced FAI models at International level) and thought about the increase in speed and rigidity the flying wing layout offered. So the idea for the SGIAN DUBH (pronounced skee an doo) came from a team racer. The

name SGIAN DUBH translates from Gaelic (ancient Scots) for BLACK KNIFE, i.e. the old Highlander`s dagger hence the emblem on the nose.

Once I had more or less finalized the layout, I built a 1/4 scale radio controlled model and put it through a fairly stiff program. The results were very encouraging indeed. The stall was a non event, no adverse yaw could be seen and, flying slow at tick-over RPM then applying full power produced no negative pitching (the thrust line of the engine is aligned with the wing C.of G position). The landing flare was perfect. I tried different strakes, but the results were inconclusive.

The lack of downward vision always seemed to be a problem with wings so the pilot had to be out in front, therefore the engine was put in the correct place as a pusher. I had a spare Rotax engine so that was the one I used (447).

I used the NACA 23012 section because it has a nearly neutral pitching moment, and more importantly I have the co-ordinates and some of the figures for same. The extended center section has a reflex from about 80% chord with the T/E level with the section height. The ramp effect between the extended fins should help with aero effect. The ailerons are large with small movements and have a differential of 1:1.5. For the first flights they will be set at about +3°. The rudders act "out only" and have tip plates to help with rudder authority at low speeds since they are out of the propwash. As you can see from the photo in the field (above), we were taxiing without the outer wing panels to check out the undercarriage. After this test I molded a new, stiffer undercarriage and a new nosewheel steering system.

The construction is the same as the IOLAIRE extruded polystyrene foam with 290t glass cloth and West System epoxy. All awkward contours, leading edge D`s etc. were hot-wired. The main spar is built up plywood to take the mortise and tennon wing joints. The strakes round the lower edge of the cockpit extend the " pitch platform " and are set at +1.5° covered with carbon fiber.

The tank is situated on the C.of G. Home designed and made prop and undercarriage. The all-up-weight so far, with 86 kg pilot is around 266 kg. The side stick is a slider type and the same push rod operates both elevators and ailerons. Below is an early cockpit view of the SGIAN DUBH (no engine fitted at this stage).

If you have comments or questions, you can contact Hugh at: lorimer@alpbach2.fsnet.co.uk or write to: Alpbach, Stair, Ayrshire, KA5 5JB, Scotland. tel.01292591411.

August 9, 2001

TWITT:

Congratulations for the 15th Anniversary. It has been so good to be a member of this flying wing forum. Enclosed please find $30 to renew my membership for one year.

The sketches that I'm sending you are from my on-going design of an ultralight sailplane, flying wing. It is inspired in Horten concepts that I think are quite well suited for a soaring class between conventional sailplanes and hang gliders. Being a soaring pilot, I'm getting unhappy with high costs and heavy regulations imposed to this already high demanding sport.

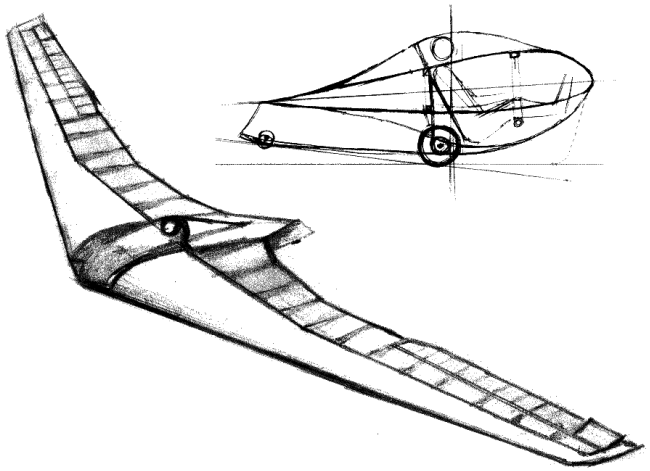
Ultralight sailplanes can cover a gap between gliding and hang gliding/paragliding, bringing lower cost and freedom coupled with intermediate performance.

The VESPER design features an enclosed cockpit and 3-axis control. It is a contribution to the effort of promoting and exploring the ultralight and small sailplane idea. Here are some specs: Span – 11.4 m; Area – 13.5 m²; AR – 9.6; weight – 75 kg and; construction – wood, glass and carbon.

Thank you.

Artur Goncalves
Rue de Pinheiro, 507
4445-561 ERMESINDE
PORTUGAL

(ed. – Thanks for the sketches and the renewal. You can see the Horten influence in the drawing and I'm sure a lot of pilots would appreciate the sitting position versus prone. Keep us informed as you proceed with the concept.)



August 20, 2001

TWITT:

Thanks for the great job you fellows do for TWITT.

My main interest is soaring flight, primarily birds.

The wing with the adjustable primary feathers was very interesting – amazing.

My friend Franklin Farrar that designed and built the prone place tailless glider in 1950 died this summer. Gus Raspet gave Franklin technical support. The glider was taken to Grand Prairie, Texas on car top for the SSA National's.

Renewal due in December is enclosed.

Keep up the pace.

Charlie Person

(ed. – Thank you for the comment on what TWITT is doing. Bob Hoey is still doing experiments with new configurations, but hasn't come up with anything revolutionary enough yet to warrant an update presentation. We continue to stay in touch with him so when it happens, we will have some new information for everyone.)

(ed. -Allan Morse sent along the following drawing to go with last month's letter on his modifications. I apologize for it not being larger, but I was having a lot of difficulty getting it to overlay into the newsletter at a size more readable. I will add it to the web site under Allan's model page so you can see it better.)