

T.W.I.T.T. NEWSLETTER



This has been on the cover before but it symbolizes the material contained in this issue. This link will take you to a flash player screen that allows multiple sided views of this Horten design.

<http://channel.nationalgeographic.com/channel/content/hitler-s-stealth-fighter-3942/>

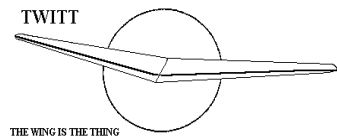
T.W.I.T.T.

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., **0907** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, July 18, 2009, 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).

TABLE OF CONTENTS

President's Corner 1
Letters to the Editor 2
Ho 229 Nat Geo Program Recap..... 4
Available Plans/Reference Material..... 11



PRESIDENT'S CORNER

Well, I hope most of you had a chance to view the National Geographic program on June 28th so you will have some opinions to add to those included in this issue. Starting on Page 4 I have compiled as much as I thought relevant from the Nurflugel group since they had a lot to say, both good and bad. I have also included a few photos of the Northrop project but you can see and read more by going to the Nat Geo web site and just typing in Horten in the search window. This seems like the best way versus trying to copy a very long URL link.

The other thing I need to note is the fact that this issue does contain many references to model wings versus the manned versions. I know there are many of you out there that are not interested in models, but there are probably just as many that are avid modelers or like it as a hobby even though they fly full size aircraft. The main point to be made here is that I can only publish what I receive from the members or can pick up from other resources. This is a volunteer effort on my part and I still have to work a full day plus take care of the many other duties I have with several organizations. I don't always have time to spend doing on-line searches trying to find relevant material each month, some of which would be copy righted and possibly not very useable.

So, while I understand your comments on the level of content in specific issues that may seem to be slanted in one direction or the other, it is a matter of timing and what is available at publishing time. You as members can make the difference by providing me with articles on your projects, new things you have found that should be shared, etc. I would rather have more than less each month.

Andy

THERE IS NO SPEAKER OR PROGRAM FOR THE JULY MEETING.

There will people at the hanger and you are more than welcome to drop by and talk flying.



LETTERS TO THE EDITOR

May 12, 2009

I just came across the American Junior Classics web site www.americanjuniorclassics.com, which has Jim Walker's original U-Control patents as well as plans for his early U/C (Control Line or C/L) model airplanes.



The "resurrected" company also sells reproductions of the original "Interceptor" and "Plain Jane" 'double-folding-wing' catapult-launched balsa gliders, which were actually used to simulate enemy aircraft for gunnery practice in World War II! The armed services had special high-powered "bungee" catapult launchers that shot the little gliders up to 300 feet, from where they often stayed aloft for up to half an hour when not shot down. One of these launchers is demonstrated in photographs and a video on the web site.



I can't help but think that heavier balsa versions of the "Sling Wing" www.slingwing.com (above) and "Zing Wing" www.zingwing.com (top, right) folding-wing, catapult-launched Flying Wing gliders could be sold to the armed services in large quantities today to serve as very low-cost aerial targets anti-aircraft gunnery

practice. A high-powered "bungee" launcher could probably hurl them higher than 300 feet up.



Jason Wentworth
<blackshire@acsalaska.net>

(ed. – If you have kids and you haven't tried any of these, you are missing some fun at your local play ground. I never have figured out why the Sling Wing and Zing Wing folks just don't combine shops since the models look so similar.)

May 15, 2009

While the following web page has no material on tailless aircraft, it might be interesting to those TWITT members who are model airplane flyers as a look at "how others live." It could also provide food for thought that could be pertinent to any future tailless model aircraft educational programs, which TWITT might institute.

The Greek GALAXY program (see: <http://jkon.aeromodelling.gr/ninter-014.html>) includes a series of F/F (Free Flight) model gliders and airplanes with progressively more advanced features, the plans for which can be downloaded and printed from the web page. (Fortunately, most of the text is in English.) The models are designed for simplicity of assembly rather than maximum performance, and children who participate in the program are encouraged to re-design their models for improved performance after they have flown as "built-to-plan." The designs include Hand-Launched Gliders (HLGs), towline gliders (including such gliders with three different airfoil types), rubber-powered "stick" model airplanes, CO2 powered "stick" model airplanes, and a P-30 class rubber-powered model.

For American children, the GALAXY series of model aircraft also provides ample opportunities for them to become familiar with the metric system by using it. They will quickly discover that there is nothing mysterious about it, as it is no different than counting change with money (our money, like the metric system,

is a base-10 decimal system.) All of the model dimensions on the plans are in millimeters. (The specified sheet balsa thicknesses are also given in millimeters, but one can simply substitute the closest fractional inch-based thicknesses.)

Jason Wentworth

(ed. – I know we have at least one member who enjoys working the kids doing things like building model wings and using them to learn things like glide ratios by having flying contests. This can be done through local schools or recreation centers and provides a basic introduction to aerodynamics and possibly spark an interest in engineering.)

May 21, 2009

A 2 meter model of the Horten IX glider was flung from the cliffs of Pacific Grove California yesterday. Video here: <http://www.rcgroups.com/forums/showthread.php?t=1005136&page=6#post12285002>

Norm Masters
< nmasters@acsol.net >

(ed. – There are several short clips of this glider being flown off the cliffs. You may have to play with the site a little bit to get the lineup of clips, then click on the title at the top left of the boxes.)

June 7, 2009

Have you ever considered distributing tailless promotional gliders that are imprinted with the TWITT logo? I have found companies that offer tailless promotional gliders.

This firm www.imprintitems.com/airplanesgliders/foam has two swept-wing tailless gliders, and this company <http://www.ennistagandlabel.com/gliders.htm> has a swept-wing glider called the "Logo Jet."

Jason Wentworth

(ed. – I wrote Jason back saying that we have done member surveys in the past that haven't shown any interest in purchasing such merchandise just to have something with the logo on it besides the newsletter. However, since we have had some turnover in the membership since that survey, if there was enough

interest expressed by our current members, I would be willing to look into it further.)



June 15, 2009

My name is Mike, and I am contacting you regarding your R/C site at <http://www.twitt.org/> I must say that I found your site engaging, informative and well-organized.

I'm working with Plantraco Microflight (www.microflight.com) to spread the word about their small R/C flyers. Plantraco is quite well known in the R/C community and has some really amazing little planes. This is a Youtube video of one of them in action on the beach in Mexico!

<http://www.youtube.com/watch?v=ea5pCL5Fpwg>
I would like to request a link to our Radio Controlled Airplanes section at <http://www.microflight.com/Online-Catalog/ARF-Kits> . We're trying to get some visits to this area of the site so people can check out these cool little planes! If you want, you can copy and paste this HTML link into your site: <"<http://www.microflight.com/Online-Catalog/ARF-Kits>"> Plantraco's RC Model Airplane Kits



I think that our page matches the theme of this page well: <http://www.twitt.org/justlinks.html#top>

Please let me know if this provides you with the appropriate information that you need to consider our site for linking.

Mike
Microflight.com
Plantraco.com

(ed. – I was remiss in not replying to Mike indicating I would place these links on the appropriate pages of our web site. These look like neat little airplanes that can be flown in parks and school yards without bothering anyone since they are electric.

Before you write me and say there is too much information relating to model flight, please read my column on page 1.)

June 27, 2009

The Insitu/Boeing ScanEagle drone has been in the news lately. Larger than a typical model RC aircraft but smaller than a homebuilt manned plane, this design is said to be quite efficient, and has flown across the Atlantic on very little fuel. Its plan form is a pod with pusher engine suspended beneath a 23 degree swept wing with winglet/vertical fins at the tips.



<http://www.boeing.com/defense-space/military/scaneagle/dvd-1392-1.html>

If other TWITT members would Google for pictures and information on this design, could we then have some discussion here of its merits? Seemingly, this would be a good plan form for scaling up for a manned version of ultralight weight.

Thanks,

Bart Brown
<bartbrown08@gmail.com>

(ed. – Thanks for the input. I have included a couple of pictures so everyone will know what you are talking about and the show the relative size. Any comments are welcome.)



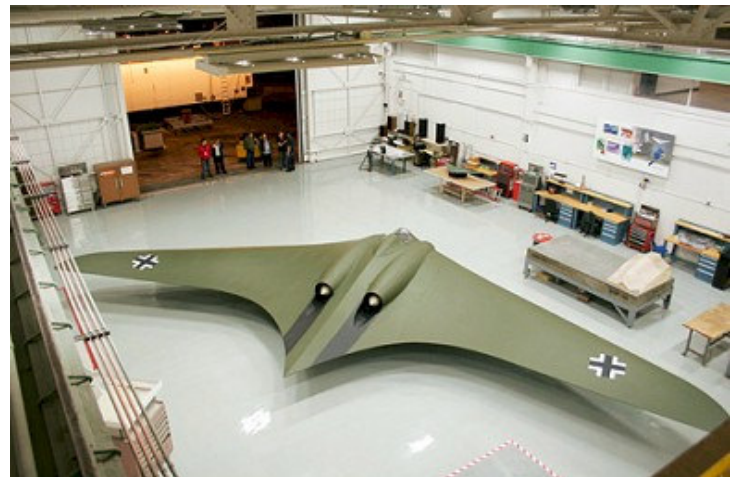
<http://www.boeing.com/defense-space/military/scaneagle/dvd-1394-1.html>

June 28, 2009

Greetings from Hans-Martin Riehle (Germany) A flight of an artificial eagle can now be seen on YOUTUBE. Just enter my name.

<http://www.youtube.com/watch?v=SZ7lsgZAOjE>

Horten 229 – Was It Germany’s Stealth Fighter?



Photograph by Linda Reynolds/Flying Wing Films – Source: www.nationalgeographic.com

This is a photograph of National Geographic’s and Northrop-Grumman’s collaboration in building a full size replica of the Horten 229 for stealth capability testing. It was the subject of a recent one-hour television program on how the project came about and

the results of Northrop's radar evaluation using their very sophisticated system in the Mojave Desert.

What follows is an extract from an article in the June 23, 2009 issue of the San Diego Union-Tribune that covered this project and the display of the replica in the San Diego Aerospace Museum. Then there will be a continuous narrative of comments on the National Geographic program by members of the Nurflugel bulletin board group, which will give everyone some idea of what was thought of the technical and historic aspects, from their perspective.

To take the suspense out of waiting to see the testing results, the Northrop engineers reported they found the design and construction techniques of the time yielded a 25% reduction in the radar signature of the aircraft.

"San Diego air museum will house replica of German stealth prototype", by Diane Bell.

Toward the end of WW II the futuristic looking aircraft (Ho 229) was discovered by American troops in a top secret German facility. The prototype that resembled a massive bat wing was brought to the US under the military project "Operation Seahorse". In the early 1960s it was transferred to a Smithsonian facility in Maryland that is off-limits to the public and remains there today. *(ed. – Below is a photo of what it looks like today still waiting for a restoration that would allow it to be displayed. The picture at the top right is the Northrop model from the front so it can be seen the replica is as close as possible to the original.)*



"There have been no documents released on it, and the public has no access to it," said Michael Jorgensen, a documentary filmmaker who secured National Geographic Channel backing to assemble a team of Northrop-Grumman aeronautical engineers to study the craft and build a full-size replica from original

plans. *(ed. – Al Bowers was involved to a small extent in the production and had a high regard for Jorgensen's integrity and ability to produce a quality presentation.)*



The big mystery was whether this was a stealth aircraft developed more than three decades before modern stealth technology emerged. Could the wedge-shaped jet almost completely formed from wood actually evade radar detection of the time. This made military analysts wonder if the outcome of the war would have been different had the German's introduced this fighter in any great numbers during the war.



Above: This is the center section during the buildup phase. The original had a steel tube inner structure so special paints were used to simulate the effect it would have on the radar signature.

The reconstruction process was conducted over a 3-month period while Jorgensen's film crew followed its progress. The final step was to place it Northrop's five-story high test rig so it could be evaluated from any all possible angles.

(ed. – Now that the premise for the documentary has been set, here are the post release comments by the Nurflugel group. I am not going to include names or dates, but just put together the continuing dialog of meaningful information that came out of the exchanges.)

Link:

<http://channel.nationalgeographic.com/episode/hitler-s-stealth-fighter-3942/Overview>

Having been involved with some of the production of this show, I (Al Bowers) am pretty sure Producer Michael Jorgensen paid for this out of his own company, Myth Merchant Films. Nat Geo didn't come in until much later (after I was involved with the shooting). Now they may have bought in at that point, but none of the people early on were Nat Geo folks. We'll wait and see...

I have not seen the final production, but it should be VERY good. Michael has done some truly excellent work before, and he is VERY good at what he does...

On the website regarding the new NG documentation I found a picture of a Ho 229 tubular framework:



<http://channel.nationalgeographic.com/channel/content/hitler-s-stealth-fighter-3942/albums/album-09.html>

It was the last picture in the set of blueprints (which are the Bentley drawings).

According to the Oxygen bottles installation it seems to be a V6 framework (V2 -V5 had these bottles inside one of the wings). I know the original plans so it is not a perfect reconstruction - all the joints are welded, while the Ho 229 had numerous connectors between the tubes.

So it is not the mockup used for the documentary, because the mockup used for it is without a tubular

framework.

But what and where is it? Whose project is this and what is the purpose of it?

It would have been a much better test object for the radar test (testing only an all wooden mockup seems to be useless in my opinion).

I assume you are referring to the blue spheres as oxygen bottles. They could be hydraulic accumulators. "Sauerstoff-Flaschen" or oxygen flasks would be painted international green color code or white.

Re The Oxygen bottles – The International Green that you refer to was American. British oxygen bottles were Black with white quadrants painted on the neck, German oxygen bottles were Blue with white banding painted around them, German compressed air bottles were also blue but with red bands. Take a look into a 1940's German cockpit and you will see that the Oxygen Flow, Pressure Gauge (Gage), demand regulator and hand wheel shut off valve were also the same blue with white banding. The bottles that you are referring to in the photograph are the standard bottles used in practically every German aircraft of the era. (Fw 190, Me 262 etc..) I will look for a few photo's and other details and post them later.

I've seen a lot of pre-post war German welded tube structures that were expertly done. If they were that good at it, why choose any other way to make a steel tube frame?

To my eye, it seems likely the engines would ingest gun gas with the gun muzzles that close to the intakes - although they may not have known about the problem.

As much as I like the idea of this project, already the persons involved and the hype concerns me. Each year that passes, I see our history being rewritten by shrill "hysterians" spouting their jingo and inflated theories and conspiracies. With such exposure, they over ride facts and become the accepted versions. Look how in much of our country, and especially the outside world, Oliver Stone's bizarre story telling has come to define the Kennedy Assassination.

I wonder if Gotha will even be mentioned? And will they address why Mosquitoes weren't stealthy? Or Me321s? Or why they don't make B-2s out of plywood?

Just finished watching it. It had good points and bad points. Lots of psuedo-history presented as fact. Myhra didn't come off too well, tended to sound a little flaky. I really wish more of the technical stuff would have been shown rather than the historical "re-enactments".

I'm concerned that they didn't really duplicate the internal structure, and what's worse, they showed them painting the outside of the model with metallic paint. I would have thought that the idea was to duplicate the properties of the existing skin (although they did show

them measuring that, so they might have skipped some technical stuff).

In response to the wooden center section, if you look on the National Geographic forums regarding this documentary, one of the people from Northrop-Grumman states that over their years of radar testing, they have developed coatings to mimic internal metal structure, so it looks like the plywood center section had coatings on it to mimic the radar reflectivity of a tubular steel structure.

Radar absorbing paint? Can you please tell me the source of this statement?

The Germans had an anti-radar coating they used on submarines with some success; so it is possible they used, or planned to, on the 229. I can't help but wonder if in the future we will see advanced operational aircraft based on the 229.

I haven't seen the documentary, but they said they found carbon (charcoal) in the paint layer when they examined the original. They theorized that the carbon was an attempt to absorb radio waves, which fit with the whole speculation that this plane had stealth design features.

Any wood and fabric aircraft requires an opaque paint layer to protect the fabric and wood from rapid sunlight degradation. In the US, we use powdered aluminum pigment in 'dope' although I've read that some early aircraft used lampblack or carbon powder for this purpose. In WWII Germany, aluminum may have been too expensive so the carbon in the paint may have been there just for its opacity.

As I understand the concept of 'radar absorbing paint', it must contain fibers whose length is 'tuned' to the radar frequency. The fibers are resistive so the induced currents in them are converted to heat rather than reflected back to the radar set. WWII radars were long wave so the fibers would have to have been much longer than anyone is talking about.

Back in the late 70s, the NASM Ho229 was being surveyed for restoration. It was determined that the top layers, and perhaps all of the colored paint had been applied in the US. I believe all the photos I've seen in Germany only showed a bare framework with only clear paint as you can see the wood grain. The Paperclip teams were known to prefer to bring back aircraft from factories and testing units to get the latest examples, and avoid those, which had suffered in the operational morass. A lot of the photos of them being loaded on ships shows bare metal with body putty over joints in things like Me262s, He219s, and Ta152s.

When they got to the US, they were front and center as "war booty" in military displays and bond drives, which continued for years after the war. They were liberally decorated, often painting over the FE evaluation numbers, to make them look meaner for the

taxpayers.

The film is quite entertaining, but so full of wishful thinking and what ifs to be classified as fiction.

And some of the chaff used in WWII was in the neighborhood of 6mm to match the radar frequency. Even our chaff today is pretty good sized.

Depending on what radar the effective length would have been huge. For example Chain Home was about 12m and Chain Home Low was 1.5m. The airborne stuff was shorter I think towards 10cm at the end of the war.

I was trying to remember what they used the carbon black for. I knew it was a old way of making black paint but I thought it was used as a primer. Mind you that's exactly what Bill is saying it is as well. I doubt the aluminum was expensive per se more that it was hard to get or they didn't have the priority for using it that way late in the war. Also when did aluminum powder as UV barrier come into use? I thought it was in the 50's.

I'm pretty sure it was in use by the thirties, and would point out that few aircraft had the white/yellowish cloth wings by that time. Note that Spirit of St. Louis had aluminum powder colored and filled wings while clear dope alone would have served for weight. Also, military craft, and metal civil craft all had fabric painted silver, even if some had wood wing or tail plane structure.

I've restored a few 30s light planes that had original fabric, and recall a silver layer. I recall that it was a lot lighter to fill the weave than pigmented dope, but am sure the deterioration was well recognized by then. Only the floater sailplanes of the era avoided any colored fabric. At the same time, it was the practice in Germany especially to paint a lot of sailplanes with cream-colored paint of some variety. Note all the Grunau Babies and Ho gliders.

Another issue with the documentary is, that they used a mockup with a V 3 shape. V 3 - V 5 were only experimental versions of the Ho 229. So this version would not have been used for operations. Gothaer Waggonfabrik were building the V 6 mockup as the prototype for the operational version, and this version was different in some aspects- The center section was bulkier, and the engines were better integrated into the wings (more like the V 2). At the same time Horten developed a two-seater version with a different center section. So they should have had to test one of these Versions.

The short version: 20% less radar signature than other fighters of the day. Combine that with high speed, and if you're crossing the channel to attack England, they have a much harder time sending up anyone to stop you.

And, of course, we have that wonderful model to

look at. Gives me an excuse to go down to San Diego some day.

I agree with you. The original Ho229 was also painted with radar absorbing paint. Did the Ho229 actually ever fly in a dogfight with the Me262?

It never flew. Only the Ho9 V2, and that just once with fatal results for Jorg Ziller.

The Me262 was not a dog fighter, relying on making high speed firing passes. Likely would have been same tactics for Ho/Go229.

OK, a question. I've looked over a lot of original documentation, and the Horten projects are titled Ho9 fitting with their series. When the production passed onto Gotha, it became the Go229. I have never seen any period info from the Germans referring to a Ho229. Is this another historical revisionistic blending of facts?

It was H IX V-2, which has been flown at least three times by Erwin Ziller, the father of PhD Joerg Ziller: proved Feb 2nd, 8th and 18th, when he crashed fatally with it, due to flame out as first failure, as far as it is known to me. Uncertain, as not proved with help of log books a.s.o. are all other dates before.

'IX' is the Romanian 9, Reimar and Walter Horten designated all their planes with Romanian numbers. The RLM issued the official Type numbers when registered there with Arabic numbers. So the Horten H IX received the 229, and, as it is a Horten design the Ho 229, as the piston-twin H VII became Ho 227. As far as I know it never became Go 229, as the (Bf) Me 109 or other planes haven't gotten changed their designation when built under license in other factories, as for example the DFS 230 (combat glider) remained DFS 230, although all series production has been made by other companies, including Gotha. It could be that one reason for the confusion is, that in the official production lists of the RLM issued every month has been used the number only, and in a next column the factory plant, a.s.o.. (*Peter Selinger*)

Many thanks Peter for the many detail corrections. I misremembered Erwin's name (my bad) and you filled in a lot of details. I based my info mostly on the box of Wright field documents at NASM, that were as you can imagine far from complete.

I have copies of a lot of official German vintage documents, many mention a 8-229 or H IX, some a Ho 229 but I have not yet seen any vintage German document mentioning a Go 229 - even Documents from the Gothaer Waggonfabrik do not use the designation Go 229. If you find one, please tell me.

But back to the welded tube frame - does anybody know which project this is?

The pictures taken by US staff just after capturing the V 3 show an unpainted center section of the aircraft. So it does not make sense to me to analyze its paint. I have not seen a photo of the wings before they

were taken to the US, so maybe they were painted. The wings were not at Friedrichroda, they were built in Sonneberg.

The NASM wings are rather crudely skinned compared to the painstaking work done on the center section. When it was put on the restoration list in the late '70s, I raised a question as to whether it was complete enough to be restored. I pointed out that the wing skins seemed to have been hastily applied and many internal systems were missing. Especially that there is no indication for tip drag rudders of any sort that the Hortens used in their other craft, nor was there any linkages or cables. In fact, the trailing edge controls don't have all the linkages present. There are fuel tanks in the wings, but no fuel lines.

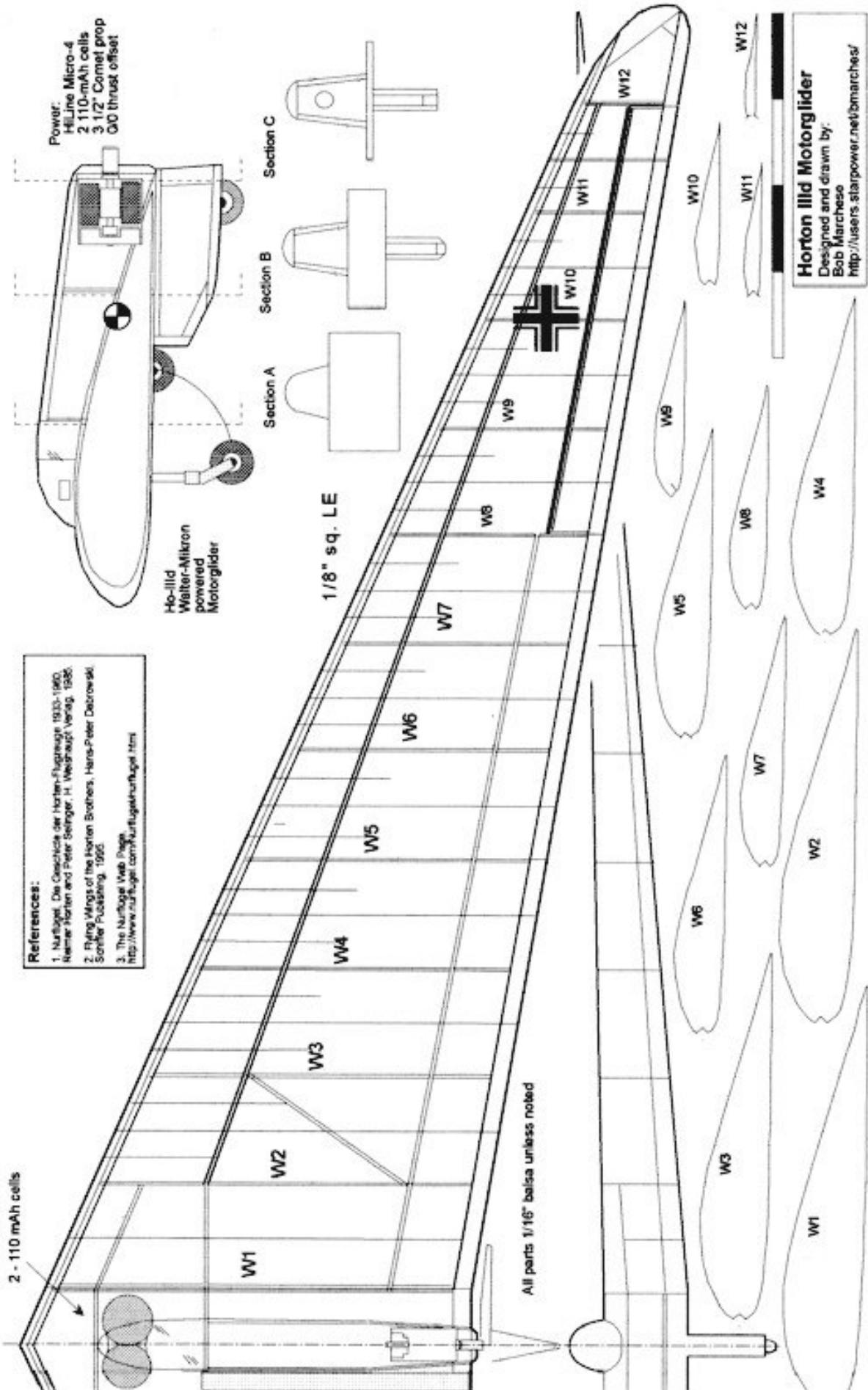
A possible explanation was that the wings were found in a jig, partially finished, and quickly skinned to protect them in shipping to the US. The plywood is poorly finished, has roughly trimmed unfinished edges, and looks like substandard quality work and perhaps even plywood. In addition, the drawings on hand did not detail a final yaw control. We can only speculate the effect of Ziller's accident on this ... perhaps some indecision between the Hortens and the builders?

I always considered the choice of Gotha to build a rival's craft to be at least potentially fraught with tensions. They had proposed rival craft that were roughly similar in design, and that of course, Gotha claimed more capable. I don't recall Gotha even being mentioned in the video.

Rather than dwell on the errors and hand waving involved in the Nat Geo program, note that they spent much time on "historically correct" set pieces in Goering's office, flight-testing (including the Me262 dogfight!) and the discovery of a complete (!) Ho229 in a dramatic empty hangar. Fully half the video is spent showing guys tacking together a visually exciting, but laughably incorrect structurally mock up.

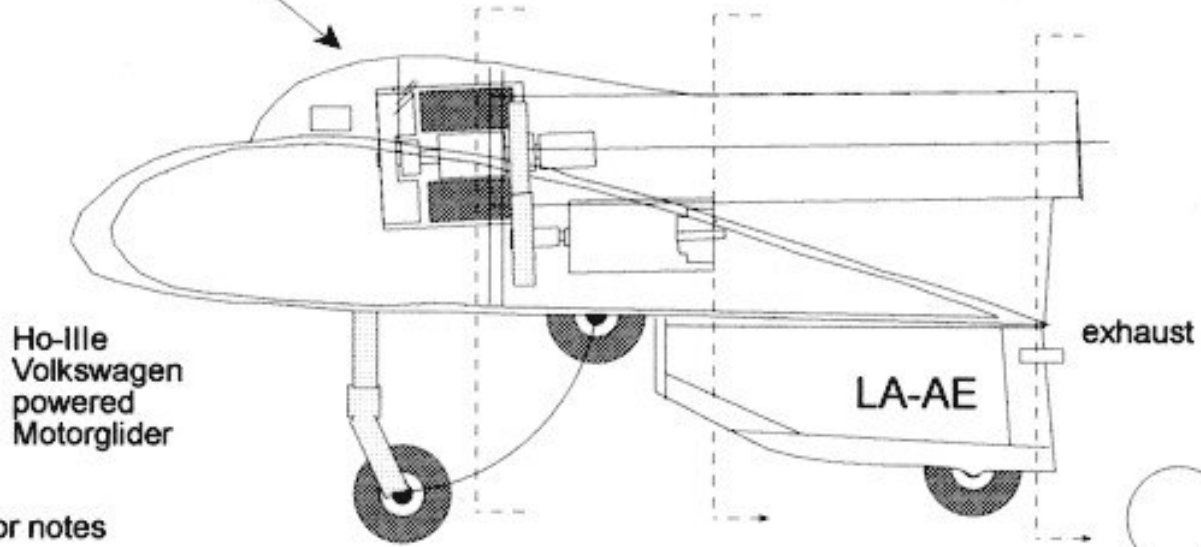
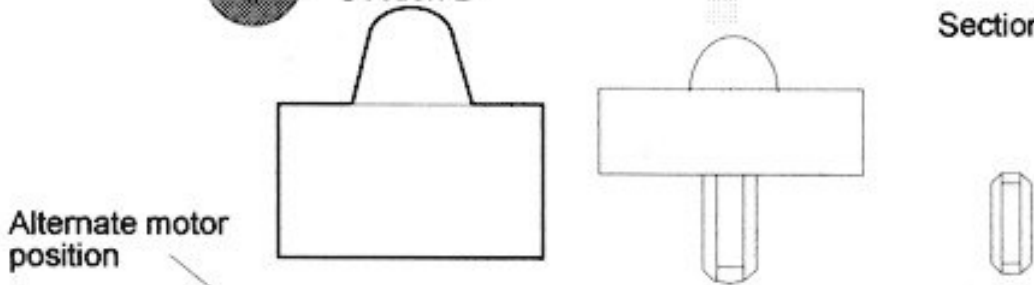
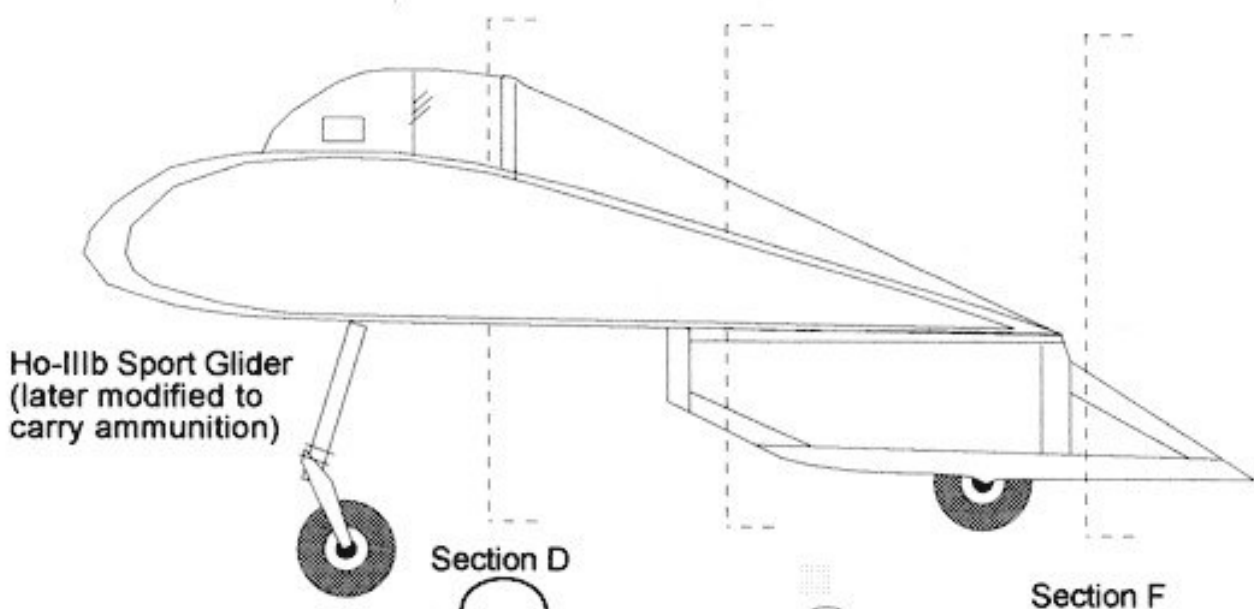
Did you note that they spent a lot of time on the visually dramatic "recreation" of the England penetration mission, without mentioning that such tactics had been abandoned by 1945. Radar existed all over France and the low countries by then, and that all the criteria they were using to judge effectiveness had only applied to the pre-D-Day conditions. I had to rerun the last segment several times to try to suss out the "conclusions" of the radar stealth testing. They flew over it so quickly as if almost embarrassed by the findings.

The next two pages have the images from Jason Wentworth's letter on the Horten III d peanut scale motor glider from last month.



References:

1. Nurliget, Die Geschichte der Horten-Flugzeuge 1933-1960, Reiner Horten and Peter Seifinger, H. Weidmann Verlag, 1986
2. Flying Wings of the Horten Brothers, Hans-Peter Dabrowski, Schiffer Publishing, 1995
3. The Nurliget Web Page
<http://www.nurliget.com/nurligetflugzeug.htm>

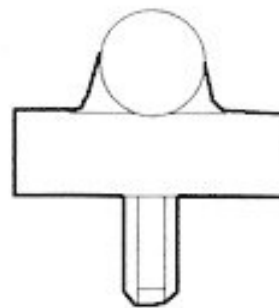
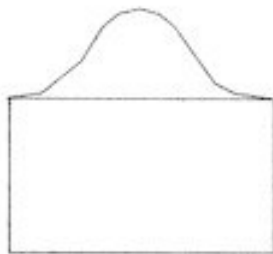


Color notes

Ho-III d: overall cream w/Balkenkreuz

Ho-III e and b (sport): cream with red(?) forward of spar, aluminum center

Ho-III b military: Green and brown camo top, light blue bottom



AVAILABLE PLANS & REFERENCE MATERIAL

Coming Soon: Tailless Aircraft Bibliography Edition 1-g

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

But don't despair, Edition 1-g is in the works and will be bigger and better than ever. It will also include a very extensive listing of the relevant U.S. patents, which may be the most comprehensive one ever put together. A publication date has not been set yet, so check back here once in a while.

Prices: To Be Announced

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Books by Bruce Carmichael:

Personal Aircraft Drag Reduction: \$30 pp + \$17 postage outside USA: Low drag R&D history, laminar aircraft design, 300 mph on 100 hp.

Ultralight & Light Self Launching Sailplanes: \$20 pp: 23 ultralights, 16 lights, 18 sustainer engines, 56 self launch engines, history, safety, prop drag reduction, performance.

Collected Sailplane Articles & Soaring Mishaps: \$30 pp: 72 articles incl. 6 misadventures, future predictions, ULSP, dynamic soaring, 20 years SHA workshop.

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Bruce Carmichael brucecarmichael@aol.com
 34795 Camino Capistrano
 Capistrano Beach, CA 92624 (949) 496-5191



VIDEOS AND AUDIO TAPES



(ed. - These videos are also now available on DVD, at the buyer's choice.)

VHS tape containing First Flights "Flying Wings," Discovery Channel's The Wing Will Fly, and ME-163, SWIFT flight footage, Paragliding, and other miscellaneous items (approximately 3½+ hours of material).

Cost: \$8.00 postage paid
 Add: \$2.00 for foreign postage

VHS tape of Al Bowers' September 19, 1998 presentation on "The Horten H X Series: Ultra Light Flying Wing Sailplanes." The package includes Al's 20 pages of slides so you won't have to squint at the TV screen trying to read what he is explaining. This was an excellent presentation covering Horten history and an analysis of bell and elliptical lift distributions.

Cost: \$10.00 postage paid
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VHS tape of July 15, 2000 presentation by Stefanie Brochocki on the design history of the BKB-1 (Brochocki, Kasper, Bodek) as related by her father Stefan. The second part of this program was conducted by Henry Jex on the design and flights of the radio controlled Quetzalcoatlus

northropi (pterodactyl) used in the Smithsonian IMAX film. This was an Aerovironment project led by Dr. Paul MacCready.

Cost: \$8.00 postage paid
 Add: \$2.00 for foreign postage

An Overview of Composite Design Properties, by Alex Kozloff, as presented at the TWITT Meeting 3/19/94. Includes pamphlet of charts and graphs on composite characteristics, and audio cassette tape of Alex's presentation explaining the material.

Cost: \$5.00 postage paid
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VHS of Paul MacCready's presentation on March 21, 1998, covering his experiences with flying wings and how flying wings occur in nature. Tape includes Aerovironment's "Doing More With Much Less", and the presentations by Rudy Opitz, Dez George-Falvy and Jim Marske at the 1997 Flying Wing Symposiums at Harris Hill, plus some other miscellaneous "stuff".

Cost: \$8.00 postage paid in US
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VHS of Robert Hoey's presentation on November 20, 1999, covering his group's experimentation with radio controlled bird models being used to explore the control and performance parameters of birds. Tape comes with a complete set of the overhead slides used in the presentation.

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