

# T.W.I.T.T. NEWSLETTER



In November 2005, Boeing announced that two examples of a smaller (8.5% scale) BWB testbed, designated **X-48B**, are being built and are planned to be flown in 2006. NASA has already flown a smaller (3.7 m (12 ft) span) model of the X-48B in a wind tunnel (above). The U.S. Air Force is now also involved in the BWB program, since the Air Force Research Laboratory is listed as a participator in the X-48B development. Source: <http://www.designation-systems.net/dusrm/app4/x-48.html>

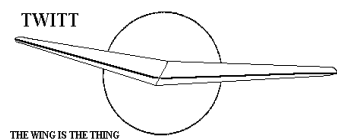
## **T.W.I.T.T.**

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., **0606** means this is your last issue unless renewed.

**Next TWITT meeting: Saturday, July 15, 2006, 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 (#1720), east side of Gillespie or Skid Row for those flying in).

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**PRESIDENT'S CORNER**

**A**lthough those of us at the hanger on May's meeting day were glad to see Dale Smith, it was totally unexpected. The best I can determine Dale sent me a confirmation message that he would be able to come down and speak, but I never received it. He then sent another one about car-pooling with Bruce and others, but I didn't receive that one either. I was remiss in not doing a follow-up with Dale to my original message, but I have come to learn that not hearing back has usually meant the recipient is not interested. Dale checked his in-box and said he couldn't find the acknowledgement message he thought I had sent, so there were communication problems all around.

I really feel sorry that we only had a few people there and we found out Dale won't be able to come back at a future date since he is moving to northern California in the next month or so. I apologized to him for the breakdown in communications between us and he was very understanding.

This issue will use some of the message traffic from the Mitchell Wing Yahoo group to sort of go along with the meeting theme, although it was really on the B-10 versus the U-2.

Don't forget that the July meeting will be our 20<sup>th</sup> anniversary party with cake and ice cream. Hopefully, I will be able to find some type of program to go with the celebration so we will have a good turn out. It is hard to believe we have been doing this for so long, but if you look at the issue number (240) that is 12 a year for 20 years. We have only had two editors that I am aware of, Marc dePolenc and myself. I assume I will be doing it for the foreseeable future since the group has gotten relatively small and there aren't as many members in the immediate area that could take it over.

Hope everyone is enjoying the improvement in the weather throughout the US and is getting back into the air.

**MAY 20, 2006  
MEETING RECAP**

**W**ell, even though I said we didn't have a program, it turns out we did have the speaker I was trying to contact. Somehow we had a really bad mix up in the e-mail traffic and Dale Smith showed up to tell us about his Mitchell B-10 ultralight. After I apologized for the lack of an audience, since there were only four of us present, we all had a friendly roundtable type of discussion on the B-10 and many other flying wing related subjects.

Dale had a DVD of his project and we assume some footage of it flying, but as luck would have it his DVD machine would not communicate with the TV through the VCR and put up a viewable picture. So with this failure, Dale had to sort of wing it since he was going to use the video as the key points for his talk. Andy suggested that maybe we could just ask him questions about the B-10 and let him amplify from them.



**ABOVE & RIGHT:** These are not Dale's ship, but reminds everyone of the basic layout of the Mitchell B-10 wing.

He showed us an example of one of the wing ribs from the section of the wing right about the folding point. It is very simple in construction being made up of square spruce formed in a jig, glued together and then strengthened with gussets at each of the joints. If you have built any models, it is very similar how a scale Piper Cub wing rib looks. The B-10 has been equated to just building an full-sized model airplane due to the simplicity of the structure.

Bob Chase commented on the fact that Don Mitchell had specifically stayed away from using any type of advanced or laminar flow airfoil on the B-10. This was because Don anticipated the typical owner

would want to go out and fly it after work and didn't need to spend a lot of time cleaning bugs off the wings before being able to fly.

Dale commented that he found the airfoil to be too stable and required a lot of control movement to get things moving in a new direction. You had to tell which direction to go, hold the control until it moved and then relax as it assumed the new flight attitude. He also commented on it being a little pitch sensitive due to the control authority incorporated into the elevons.



Bob mentioned something about a pilot using a modified VW engine on the pilot pod to set a new distance record. Dale noted that the pilot was John Jacobson using a two-cylinder cut-down VW engine that was very efficient so he traveled the greatest distance on the least amount of fuel (the figure of 74 mph was mentioned) for the specified weight class.

Pat Oliver gave us a little history behind the modified VW that was used for this record and Dale had several pictures that showed how the block had been cut in half with a steel endplate welded on where the usual thrust bearing would be. Pat noted these particular engines were nearly bullet proof and produced good horsepower for their size and weight.

Dale's first flight was set to be done at El Mirage dry lake. The initial attempt resulted in running down the lakebed in the takeoff attitude but not even giving any indication of liftoff. He had a couple times when one main wheel or the other would come off the ground, but not both simultaneously. The kept playing with the carburetor but it continued to run too lean since the motor had been originally tuned at sea-level before taking to about 3,000'.

They were just about ready to load it back on the trailer when one of the kids riding motorcycles in the area asked if they had raised the needle. That created

an immediate question on what was raising the needle. Apparently the needle had several different levels where it was in the fuel stream and by backing it out a couple of levels the motor began running richer and producing the needed power.

Dale made the comment about a pilot always being ready for takeoff even during taxiing. Well that's what happened on the next attempt. He was taxiing downwind and the B-10 takes off, totally unexpected.

Once in the air it flew very nicely and was quite stable. He commented that the stick wasn't always needed for making attitude changes since some weight shift in the cage would take care of minor adjustments.

One of his original goals for the aircraft was to use it for soaring flight, but he hasn't been able to do that yet during the two flights so far. His second flight was out of Perris Valley Airpark, but there weren't any thermals for soaring.

Dale selected the B-10 since it came up on eBay and was about 80% complete. He had wanted to try his hand at building a homebuilt aircraft, but he figured he needed to start small, so this met his criteria. He bought it in 2001 and took him about two years to complete. He sort of made it his tribute to the Wright Brothers, figuring they were homebuilders and certainly we had learned enough in the past 100 year for him to successfully put an airplane in the air.

Bob asked where Dale planned on conducting more flights, to which he replied he would probably only fly it one more time before putting it up for sale. His pending move to northern California will be to a community with an runway right out the back door so he will look into getting something in the sport category versus retain the B-10. Part of this decision was related to some bad experiences with people and their response to having an ultralight on their field.

Dale added a side note about making sure you have adequate photo coverage of your first flight attempts. He suggests at least two cameras, preferably digital since they can be analyzed better than regular movie film. He was amazed at some of things he saw in the movie footage of his attempts and flight at the dry lake, not realizing he had done them.

Bob added another not to this thought by saying it was important to always take someone else along when going flying, especially at remote sights like El Mirage dry lake. He knew of instances where pilots had not returned and it wasn't known until the next day resulting in a protracted search.

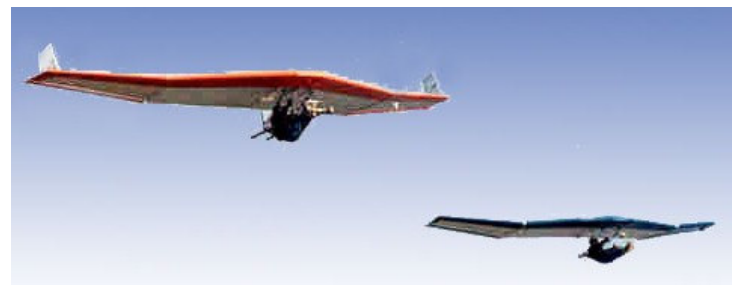
Dale showed us a cutaway drawing of the wing and noted that he wished he had had a chance to talk with Don Mitchell about some of the construction

techniques. One of these areas was the wing tip rudders. The original design has them on top of the wing and not all the way out at the tip, plus they slant inward in couple of degrees for stability. Dale would have blended them into the wing tip in a smooth transition, plus reduce them in size, we imagine something like those on the SWIFT.



**ABOVE:** This shows the location of the wing tip rudders so you can see how they are in-board of the tip and relatively large.

He knew of one builder has added spoilers just behind the D-tube in the outer section and really likes them for roll control. He also commented that with newer materials there were probably a lot of other changes that could be made that would improve the performance and reduce the overall weight.



**ABOVE:** I found this one rather interesting since the left wing has the tip rudders, but the right wing doesn't. Not sure whose aircraft these are so can't answer the question on why the differences.



As we got toward the end of the meeting we all started telling various types of war stories and discussing the direction that flying wings could take in the years ahead.

We all thanked Dale for coming down from the Los Angeles area and spending some time with us and sharing his experiences with the Mitchell B-10. Andy again apologized for the lack of attendance due to the confusion in the communications. With that we adjourned.



**LETTERS TO THE EDITOR**

March 8, 2006

I don't know if this is useable material or not and, if it is please feel free to edit this however you see fit. A friend downloaded this from a free flight plan site. I tried to find it myself but was unable, so I don't know if you would be able to publish it or not.

Some friends and I built a couple and staged a contest. Although none of us reached the claimed 2 minutes 38 seconds, we reached well over the one-minute range. The ones in the photos are mine, Glenn Jackson and Victor Mendoza.

I am sorry I don't know more about the glider, but I had a good time building and flying it.

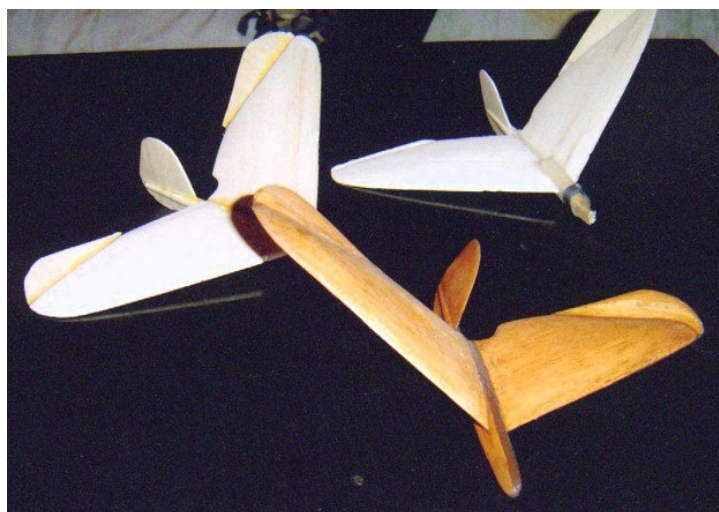
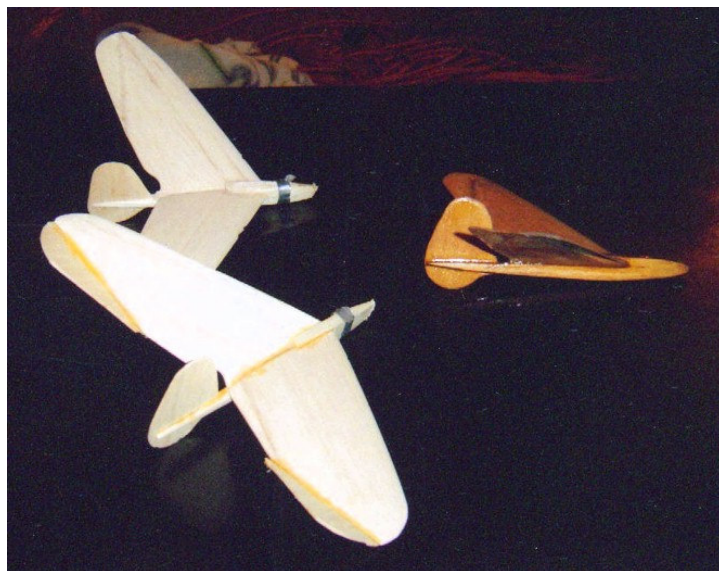
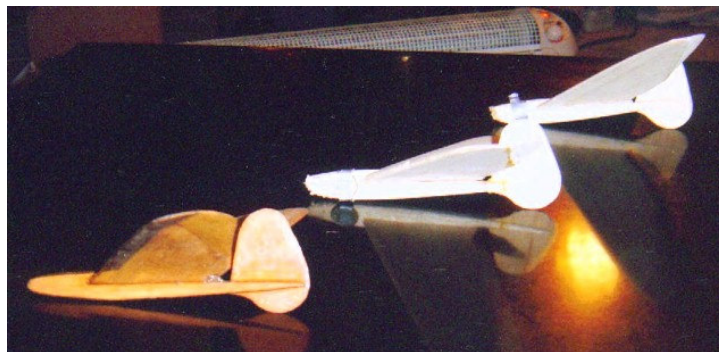
Larry Routson  
Tulsa, OK

*(ed. – This came in a couple of months ago and I managed to set it in a pile that got overlooked when I was doing the March issue. Better late than never.*

*I have included the three pictures Larry included in the letter so you can see the models from different angles and get an idea on how they were set up for flying.*

*It looks like they would be fun to experiment with in terms of getting them to circle. Trying them outside on a warm day might see some thermal flights and even it got carried away you wouldn't be out very much in the cost of building it. Good place for a video camera so you can prove it really caught the big one.*

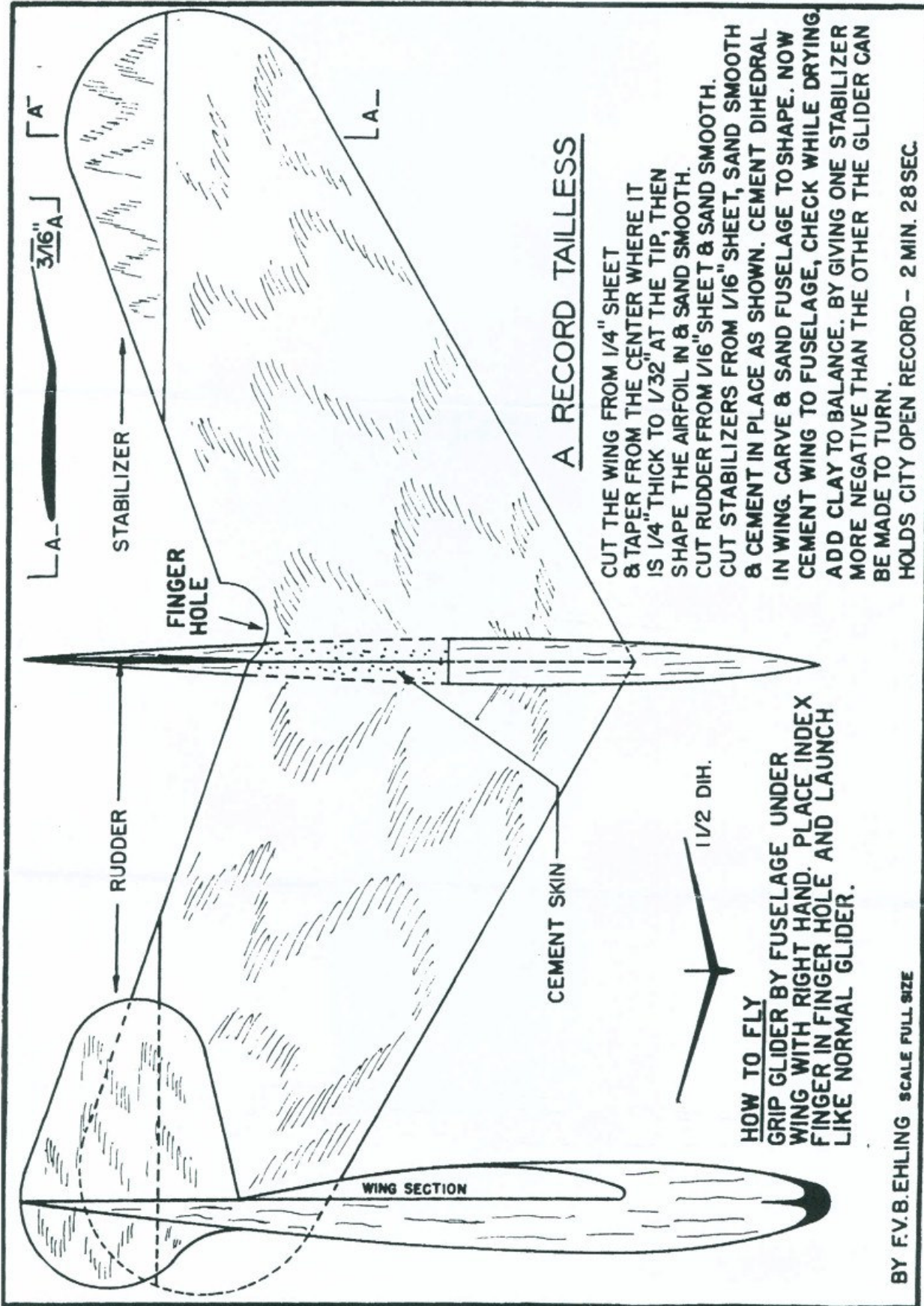
*The next page is the drawing you can use for constructing this simple soarer.)*





**"TINY" TAILLESS GLIDER**

Build and fly this at school or camp



**A RECORD TAILLESS**

CUT THE WING FROM 1/4" SHEET & TAPER FROM THE CENTER WHERE IT IS 1/4" THICK TO 1/32" AT THE TIP, THEN SHAPE THE AIRFOIL IN & SAND SMOOTH. CUT RUDDER FROM 1/16" SHEET & SAND SMOOTH. CUT STABILIZERS FROM 1/16" SHEET, SAND SMOOTH & CEMENT IN PLACE AS SHOWN. CEMENT DIHEDRAL IN WING. CARVE & SAND FUSELAGE TO SHAPE. NOW CEMENT WING TO FUSELAGE, CHECK WHILE DRYING. ADD CLAY TO BALANCE. BY GIVING ONE STABILIZER MORE NEGATIVE THAN THE OTHER THE GLIDER CAN BE MADE TO TURN.  
 HOLDS CITY OPEN RECORD - 2 MIN. 28 SEC.

**HOW TO FLY**  
 GRIP GLIDER BY FUSELAGE UNDER WING WITH RIGHT HAND. PLACE INDEX FINGER IN FINGER HOLE AND LAUNCH LIKE NORMAL GLIDER.

BY F.V.B.EHLING SCALE FULL SIZE

May 8, 2006

Low Aspect C.G.

Hi TWITT Club:

**D**oes anyone know of the center of gravity location on low aspect flying wings like the Vought V-173 or XF5U-1. I'm participating with Chuck Tucker (Feb 2006) newsletter and he is now testing His Vortex D model. Pitch irregularities occur with reduced power and dives without power.

I'm participating with a full-scale ultralight flying wing called Hummingbird with Barry Jones, of Grass Valley, Calif. After high speed taxi tests, we did not have pitch authority when C.G. was 25% chord. After utilizing Austin's X-Plane software, we discovered "stable" pitch and overall better control when C.G. was relocated aft to 40% chord. Comments and replies welcome. Elevon/vortelon used for pitch control.

Stephen Sawyer  
<s-sawyer@sbcglobal.net>

*(ed. – I sent this message off to Bruce Carmichael who passed along several references Stephen could use to answer his questions. Stephen also wrote to Serge Krauss (message below) soliciting information on this subject, but I don't have any of the feedback to pass along.)*

Greetings Serge Krauss,

Stephen Sawyer here in Lincoln, California, Playing with several flyingwing projects with different people here in northern Calif. High wing ultralight approx. 14' x 14' profiled similar to Vought V-173, Full scale 56' Horton IX in Red Bluff Calif., Vortex model, Octowing model, Trophy wing model. I'd like to learn more about Center of Gravity locations on low aspect ratio wings. Seems 25 % chord is too far forward, and pitch down occurs after power reduction, up elevons and reflexed trailing edges reduce lift also. Approx. 40 % chord CG results with better control. Your comments or reply with your ideas in this matter is welcome.

Also, there are few illustrations of "simple" elevon control mix assemblies. Can you share any you know of that might have an "A" bellcrank/bellhorn assembly. I have never even seen how the Horton brothers did theirs. Perhaps you know where some of these answers are hiding. Please tell me about your

book or gathering of information on flying wings or tailless aircraft.

May 17, 2006

Horten Gliders

**T**hanks for your reply and investigations in the old copies.

The term  $B \times (y^3/s)$  is ok with me, for it contains the cubic term over the span  $y$ . This is the main point!

It also looks consistent with the following equation

$$e = 2^\circ (y/s + y^2/s + y^3/s).$$

The main thing is: what was printed in the original paper, and this will be correct, somehow. Nevertheless I agree with your archivist that the formulas should look like this:

$$e = e_0 (A \times y/s + B \times (y/s)^3) \text{ and} \\ e = 2^\circ \times (y/s + (y/s)^2 + (y/s)^3)$$

Using the term  $y/s$  makes the polynomial term dimension less (as "s" is the max half span), which is normally done so. Nevertheless, any dimensions can be corrected within the constants "A" and "B" also. But they must be used. And engineers don't care so much about dimensions, they just want to have some handy formula to calculate. But with the Hortens there were some mathematicians.

I hope I don't confuse you too much.

Greetings,

Christian Daniel  
<Christian.Daniel@space.eads.net>

*(ed. – I have gone back into the documentation and looked a little harder at how the formulas were presented, then taking into consideration the capabilities of typewriters in those days. Gavin and I have come to the conclusion that the formulas should be modified on the website to look like Christian's final proposals.*

*I will go back through the entire document and see if there are any other formulas that need similar correction, although I am thinking there may not be any*

others since Christian didn't make note of them. This will take some time, but worth it to make sure the document is as accurate as possible.

Our thanks to Christian for having the knowledge and willingness to let us know there was a problem.)

May 29, 2006

RC Birds

Bob:

I have been enjoying your work on RC birds online and have been wondering what your most recent project is? I did see your Turkey Vulture plans are available online but what about the Seagull? I actually have an RC Gull model (that still needs to be built) but it's a 'cheater' in that it uses a small vertical fin made out of clear plastic to keep the model under control. BTW, how many hours do you estimate to build the Turkey Vulture from plans?

Best regards,

Matthew Richards  
<rifreediver@cox.net>  
SK, Rhode Island

*(ed. – We haven't seen a reply back from Bob on these questions, but I know from previous conversations that he and the group haven't planned on producing building plans for their designs. I don't recall how the Turkey Vulture plans got produced, but it is the only one in the series with some type of plans.)*

*The evolutionary process Bob and his group go through trying to tweak the designs is probably one of the main reasons for not trying to produce any designs. Just as soon as they were printed they would certainly find another improvement in handling or a revision in the a shape that would make the plan obsolete. I am sure if enough modelers were interested in building R/C birds the commercial companies would work it out on their own and make them available.)*

May 30, 2006

B-10 Model

I would like to build a 1/4-scale model of the Mitchell Flying wing B-10 however I do not have the

technical skills to down size the full scale drawings that I have for construction of a full size B-10 Mitchell wing. Any suggestions would be very helpful.

August Hahn  
<augusthahn@sbcglobal.net>

*(ed. – The first person I thought of for answering such a question was Al Bowers, but I haven't heard back from him yet due to his busy work schedule.)*

*My suggestion would be to take the drawings to a copy shop that has one of the larger blue-print type machines and see if they could photo reduce the plans to the desired scale. As noted in the meeting recap, the B-10 is almost an oversized model kit, so there shouldn't be many problems building a scale model that will fly well.)*

June 1, 2006

Specifications for Scott Winton's Facet Opal?

Are any of the specifications for the Facet Opal? Airfoil, wingspan, chord, o/a length, etc?

Fred Fighter  
<fredfighter@spamcop.net>

*(ed – As noted in previous newsletters, we don't have very much information on the Facet Opal. I wrote back to let him know this, surmising that the family has chosen not to release the information. When we had members in Australia, we still couldn't get any new information on the design so hold out little hope that we will ever know the answers.)*

May 16, 2006

To see these letter and pictures from Thomas Bircher in the newest edition of TWITT newsletter was and is a very, very great surprise for me, because I've been there close by when they flew LEA.

Until your publication of what Thomas Bircher sent to you I didn't know, what I had photographed. By postal services I'll send you a CD with my pictures mostly made from far away with 640 mm lens and only a few made close to them before I was asked to leave the area.

Kind regards, sincerely



Peter Selinger  
Stuttgart, Germany

*(ed. – Thank you for the pictures. I will include a few here and when I get time post them to the web site under the area that already includes some of the LEA project.*

*I have already contacted Thomas to let him know that Peter had been to their flying site and see if he would consider inviting Peter back for a more close up inspection of LEA.)*



**ABOVE:** Nice side view shot and a good look at the tip rudder arrangement. You can also see the folded propeller. **BELOW:** A good shot showing the relative size of LEA compared to the person carrying it. For better orientation in the air, the underside of the wing is all red except for the left tip area that is colored yellow and, the entire top of the wing is yellow except for the red right tip area.



**ABOVE:** Peter did a nice job of framing this shot against the mountains surrounding the frozen lakebed. From what I can see all the approaches are done in an unpowered mode. **BELOW:** An airborne shot with LEA on what looks like the downwind leg leading to the picture above.




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**U-2Wing@Yahoogroups**

From: Steve Hudson

From reading the article from Klaus Savier it looks like the U-2 needs a lot of modification to fly properly.

Has anyone used these modifications? If so do they work and what are the measurements and where?

From: Richard Avalon

I know Klaus Savier very well. Could you drop me an e-mail and let me know how to get a hold of him. My address is: mitchellwing@earthlink.net

Steve's Reply:

I was looking at articles under U-2 stuff on the yahoo U-2 group site and ran across the article by Klaus. My understanding of the article is there are several things that can be done to the U-2 to improve it. I am planning on building one soon entirely of carbon fiber. I am trying to find out if these modifications Klaus mentioned were valid improvements. I e-mailed him at Light Speed engineering about this article but got no response. He is the owner of Light Speed. Any questions let me know. Hope you are well.

From: Guy Provost

Maybe I should not have put the copy of that letter in my file section but I thought that any info about the U-2 is good info specially if it comes from real experience. I did not read that letter since a good while but I remember that his ship behaved differently than mine. I think that he might had his thrust line not pointing to the center of mass to start with but on the other hand, his ship seemed to be a lot lighter than mine...He was going a lot faster than mine...I did add the reflex to the outboard wings and that reduced the stall speed and increased cruise...

*(ed. – Early in TWITTs existence, Klaus came down in his highly modified Vari-EZE and talked to us about the types of modifications he was making. His talk also included some of the things he did to the U-2. I don't recall exactly what they were, and haven't been able to find a prior newsletter that contains this information. Some of the changes were to smooth out the airflow, while others were to improve the control effectiveness, if I remember correctly. As to the thrust line, I don't recall what he said about that part.)*

From: Norbert Mosson

On the U2 drawings, it is specified 0 to 30° travel for elevon, taken at root section of outer panel. I know also that some U2s had -5° to +35°. But has anyone of you had the travel only for pitch, with roll at neutral,

and the travel for roll, with pitch supposed at neutral (+15°)?

From: Guy Provost

Mine are set up from -5 to +35....why? I have been told to do so by John Connors who at a certain time studied and modify the U-2. I never measured the elevons with the stick sideways. I assume that if moving the stick back and forth makes the elevons more deflections, same will apply when the stick moves sideways....The mixer was built according to plans and I never had a problem with it...BTW if you adjust the elevons for whatever you decide, make sure when you sit in the machine that you will be able to move them the same. The cabin is very small...

Norbert's Reply:

I have no trouble with the stick travel. I used to be a glider pilot, and the U2 cockpit has lot of space compared to most of single seat gliders... I have another additional question: what are the empty weight and airborne weight of your U2? Mine is heavy (empty weight approx 170kg), because built by an aircraft specialist like a standard aircraft and not like an ultralight... But this is not bad, because I live in an area where there is always wind, lot of wind. The average wind speed over a year is 10 kts, and increasing the wing loading will increase performances for speeds above 100 km/h. On the other hand, sink speed and stall speed will increase a little.

Back from Guy:

Most of the rare completed U-2's I heard are heavier than what was advertised. However with a 1.5 mm web for the main spar, John Connors did some spar tests with a gross weight of 580 pounds and it was acceptable. If you have a 1 mm web for the spar, you should add up some fiberglass in the back (mandatory). Read my previous posts about it. My own gross weight on takeoff is between 570 and 590 pounds. Bare bones U-2 should be about 300 pounds. Adding up instruments, BRS chute, wing tanks, shock absorbing landing gear, radio will drive up the weight by a good 40 pounds not to mention the 6 gallons of gas...Also the nylon rims for the 3 wheels has to be changed for aluminum (heavier). Dick Rowley had his U-2 at 613 pounds. Hope this helps you....

Finally from Norbert:

I estimate the airborne weight between 595 to 620 lbs. The landing gear attach was heavily modified and reinforced to avoid any damage to the spar itself, but it is not easy to identify if the spar web is 1 or 1.5 mm. In the other hand, the spar web supports only sectional effort and 1mm web on the spar can support up to 650kg (each spar) at root, i.e. a total of 1300kg. The remaining sectional effort at wing root is total weight minus wing itself weight (i.e. pod + pilot + motor + fuel + instrumentation + chute..) times acceleration. with original 1mm spar web, it is easy to see that the wing is calculated at 6G, i.e. for a max in flight load factor of 4 (6 divided by safety factor of 1.5, commonly used on wood aircraft design). The only problem of the U2 is not to exceed this value at landing to not damage the web between gear and root of the wing, and 4G impact landing is not rare... If made by myself, I would put a 2mm web between landing gear legs. I will start flight test as the U2 is and check frequently the spar web.

From: Dave Gingerich

It might be worthwhile for you to go back and read the past group discussion. There has been extensive discussion of the spar strength/landing gear issue in the past year. You appear to have a good background in structural analysis, so here is my summary of the situation. The spar is indeed designed to some flight load factor, probably close to your estimate. If you look at the landing gear mounting, you will see that the entire gross weight of the airplane is fed in 6" behind the spar, generating a torsional moment. For this reason, what Guy reported in the earlier discussion is to be expected---the 1mm web and the plywood in the d-tube leading edge gradually get beat to pieces when taxiing over rough ground. Delamination is the first symptom.

After the earlier discussion, I abandoned my completed gear, and replaced it with birch legs mounted beneath the fuselage cage. This is shown in the pictures in "Tom"s U2". Also, the single bolt per side holding the cage to the bottom chord of the spar is not enough.

Also, further back, there was discussion of the elevon travel issue. The figures given in the plans and manual are apparently for the stick centered. I think the consensus was about 8 deg. down and 35 up, for the stick in the front and rear corners. Guy is right---it may not be possible to get the stick into the corners.

I don't think the U2 is a bad airplane. I just don't think it lives up to the performance claims that were made for it in the beginning.

Back from Norbert:

Thanks, Dave. I already read the past posts about that original design with the main gear. The spar is nota bad design, lots of planes, wood construction, are made like this. In France, we very well known the JODEL series as well as CAP aerobatic airplanes. The difficulty is to put the wood where it is needed.

One of the first error in the U2 is that you never bolt through spar caps unless there is enough hardwood added to the web to support the tangential effort. The spar caps should not have a direct tangential effort. You have also to add thickness to the caps to take in account the loosed cross surface due to the holes. My U2 was modified in that way. Once this corrected, the spar caps will not be damaged even in the case of hard landing, but web can suffer (D-box web and spar web).

For the spar web itself, it should be designed to absorb impact vertical effort of at least 4G. Even with 1mm web, this will be OK, but if you add on the rear web of the spar max torsion + max sectional effort, it is marginal (Never forget that the rear spar web close the D-box) but seems acceptable.

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