No. 194 AUGUST 2002

T.W.I.T.T. NEWSLETTER

Here is Dave Freund and his Fast Banana (left), along with his earlier prototype test model he used to conduct flight analysis of oblique wing performance characteristics. Visualize that the fin is pointing in the direction of flight and you have an idea how strange they must look in the air. For more on these interesting concept models, read the meeting recap starting on page 2 inside.

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., **0208** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, September 21, 2002, beginning at 1:30 pm at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive #1722 - 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 (#1720), east side of Gillespie or Skid Row for those flying in).

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PRESIDENT'S CORNER

Meeting day ended up being really busy. We had an excellent program by Dave Freund (better known as R/C Dave) and anniversary cake for our 16th year of operation, along with celebrating Bob's 87th birthday, which was on July 9th. Then a group of us proceeded to Doug Fronius' home to help give Bob a special surprise birthday party that completely caught him by "surprise". There were about 45 family and friends singing the refrains of Happy Birthday before he cut the special cake. Congratulations Bob, and may there be many more.

I have been giving some thought on how to let our electronic world members see the newsletter in full color in addition to the hardcopy one you normally receive. You can see what one looks like by clicking the Feb 02 item on the home page. It is an Adobe file of about 850kb, so for those on modems the download time could get a little long.

So I was toying with the idea of putting it on a special web page then e-mailing the unique URL out to members with e-mail addresses. The page would have both a full and zipped version of the newsletter so you could elect which one you prefer to download. Each month the URL would change so the newsletter would remain as exclusive as possible to our members, who would be asked not to forward the message to friends.

I would like to hear from those of you who would be interested in utilizing this service. An alternative would be to simply e-mail you the full or zipped file directly, so you might respond about that option also. It is my desire to improve member services using existing technology so you can see some of the exciting things we have in color, which makes them much more entertaining and enjoyable. I am looking forward to your comments.

Andy

SEPTEMBER 21, 2002
PROGRAM

We are pleased to announce that Bob Hoey will be our speaker for September. As many may recall Bob and his group have been experimenting with radio controlled bird flight, achieving a lot of success with various designs. He will be giving us an update on the groups latest activity and what has been learned in the past couple of years.

ABOVE: The Seagull model has been equipped with a flexible section of wing to allow for a smoother flow transition for the tip-aileron. The wing section is covered with ripstop nylon (from an old parachute)

This is an opportunity to ask those questions about simulated bird flight that you always wanted to ask. Bob is very knowledgeable and enjoys the exchange of information and ideas this type of program offers both the speaker and the audience.

So mark your calendar for the third Saturday of September. We will have more detail on Bob's presentation next month.

JULY 20, 2002
MEETING RECAP

Andy delayed starting the meeting hoping that some of our members coming down from the Los Angeles area could make it through the I-5 traffic jams, but to no avail.

We did have a couple of guests, Steve Kiblinger who had recently built a Legal Eagle ultralight and, Mike Ward who is just starting on one. Steve has always liked the Mitchell U-2 design and purchased a set of plans some time ago. He is now ready to start building and was looking for kindred flying wing folks for support. We mentioned to them about contacting Richard Avalon of U.S. Pacific who is the exclusive Mitchell dealer and possibly locate Klaus Saviar who did some interesting modification to a U-2 many years ago. Speaking of Richard, Andy mentioned that some of the latest upgrades to the website involved Don Mitchell material sent to us by Richard in the past several weeks. We are also expecting some information and pictures from his recent trip to Europe meeting with Mitchell wing owners.

With no other business or announcements to cover, Andy introduced Dave Freund, also known as R/C Dave, who was going to tell about his designing and experimenting with oblique flying wing models.

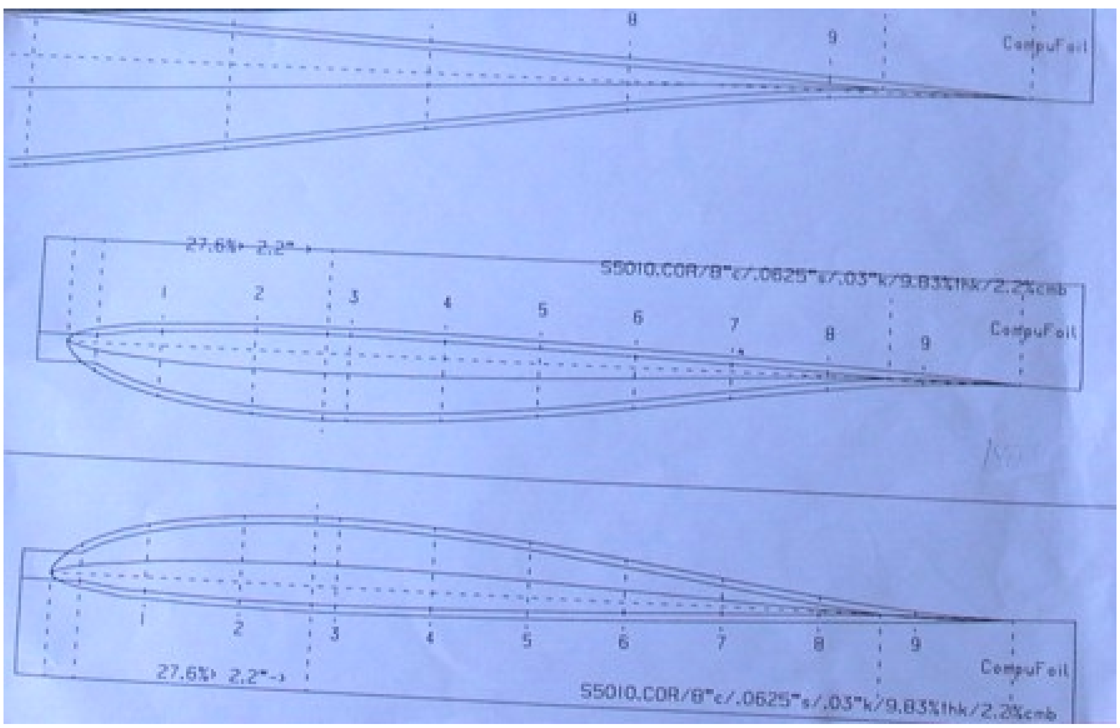
Dave became interested in oblique wings after seeing an article on Steve Morris' project at Stanford on building a large, powered oblique wing. While is was very asymmetric it had a very conventional shape which surprised him. As he looked at the various designs like those of R.T. Jones and the proposed SST pivot wing, he decided that using a basic plank design as the starting point was the way to go. He then had to decide where to place the vertical fin, since some of the past designers had mentioned problems with fin placement.

He worked his test models up to a fully asymmetrical shape since the symmetrical ones had a tendency to stall into the trailing wing (meaning the tip furthest aft when in swept flight). The model in the right of the picture (next page) was the first one he could get to stall straight ahead which was one of his important goals with this project, along with good flight characteristics. His other goals were a stable platform, quick and cheap to build, and be controllable at a number of different angles (35-55 degrees).

ABOVE: Dave holding his early hand launch test model (bottom) and the first R/C oblique wing. You can determine the flight sweep by looking at the vertical fin position and, the different configuration of the left (leading) wing tip.

This model was scaled up using a copy machine and built to be very light, coming in at 750 grams flying weight, because he felt wing loading could be a problem. Initially he kept the tail inboard and it ended up being almost on centerline at full sweep. Although the Morris design was his guide he felt they had made some mistakes by not paying attention to history. For instance he thought they should have used top and bottom engines a la Gotha.

He also wanted to see about the center of gravity movement with sweep change. At what point does the area move so far ahead of the CG that the wing becomes unstable. He had some surprising results in this area which will be covered a little later.



This model had washout and only the dihedral effect given to it by the washout and it turned out to be a bad thing. The washout varied with sweep angle and caused difficulties so almost all the twist was taken out and reflex added. He went back to airfoils that were stable and ended up deciding on the Selig 5010 (below), however, he couldn't find the coordinates and ended up with a 5020 generated on Compufoil. It was not as adequate, but was available and he added some reflex to it for stability.

He wondered during building if it would be necessary to put wash-in to the forward tip which would be bad for tip stalling but better for stability. As luck would have it he didn't have to go down that path.

He fully expected the model to turn beautifully one way and the rudder drag it into a spiral other way. He had video crews ready just in case this was the case. At this point, Dave put on a 3-minute video of the wing flying for the first time at Torrey Pines in a nose heavy configuration for safety. As the video proceeded the sweep angle was gradually increased. We all saw that it flew and very well through the first turns, which sort of amazed Dave at the time. It didn't really want to stall on its own, so he provoked it with it falling off straight ahead versus off on a wing tip and, tended to straighten itself during the recovery.

At various sweep angles it had to be re-trimmed, but overall it turned out to be a very benign airplane. The video showed it rolling into both wings during sweep, although the roll rate wasn't something to write home about. One of the final shots was the wing making extremely tight turns, almost like a death spiral, yet it wasn't losing any altitude since it was in lift. It was a very impressive sight. At one point he put a trailing streamer adjacent to the rudder to confirm the angle that the wing was flying in relation to the rudder.

While we had the doors closed, Dave put on another tape that had more footage of the first flight before being edited onto the previous tape. As the tape ran, Dave talked about having to deal with both spanwise and chordwise CG locations, where should the centerline of the pod be placed, as well as where to place the vertical fin. As the footage continued he noted that it was not initially that well behaved on the lead wing. It took some doctoring by putting in more lift on the lead wing by increasing the area. Doing it with control surface movement or modifications to the CG weren't as successful.

ABOVE: This is a picture of the Fast Banana wing under construction. You can see the carbon fiber strips being used for stiffness. It sounded like the form was made out of plaster to help speed up the building process. The elevon servo was permanently mounted in the wing and Dave says it hasn't been a problem, so far. The skins were not done in carbon fiber since the radio antenna had to be run out along the wing and the carbon would have hindered reception.

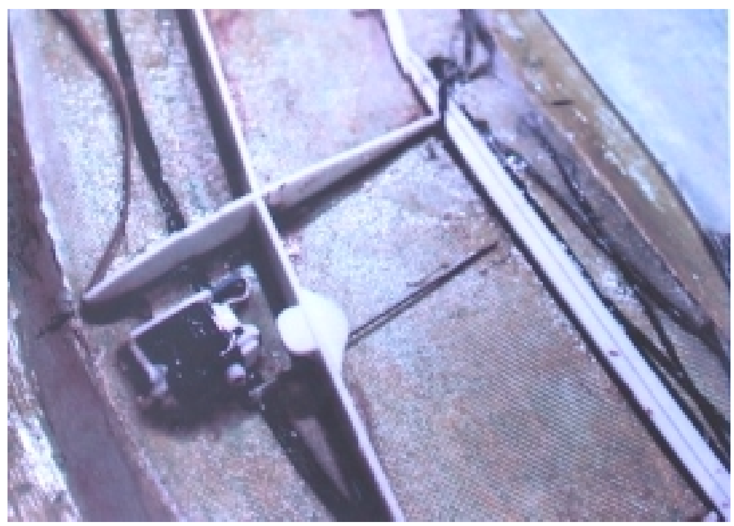
Dihedral turned out to be kind of important. As the sweep angle was changed, small changes in the control surfaces were required and, that took a very powerful radio control unit to mix the elevons into the fin. By the end of the time he finished test flying this particular model he was able to change the sweep angle hands off since it was staying in trim. This made it much easier to fly as the radio took care of the trim changes. Washout was a problem until he broke the wing and was able to make some changes. The fins went through a number of variations until he finally settled on the large, low aspect ratio ones seen in the photos. He also developed the large folding bottom portion that wouldn't get damaged during landings. He worked hard on this feature so in the event there was a midair collision the lower portion of the fin would come up into an almost trailing position and create very little drag. The question was asked why he put so much area below the wing and Dave responded that taller fins had some negative affects like pitch changes during sweep.

Sweep and trim changes were some of the things he was interested in testing. It turns out that as the wing sweeps forward and the CG moves aft, the range of possible CGs becomes quite large. So the model stayed stable at a variety of sweep angles without changing the CG.

The problems identified in the first model led to the second model called the Fast Banana, since it is that shade of yellow. It has double the wing loading of the first model and is made of fiberglass and carbon fiber. Being so heavy it required the nose weight to be further out in front of the leading edge, hence the longer nose of this one. Dave noted that if the aircraft could be made more unstable, like the Stanford model, a much shorter nose could probably be used. This model seemed to have a "happy" sweep angle that Dave attributed to the longer nose and its tendency to create more directional stability. It has about the same size wing tips, but is scaled down about 15% from the earlier version. This one also turned out to be very docile and had no bad habits that he could find.

It was simple to fly other than looking at it. One problem was determining when do you come out of a turn when the plane is flying sideways and, when it is coming towards you it is too late. He found you couldn't really look away from it for very long, because you can't really determine which way it is flying based on the nose direction. He used the fin as a guide and found you had to sort of watch the glider's track for a few seconds before attempting a control input. Since it was easy to fly, he let others try it with some having little trouble keeping it oriented, while others would get confused quickly and need help getting it back on track. Although it is a good flying machine, albeit unusual in the air, he doesn't see any need to try and kit it.

The Fast Banana really turned well since he increased the size of the control surfaces. As can be seen in the picture below, there is a lot of carbon fiber in the elevons to give them the necessary stiffness. He was able to use the Selig 5010 airfoil, with a slightly modified camber, on this one and it seemed to work well with just a little stability difference. One thing different about this model was that it needed more trimming at the large sweep angles. He found that at higher angles the trim needed to be changed as the speed changed and this meant some sort of autopilot would have to be used to keep up with it. They are available now, but require more funding than he has access too.



ABOVE: A closer shot of the servo mounted on the bottom wing skin before installing the top skin. You can see more carbon fiber in the elevons trying to keep them as stiff as possible to prevent torsional problems with air loads.

The plane flew so well that he sort of lost interest in the project. Since he doesn't have to be in them, he likes them a little less docile to make them a challenge to fly. The Fast Banana sort of turned out to be dull based on the benign flying characteristics.

Dave talked about some of the things he would like to do in the future. One would be to eliminate the nose moments by putting the batteries all along the leading edge and keeping the structure aft of the spar as light as possible. This was the case with the first model, but with the Fast

Banana he wasn't as cautious, which brought about the large nose. He thinks there are ways to change the wing shape so area changes are not so dramatic during swept flight. Through planform shape could you control how much the aerodynamic center moves compared to the CG? This led him to new shapes like those in the photo on the next page. It could have possibly led to a powered design, but for right now Dave has moved on to other projects.

ABOVE: A closer look comparing the planform and size of the two models. The weight of the Fast Banana necessitated the longer nosepiece, which also caused some unwanted directional stability problems.

Dave noted that although there might not be much need for oblique wings as models, there were definite advantages in the real world. As an airliner it would have to be a 400' span in order to be thick enough to carry people and/or cargo. There was some general discussion about the problems with airport infrastructure that came up during talks about the blended wing body proposals. He noted that the scissors wing project done by NASA probably had some problems with fuselage/wing interference, which is what he found on some of his smaller test models.

Dave had one thought about how the design could be used. Many of them could be packed into something like a Mach 2 missile then launched when close to the target. Mobile missile launchers like those for SCUDS wouldn't have time to get away with the fast approach of the main vehicle and then the stealth of the oblique wings. With autopilots and on-board recognition software, the wing could deliver an explosive on the designated target.

Dave covered some of the other problems associated with a full size version of this design. One is mounting engines, which he felt was done incorrectly on the Morris model (both under the wing in a conventional manner). He thought they should be mounted above/below each other on the top/bottom of the wing. This would make swiveling them during sweep easier and keep them closer to the CG and aerodynamic center. The landing gear needs to swivel on the ground to allow for takeoff in cross winds and to maneuver into gate areas at terminals. One side benefit would be to stick it in a hanger lengthwise making much better use of often-limited floor space.

ABOVE: Clockwise from left: initial concept test model; blended wing test model of current project; maple leaf test model; early test model with a fuselage section, and; (center) a small foam oblique toy wing designed and produce by Les King.

One thing you can have is variable thickness airfoils with no moving parts, because as you change the sweep the airfoil chord line changes and thins the section. It eliminates the need for pumping fuel around for controlling the CG position. It might also be possible to design into it inlets that would adjust the airflow for various speed and sweep ranges without having any moving parts. This makes construction much simpler and cost effective, especially since you also don't need to build a tail section.

Dave stressed that before a lot of heavy design and research work was done there should be a definite goal for the use of the airplane. He has considered the use of slats and flaps although the Morris team thought the wing had enough lift to eliminate the need for these things. This could take more internal space and if the wing was being used as a span loader some usefulness would be lost and other problems with balance might crop up.

At this point the group started throwing out ideas, like using a track ball arrangement as landing gear on the model. Dave didn't put any landing gear on the models trying to keep them simple, but he was always worried about bashing in the balsa leading edge on the first version.

As you can see from the picture (previous page) Dave has lots of other ideas. The blended wing body one at the top is reminiscent of Jerry Blumenthal's RATTLER so Dave found that others are thinking along the same lines which seemed to tickle him. And this seems to be the project he will concentrate on this year.

With all this said, Dave wrapped up his presentation and we all headed for the cake and ice cream to celebrate our 16th anniversary. Everyone seemed to enjoy the party.

LETTERS TO THE EDITOR

July 4, 2002

TWITT & Stefanie Brochocki:

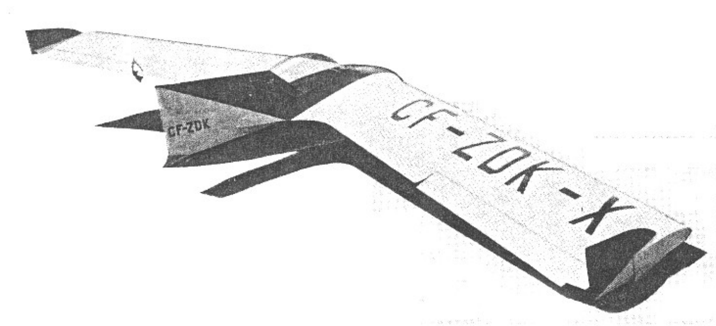
I am 83, a Navy veteran of WWII and Korea and a retired mechanical engineer (Boeing 1984). I have been associated with Witold Kasper (deceased in 1992) and his aerodynamic projects since the mid-sixties. I joined his car pool so I could get some of his ideas. Later the Kasper Aircraft Corp. was formed to develop a powered prototype of a 4-place tailless airplane. For a while I was a vice president of the corporation. I have copies of Kasper's patents and some of the corporation papers.

Last May, my son David, a former Navy carrier pilot, made me copies from his computer of several papers on the TWITT website. I can fill in some details that Stefanie's papers raised.

When Witold began flying the BKB, he saw need for some improvements:

1) The end plates of the wings were increased in size and toed-in about 3 degrees. In the vertical plane they were canted about 5 degrees (like + camber on auto front wheels).
2) The size of the rudders was increased and aerodynamic balance panels added.
3) Drag compensating tabs were added to the elevons to correct adverse yaw. See page 37, Figure III-7 in The Kasper Wing from Joe Meheen listed in the bibliography.
4) The size and shape of the elevator trim panels were increased in area and camber.

Yes, the BKB flying wing (above) will tumble, forward and reverse with positive recovery in each direction. Kasper reasoned that since both the German design and Northrop's flying wings had tumbled to crash on the ground, he would need to prove the BKB could recover from tumbles if it were to be a success. Kasper tumbled the plane at 60 rpm – he counted flashes of sunlight while timing with a stopwatch. He then put some adverse ballast in the nose and tumbled at 100 rpm forward and back with positive recovery. I have seen him tumble the glider several times (without ballast).



Item 2 of the bibliography – Kruppa tested models in a wind tunnel. The vortex lift phenomena is sensitive to Reynolds number, i.e., full size specimens must be tested in wind tunnels that blow slowly enough to avoid blowing out the vortex. At a NASA wind tunnel the aerodynamicist noted no vortex evidence on tufted wings. Kasper put some tufts on a stick and found the vortex above and aft of the upper camber of the section.

As to the death of Curtis McPhail at an air show – I met Curtis and his wife. She was the Kasper Corp. secretary for a short time. Curtis was a former Air Force pilot. Having received Navy flight training, I can say that military pilots can be bold because some methodical test pilot has tested the limits of a particular airplane. As long as the military pilot does not exceed the limits he won't kill himself. Witold had strongly cautioned Curtis NOT to attempt maneuvers, which suddenly stall a wing deliberately such as snap rolls, spins or turn reversals. The reason – the tailless wings would not stall thus overloading the airframe.

Curtis was attempting a Cuban 8, which involves a ½ snap roll from an inverted position. When McPhail completed the partial loop he was inverted in an approximately 45 degree dive. He attempted an inverted ½ snap roll and the main wing spar broke. The remaining wing allowed the glider to spiral slowly down to the ground. McPhail made no attempt to leave the glider. An autopsy showed he had died from a massive brain hemorrhage – like that caused by very high G-force. From the breaks in the structure we calculated that the force had been 11 G's. A human body without a G-suit can endure for a short time less than 6+ G's. *(ed. – at this point Hugh began talking about Kasper's powered prototype, which I will include separately below. The following is Hugh's postscript.)*

P.S. – Witold's Bekas glider with 50' span had flutter problems. The torsional stiffness with one wing spar was insufficient. The B-47 had the same problem. The engines were used as mass balances and located so as to damp out oscillations. Witold located a mass balance in each wing with help from an engineer who solved the B-47 problem. The Bekas had a fantastic L/D ratio of about 50. An inexperienced pilot crashed it.

I helped Witold launch his glider on several occasions holding up one wing until he became airborne at about 12 mph. Just before lift-off there was a whirring sound like a large vacuum cleaner at low speed. To me this indicated a vortex has formed over the wing.

I have seen an 8 mm movie film made of one of Witold's flights. In one scene he puts the glider in a steep spiral dive resembling a spin. When he stops the rotation the glider does not dive to pick up speed but climbs straight up to the altitude from whence he started the maneuver. Several pilots came to have a close look at the glider once he had landed. "What are you looking for?" asked Witold. "We want to see where the rockets are mounted" was the reply. Of course there were no rockets used. Energy "stored" in the vortex had been used to climb.

I hope these notes have been useful to you.

Sincerely,

Hugh Melrose
Bellevue, WA

(ed. – I sent this material to Stefanie Brochocki and she provided the following comments, based on her research and knowledge of events.)

July 14, 2002

As for Melrose's letter, he may be a valuable source of contacts. I've been trying to locate MacPhail's wife for some time without success, particularly since Horst Petzold had given me a different set of circumstances for the crash of the glider.

Horst also gave me the name of the pilot of the motorized plane, Alwin or Alwyn or Alvin Peters. Though I've had some people searching for him, we've come up empty-handed. Melrose might know his whereabouts.

As for the claims in the letter, well, it's the same old story. I've heard them all before, but so far they're all Kasper-generated. I've not found anyone who was there when any of these events happened. It was all second hand accounts.

As for the glide ratio of 50/1 of the Bekus, this strongly contradicts Paul Bikle's (commander of Edwards Air Force Base) account of its performance, which I got from Jim Marske.

I'm not sure what a vacuum-cleaner noise over the wing would indicate, but I wouldn't jump to a vortex conclusion. When I was in Seattle in February, I got to talk to a number of people concerning the tuft tests evidence. Apparently there's not a shred of evidence of sustained vortex lift (aside from the initial transient one, which I think is generally accepted) in the photos or written description of the events. But I'll keep searching.

It was very kind of Mr. Melrose to take the time to write. He's obviously a very sincere, kind man as were most of the people Kasper convinced to join his programs. I'm looking forward to talking to him.

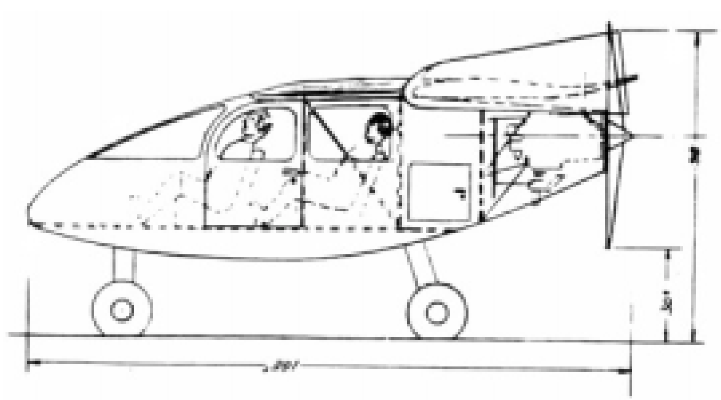
I've been working with Kasper's nephew, Zbigniew, to try and recover the films Walter Seraphin borrowed from Zbig, on the promise to convert them to video and then return them. George went to Chicago in March to get the films from Walter as Zbig had arranged. But Walter would only give up one of them.

This film is not in good condition; I'm going to have it cleaned, but on first viewing it appears to have similar content to the one I brought to California, though it's about 10 min longer. There do not appear to be any tumbles, and if there is any evidence of the steep descent at high AoA, there are no reference points by which one could determine it. There is, however, footage of the Bekas in flight. All of it needs closer examination after conversion to video format.

Walter retained the films of the tuft-testing. I'm not too worried about that. I doubt they will show anything earth-shaking. Steve Grossruck told me he had seen some of them years ago. He said they showed reverse tuft behavior for only about 10 sec. whereupon Kasper had to change the angle of attack to reinstate it. That's consistent with dynamic stall and the description Harry Higgins had written at the time.

(ed. – Below are two pieces Hugh included with his letter. Both cover Kasper's powered aircraft, which obviously used the basic layout of the BKB wing planform.)

The powered prototype program was a comedy of errors. Witold had bought an overhauled Continental 4-cylinder engine of about 85 hp. A friend had given him a suitable wooden propeller. He sketched a plan for the fuselage to be made of welded steel tubing covered with flat aluminum panels. A retired Pan Am Clipper captain was in charge of fabrication. He was a certified aircraft welder. When he found the .025" wall thickness tubing hard to obtain, he substituted .061" wall thickness. Besides, his Dutch instincts favored "hell-for-stout" construction. Witold completed building a wing of spruce plywood about 40% larger in area than the glider wing – beefed up to suit the heavier load. We finally got it put together. The first test flight was to be a high speed taxi with controls moved to lift the nose. No luck. At 65 mph, full aft stick produced nothing. Two more runs – same results. So I found out that Witold had not weighed the A/P. I bought a commercial platform scale and we weighed it. The CG was way out. The thick tube fuselage weighed 3 times what Witold had estimated.



We also reasoned that since the pitch was controlled by a shift in the center of pressure on the wing, there would not be a large enough moment available to rotate the fuselage about the main landing gear axis. So we changed the landing gear geometry to give the plane an initial nose-up attitude.

The test pilot Witold chose was an ex-military pilot who was willing to sign a waiver (in case of death or injury). He had made the taxi runs and evidently expected the same result. Witold instructed him that the airplane would now answer the stick because of the changes we made. He was to do a fast taxi but not get airborne. He said “I’ll get it off the ground if it will and set it back down”. The pilot got it up to about 75 mph and evidently pulled the stick clear back as before. The airplane climbed almost vertically to about 300 feet. The pilot must have been surprised, though the plane did not whip stall, but assumed an almost level attitude. Had the pilot left it that way with power on it probably would have flown away beautifully. Instead he panicked and cut the power. He said he wanted to land in the grass rather than on the paved runway so he banked to the right. The plane was not crashing but was restrained by the vortex lift on the wings. It hit the ground with the right wing first and wiped out the landing gear. The pilot climbed out with only a rip in his flight suit. An FAA examiner who witnessed the whole flight stated that the pilot made three fatal errors but was saved by the design of the aircraft.

With the prototype wrecked the directors and stockholders bickered pointing fingers of blame at Witold and gave up trying to raise more money. Kasper Aircraft folded quietly after some cursory attempts to sell the idea without a prototype. In 1995 I asked an investment counselor to look into rejuvenating the company. He looked at the papers I sent and said the patents were long dead and he would not himself get involved. I enclose some sketches of the proposed design and Witold’s instructions on flying a tailless airplane.

July 26, 1985

Flying the Kasper Wing Airplane

(Written by Hugh Melrose using information from Witold Kasper.)

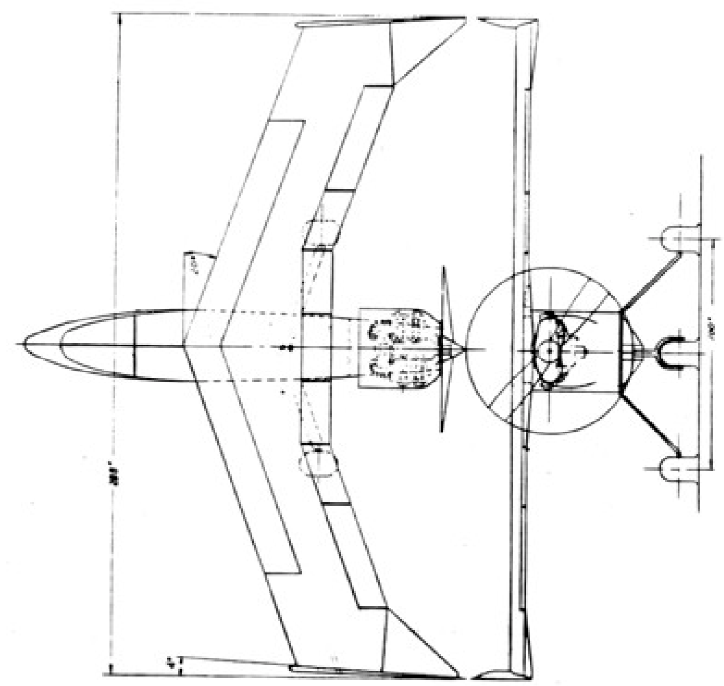
The pilot must consider the unique design features of a Kasper Wing and learn how they affect performance to become expert. The Kasper Wing differs from conventional aircraft in four important ways:

1) Its attitude is controlled by shifting the center of lift. The attitude of a conventional airplane is controlled by aerodynamic forces applied to a moment arm.

2) It has true positive stability in all three axes.

3) It is capable of generating very high lift at slow speeds using a unique vortex flow, or may use laminar flow lift generation at higher speeds.

4) The Kasper Wing does not stall with turbulent flow like a conventional airplane.



A pilot skilled in flying a conventional aircraft should have no trouble flying a Kasper Wing, if he will change his flying habits to suit.

The landing gear of a Kasper Wing must be designed to provide a positive angle of attack for the wing. Since pitch attitude is not controlled by elevators at the end of a fuselage moment arm, the aircraft cannot be rotated in pitch about the axle of the main wheels. Its no problem to provide the positive angle of attack using a “tail dragger” gear. The “nose high” geometry in a tricycle gear may be more awkward. Should gear damage or a blown tire prevent the gear from providing the positive angle, the airplane will not take off.

On take off, keep the controls neutral and accelerate down the runway with all the wheels on the ground until lift-off. After this the pitch attitude of the airplane may be changed to suit conditions. If a lot of “nose up” control is used (stick back) in an attempt to rotate prior to lift off, the aircraft attitude will suddenly change as soon as the wheels leave the runway producing a steep climb.

When airborne off the runway, the pilot may accelerate in a moderate climb with the wings in the laminar flow mode. If obstacles must be cleared the pilot can pull back on the stick or yoke to an airspeed of 20-25 kts and use vortex lift. The airplane will then climb much more rapidly with less forward movement.

Should the engine fail on take off the pilot usually should slow the airplane to vortex lift mode and either descend straight ahead if runway length permits, or make a wings level, nose high turn back to the runway. The landing may be made in vortex mode to shorten the landing space required.

In hot weather, vortex lift offers the best take off condition. Hot air increases the lift available from vortex flow.

To make turns it is necessary to depress either rudder pedal a certain amount (depending on the rapidity of turn desired) and hold it there throughout the turn. When the rudder pedal is released the airplane will resume straight flight. This produces a coordinated ball-in-center turn without need to pull back on the stick. Using the ailerons in addition to the rudders usually results in over-controlling and pilot induced oscillation (PIO).

Three things happen when the rudder is depressed:

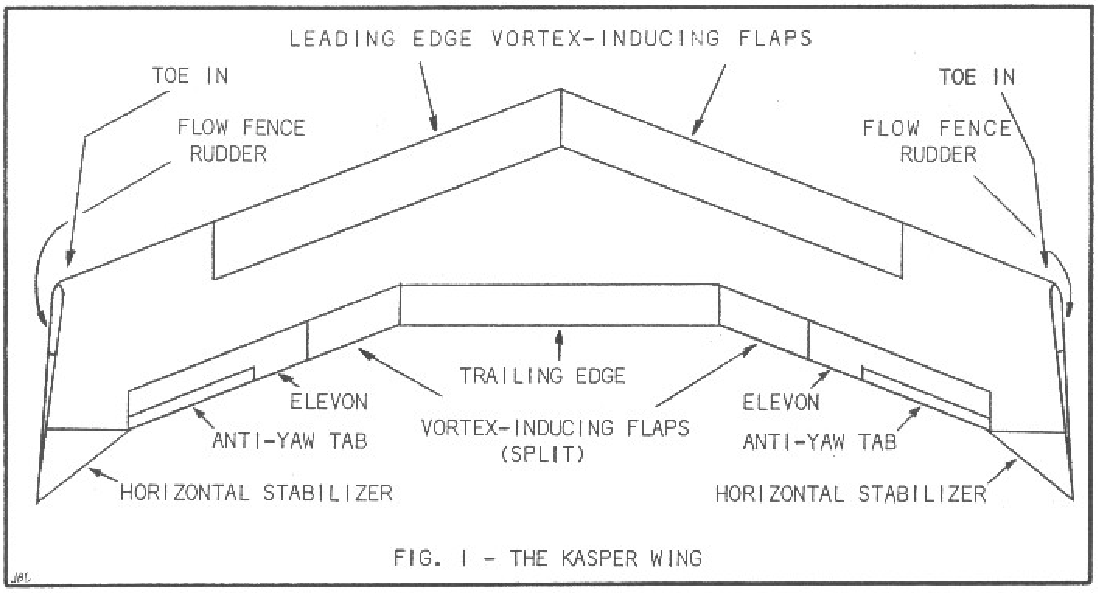


FIG. 1 - THE KASPER WING

1) The rudder "plate" portion forward of the pivot spoils the lift over a portion of the tip. This causes the wing to drop rolling the airplane in the direction of the active rudder. Because lift is reduced at that tip, the center of lift moves inboard (toward the airplanes center) producing a nose up moment.

2) The rudder "plate" aft of the pivot causes high drag at the wing tip making the airplane yaw in the direction of the turn.

3) The rudder deflects a stream of air away from the triangular stabilizer trim panel. This reduces its normally produced "nose up" moment and partly cancels the effect noted in step 1). With a balanced design this automatically applies just enough nose up moment to produce a level turn.

The ailerons should be used in cross control maneuvers:

1) Side slip to hold one wing down.
2) Crosswind landing to hold wings level while heading airplane into the wind with rudder(s).
3) To hold wings level when in vortex lift mode.
4) Faked "spin" with cross controls.

Forget the ailerons for rolls or turns. Use the rudders. Depressing both rudders at once increases drag and spoils some lift. Use as airbrakes. Avoid opening the rudders on take off unless braking effect is really needed.

Double movements are required on the controls of a standard airplane to change attitude. To nose down, for example, the pilot pushes forward on the stick until the desired angle of dive is attained. (Leaving the stick pushed forward would result in an outside loop.) Then the stick is neutralized and trim applied to compensate for the increase in airspeed. The same double movements would be required for banking for turns and climbs.

When flying the Kasper Wing do not use double movements. Think of the airplane as being rigidly attached to the stick. To increase speed move the stick to the desired angle and hold it there. If the stick is returned to "neutral" the airplane attitude will immediately change to the selected position. To execute a loop the stick is moved aft smoothly and continuously up to the top of the loop, then reversed smoothly to neutral. Pilots who fly the Kasper Wing using the same movements as for conventional airplanes over control the wing and experience PIO. No panic. Just return all controls to neutral position and the airplane will level off.

Conventional aircraft have stability comparable to a pendulum with damped oscillations about a central position. When upset by air gusts, recovery without pilot action is not immediate but may require several cycles to damp out. When the Kasper Wing is upset by gusts the basic opposing moments immediately restore the attitude to that determined by control positions without action by the pilot. When flying in rough air don't work at keeping the airplane level. Keep the controls in neutral as much as possible and let the airplane right itself. Because of this characteristic, Kasper Wing gliders will center themselves about a thermal updraft once a turn is established with no action needed by the pilot. Powered Kasper Wings would be the same.

Once the nose position has been selected to give the desired speed, the stabilizer trim panels may be adjusted to hold this attitude without control stick pressure. Adjust throttle to control gain or loss of altitude.

There are certain maneuvers a Kasper Wing will not do because of its unique design. (Note that birds don't do them either!) In doing a slow roll the rudder on a conventional airplane becomes an elevator at the 90-degree point to keep the nose up. Kasper Wing rudders change the center of pressure over the wing and will not keep the nose from pointing down at the 90-degree point. When the wings reach 90-degrees of bank the nose will be turning to point toward the ground.

Since the Kasper Wing does not stall any attempt to perform maneuvers which involve high speed induced stalls of either one or both wings are prohibited. These are: snap rolls; split S's and Cuban eights; cart wheels, and; true spins (involving one stalled wing).

The control forces necessary to induce stalls at higher speeds can produce loads that no aircraft structure can withstand <u>if the wing does not stall</u>. Nor can the pilot's body endure such loads without massive damage to blood vessels.

A maneuver which resembles a spin can be made with the Kasper Wing. This is in reality a steep diving spiral without either of the wings being stalled. It could be called a fake spin and is done with crossed controls – ailerons vs. rudder. Recovery is immediate and a climb may be immediately begun to regain altitude. No dive is required during recovery.

The Kasper Wing may be landed like a conventional airplane in its laminar flow mode. For short field landings the vortex lift mode will permit approaches at about one third the speed of laminar flow. The pattern may be flown at speeds comparable to conventional aircraft in the laminar flow mode and then shifted to vortex flow just before landing. Use of a little power during vortex flow mode will slow the rate of descent.

For cross wind landings maintain a straight flight path over the runway using the rudders. Keep the wings level with the ailerons. Straighten the aircraft heading, if required, just before touch down. Not much change is usually required since the rudders can be used to move the airplane into the side wind while the fuselage is almost parallel to the runway. This is similar to a slip. Note that severe slips in the vortex mode may blow out the vortex. Experiment with this at altitude to know how far you can go.

By studying the aerodynamic principles of the Kasper Wing, and observing how they affect the flying characteristics, one can become skilled in getting optimum performance from a Kasper Wing under a variety of conditions. Note: German and U.S. flying wing airplanes built from 1936 –1954 were unstable in pitch and crashed while tumbling. Aerodynamicists believed that tumbling was inherent in the design. No recovery from tumbling was thought possible. The Kasper Wing glider has been tumbled in both directions at 60 & 120 rpm. Positive, rapid recovery was obtained in both cases. Tumbling occurs in the Kasper Wing only with deliberate control movement.

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