No. 216 JUNE 2004

T.W.I.T.T. NEWSLETTER

"Is it real or is it Memorex?" Remember those ads? Take a guess at whether this is a the real BKB-1 in flight or a scale model. For more on this read the Letters to the Editor section inside.

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

The number after your name indicates the ending year and month of your current subscription, i.e., **0406** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, July 17, 2004, 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

In my haste to put the cover together last month I reversed some words when labeling the aircraft in the photo. They should be Dyke Deltas, so please make the mental connection to the correct terminology.

This month I am going to start several different serial presentations. A couple of them have to do with forward swept wing designs and I don't recall having put this type of information in the newsletter in the past. Another one will be excerpts from Dr. Richard Hallion's 1986 paper on the history of flying wings from 1903-1958, which he has graciously granted permission to reprint. By doing it this way you get some variety in each issue rather than having a single subject.

I have heard from several people confirming that they really like receiving the hardcopy version of the newsletter, so I am not going to worry about going to a true electronic version. I will get busy and put the rest of the past newsletters out on the website so they are available to those of you who like to view the color pictures that are sometimes included. I have managed to keep the file sizes under better control so the download times should be a lot less than in the past.

We all want to wish Pat Oliver a speedy recovery from open-heart triple by-pass surgery in early June. Fortunately, it was not an emergency situation but something that needed to be done to restore his quality of life. His doctor was very pleased with the way everything went and expected Pat to make a full and complete recovery. All was so good that Pat was sent home after only 7 days in the hospital, so we look forward to seeing him again at the next meeting.

I want to thank Gavin Slater for suggesting I contact John Seeling about doing a program. His sailplane may not be a flying wing, but I think everyone will learn something they can use to help with the design process by taking into account building techniques.

JULY 17, 2004 PROGRAM

Hurray, we have a program for you in July. We are pleased to have **John Seelig** come in and give us a presentation on the construction techniques he used to build a Laister LP 49. I know, it isn't a flying wing, but the techniques can be applied to any type of aircraft, and it is always good to know as many building tips as you can get a hold of.

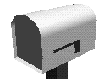
Please make sure to mark you calendar for July 17th right now so you don't forget about it, since we haven't had any real meetings for the past several months. We would like to have a good turnout after so long a break.

John grew up around aviation since his father was a CFIA. He had little interest in flying at that time but dreamed of building an aircraft. In 1980 he became intensely interested in soaring flight, earning his private certificate and began looking for an aircraft to build. The only viable options at that time were the Laister LP-49 kits or the Schreder HP aircraft. Building his own seemed a natural thing to do in that his grandfather had been a contractor and John loves to work with his hands.

In his youth he sought a mentor. He had majored in public administration (hated it) and began a five-year self study in mechanical and civil engineering. This led to training under the former assistant chief engineer of General Dynamics Convair Division pursuant to a General Engineering License issuance in California in 1981. He began flight instructing for Sky Sailing at Warner Spings, CA four years ago. He is currently building a Schreder HP-18.

MAY 15, 2004 MEETING RECAP

There isn't much to say about the meeting. We had a few of the regulars show up, we did a little hanger flying, political discussions, etc., and then called the meeting adjourned. Those of us there enjoyed the afternoon sharing stories, but were sorry we didn't have a full program and more of our friends present.



LETTERS TO THE EDITOR

May 12, 2004

TWITT:

I have test flown a 1/5 scale model of the BKB-1, and would like to send Stefanie Brochocki a few pictures of the glider.

The model is going to fly at the Woodcrafters event at Muncie, Indiana late this month in a scale competition. Plans exist in a un-polished form and there are more pictures including some construction. I imagine that I can write a short article.

Thank you for your help

Ken Bates

From Stefanie Brochocki:

Ken,

I'm absolutely delighted you've made and flown a model. It's something we've wanted to do but lacked the time. I'd love to see the pictures and to talk about the model's flight characteristics and performance.

I must confess that I am in awe of your model-building skills. I thought I was looking at the real thing. I am trying to forward the photos to my brother who will take them to show my dad. Stefan was delighted to hear about your project and looks forward to news of its flying. I only wish we could go to Muncie next week to watch it.

Over the last five years or so, I have amassed a great deal of information on the BKB-1 from my dad and many other kind individuals who had some involvement with the glider. I have been trying for two years to find time to compile a CD with available data and test flight reports to distribute to interested parties.

My father recommends that you read (and you might already have done so) his OSTIV report, A New Tailless Sailplane, available on the TWITT website. It illustrates the concept very well. Much of the data there is based on the 1959 test flights of David Marsden. If there is any other information you require, we'll do our best to provide it.

I have to tell you it's very exciting for our family to know the BKB is flying once again. Many thanks for your efforts!

Keep in touch.

Kindest regards,

Stefanie

June 2, 2004

TWITT & Stefanie:

The Woodcrafters event was a qualified success, qualified because after the official flying was finished, I flew the BKB in an exhibition flight and crashed it. The tow was very high and I and the tow pilot became disoriented. In the ensuing gyrations I released inverted. The canopy came off and the BKB stabilized in an inverted spiral descent and did not respond to controls.

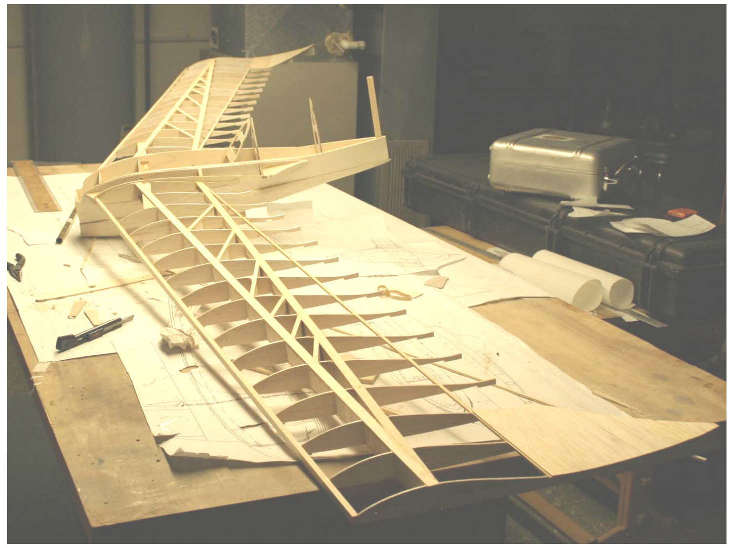
Examination at the crash site found the canopy retaining system (rubber bands and hooks) to be missing, and the power lead which ran past this area to the receiver to be unplugged, explaining the lack of control. There was some elevon flutter of a low frequency observed but the lack of power to the servo explains that also. The ship was such a joy to fly that it is being rebuilt.

The BKB finished in 4th place in the scale competition, just a few points out of first place. If I had been able to get it trimmed so the later flights in which it thermalled or at least aero towed to an altitude sufficient to make the required flight duration, it would have placed even higher.

The first flights were off the winch and used to begin adjusting CG hook and CG locations. These launches were fast and “zoomed” after release. Then I worked up the nerve to try aero towing and what a joy! It was much easier! The model is heavy due to my desire to not have flutter or flex be an issue. At the flying weight of 8 lbs (16 oz/ sq ft) the ship was kind of mushing along with a lot of up elevon. As the competition progressed the CG was moved back until the ship could be rotated and lifted before the tow plane, and flown with neutral elevon.

While very fast at this point and still probably somewhat nose heavy, it was quite efficient and had an excellent L/D as well as thermalling reasonably (still too fast for tight low circles efficiently). Many pilots commented on its beauty, speed and realistic appearance as well as how hard it must be to fly. This perception is interesting as it persisted in spite of my protests that it was actually very easy to fly and its appearance of stability and “groove” in flight. As I mentioned earlier the BKB is being rebuilt and plans are forming on how to lighten a second model as this ship was way too much fun to not pursue further.

Ken



(ed. - This is a great story. The cover shot tells it all since when viewed in its original form you are hard pressed to say it is a model and not the real thing. It took me a few minutes of staring at the cockpit area to determine it was a model pilot. Ken should be congratulated on a very fine job of building, and obviously of flying it to a great finish in the contest.)

May 17, 2004

TWITT:

Hello- I am glad to see that some folks are in an environment that allows them to get work done. Would that were the case here. Please find attached to this e-mail an article, while not regarding the tailless aspect of flight, might be of interest to the membership. It is on part of Operation Rumpelkammer, the V weapons attack on Great Britain. Also attached is a sketch of a low aspect ratio development of the basic airframe I have been working on for the last two years.

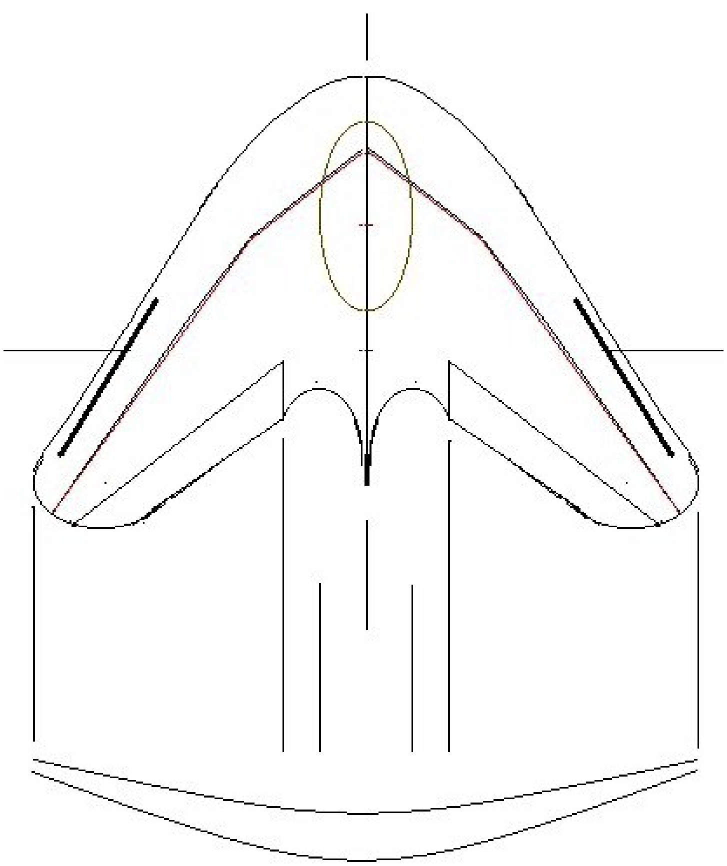
Sincerely,

Henry E. Whittle
Gulfrose@Juno.com

(ed. – Thanks for the new drawing of your project which I have included below. I have also included the Rumpelkammer article since it is in line with the various D-Day celebrations that have been going on at this time of the year and made a good interest piece.)

The drawing is of a low aspect ratio development of the basic design I have been working on for the last two years. I am a firm believer in leading edge slots and I've gotten a slope of better than 70 degrees in models with them. I haven't included a view of the internal structure, the internals are designed for maximum fuel tankage with great strength and a view to simplicity of construction. There is more to the control surfaces than shown. The frontal view shows an arc development across the bottom of the span. This is the most stable flow form I've found. I haven't fixed the form of the upper center section yet. I need some input.

Once a Gilbert and Sullivan-like chorus on the other side of the fence from my shop stated "It can't be done" to my posing the viability of the nurflugel for controlled supersonic flight. OK. Why or why not.



OPERATION RUMPELKAMMER

The passing of the night of June 12-13, 2004 will mark the 60th anniversary of the start of Operation Rumpelkammer, the operational use of the Fiesler 103 (FZG 76) pulsejet engine propelled flying bomb against England by the German Luftwaffe.

Flak Regiment 155, of the III Flak Corps, located in the Pas De Calais after recruitment in Northern Germany and a working up period in Kiel, opened fire with the first V-1's. The Propaganda Ministry gave the appellation Vergeltungswaffe (Reprisal Weapon) to a series of new weapons Germany tried to field towards the end of World War II.

The first day only four of the ten launched actually hit anything in England. By the 15th they were able to get off 244 in a 24-hour period. The majority of them struck London and, in the first three weeks, killed 2,752.

It is surprising that none were ever directed against known troop concentrations along the English coast. I was told by members of the US 4th Infantry Division that they saw the flare of the engines and heard the distinctive sound of the Argus engines as they flew east to west slightly to the north of the ships they were on, waiting to sail to the Normandy Beachhead.

After the middle of July the Allied advance began to take ground used by the Germans as launch points. The Luftwaffe began night launches of the V-1 from Heinkel 111 twin-engine bombers in an attempt to continue Operation Rumpelkammer. The missile-launching operations of III/KG 3 were begun from Venlo in Holland, and the group had launched some 300 Fi 103's at London and a further 90 at Southampton, as well as about 20 at Gloucester by the end of August. After a lull between September 5 to 15 while KG 53 transferred from Venlo to Northwest Germany, Fi 103 operations resumed September 16. Airborne launches being made on most nights up to the end of the month, a total of 177 missiles being dispatched against the British Isles. The total increased to 282 in October and 316 in November, but the hazardous nature of the operations took a heavy toll on KG 53, 12 aircraft being lost in two operations as a result of their stores detonating shortly after take off. These air launch operations finally terminated on January 14, 1945. From first to last the launching units had lost 77 aircraft from all causes and more than 1,200 missiles being launched.

A Staffel of KG 200 was worked up to use a piloted version of the Fi-103. Though several examples were built they were never used operationally.

NACA LANGLEY MEMORAIL AERONATUICAL LABORATORY MEMORANDUM REPORT

For the Air Technical Service Command, Army Air Forces MR No. L5K21

FREE-SPINNING, LONGITUDINAL-TRIM, AND TUMBLING TESTS OF 1/17.8 SCALE MODELS OF THE CORNELIUS XFG-1 GLIDER

By Ralph W. Stone, Jr., and Lee T. Daughtridge, Jr.

SUMMARY

A series of tests has been performed in the Langley free-spinning tunnels to determine the spin and recovery characteristics, longitudinal-trimming

characteristics at extreme angles of attack, and tumbling tendencies of a 1/17.8 scale model of the Cornelius XFG-1 glider. The wings of the glider are swept forward and are located near the rear of the fuselage and have spoilers to aid in landing. The glider has a conventional vertical tail surface but has no horizontal tail surface, the elevator controls being on the wings inboard of the ailerons. The tests were made at an equivalent altitude of 15,000 feet.

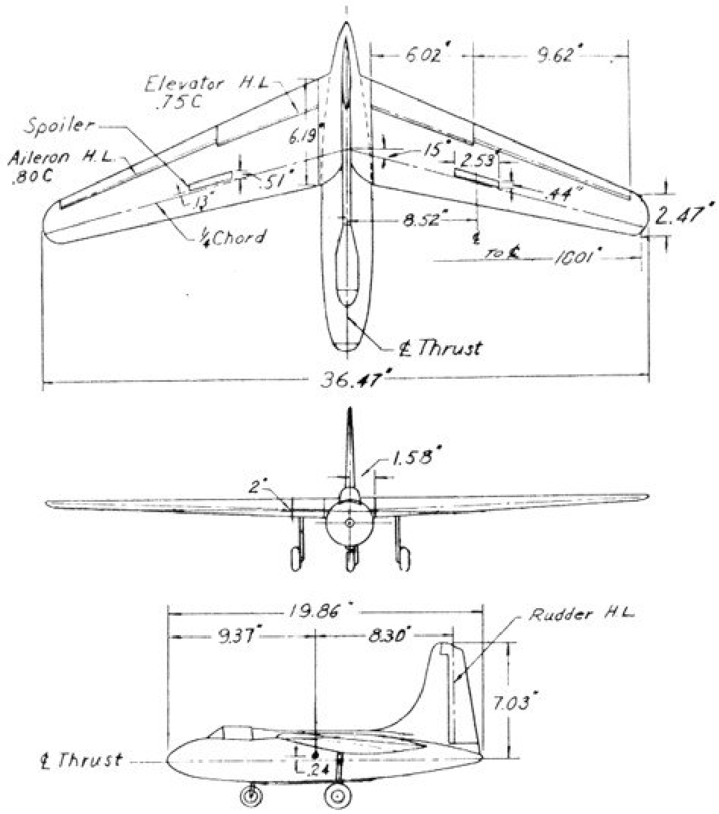


FIGURE 1

Two loadings were tested, corresponding to the glider in the minimum flying weight condition, and in the fully loaded condition. The spin and recovery characteristics for both loadings were determined with the spoilers neutral or extended, with the landing gear on and off, with forward and rearward positions of the center of gravity, and with various moderate changes in mass distributions. The inverted-spin characteristics for both loading conditions were also determined, and the effect of increasing the wing dihedral was determined for the minimum flying weight condition. Spin-recovery tail parachute tests were made for both loading conditions. The longitudinal-trimming tendencies of the model mounted free to pitch were investigated, the effects of spoilers, landing gear, and center of gravity location being determined.

Tumbling tests were made for the model in the minimum flying weight and fully loaded conditions, during which the effects of center of gravity positions, spoilers, and landing gear were determined.

The results of the test showed that the model would spin in a flat attitude with extreme oscillations. In general, reversal of the rudder alone or extension of the spoilers stopped the spinning rotation, but the model remained in a stalled glide. Movement of the elevator down pitched the model out of this glide. Longitudinal-trim tests indicated that increasing the elevator-down setting to 20º insured pitching the model from this stalled glide, but the spin results indicated that care must be exercised to avoid entering an inverted spin. A 4.5' and 7.5' (laid out flat diameter) silk tail parachute effected satisfactory recoveries when opened during spins of the glider for the minimum flying weight and the fully loaded conditions, respectively. The model would tumble unless the elevators were held against the rotation.

APPARATUS AND METHODS

MODE 1

Two dimensionally identical 1/17.8 scale models of the XFG-1 glider were built and prepared for testing by Langley. Two models were built in order to expedite the tests in case of excessive damage to one of the models and because a model built to be ballasted for the light loading would be too weak structurally for the heavy loading.

The dimensional characteristics of the full-scale glider and a three-view drawing of the model with the landing gear on is presented in Figure 1 (left).

The models were ballasted with lead weights to obtain dynamic similarity to the glider at an altitude of 15,000'. A remote control mechanism was installed in each model to actuate the controls for the recoveries. The landing gear was independently ballasted so that correct mass characteristics were obtained for the model with landing gear off and on.

The tests were performed in the Langley free-spinning wing tunnels – the spin and tumbling tests in the 20' tunnel, the longitudinal-trim tests in the 15' tunnel. With few exceptions, the operation of the two tunnels is similar. The model launching technique for spin tests has been changed from launching with a spindle to launching by hand with spinning rotation.

<u>Spin-tests</u> – The spin data have been converted to corresponding full-scale values. Because of the oscillatory and wandering motion of the models, quantitative data could generally not be obtained; therefore, only a description of the model motion before, and the flight path after, control reversal is presented, together with the number of turns it took the model to stop rotating after the control was reversed.

The tests were performed for the normal spinning control configuration (elevator full up, ailerons neutral, and rudder full with the spin) and for various other aileron-elevator deflections of the surfaces for the various conditions tested.

For the spin-recovery parachute test, the model was launched into its spinning condition with the rudder set full with the spin. Recovery was then attempted by opening a tail parachute. The parachutes used were the flat circular type made of silk and had a drag coefficient of approximately 0.7 based on the surface area of the canopy. The diameter was measured when the parachute was laid out flat. The towline was attached to the tail cone of the model and the parachute was packed in such a matter so as not to change the spinning condition.

Longitudinal-trim tests – For the longitudinal-trim tests, the model was mounted on a special rig fixed in the center of the tunnel. The model was restrained from any movement about the roll and yaw axes, but was free to rotate about a pitch axis through an angle of plus or minus 90º. Provision was made for mounting the model at various center of gravity locations through a range of from 9% to 19% of the mean aerodynamic chord. The model was mass-balanced about the pitch axis for the particular center of gravity location desired.

The model was rotated to zero angle of attach by strings attached to the nose and tail. The airspeed in the tunnel was then increased and the model was allowed to assume an angle of trim. In order to determine if there was more than one angle of trim for any condition, the model was operated by means of the strings, and the trim angle was measured when the strings were released. The trim angles were read by means of a protractor mounted on a tunnel window, which was approximately parallel to the plane of symmetry of the model. These tests were arbitrarily performed with an approximate tunnel airspeed of 44 feet per second.

Brief force tests were also run in the free-flight tunnel to determine the neutral point of the model and to obtain data which could be compared with the results of similar balance tests performed at Wright Field.

Tumbling tests – In order to determine the tumbling tendencies of the model, the model was either released from a nose-up position to simulate a whip-stall or was given an initial pitching rotation about a lateral axis. In the tests in which initial rotation was given the model, because of the confined space of the tunnel, only enough pitching moment was applied by hand to insure that the model would make at least one complete turn before it struck the safety net for cases in which it would tumble, or that the model would make approximately one complete turn before it stopped rotating for cased in which it would not tumble. The number of turns the model took before it ceased to tumble or before it hit the safety net was observed, as well as the behavior of the model while it was tumbling and after it ceased to tumble.

Moving pictures were taken of both types of tumbling tests so that a study of the model motion could be made. Approximate vertical rates of descent of the model during the tumbling tests were determined from the film records of the tumbling maneuver and from the tunnel airspeed. The camera speed being known, the apparent vertical rate of descent was determined from the number of frames of film in which the model moved a certain vertical distance. This apparent vertical rate of descent was added to the tunnel airspeed, giving an approximate vertical rate of descent of the model during the tumbling maneuver. Three rudder-aileron control combinations were tested for elevator full up, neutral, and full down: rudder neutral, ailerons neutral; rudder fully deflected, ailerons neutral; rudder neutral, ailerons fully deflected.

Inasmuch as the motion of the model during spin tests was mostly very wandering and oscillatory, the only precise data obtained were the number of turns the model took to stop rotating after control reversal. These turns are believed to be the true model values within the following limits: ± ¼ turn when obtained from film records; ± ½ turn when obtained from visual observation. These limits may have been exceeded somewhat for cases in which the model was extremely difficult to test. Only approximate values of rates of descent and rotation could be obtained.

The angles of trim of the model obtained from the longitudinal-trim tests are believed to be within ± 2º of their true values.

A comparison of model and airplane spin results indicated that the spin-tunnel results were not always in complete agreement with the full-scale airplane results. In general, models spin at a somewhat smaller angle of attack, at a somewhat higher rate of descent, and with 5º to 10º more outward sideslip. The comparison showed that 80% of the model recovery tests predicted satisfactorily the corresponding full-scale recoveries and that 10% overestimated and 10% underestimated the full-scale recoveries.

Because of limits of accuracy in ballasting the models and because of inadvertent damage to the models during the spin test, the measured weight and mass distribution of the model varied from the true scaled-down values. The controls were set with an accuracy of ± 1º. At the start of the spin tests the maximum down elevator travel was only 10º, but subsequent to the longitudinal-trim tests the elevator down deflection was changed to 20º.

Variations in mass distributions were investigated in order to allow for the limits of accuracy of the computed glider and model values and also to allow for any rearrangement of loading which might lead to a spinning condition in which a longer period of time is required for recovery after control reversal. For the investigation of the effect of wing dihedral on the spinning characteristics of the model, the wing dihedral was increased from 2º to 8º.

Spin Tests – Minimum Flying Weight

Normal Condition – When the controls were set for the normal spinning configuration (elevator full up, ailerons neutral, and rudder full with the spin), a motion oscillatory in roll and pitch took place, with approximately four oscillations per turn of the spin. Although this motion resembled a wide radius spiral, a definite condition of equilibrium appeared to be present. Reversal of the rudder stopped the rotation in less than one turn, but the model remained in a stalled glide.

Deflecting the ailerons with the spin generally retarded recoveries slightly. Setting the ailerons against the spin was favorable in that the model would not spin when the elevators were neutral or down. When launched with rotation into the tunnel for these latter two conditions, the model oscillated violently and turned over into an inverted attitude. For the spins obtained, the approximate average rate of descent was 120 feet per second, full scale, and the approximate average rate of rotation was 1/6 revolution per second, full scale.

Simultaneous full reversal of the rudder and elevators for all elevator up spins resulted in rapid recoveries in which the model went into a steep dive and then over onto its back.

Extension of the spoilers generally decreased the oscillations and caused the model to stop rotating, even when the rudder was full with the spin. When the elevators were up, however, the model remained in a stalled glide after the rotation ceased; reversal of the elevators from full up to full down after rotation had ceased caused the model to go into a steep dive. When the elevators were down, a spin could be obtained from which a rapid recovery was effected by full rudder reversal. These results, when compared with those with the landing gear installed, show a slight adverse effect on the spin and recovery characteristics of jettisoned landing gear. There was little effect of increasing the wing dihedral from 2º to 8º.

A SYNOPSIS OF FLYING WING DEVELOPMENT, 1908 – 1953

By Dr. Richard P. Hallion
Air Force Chief Historian

(Reprinted with the permission of Dr. Richard P. Hallion, June 3, 2004)

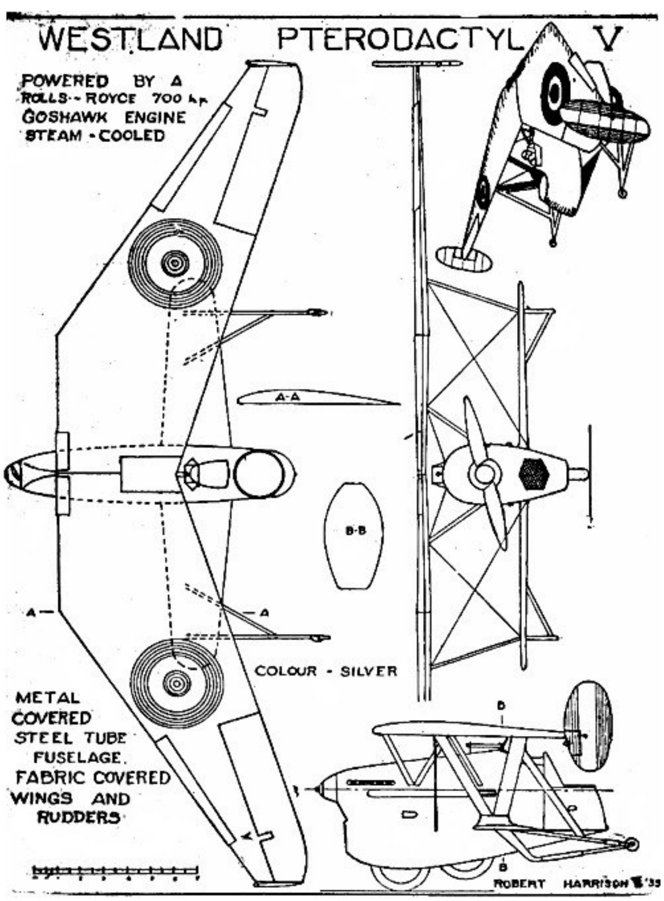
History Office
Air Force Flight Test Center
Edwards AFB, CA 93523-3000
January 9, 1986

Historical Development to the XB-35/YB-49

Though some rudimentary interest in the flying wing configuration existed prior to the Wright brothers' flights at Kitty Hawk in 1903, the first significant flying wing aircraft to fly were those of John Dunne, a British military officer, pilot, and aircraft designer, who was convinced that such craft would have a high degree of inherent stability, and would be more efficient than conventional designs or the canard pushers popular at the time. Dunne's first powered flying wing aircraft, the D.4, first flew in 1908. Dunne made use of both the

swept-wing planform and reduced wingtip incidence (relative to the inboard portions of the wing) to achieve the self-restoring stability properties for which the Dunne family of tailless aircraft were noted. The D.8 appeared in 1911, and made a successful cross-Channel flight. Dunne's work influenced the subsequent efforts of British designers G.T.R. Hill and the American John K. Northrop, and an American entrepreneur, W. Starling Burgess, produced a number of Dunne aircraft for sale in the United States. Overall, however, the Dunne machines had too few advantages over conventional designs to radically reshape the future course of aircraft technology. Indeed, the very stability characteristics that endeared them to their inventor imparted difficulties in maneuvering the aircraft that, couple with their underpowered design, resulted in their being rejected by the military as unsuited for large-scale service. Similar criticisms would be voiced about other flying wing aircraft in the years ahead. (1)

The exigencies of combat demands forced termination of tailless aircraft development during the First World War. The 1920's and 1930's, however, were a fruitful time for experimentation by tailless enthusiasts both in Europe and America. Notable experimenters in this time period included France's René Arnoux, Georges Madon, and Charles Fauvel; Soviet Russia's B.I. Cheranovskiy; Switzerland's Alexander Soldenhoff; Germany's Gottlob Espenlaub, Reimar and Walter Horten, and Alexander Lippisch; Great Britain's G.T.R. Hill; and America's Jack Northrop and Waldo Waterman. Of these, the best remembered – and most significant – were Hill, Lippisch, the Hortens, and Northrop.



Hill arrived at the flying wing configuration while searching for a stall and departure-resistant airplane. Like Dunne, he adapted a swept planform (Dunne, indeed, had given the flying wing the basic swept appearance that would come to characterize the type), and relied on movable wingtip control surfaces functioning together as elevators and differentially as ailerons, a forerunner of the modern elevon. Hill's aircraft, manufactured by Westland and dubbed Pterodactyls (after the prehistoric winged creature they somewhat resembled) first flew in 1926 and proved to have excellent stall-resistant properties even at high angles of attack. Advanced experimental models built in the 1930's could be spun, rolled, and looped, often participating in a special "slow flight" routine at annual Hendon air shows in company with autogiros and STOL biplanes. Again, however, the apparent advantages of the flying wing configuration did not offer such an improvement over contemporary conventional technology as to warrant introduction on a large scale. (2)

Lippisch, best remembered as the "father of the delta wing" (though this must be carefully qualified, as American delta aircraft owed nothing to his work, in contrast to popular myth), pursued development of elegant flying wing sailplanes having moderate sweepback while director of aeronautical research at the Rhön-Rossitten Gesellschaft's Wasserküppe soaring research institute. He selected the swept-wing not merely for aerodynamics and stability, but because it offered the simplest structural problems, in contrast to the "M" wing planform of the seagull-like Weltensegler glider design of Dr. Fritz Wenk, which had inspired Lippisch's initial interest in tailless designs. Lippisch selected a high-wing configuration with end-plate vertical fins (reminiscent of Dunne's biplanes of over a decade earlier). His Storch VII of 1930-1931, equipped with a small pusher engine, had an elevon configuration similar to the ailerons of the present-day British Lightning F.Mk. 6 interceptor. Having an "ultimate aim" of a "pure all-wing craft", Lippisch developed the Delta I which first flew in 1931, furnishing him with much useful information on the behavior of a reasonably large tailless flying wing design. It spawned a number of successors, but the intensive work required to ensure the safety and controllability of such designs mitigated against their winning general acceptance by the aviation community. Undaunted, Lippisch continued onwards, as will be seen. (3)

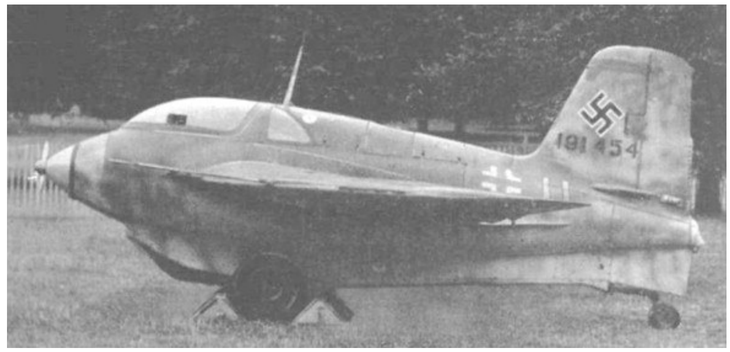
Meanwhile, Lippisch-like experiments took place elsewhere. In the United States, for example, designer Waldo Waterman developed the so-called Arrowplane in an attempt to generate a cheap and "safe" general aviation airplane. Waterman's own health problems, the depression, and ultimately the Second World War all combined to frustrate his plans. The major factor, however, continued to be the marginal benefits of the flying wing over more conventional designs. Though swamped by the ready availability of more conventional sport biplanes and monoplanes, Waterman-like designs continued to appear from time to time, and indeed may be seen as forerunners of the tailless pusher enclosed cabin “sophisticated” ultra-lights of the present day. (4)

The first true examples of a pure flying wing – one lacking a fuselage in the conventional sense, tail surfaces, or even vertical fins – were those built by Germany’s Horten brothers beginning with the rudimentary Ho I sailplane of 1930. The Ho III of 1938 featured inboard landing flaps, elevons, and drag-petal-type rudders for directional control. Though possessing marginal stability and control characteristics, the Horten family of gliders could not be stalled or spun. Eventually the Horten’s work led to the Ho VI, a glider having an aspect ratio of no less than 32.4 which reportedly “demanded great skill from the pilot,” as well as a wartime jet fighter-bomber project to be discussed later. (5)

In Great Britain, the Handley Page company developed a disappointing and troublesome twin-pusher design called the Manx. The Manx, a product of Gustav V. Lachmann (who, together with Frederick Handley Page, was responsible for development of the wing slot and slat) was simply a poor aircraft, and the problems that it possessed were less attributable to its tailless design than they were to its being simply a bad, overweight, and underpowered vehicle. In three years of test flying (beginning in 1943), it accumulated only 17 flight hours in approximately thirty flights. Other British ventures in this field proved equally lacking in merit.

In Germany, however, things went much more auspiciously. By the outbreak of the war, Lippisch had joined the staff of Messerschmitt A.G., bringing with him a fifteen-man team (including his own test pilot) and establishing it as Abteilung L (Department L) of the Messerschmitt concern. Here, until personal disagreements with Willy Messerschmitt compelled his departure in 1943, Lippisch toiled away on a variety of propeller-driven, jet, rocket, and ramjet-powered flying wing and tailless designs. Two of these studies were the Project P 08 for a four-engine flying wing bomber and transport, and Project Me 329 for a twin-engine fighter attack aircraft. Though these remained paper studies and, indeed, prime examples of Germany’s fascination with the technologically fanciful at the expense of science and technology that might have enable the Nazi state to prosecute its war aims more vigorously and effectively, one of Lippisch’s efforts did see production: the Messerschmitt Me 163B-1 Komet rocket-propelled interceptor.

The little Komet entered service in 1944. A swept-wing tailless design, it suffered from an extremely hazardous propulsion system using hypergolic fuels of such sensitivity as to render emergency landings virtually an impossibility. Armed with twin 30 mm cannon, the Komet did prove troublesome to Allied bomber crews whenever it made its infrequent appearance. However, Allied fighter escorts coped with the Komet by shooting it down during its powerless descent to land. This “boost-glide” interceptor did not represent a realistic aircraft for the kinds of tasks the Luftwaffe was required to perform in the 1944-45 time period. Beyond this, it exhibited a new series of stability and control problems that would



afflict the tailless and flying wing aircraft of the early jet and supersonic era: those stemming from transonic trim changes that imparted at the least sustained mission-inhibiting longitudinal pitching motions or, at the worst, violent diverging longitudinal pitching motions that destroyed these craft above Mack .80. The Komet, for example was virtually uncontrollable above Mach .8, experiencing increasing lateral-directional coupled motion instability that would eventually result, at Mach .84, in a violent nose tuck, followed by immediate engine starvation from negative g. Lippisch played around with many variations on the Komet theme, but after he left Messerschmitt, he turned increasing attention towards the delta airplane, and less and less on swept-wing tailless and flying wing craft. (6)

(1) Winged Wonders: The Story of the Flying Wings, E.T. Wooldridge, 1983, pp. 14-16.
(2) Legacy of Flight: The Guggenheim Contribution to American Aviation. 1977, pp. 40, 129, 133, 135, 142 and 150. Westland 50, John W.R. Taylor & Maurice F. Allward, 1965, pp. 60-64. Aviation: The Creative Ideas, 1966, pp. 185-190. “The Tailless Airplane”, G.T.R. Hill, April 1926.
(3) The Delta Wing: History and Development, Alexander Lippisch, 1981, pp. 2-27.
(4) Woolridge, pp. 60-61
(5) Ibid., pp. 35-38.
(6) Lippisch, pp. 45-79.

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This and the others were contributed by Eugene Turner, but I am not sure of the magazine source.