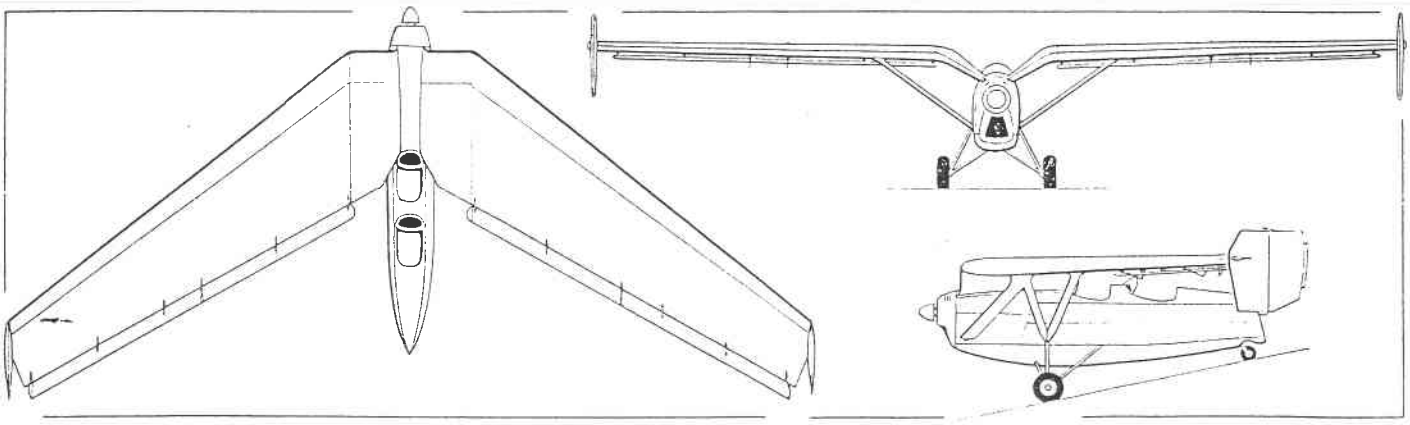
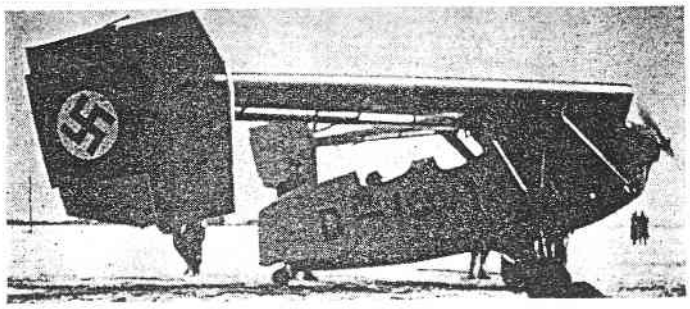
No. 94 APRIL 1994

T.W.I.T.T. NEWSLETTER





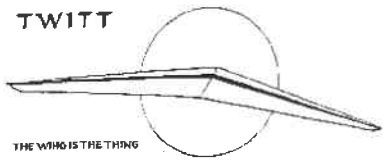
RIGHT & ABOVE: The Gotha GO 147b was the second prototype which was considered both as an aerodynamic test-bed for a projected twin-engined fighter with for and aft engines, and as a potential short-range air observation post and gunnery trainer. The wing was a wooden two-spar structure braced to the welded steel-tube fuselage by aerofoil-section splayed N-struts, almost the entire trailing edge being occupied by slotted "flaperons", and the undercarriage was fixed. Flight characteristics left much to be desired and further development was abandoned in 1938.

It was powered by one Argus As 10 8-cylinder air-cooled inverted-vee engine rated at 240hp. Span - 40'1½" Length - 19'2"; Area - 208.819 sq'; Height 9'6"; Empty Wt 2083#; Max Wt 2524#; Max Speed - 137 mph; Continuous Speed - 121 mph @ 6560', Service Ceiling - 18,045'. (Warplanes of the Third Reich by William Green - Contributed by Kevin Renshaw)

T.W.I.T.T.
The Wing Is The Thing
P.O. Box 20430
El Cajon, CA 92021

The number to the right of your name indicates the last issue of your current subscription, e.g., **9404** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, May 21, 1994, beginning at 1:00 PM at Battery Ashburn on Cabrillo Drive near the Cabrillo Lighthouse on Point Loma in San Diego.



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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Wt/#Issues	FRG	AUSTRALIA	AFRICA
1oz/1	1.00	1.00	1.00
12oz/12	5.00	6.75	5.00
24oz/24	9.00	12.25	9.00
36oz/36	14.00	19.50	14.00
48oz/48	16.75	23.00	16.75
60oz/60	21.75	30.25	21.75

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).

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PRESIDENT'S CORNER

As an opener this month I would like to congratulate Bob Chase on his new position as Vice President. Bob has been an active and contributing member for many years, and is a welcome addition to the Board of Directors. Bob has indicated he would like to become more active and will be submitting an article next month with some new ideas.

A quick reminder to those of you who have memberships coming up for renewal. **Don't forget the subscription rate has increased to $18.00/year.** Sending the right amount will save us having to put a small reminder in your next newsletter.

I know the people who braved the inclement weather last month enjoyed the program put on by Alex Kozloff. He read my mind about needing some copies of his overheads for use in the newsletter and contributed multiple copies for sale to those interested in composites (see the advertisement section for details).

Thank you, one and all, for the flood of mail we have been receiving the last couple of weeks. It is more than will fit into any one newsletter, so we will publish it as close to the order in which it arrived.

The comments being made on where TWITT should be going in the future are most helpful. Maybe we should be less concerned with meeting attendance and concentrate more on the quality of material presented in the newsletter, specifically more current developments in flying wings. Keep the letters coming and voice your opinion, since this is **YOUR** organization and should provide you with the desired results.

Since there has been no enthusiasm for any type of auction, I now have a bid of $150 from Bob Chase on the Mitchell B-10 plans. If no one submits a higher bid by the May 1994 meeting, the plans will be sold to Bob. Don't forget there are also a set of U-2 plans, with both sets including the building instructions. These normally sell for $150 through Richard Avalon who donated them to TWITT for the auction.

Again, thanks to all of you who are getting into the true spirit of TWITT.

Andy

APRIL PROGRAM

APRIL IS AN OFF MONTH, SO THERE IS NO FORMAL MEETING. PLEASE DON'T LET THAT STOP YOU FROM DROPPING BY THE HANGER AND DO A LITTLE "HANGER FLYING" ON FLYING WINGS AND OTHER AVIATION RELATED SUBJECTS.

ADVANCE NOTICE

THE MAY PROGRAM (5/21/94) WILL BE SOMETHING SPECIAL. WE WILL BE COMBINING OUR MEETING WITH THE POINT LOMA HISTORICAL PLAQUE DEDICATION. SO FAR, THE HISTORICAL GROUP HAS PUT TOGETHER WHAT LOOKS LIKE A VERY INTERESTING PROGRAM OF SPEAKERS AND AERIAL FLY-BYS. SO MARK YOUR CALENDAR, AND PLAN ON COMING OUT FOR A ONCE IN A LIFETIME EVENT.

MINUTES OF THE MARCH 19, 1994 MEETING

The meeting was opened by Andy welcoming the group and thanking those who had travelled from up north to be there.

After the usual housekeeping items he announced that Chris Tuffli had brought in some Trade-A-Planes and other reading material for the membership to use. Chris also donated two items to the library. The first is the video "The Flying Wing" and "The Story of Edwards Air Force Base" which cover the YB-49 story, and the history behind the base at Muroc Dry Lake being named after Glenn Edwards. The second is a copy of H.P. Dabrowski's The Horten Flying Wing in World War II - The History & Development of the Ho 229. A big thanks to Chris for these items.

The raffle prize for the day will be the Pioneers of Flight postage stamp collection and historical book.

Phillip Burgers gave us a brief recap of his recent trip to the Smithsonian's Silver Hill facility and meeting with Russell Lee, Curator. Phillip was interested in seeing the Horten aircraft, specifically the Ho IX, in storage. Unfortunately, the Horten III and VI aircraft had just been shipped out to Germany for complete restoration, so Phillip was out of luck (as usual in these matters), except for viewing the remains of the IX.

Phillip remains in contact with Russell Lee, who is well aware of TWITT. To further this connection we decided it would be a good idea to send him a complimentary copy of the newsletter each month in the hopes of obtaining some of the information he has about Horten and other flying wing projects. It appears that Mr. Lee is also trying to assist Dr. Karl Nickel in getting his book published in English, which we hope will happen in the not too distant future.

Bruce Carmichael told the group that Jim Maupin, of the Carbon Dragon ultralight and Woodstock fame, had passed away last month. This is a great loss to the sailplane homebuilding movement.

Bruce also noted that Bob Noble was recovering nicely from his illness and would be getting active again very soon.

Bob Fronius told the group about the continuing efforts of an off-shoot of the Hunsaker Foundation that is working to put a National Soaring Landmark plaque at a site on Point Loma. This would be in honor of people like Hawley Bowlus, John Barstow, Bud Perl, and Charles and Anne Lindbergh. The U.S. Navy has now given permission for the plaque, but now funds are needed to purchase it and the mounting stone. Bob is looking for interested parties, including TWITT, who would like to contribute to this cause. The plans call for a ceremony at 1:00 PM on May 21, 1994 at the Point Loma site.

In addition to the above mentioned people, Bob indicated the group is trying to locate current information on these individuals: William Beuby, Lowell Bullen, Alan Essery, Albert Hastings, Forrest Hieatt, I.N. Lawson, Earle Mitchell, Allison Moore, and William Van Dusen.

Andy moved on to the business of electing a new Vice President. He opened the floor for additional nominations, besides the previously nominated Bob Chase, and asked anyone interested in running for the office to please introduce themselves to the group and explain why they would like to run for the office. Dave Pio addressed the group explaining he was the Vice President, had a stroke and been away, and would like to run for re-election. After asking again for any further nominations (there were none), it was motioned and seconded to close the nominations. The motion was passed on a voice vote.

Due to the unusual situation of only having one nominee for the position, Andy asked for a motion to waive the By-Laws requirement of a written ballot and complete the election by voice vote. The motion was made and seconded, and approved. Andy then called for a vote on Bob Chase as the Vice President. A majority of those present voted yes, with one no vote. Bob Chase was congratulated on this new position.

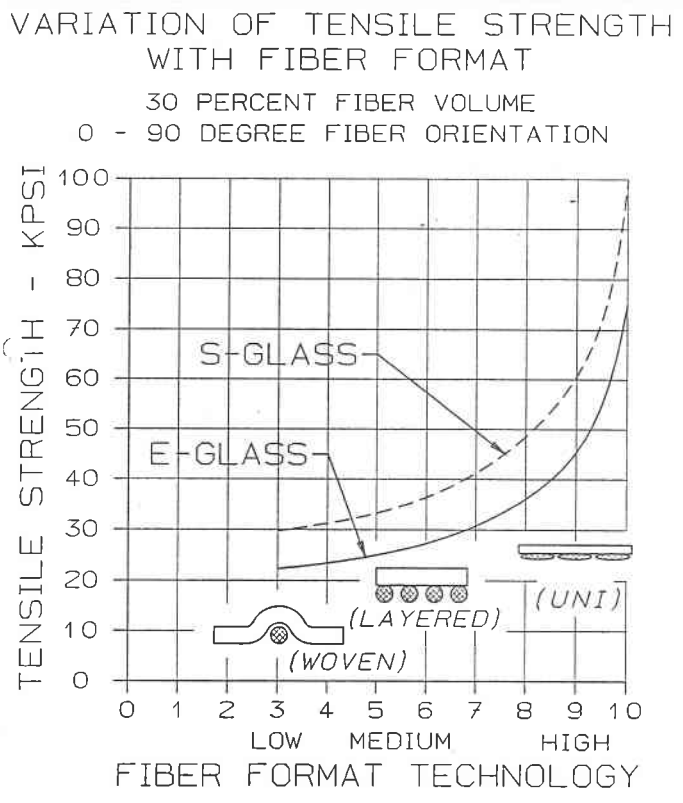
The group was treated to a short video on paragliding in Florida, which included the First Edition news reporter strapping a 22hp motor to his back to provide the necessary power when there wasn't enough wind. There were a few comic moments as the reporter tried to gain his wings, including one "crash" landing. (We have been including this with the video tape advertised in the back of the newsletter.)

Andy then introduced Alex Kozloff, who would be the main speaker for the day, covering composite construction materials. Alex donated

12 booklets to TWITT which contain copies of the overhead viewgraphs he would be using (several of the 34 pages of graphs and tables have been reduced and included here to give you an idea of the type of material in the booklet). His desire is that these be sold for $5 each to raise a little extra cash for TWITT while providing members with some useful information. Andy indicated he would also throw in a cassette tape of the program so a purchaser could hear Alex's explanation of the various charts and graphs.

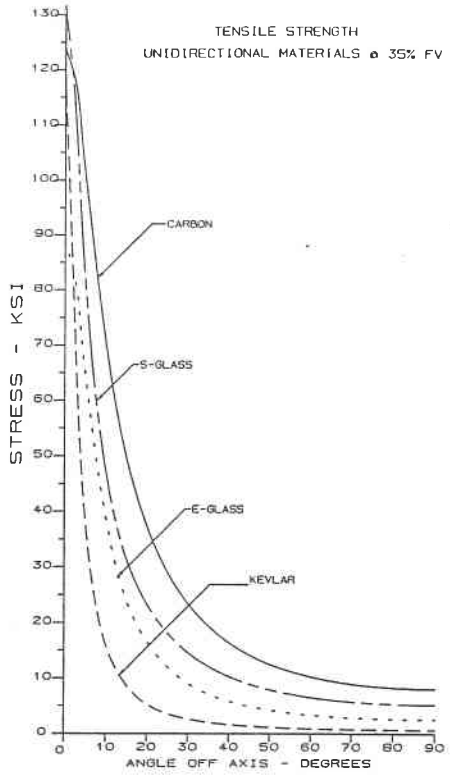
Alex began be explaining today would be an overview of composite structures. The key to good composite structures is having a cloth that has its strands running in the same direction as the applied load with the minimum resin about each fiber, with no crimps, twists or waviness.

The first chart showed the variation of tensile strength with several fiber formats. These were: woven, where the strands weave in and out around each other; layered, where the strands lay on top of each other avoiding the crimps associated with woven types; and, uni, where the layered strands are 3-times as wide and 1/3 as thick to provide more wetted area. He talked about four different types of glass: S-Glass, E-Glass, Kevlar and Carbon, and noted that each has its own unique properties.



The chart showed that woven cloth at 30% fiber volume and 90° fiber orientation gives you about 22,000 psi tensile strength, but by using a layered cloth you increase this strength to about 27,000 psi. The uni fiber concept raises this to the 47,000 psi level simply by changing the format of the same weight of cloth.

The next overhead showed the various formulas for determine composite density and thickness, and were used to derive many of the remaining charts shown throughout the program.



The next series of charts showed the tensile modulus of the four types of cloth at different volumes and formats. Modulus relates to the stiffness or deflection of the wing. It shows the degree of strength lost as the fibers get off-axis from the direction of tension. The numbers shown are those which should be attainable through normal layup and hand squeegeeing to the desired level of resin penetration.

Alex talked a little about "uni" materials that have less volume, have some of the characteristics of woven cloth, and whose fibers are not spread as well. This obviously affects the tensile and compressive strength of the material. However, the advantages are that they are less expensive and they drape very well over complex surfaces.

The more fiber volume you have the stronger the material. The volume difference between unidirectional and uni clothes is 35% vs 29.3%, respectively, with about 1/3 of the unidirectional's strength coming from the increase in volume and the remainder coming from the format

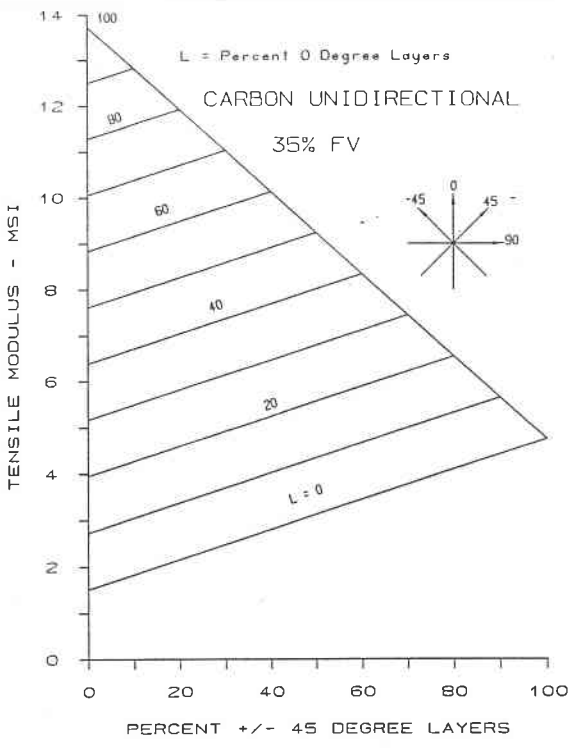
of the cloth.

The next series of charts covered the compressive modulus of the cloths, which are very similar to the tensile figures. Alex was partial to carbon for its properties in both modes, however, it is more costly than the E- & S-Glass material.

The next four charts got into the tensile and compressive strengths of the four types of material as the orientation varies from the load directional axis. Alex explained that many people like to work with double biased material (fibers oriented at 45° to each other) since they wet out well and are very form fitting. However, he points out that this results in only about 1/10 of the strength of 0° oriented cloth.

There is more of a tendency for fibers to fail under compression, rather than tension, there-fore, you want a high compression modulus and strength in the material you use. Carbon has the best of the four with Kevlar having the worst, whereas, E- & S-Glass have similar capabilities as carbon, but at far less cost. Alex also noted that these glasses don't have as high a degradation in strength as you move away from the load axis as does carbon fiber material. This means the average builder gets about the same performance from a cheaper material even though there are errors in alignment during the building process.

The next series of charts were called carpet plots. Construction usually involves some fibers running longitudinally to take the bending strength, some at ± 45° to take the torsional load, and some at 90° to allow for shaping the wing surface. So a chart was developed that combined the factors from the different orientations to yield an overall tensile modulus value. These charts also lend proof to the fact that E-Glass at 35% fiber volume provides a satisfactory solution to many building configurations.



Alex indicated this next chart was the meat of the whole thing (there are a number of charts and tables covering this area for the four types of material). It was titled "Uni Material Thickness vs Areal Weight." Areal weight is the grams per square meter, and the graph yielded straight lines showing that as the material gets thicker the weight increases linearly. He also noted that most material is about 10% thicker than the chart shows due to slight variations in manufacturing.

There were a number of relationship tables showing how weight will vary as a function of fiber volume and the amount of resin left behind. He did note that from a practical point you can get down to about 75% fiber volume without loosing structural strength. So the average homebuilder usually doesn't have to worry about getting too much resin out.

The next set of charts were put together to show the strength of carbon fiber as a factor of fiber volume. They have taken four layers of 9.4 oz material put in a unidirectional format, and run it through a "sandwich" computer analysis program called the PBJ program (peanut butter & jelly). The chart shows the relationship between fiber orientation in degrees to the compressive modulus in psi, again showing some key information. Alex noted that after the first 10° of orientation variance the fiber volume becomes less and less critical in relationship to strength.

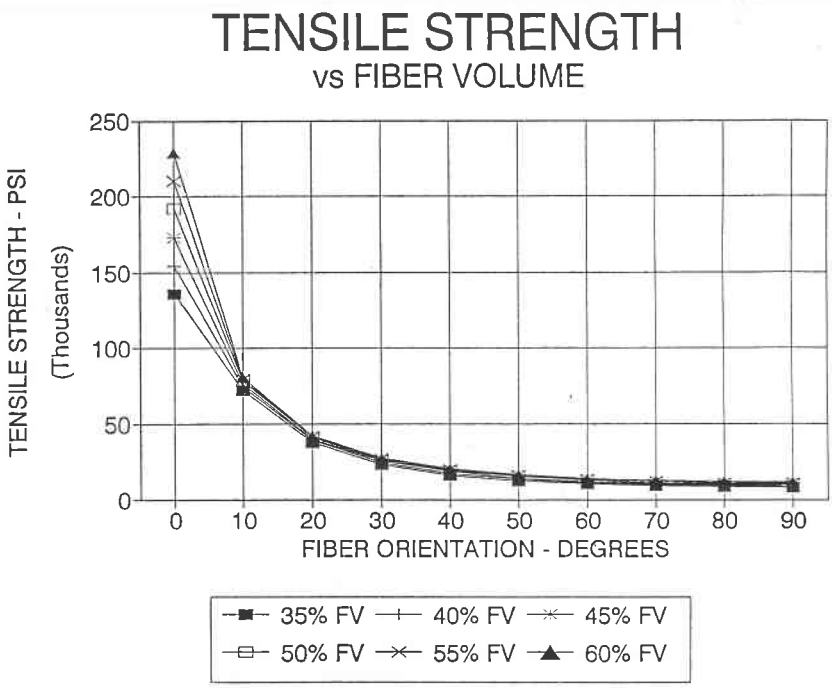
In tensile strength the orientation for carbon fiber becomes even more important, since the losses are quite dramatic within the first few degrees of variance.

The last graph in the series was a combination of the previous ones to show the overlapping curves of compression and tension for carbon fiber material as orientation varies.

The last table in the series covered "Tensile Load Carrying Properties of a Number of Fiber Materials per Layer per Inch of Width at 30% Fiber Volume." Alex went through an example using an E-Glass cloth of 4 oz that has a tensile strength of 190 psi per inch of width per layer. If you went to an autoclave and got it down to 5,000th of an inch thick the tensile strength would be 38,000 psi. But is you multiply the 38,000 psi by the 5,000th square inches you get back to the 190 psi tensile strength. For the homebuilder, say you end up with more resin and a layer that is 10,000 of an inch thick yielding a 19,000 psi, but this multiples out to the same 190 psi. So it shows you can be a little sloppy with the resin as long as you keep the fiber orientation parallel to the load.

Sloppiness in building doesn't really hurt in the strength area, and actually helps by

providing greater stiffness. However, the penalty is usually an increase in weight, that for most airplane designs is undesirable.



Alex noted that Bob Noble had pointed out over ten years ago was that all you need to know to design an aircraft is the strength per inch of width per layer. Alex noted a couple of examples from the last table showing that the cloth format has more to do with the increase in strength than going to a thicker cloth that is not correctly orientated.

In summing up, Alex noted you don't really cover something with uni clothes, but rather plank it since the fibers are all running the same direction. He offered the following advantages of planking:

1. Better mechanical properties and low resin content assure a strong, light structure.
2. The unidirectional materials are applied in the direction its longitudinal properties are required.
3. No overlap is needed at the edges of widths of material oriented in the same direction.
4. High fiber content easily obtained by hand lay-up methods.
5. Wets out quickly with short nap roller or brush.
6. Bubbles and excess resin easily removed with a plastic squeegee run in the direction of the fibers.
7. Great inter laminar shear properities (no mat is rquired to interface between the peaks and valleys common to woven goods.
8. Lends itself readily to both male and female mold construction.
9. No scarf joints are required.

You don't need to overlap or scarf them since they are so thin. They are easy to wet out and the eventually take less resin than woven cloths because there are no little valleys or pockets which are created by the weaving process.

The meeting continued with some questions and answers. Phillip asked about planking the wing and Alex responded by saying that since the wing skin is lightly loaded it would be over kill to use a unidirectional material when a good S-Glass cloth would work well. If you need to achieve some torsional strength you would be better off using two layers of uni running at 45° to each other than by using a double-biased material with all its weaving.

Alex had brought along some samples to show the group. He did warn us that you need to be careful when working with this stuff do avoid getting splinters of it in your skin, so be sure to wear gloves. Also, when sanding it make sure to wear a mask, whether it is glass or carbon. He noted you can't sand Kevlar since it fuzzes up on you and causes all kinds of problems. He gave us a clue to cutting Kevlar, and that is to put a piece of masking tape on one side before cutting to keep the fibers from moving around and the cut goes much easier.

He showed us some hybrid cloth, a mix of Kevlar and carbon, but he felt it was not necessarily a good combination due to the strength properties of each. He also had a mixed S-Glass and carbon cloth that he said would make a nicer looking shirt than the Kevlar/carbon mix.

He had some 1 oz E-Glass cloth from Graphite Masters in Los Angeles that he said would be good for covering carbon fiber to protect it from abrasion, and isolate it electrically when using it over aluminum, etc.

Phillip then asked the ultimate question of someone who builds with composites: which can be built lighter, a composite or metal aircraft? Alex quickly responded that metal would be lighter, but that a composite aircraft would be faster and probably better looking. Alex said his ideal aircraft would have a wooden wing, aluminum ailerons and elevator, and a composite fuselage.

Composites are good for the many compound curve areas of an efficient aircraft. Alex pointed out that if you have "lots" of money and can afford the tooling, that explosive formed aluminum parts can be just as streamlined and would probably weigh less than a comparable piece done in composites. Therefore, for the average builder composites provide the means of getting to the same point but at a slight weight penalty.

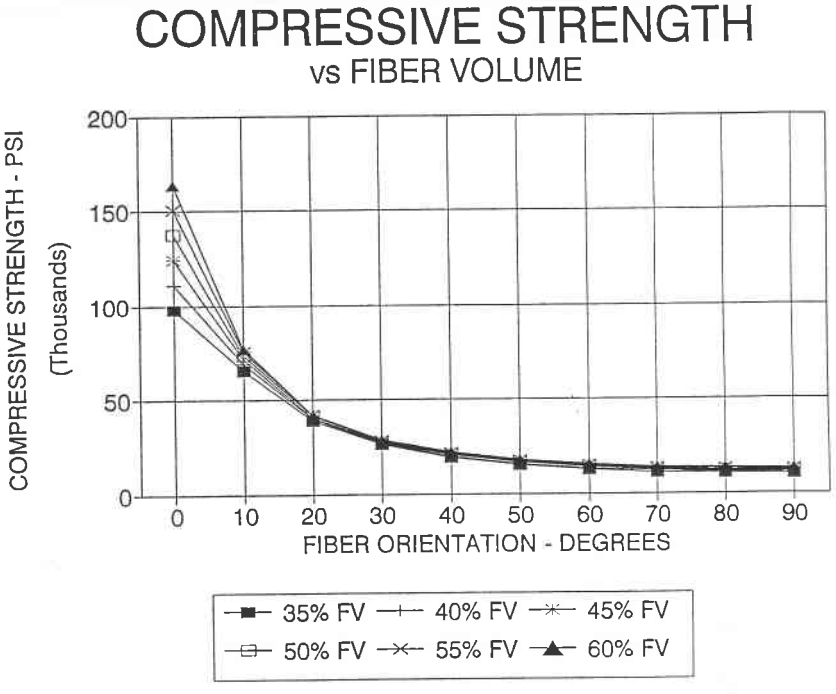
Alex pointed out that sometimes it is good to combine wood and carbon fiber, since they seem to have the same expansion ratio and moisture absorption rates. This makes for some very stiff structures, so there are times when just composite fibers by themselves are not the ultimate answer. The idea here is to find

the right mix of materials to handle the loads at the various points within the structure at the minimum weight.

Bruce asked why Kevlar is so bullet proof. Alex commented that it is because nothing sticks to it. The problem with it is that you can't get a sizing on it, and it must be very dry before being used. The bullet proof part comes from its high elongation factor of about 5½% that telegraphs the load throughout the entire structure. He felt that Kevlar was great for tension applications.

Jorge Paullada asked about the differences in fatigue factors between metal and composites. Alex noted that composites are stronger, have better fatigue characteristics, is usually quieter, can take lower temperatures, it doesn't corrode, and is easy to form over compound areas. Metal has advantages in that it is here, its cheap, its easy to replace, its non-toxic, and it has the same modulus of elasticity and strength in all directions. The latter means you can drill and put screws in it, whereas, with composites you have to make special provisions for these types of connections between pieces.

Alex explained one method of making parts would be to make a mold that a foam sandwich material could be draped over. Then glass the inside part of the foam before placing it over the mold. Use dry-wall screws through the glass to hold it to the mold, do your forming of the outer foam to the contours, and then glass the outside. Remove the screws, pull it off the mold, and you have a stronger, fully sandwiched structure versus just the glassed outer skin.



Alex talk about the pre-preg materials. He thought they were good because the glue held the fibers in line. However, they have some disadvantages in that they must be deep frozen before using, then you have to remove the resulting moisture before bonding, and you can only remove it from the freezer so many times before it becomes useless. The other factor is that they develop a memory while in this hibernation state. So you have to make sure they are absolutely straight and bonded very well at the right temperatures. He mentioned that by using some of the light materials (e.g., the 1 oz noted above) some de-bonding characteristics of pre-pregs can be overcome, along with the small pin holes that often require extensive filling.

Jorge asked about resins for bonding these materials together and to structures. Alex noted that polyester resins were brittle, vinyl resins were less brittle and epoxy resins were the best from this standpoint in that they were most shock resistent. His favorite resin is vinylester for these reasons; its less costly, it is less toxic during the mixing process and less complex in the mixing ratios, the work time is about as long as other types, the heat distortion factor is higher, and it is chemically resistant to petroleum products. The adhesive properties are also very good and it doesn't attack some types of foam like an epoxy. Alex noted that like cloth, the choice of resins depends on the application and the strengths in tension and compression you are trying to achieve.

Bob Fronius asked Alex and Ralph Wilcox to explain their theory for a new, light weight material. This turned out to be a helium filled foam for the sandwich material. Ralph noted it was hard to manufacture since it keeps floating up to the ceiling, and Alex commented that many of the shipments simply float away. Ralph said one advantage is that when you do ship it, all you pay for is the shipping container, and Alex mentioned that if enough material is in the container the shipping company would probably have to pay you since there would be a negative weight to be shipped.

This new material would result in a barn door being able to have an excellent L/D ratio, thereby reducing the cost of equipment necessary to be a competitive soaring pilot. The power requirements would also be minimal, Alex noting that a good mexican dinner might be all that is necessary for launch.

With that last bit of enlightenment, the Alex and Ralph show came to a conclusion.

Bob Chase wanted TWITT to salute Barnaby Wainfan who has developed a low aspect ratio flying wing using straight runs of aluminum tubing with no compound curves. He has now got a prototype flying. Once he has flown the FAA restriction time off, he has indicated he would bring it to a future TWITT meeting.

Andy then conducted the raffle, which was won by Bob Fronius. That concluded the last

part of the meeting and Andy thanked everyone again for coming out.

LETTERS TO THE EDITOR

The following is a combination of letters received from Greg Warner on 1/28 and 3/11/94.

I am fascinated with WINGS and appreciate sources of information on these devices. I have decided to join the crew.

Thank you for your prompt response to my subscription. Could you send me a list of the stuff in the TWITT library or simply recommend a couple of references to flying wing design. I have Dr. Horner's books on lift and drag as well as the Smithsonian book on wings and the history of the Northrop company.

I have written a spreadsheet application based (loosely) on Davis' "Handbook for Amateur Airplane Designers" and wonder if you would be interested in seeing some of the results. I wondered if a 4 or 5 place flying wing could be designed that would have a better performance range than the Lancair IV. Has anyone in TWITT attempted to do so? The Lancair may be as close to the limit as possible, but I somehow doubt it. Anyway, this is something to think about.

Do any of you have any knowledge of the status of Gil Davis' "Starcruiser Gemini" project. Last I heard Mr. Davis was badly injured a few years back and had stopped working on the project. That project seemed to include many of the design features of the large Northrop wings in a more reasonable size. I wonder if any of your gang would be interested in taking it over as it seemed to be a really neat design?

Is there a list of your members and could I have a copy. I would like to know is there are any people here in the frozen Northeast that share this obsession.

I was looking at the picture of the center section of the Horten Ho X jet fighter in the Smithsonian book and noticed the design used a distinctly cambered airfoil (this is also noticeable in the PUL 10) as contrasted with Northrop's choice of a symmetrical airfoil. How did Horten control the pitching moment generated by the cambered airfoil or was the airfoil similar to the NACA 230xx series with a very low moment. The Horten wings do not use the "pitch trimmers" that Northrop used on his designs. I guess they just reflexed the trailing edge.

I did an article a couple of years ago for HOT KITS & HOMEBUILTS magazine about an engine testing dynamometer. I have since designed a unit that could either be carried in the back of a pickup truck or on a small trailer to a place where the neighbors, or lack thereof, wouldn't mind the racket of an unmuffled engine and exposed propeller. The design is based on a unit built by a local EAA member. The dyno tested everything forward of the firewall. Would you be interested in publishing an article on this machine? I would be glad to write one because I think that the ground is the place to find out if the cooling system will work or if anything is going to vibrate itself apart.

Automotive alternator mounts are massive in order to raise the resonant frequencies of the thing well above the normal operating range of the engine. I am concerned with the possibility that a builder might use a lighter mount in the effort to save weight that would, in combination with the higher operating speed of the converted engine, change the natural frequency of the mount to resonance with the engine or one of the major harmonics. Better to find this out on the ground than have an alternator wandering around under the cowling. Most noisy, expensive and embarrassing.

Why do some airplane designers badmouth tailless aircraft? The tailless wonders may not be able to use the absolutely maximum C_l available but neither does the Long-Ez and a few conventional aircraft have as low a parasitic drag. I think that flying wings just trade longer takeoff and landing distances for the lower parasitic drag and the avoidance of tail surface weight and download.

Well, enough for now. Keep the faith.

Sincerely,

Greg Warner
10 Pendleton Lane
Londonderry, NH 03053
(603) 432-8949 (home)
(617) 556-1074 (work)

(Ed. Note: Let me welcome you to TWITT. I hope by this time that Bob has gotten your back issue order to you in the mail. The January 1993 issue has a membership listing which hasn't changed much during the past year.

I am sure some of the members would be interested in seeing what you are doing with the spreadsheet program, so please send us something you think would be of value to the largest portion of the membership.

There has been some material in past newsletters about the PUL 10, and Kevin Renshaw and Barney Vincelette have sent us some more, but unfortunately it is in Italian.

I am sure some of our builder members would be interested an article on the engine test stand. If you could keep it to about two pages as they appear in the newsletter, it would be appreciated. Also, if you are doing it in WordPerfect, just send me a 5¼ low density or 3½ high density disk and I will format it. If you use some other wordprocessing program just do the text in plain ASCII and I should be able to import it (also send a hardcopy).

Some of our member's should be able to

answer your other questions, so I have included your address so they can correspond with you directly, if they wish.

Thanks for the keen interest in flying wings, and we look forward to seeing you next contribution.)

2/17/94

TWITT:

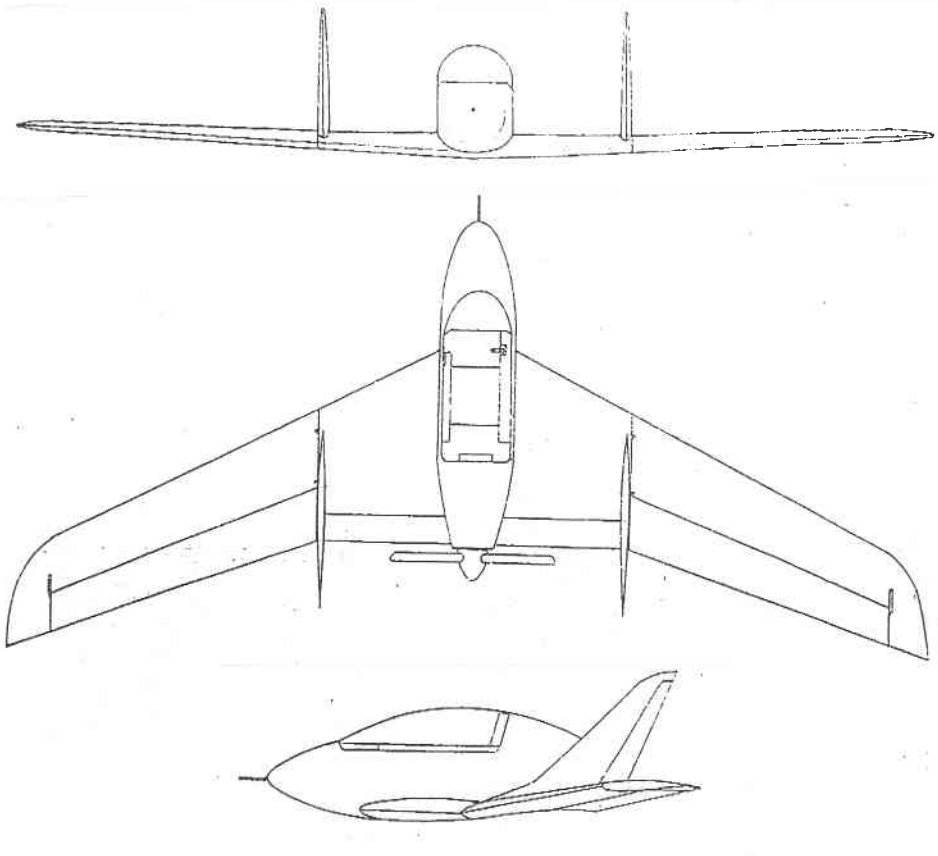
Enclosed is $8 for a copy of the SWIFT video and other flying wing subjects.

Also LARON Aviation Technologies, Inc., Rte 1, Box 69B, Old Municipal Airport, Portales, NM 88130 is working on their CFM IMAGE flying wing, expected to become available within a year. (Personally, I think the Davis wing has more charisma and we all hope for his recovery to make his dream - and ours - possible.)

Respectfully yours,

Barney Vincelette

P.S. - The PUL 10 sells for about $23,000 without an engine, and it is no match to a Davis design.



(Ed. Note: Thanks for the material. I will try to enhance the 3-view of the CFM IMAGE and print it in this issue.

Since you have a love for the Davis wing, you might want to get together with Greg, being that you both live in the "frozen Northeast.")

2/28/94

TWITT:

While looking through my back issues of Soaring magazine, I came across a couple of tailless designs that fall into the "whatever happened to" category. Maybe some of our members can find out if these designs are still around.

In the November 1985 issue there were some photos from the Sailplane Homebuilders Workshop at Tehachapi that showed a flying wing called the H-1 built by Robert Hoppe (no address given) *(Ed. He used to belong to TWITT).* In the October 1982 issue there was an item concerning the Sierra Monarch built by Tim Weakley of Olympic Valley, CA. I have included a copy of both items, but I'm not sure the photos will reproduce.

I have also included an article on the PUL 10 which was in the December 1993 issue of the Italian magazine Volare Sport (Sport Aviation). The text is in Italian (anybody able to translate?), but it has a couple of nice pictures. Does anyone know where to get more information on the PUL 10?

Regards,

Kevin Renshaw

(Ed. Note: Thanks for the material. I will try to get some of it into this newsletter, as space and reproduction allow.

It will be interesting to see if any of our members can provide further information on the homebuilt wings from the past.

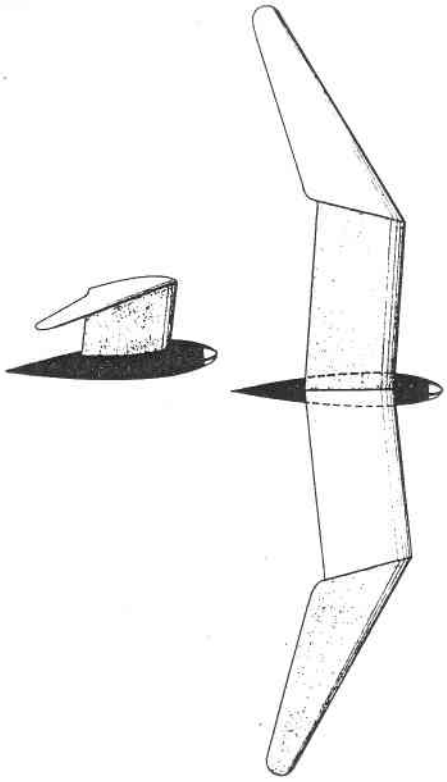
Perhaps our member Ferdinando Gale' can help us with some information from Italy on the PUL 10, including a brief recap of what is in the Volare Sport article.)

Ed. Note: The following item has managed to get separated from the envelope and letter that explained the who, what, and where of the article and its contributor. I apologize for this oversight, and hope he will drop me a note and remind me of his contribution.

I managed to get part of the article translated by one of the German high school exchange students my wife and I are currently hosting. She used her best grasp of the English language and her German/English dictionary to translate as much of the technical material as possible. Please take this into account as you read the

description.

In 1920, when the sailplanes had their first successes at the Wasserkuppe, the Weltensegler (Worldsailor) model was created, which has no tail and whose form is similar to that of seagulls. The inner wings had a little negative arrow-position, always plain vaulted profile, and a strong V-form. The outer wings had about 30° arrow-form in the ground plan, have been made longer than the inner wings, and with a negative V-form (so the wings were bent). To get the necessary angle difference between the inner and outer panels, the wing bend wasn't exactly in the direction of flight (the forward edge was canted about 10° towards the inner wing). The profiles of the outer wings were symmetric. The Weltensegler model had a streamlined look and excellent flight abilities. Only the course stability cause trouble, and this drawback to exact turning could not be removed.



ADDITIONS TO THE LIBRARY

Chris Tuffli has contributed the following items to the library. We would like to thank him for his continuing support through this and many other contributions.

The Horten Flying Wing in World War II, by H.P. Dabrowski, Schiffer Military/Aviation History, Atglen, PA, 1991. This is a history and development of the Ho 229, including many high quality photos and technical data.

Commercially prepared VHS video The Flying Wing, the story behind the development of the YB-49 and the fabulous aircraft that was totally revolutionary for its time, and The Story of Edwards Air Force Base, a history of Edwards AFB and the many aircraft that were tested there over the years.

From **Eugene Turner** comes a article and set of plans for The Easy Wing, by Ken Johnson, as published in Model Builder, April 1994, pp. 41-44. This is a derivative of a balsa stick and tissue paper indoor model designed by Dick Baxter about 10 years ago. Spans of these models range from 6" up to 13¼". If you are interested in the plans and can't find a copy of Model Builder, sent us $2 for copying, a mailer and postage, and we will send you the material.

From **Alex Kozloff**, a copy of "An Overview of Composite Design Properties" which includes all the overhead projections from his March 19, 1994 presentation. This material is also supplemented with a copy of the audio tape of his portion of the meeting explaining some of the characteristics of the graphs and charts. (See the classified ad at the back of this issue for availability and cost.)

AVAILABLE PLANS & REFERENCE MATERIAL

Tailless Aircraft Bibliography

by Serge Krauss

3rd Edition: An extensive collection of books, articles and other items related to the development of flying wing (tailless) aircraft design and construction.

Cost: $20
Order from: Serge Krauss
3114 Edgehill Road
Cleveland Hts., OH 44118

Tailless Tale, by Dr. Ing. Ferdinando Gale'

Consists of 268 pages filled with line drawings, tables and a corresponding English text. It is directed towards modelers, but contains information suitable for amateur full size builders. Price is $38, postage and handling included (also applies to Canada and Mexico).

Contact: AIRLOVE, LTD.
6423 Campina Place
La Jolla CA 92037
(619) 459-1489

BELOW : These are the best reproductions we could get of the material provided by Kevin Renshaw from his Soaring Magazine archives. The include the H-1 flying wing of Robert Hoppe (under construction) and a 1976 version rebuilt to put the pilot in an upright position versus the original prone position. Also, the Sierra Monarch designed by Tim Weakley to investigate flight characteristics and construction techniques for flying wings. (If it will fit, I have also put in one of the PUL-10 pictures.)