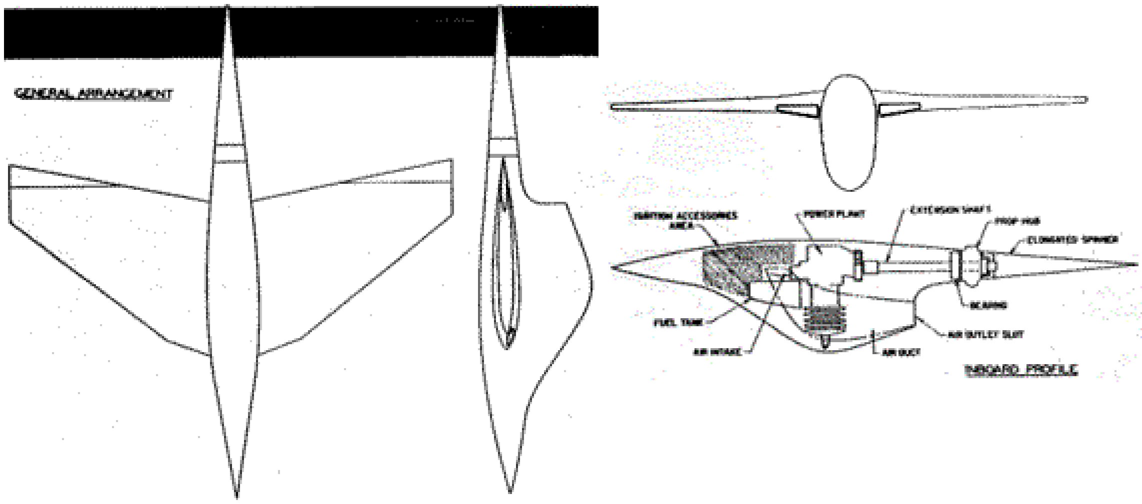
No. 179 MAY 2001

T.W.I.T.T. NEWSLETTER



"High on the list of design studies for high speed aircraft has been the all-wing and tailless type of configuration. By virtue of their basic form such aircraft are ideally suited to high speed flight. Justifiably, their adaptation to control line model flying is in order. The current proposal features the "Robin", a tailless type pusher model designed primarily for record shattering speeds. As in previous designs every effort has been made to minimize shock and turbulence as the craft speeds through the air. The resulting lines of the model are thereby functional as well as pleasing." (Air Trails Pictorial, January 1948, p. 75)

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., **0105** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, May 19, 2001, 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, east side of Gillespie).

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PRESIDENT'S CORNER

This has been a month of good news and bad news. The good side brings lots of membership renewals and orders for various items we have in the archives. The renewals are particularly pleasing, since this keeps us at the 150 level worldwide and, it seems to show we are meeting your needs for information.

The bad side revolves around the fact that none of these many letters had anything to offer for the newsletter this month. This has got to be the driest month in the newsletter's history for new material of any kind to whet your palettes. So I am digging everywhere I can to put this one together. It is going to be a real hodge-podge of whatever I can find from whatever sources are available.

The other part of the bad news involves the increase in foreign subscription fees. We have to raise them to $30 US per year in order to cover the additional costs of the last postage rate increase. It had a much deeper impact on the foreign mailings than the domestic ones, so fortunately we will be able to hold the line there for at least another year. I am looking into a way for people to use a credit card for renewals and purchases, but haven't gotten it all worked out yet. I will post its availability as soon as the deal is done.

I think we will have another installment to Mike Brown's construction series within a week or so. He has been quite busy with supporting his family and airplane habit (like all of us), but has indicated he was able to get some work done. So check the website from time to time. I will put an update sign next to the icon. Also check out the new item under Hodge-Podge covering early flying wing control mixer patents provided by Serge Krauss.

Andy

MAY 19, 2001 PROGRAM

The May program will feature **Alex Kozloff**, owner of Kozloff Enterprises, that specializes in composite structures. Alex did an excellent job in 1994 showing the group all it needed to know about handling and using composites in aircraft construction. Now he is going to bring us up to date with a refresher course and new materials. He will be covering:

- Relationship between Fiber Weight (FW) fraction of a laminate to Fiber Volume (FV) fraction for Carbon, E-Glass, Kevlar & S- Glass.
- The use of Carbon in stringer cap applications to gain stiffness and strength while saving money and weight.
- Recommended applications for the materials listed.
- Elongation and/or toughness considerations.
- Hybrid considerations.
- Sandwich core considerations.
- Material formatting and fiber orientation relationships to the mechanical properties obtainable for these materials.

Alex has expertise in the design, stress analysis, and prototyping of composite vehicles and structures. He is a Register Professional Engineer with a BS in Aeronautical Sciences, a past President of his EAA Chapter and, a member of the US Hang Gliding Association. His spare time is devoted to the construction of his "Pulsar", an all composite sandwich home-built aircraft kit which is designed to cruise at 125 mph on a 66 HP two cycle engine.

Alex's previous program was very well received and has continued to be available on audiocassette for those interested in composite structures. We know that this program will be the same, so make sure to mark your calendar and dress for some warm weather.

E-MAILS & OTHER MESSAGES

(ed. – From the website Guestbook)

April 23, 2001

You have lured me to this site and I can't help myself. Don't you have anything better to do? I'm going to order some of these crazy things *(ed. – assuming he is referring to various types of foam gliders)* for my grandchildren and test them myself to see that you're not some bunch of hippies. I've been trying to make gliders out of the Styrofoam in which Mr. Purdue embalms his frozen chicken *(ed. – must be a local company)*. I hope your stuff works, because so far every time I try to glue my wings, the stuff melts. Maybe I should go back to balsa.

John Farrell
Stratford, CT
fidem@mindspring.com

(ed. – Jay offered the following help in the Guestbook)

To make a blended wing airplane, start with some foam picnic plates. Mark out a triangle on the inside of the plate with the lower section at the middle of the plate. Shape the triangle, sort of like the outline of a blended wing but with thicker wings. Use a piece of paper folded in half to get the wings the same on each side. Then copy just the front section as an added layer of foam under the leading edge. Before gluing the foam at the leading edge with a thin bit of Liquid Nail, cut a long wedge of the left over foam and wedge that up the spine of the model so as to make a step under the body as well as a finger hold. Use the Liquid Nail sparingly. With your fingertips, warp the trailing edges of the wingtips up. Warp the trailing edge of center section down. Makes an excellent indoor glider. Use different color plates and mix the color. Felt pens are good for decorating the gliders.

Jay Sadowski
creaturegliders@gateway.net
Milwaukee, WI

What a great site.. Lots of information. Keep it going. PS - What about a link. If so, talk to the editor@glue-it.com, please.

Many Thanks.

Dave
dave@glue-it.com

Has anyone flown the new Swift Light with controllable wing-tip rudders?

John W. Bottoms
bottoms@primeline.com
Waynesville, NC

WOW.......what a awesome site! You just changed my mind on aircraft design. You should attach a link to sites like Molt Taylor's Aircar, Fulton Airphiban, and Waterman Aerobile. Awesome site guys!!!....

Juan Houston
airmini@yahoo.com
Houston, TX

(ed. – From the E-Mail bag.)

April 16, 2001

Terry,

Letter about ducted fans

There is a lot of information about ducted fans that has been published. Bob Kress, an ex Grumman engineer has done a lot of work on them and written software to design them. Basically they are a shrouded propeller and follow the same formulas as a free air propeller. The more blades and the smaller the diameter the less efficient they become.

Bill Young
byngdsgn@infomagic.com

(ed. – As noted in my comments from page 1, the following is what I could find around the house and at the hanger that I thought might be of interest to at least some of our members. Most of it is historical, but I don't recall seeing it on public display since it was originally published. I hope you enjoy the material. If not, keep in mind that I can always use some current stuff on what everyone is doing, so mail it in.

I would like to thank Keith Hauke of Marine City, Michigan for providing this items from his personal library. He sent them a long time ago and they got shuffled to the wrong stack and missed for publication in a more timely manner.)

Source: The Aeromodeller, June 1944, "Queer Kites", by D.B.M., page 365.

"One bright morning in early summer, some seventeen years ago, the inhabitants of a pretty Somerset hamlet were distracted from their peaceful tasks by a peculiar buzzing sound, rather like that of an infuriated bluebottle in an empty matchbox. This sound trickled over the skyline of trees in increasing volume until there suddently appeared overhead a strange species of aeroplane, the shape of which caused excited comment among the villagers.

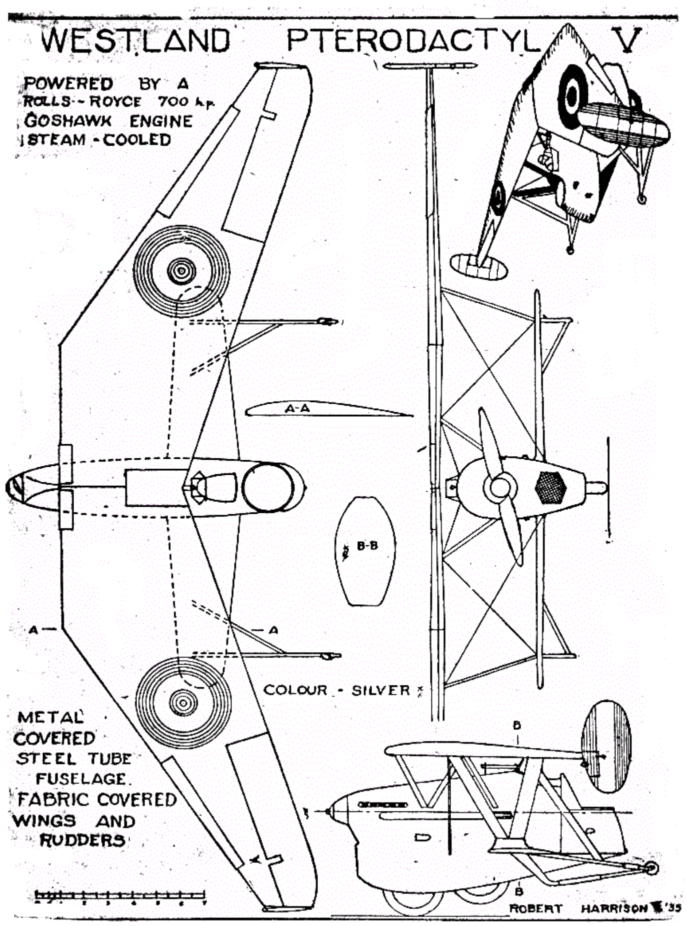
" 'Look 'ee yur, Fred, there be a big bat thing flyin' round!' exclaimed one. 'Seems to I 'er 've lost 'er back part,' said a more observant member of the community, while the matter was finally summed up by the local postman's remark, 'Must be on o' they new-fangled things they do make to Yeovil.'

"The latter assumption, incidentally, was quite correct, for the queer aircraft then passing over them was the Westland-Hill Pterodactyl Mk. IA tailless experimental monoplane, out on a test flight from the Westland aerodrome at Yeovil. And, from that day onwards, right up to the appearance of the final Rolls-engined Pterodactyl Mk. V tailless fighter esequiplane, the Westland-Hill series of experimental machines was known to Somerset villagers as 'bats.'

"The Westland Aircraft organization has, however, produced other strange and unconventional aircraft, some of which, although seemingly unsuccessful efforts at the time, paved the way to the design of aeroplanes which established worldwide reputations."

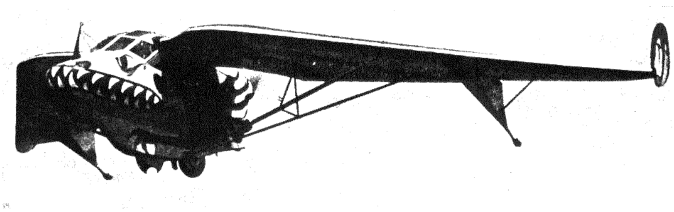
(ed. – The rest of the article went on relating a review of a historical book on the exploits of the Westland Aircraft company over the years of its existence.)

Try a Solid Model of the Pterodactyl



Source: Unknown Publication, "Test Tailless Plane For War Use," author unknown, October 15, 1934.

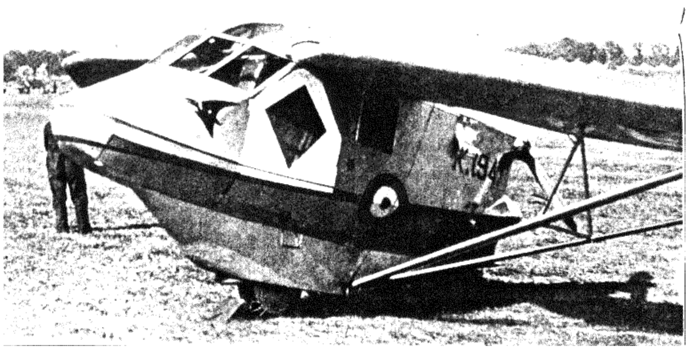
"Believing that the stumpy type of airplane known at the 'pterodactyl' has superior qualities as fighting craft, an English engineer is now testing for war use one of several of these experimental ships he has built. The fighting pterodactyl is a two-place biplane and, like other planes of the type, has no tail, the rudders and elevators being carried at the tips of the swept-back upper wings. The lower wings are mere stubs. The lack of a tail and the curious wing structure is said greatly to increase the gunner's field of view and to widen the range of fire of the plane's machine guns. These two advantages, it is claimed, will be of vital importance in an actual combat, and it is for that reason that the plan is being developed.



"The Tailless Plane is Making Progress" – same publication as above.

"After many years of experimentation with the old tailless ship known as the 'Pterydactyl', the British inventor has finally been awarded with success and has had the satisfaction of giving a satisfactory demonstration for the British Air Force. It is said that the operation of the ship is everything that can be desired.

"As will be noted from the photograph, the machine is of the tractor type which is unusual with this sort of plane. However, the lack of the propeller and tail-group in the rear gives a larger field of fire to the machine gunner in the rear cockpit."

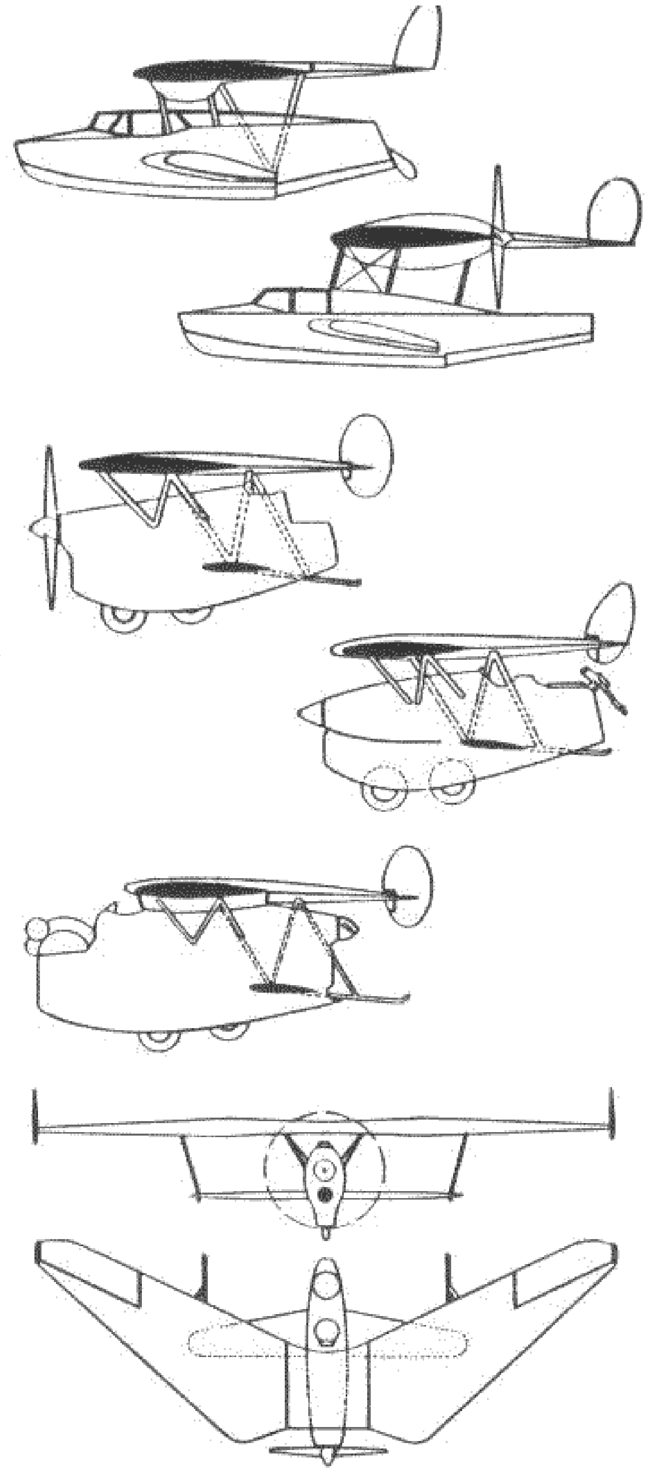


Source: Unknown Publication, "The Planes on the Cover," author and date unknown.

"On the cover of this issue is a painting of what is not only the newest observation ship adopted by the British Air Force, but probably the strangest military aircraft in the world.

"The Westland-Hill Pterodactyl is a tailless two-place biplane with twin stabilizers and rudders occupying the tips of the swept-back wings. The fuselage of this queer airplane is little more that a nacelle for the powerful water-cooled motor, with a pilot's cockpit and a tiny back porch for the observer tacked on the rear.

"Everything about the ship is new, and it must be admitted pretty practical. The undercarriage consists of two wheels mounted one in back of the other on a rocking frame. This carriage is connected with the fuselage by means of an Oleo leg, which permits easy riding over bumpy ground.



Outlines of the tractor type Hill Pterodactyl and suggested variations as a pusher and flying boat, from the August issue of the French magazine "l'Aerophile"

"The Pterodactyl is steered on the ground by means of the front wheel which moves like that of a bicycle. Brakes are applied to the real wheel only to prevent overturning. The entire undercarriage is covered with a streamlined fairing to cut down wind resistance.

"In addition to the central wheels, the ship is provided with two small side wheels, mounted on outriggers, protruding well back from the tips of the lower wings. These eliminate any danger of side tipping and permit a conventional three-point landing.

"The swept-back wings of this craft are extremely strong, due to a novel arrangement of the spars which results in very stiff torsion without excessive weight. There are ailerons on the upper wing only, and they are placed in the conventional position. The ship is steered in flight by moving either rudder independently, and the simultaneous operation of both provides a powerful air brake in landing.

"In spite of its queer and unusual features, the Pterodactyl is decidedly not a 'nut' flying machine. The model illustrated is the latest of a series developed over a long period of time both at the Yeoville works of the Westland Aircraft Co. and at the Royal Aircraft Establishment.

"Its odd design is the result of an attempt to create an airplane combining a high degree of lateral stability at low speeds, safety against spins, and high performance. This, in addition to an almost-perfect field of fire to the rear, due to the lack of tail surface, results in one of the most formidable and efficient two-seater military ships yet designed."

Source: National Power Glider, "Recent Tests of Tailless Airplanes," by Alexander Lippisch, January 1931, pp. 23-57.

"The history of airplane construction is today at a decisive turning point. After the diversity of types of construction during the first ten years of aviation, the rapid development of this industry has led to a general standardization. These types met the demands made of them, so that it was not necessary to introduce notable innovations. Since then, the field of aviation has been extraordinarily enlarged. The airplane has now become a means of transportation, which cannot be disregarded.

"It is evident that, with an augmented field of application, efficiency should be improved and that subsequent development is only possible by conforming to these conditions. Today, these imperfections of standardized constructions represent the real obstacle to the development of aviation. It is not unusual to hear it said that the airplane will always be surpassed in range of application by other means of transportation. To prove the contrary, one has first to note ways in which airplanes could be improved. Three of these ways are:

1. To diminish the weight of construction by studying the structure and improving the materials.
2. To improve the power plant, diminish the specific fuel consumption and improve the propeller efficiency.
3. To modify the aerodynamic form so as to lessen the structural drag, simplify the construction and improve the fineness ratio (L/D).

"As regards the first point, constant progress has been made during recent years. The same applies to the second point. However, a greater propeller efficiency is possible only with a new method of mounting the engine bed. This is why the third point constitutes, so to speak, the key to all the other possibilities of improvement, which cannot be applied entirely without considerably modifying the existing types of construction. It is surprising that so few improvements have been made in this connection during recent years.

"We must seek first that form of airplane most nearly approaching the 'ideal airplane'. This ideal airplane would be one from which would be eliminated all accessories not actually necessary for flight. It would then be composed of only one wing carrying the loads, possessing a power plant and having the necessary controls.

"It is a question at present, therefore, of making tests with airplanes whose wing form permits the elimination of separate tail surfaces ; of ascertaining whether this wing presents disadvantages as compared with the standard type; and, finally, of seeking ways to eliminate such disadvantages.

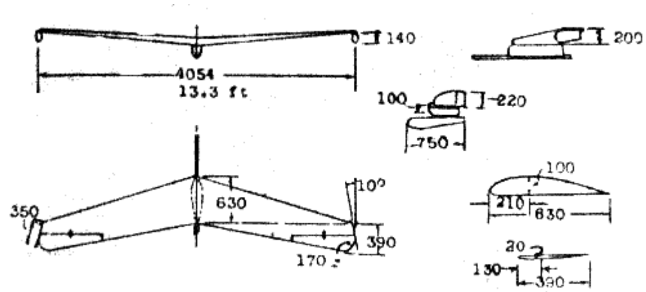


Fig. 1—Model No. 4, Wing Area 2 m² 21.53 sq. ft., Weight 14 kg. 30.86 lb.

"Some of these forms of construction, generally designated by the term 'tailless', have already been practically tested. In regard to these, it is principally problems of construction, which have brought failure to designs that promised much.

"For such an airplane whose wing is heavier 'due to unfavorable distribution of the stresses' than a normal wing of the same characteristics with tail and fuselage, its particular advantages would hardly count.

"Suppose, for example, we work out a design and wish to make it full-scale. Will it meat our expectations? We might, as is generally done, determine the aerodynamic characteristics of the new airplane in a wing tunnel. This airplane may be deceptive, however, as to its performance, because the model tests give only an approximation of its aerodynamic characteristics and stability. The effect of outside disturbances during flight cannot be determined so easily, or at least, necessitates long and costly experiments. It would be well, then, besides testing in a wind tunnel, to verify the aerodynamic stability with the aid of reduced-size models in free flight and thus test the value of the design by both theory and practice.

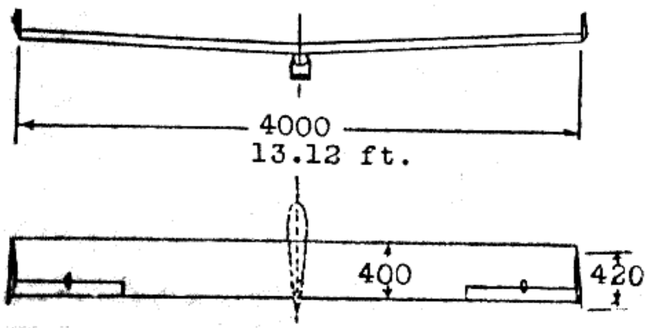


Fig. 2—Model No. 6, Wing area 1.6 m² 17.22 sq. ft., Weight 12 kg. 26.46 lb.

"That is why the author at the Institute of Research of the Rhon-Rossitan Society, began by determining the manner in which the models behaved. In order to be able to determine the flight characteristics of airplanes, it was necessary to choose their dimensions and specific loads so that the laws of aerodynamic and mechanical analogy could be applied. The Reynolds Numbers must be above the critical domain, and the wing loading must conform to the scale.

"These requirements call for airplanes of about 4 meters (13 feet) wing span, carrying 10 to 15 kg/m^3 (2 to 3 lb/sq. ft). Different tailless models, as well as the 'Canard' (duck) type, were thus tested. Model 4 (Fig. 1) shows the primitive form of the present 'Storch" (stork) type of construction. In the sketch the model shows a wing with sweepback and normal ailerons which serve also as elevators. Beneath the tips of the wings, placed obliquely and in front, are the rudders.

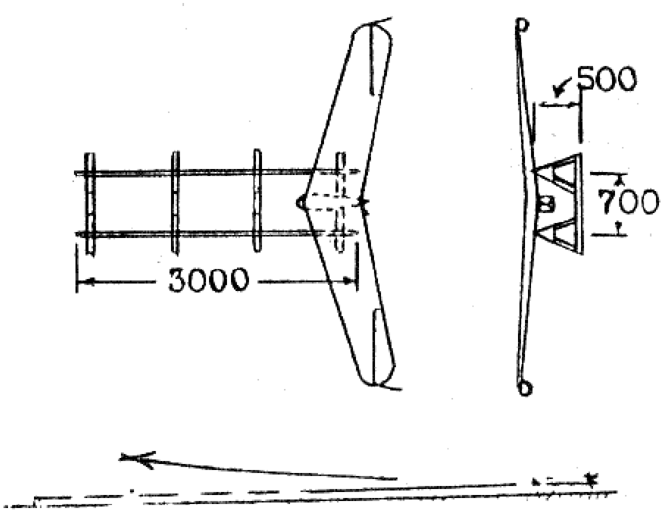


Fig. 3—Starting track for test models.

"Contrary to all the preceding types of wing construction with such a sweepback, stability was here obtained by the inversion of the profile. It is known that such a wing can be stable in flight only when the lift diminishes from the middle toward the tips. Formerly this progressive diminution of lift was obtained by the simultaneous action of the wind on the two surfaces of the wing ('Dunne' type) and the difference in lift was not held essential. In this manner, however, with the use of normal profiles, and their usual displacement of the center of pressure at different angles of attack, considerable moments of torsion are produced, necessitating reinforcement. On the contrary, if the curvature of the wing profile, instead of its angle of attack, is modified, smaller moments of torsion are obtained with the excessive sweepback of the wing than with a normal airplane wing. In the 'Storch' with an ordinary profile, the camber and thickness diminish in such a manner that the profile of the wing tip is flat and inverted.

"It is equally possible, however, to make wings tailless without sweepback by equipping straight wings with profiles having a fixed center of pressure. Such an arrangement allows a simpler construction, but occasions certain parasitic vertical motions. A model of this type was tested and showed that the theoretical objections to this arrangement were unfounded. The airplane shown in Fig. 2 is stable because the center of gravity is below the center of pressure. The whole system represents an ordinary pendulum. Since its moments of inertia and its parasitic motions are small, its flight does not differ materially from that of normal airplanes. In can be stated, on the contrary, that the stability is particularly good. The different models were tested in a large number of flights. Launching was effected by means of an elastic cable and a track. In this way one can attain, over flat ground, a sufficient length of flight to test the effectiveness of different positions of the rudder. The launching track is shown in Fig. 3. All the rudders could be fixed mechanically in definite positions, in order to determine their action in flight.

"After the main problems were solved by these tests, construction was begun on a glider like the first model. Some experiments in the wind tunnel were then made. It was found that the profiles, as designed, were unfavorable for the maximum lift. They were accordingly modified to approach the Joukowsky type. The models were tested with the fuselage and it was ascertained, on the basis of the polars, that, with an aspect ration of 8, excellent fineness ratios L/D were obtained. The profiles tested, as well as the polars, are shown in Fig. 4. Since the estimates allowed for the presence of the fuselage, no additional calculations had to be made for the structural drag of full-scale airplanes.

"An airplane for one pilot was then built like the second model. It had at first a dihedral wing with rudders extending downward, but since this arrangement gave poor maneuverability, the dihedral was completely eliminated and the lateral rudders were transferred to the upper surface of the wing. Figure 5 shows the diagrams of the elevators and ailerons. A large number of gliding and soaring flights were made with the type shown in Fig. 6, and these flights gave satisfactory results. They led to a modification of the fuselage. Furthermore, the rudders were enlarged and divided and the 'elevator-ailerons' were modified in such a way as to make their axis perpendicular to the direction of flight. Thus, the glider arrived at the form shown in Fig. 7. It then gave absolute satisfaction as regards stability, so that the action of the controls and all the special properties of tailless airplanes could be studied in numerous gliding and soaring flights.

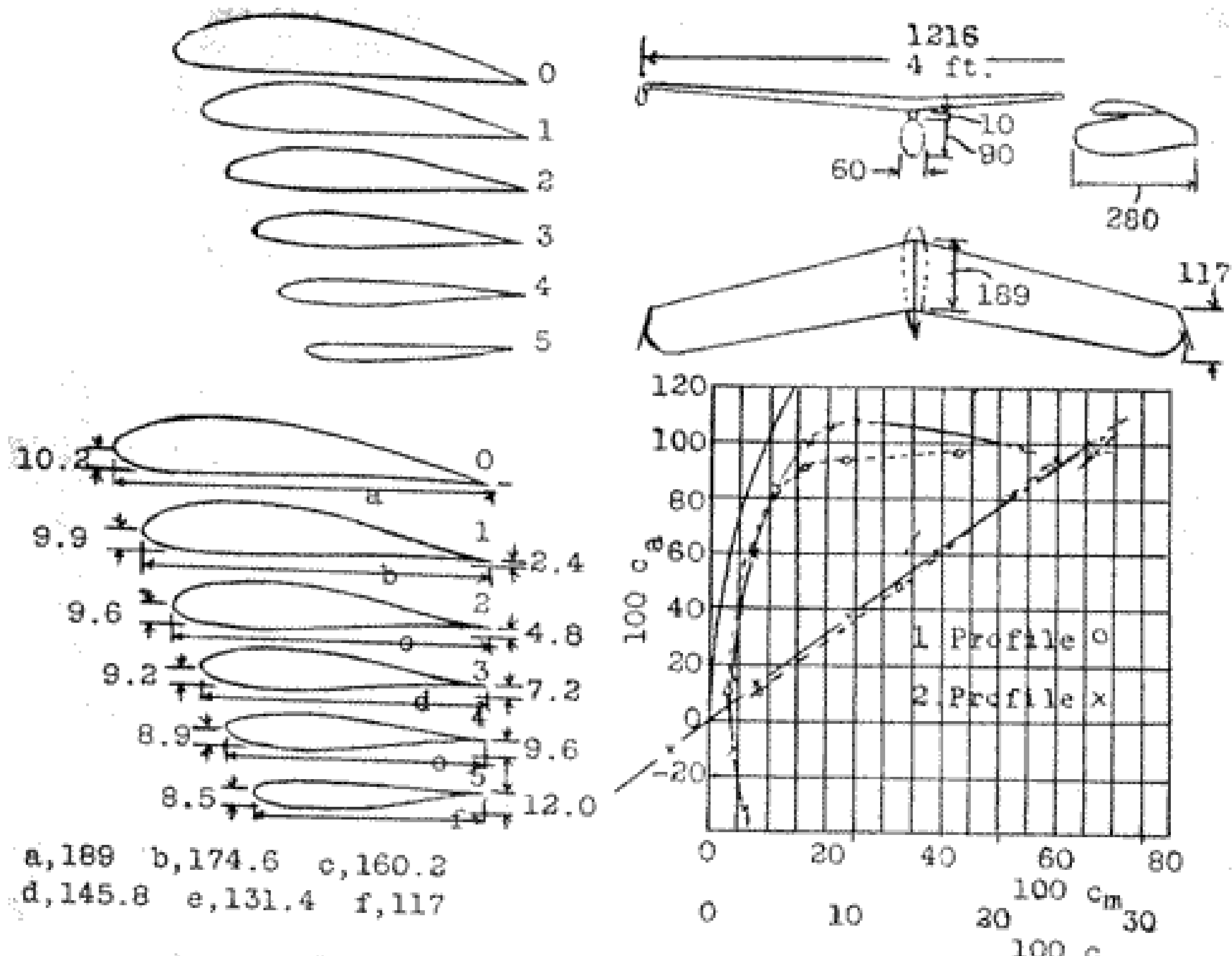


Fig. 4—Results of tests with models in Göttingen laboratory.

"These flights, which took place during the summer of 1929, gave the following results: In horizontal flight, the elevator was more sensitive than that of a normal airplane. The movements were shorter and by jerks, but this sensitiveness was not disagreeable because it facilitated the transition from one attitude of flight to another. It was likewise possible to render the glider more stable in this respect by slight modifications of the profile. It the controls were handled, as for a vertical landing, a stable attitude of flight was obtained without any tendency to side slip or assume another attitude of flight. The action of the rudders was conserved in spite of a very reduced speed, so that a change of course could be made under these conditions.

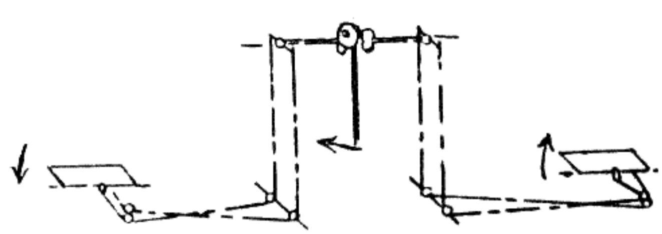


Fig. 5—Aileron and elevator controls of tailless glider.

"The setting of the elevator by degrees and locking it did not cause loss of stability. The glider ascended and descended vertically, until normal flight was attained while continuing to fly at a large angle of attack. Here, also, the extraordinary effectiveness of the controls was especially evident.

"On the one hand the most abrupt turns were made in an irreproachable manner. A sideslip was then tried very successfully. On the other hand, a reduction in the length of the glide was also attained. An effective braking action was obtained by deflecting the two lateral rudders, which could be operated independently of each other. The glider, which generally descends very gradually, can, in this manner, make a more nearly vertical descent. Fig. 8 shows the operation of the rudders.

"The results obtained with the glider being absolutely satisfactory, its reconstruction as a powered airplane was begun in the fall of 1929. The engine was chosen as low-powered as possible – 500 cm^3 (30.5 cu.in.) DKW air-cooled engine. Its power at the level of the Wasserkuppe – 900 to 1000 meters (2953 to 3280 ft.) reached 7 to 9 hp. This is why the usual glider-launching device was adopted.

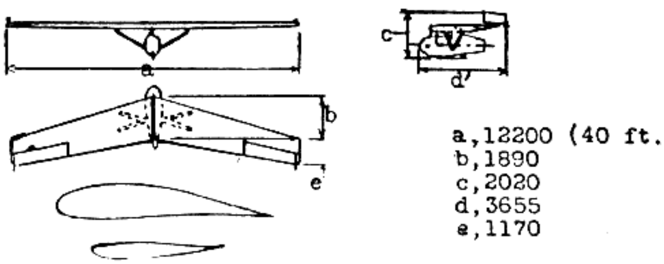


Fig. 6—Test glider model "Storch" first form, 1927.

"The engine placed behind the wing necessitated moving the pilot's seat forward. The fuselage was then reconstructed and the lateral rudders replaced by stronger ones. A special cooling system was installed with a fan and air ducts. In the course of the tests, the cooling system was still further improved and the fuel tank installed in the wing. The airplane was flown first as a glider with the propeller locked and then with the engine running. The airplane demonstrated its complete aptitude for flight although, due to the excessive dimensions of the propeller, the difficulty of cooling

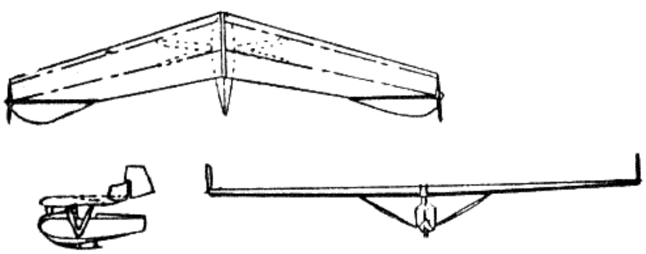


Fig. 7—"Storch" glider

necessitated reducing the revolutions to 2800 r.p.m. (the maximum power corresponding to 3300 r.p.m.). Under these conditions, however, the climbing and speed performance of the airplane were very satisfactory. The speed reached 125 km/h (78 mph) at an altitude of 1000m (32809 ft.). The airplane was exhibited in flight to a large number of German and foreign specialists. It was perfectly and successfully piloted during all these demonstrations by Gorenhoff.

"The tailless airplane is of special interest in every case where it is desired to improve the economy and maximum speed. This improvement of performance should level the barriers which still prevent the airplane from finding its use in domains where it should render valuable service in economic and social life."

Characteristics of the "Storch" Airplane

Span	12.37 m	40.58 ft.
Length	3.8 "	12.47 "
Height	2.0 "	6.56 "
Chord at center of wing	1.89 "	6.20 "
Chord at end of wing	1.17 "	3.84 "
Wing area	18.5 m^2	199.13 sq. ft.
Area of elevator-ailerons, each	0.93 "	10.01 " "
Area of rudders with fins, each	0.80 "	8.61 " "
Engine, DKW, air-cooled	7-9 hp	
Propeller, RRG	1.24/0.6 m H	4.07/1.97 ft. p.
Weight, empty	170 kg	374.8 lb.
Load carried	80 "	176.4 "
Weight in flight	250.0 "	551.2 "
Wing loading	13.5 kg/m^2	2.77 lb./sq. ft.
Power loading	30.0 kg/hp	65.2 lb./hp
Power per unit area	0.45 hp/m^2	.045 hp/sq. ft.

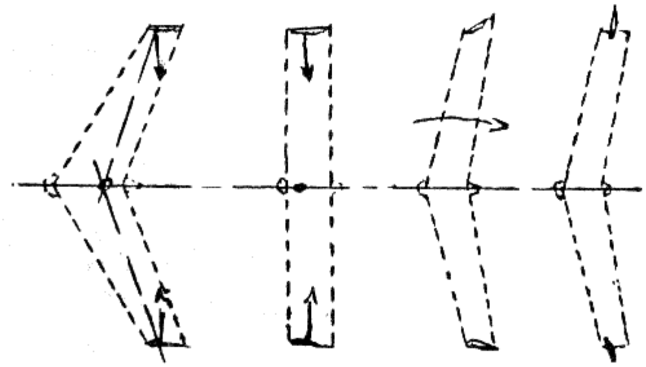


Fig. 8—Operation of lateral rudders