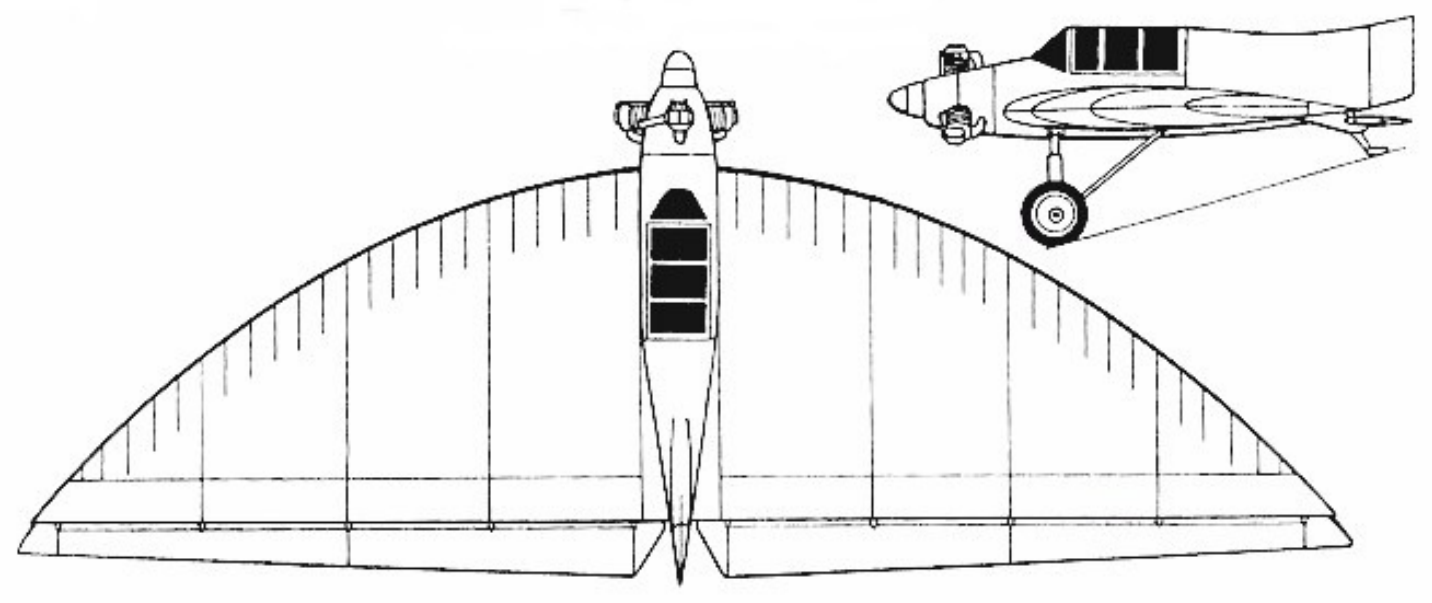
No. 374 SEPTEMBER 2017

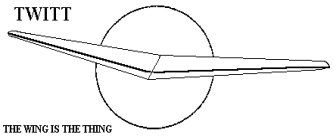
T.W.I.T.T. NEWSLETTER



BICh-7A – See page 4 for more on this historic design and others.

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., **1709** means this is your last issue unless renewed.



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.

T.W.I.T.T. Officers:

President: Andy Kecskes (619) 980-9831
Treasurer:
Editor: Andy Kecskes
Archivist: Gavin Slater

The **T.W.I.T.T.** office is located at:
Hanger A-4, Gillespie Field, El Cajon, California.
Mailing address: P.O. Box 20430
El Cajon, CA 92021

(619) 447-0460 (Evenings – Pacific Time)
E-Mail: twitt@pobox.com
Internet: http://www.twitt.org
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Wt/#Issues	FRG	AUSTRALIA	AFRICA
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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

I attended the 2017 Experimental Soaring Association (ESA) Western Workshop over the Labor Day weekend at the Mountain Valley airport in Tehachapi, CA. The keynote speaker this year was Jim Marske whose Sunday evening talk covered the development of his flying wing series of sailplanes. This annual meeting over the holiday is always worth attending by anyone interested in aviation since it covers a wide variety of subjects including Marske doing presentation on flying wing design and development.

I apologize for the lateness of this issue but I just couldn't get going knowing I was short of information or articles. I finally decided to include some images and 3-views of old designs that may have been in previous issues some years back. I have lost the source citation but I am sure you can more information on them through a Google search. If you have any comments on these please send them in so I can share with the other members.

In the next couple of weeks you might go to the TWITT homepage to find a "NEW" icon with a link to an analysis paper the author has authorized for release in that forum versus putting it in the newsletter. I hope to eventually get permission to include all or part of it in future newsletter.

LETTERS TO THE EDITOR

NURFLUGEL THREADS

I ran across this video:
3D Printed plane - Will it fly?

So has anyone printed a true tailless (without vert. stabs) yet? It seems like a no-brainer of a method for the required complex geometry. I might be able to do the cad work if someone has a concept they want modeled up.

Thanks,

Nick Strum

Hi Nick,

You can use my Excel sheet *(see link below)* to design your own model. It is made for flying wings without vertical surfaces (Horten's style). It uses Bell Shaped Lift Distribution as defined by Prandtl, although you can use Elliptical too and everything in between.

Excel will give you coordinates for airfoils across the span positioned exactly as needed. You then copy those coordinates to txt or dat files that you can import in CAD. After that you only need to loft imported airfoils and you have wing with complex geometry.

Or maybe I could do the designing of wing's shape and you do internal structure, control surface and the CAD for printing.

In both cases I would be very thankful if you would share the results with me and the group. It would be great to see the 3D printed flying wing.

Here is the link for excel file: Flying Wing Designer - Nest of Dragons Be sure to read comments in the file, if you have any trouble using it be free to contact me (Skype is also possible).

Best,

Marko Stamenovic

Great tool, Marko.

I will investigate. This is a well done spreadsheet. I would love to parametrically link a creo model to it. It would be a lot of work though. I'll keep you updated if I can get some of it figured out.

Nick

Got a rough ballpark estimate of the price for printing such a thing?

Steve Corbin

Steve,

I really don't know, I've never used a service. The printer I built was $250, the plastic filament is fairly cheap. Keep in mind it is a large time commitment for whoever is going to do the print. The print probably will have to be broken into 5inch chunks. You can print more than one chunk at a time, but printers commonly can print in a roughly 5" cube.

Most of the issues are going to be faults with the printer with a delicate (thin walled) build like this: base breaking from the print bed or some issue with filament temperature or feed. I only probably have a 75% success rate with any given print. It really isn't tuned enough that I can set it and leave. We'll see if I can get a process to drive proe/creo from the spreadsheet (or some intermediary file, and parametrically drive structure within the wing. It sounds fun if I can steal enough time to work on it. Also working on a parametric model frees me from making decisions that I don't really have answers for about what I want from an rc plane.

A company called 3d lab print is selling some beautiful designs that take advantage of the manufacturing method:

Home – 3DLabPrint

https://3dlabprint.com/wp-content/uploads/2016/10/DSC8426_small.jpg

https://3dlabprint.com/wp-content/uploads/2016/10/p38_lightning_parts.jpg

Also, I just ran into this:
3DLabPrint Tips, Tricks & Settings (Must Read!!) - RC Groups

Nick

Did I send the attached image from a cheap German Nurflugel glider, and the patent of an structure for an airplane close in shape to some NASA lifting bodies?

About the wingless PAV derivative of Facet Mobile, I'd like having an opinion, perhaps some basic calculations, about feasibility of making the bulkhead/ ribs shaping the body of this lifting body/ wingless machine in plaster plates with a honeycomb interior.

I have no data about specs and weight of this home construction material, but the concept in it is 100 % aeronautical.

Thanks, have a nice season, regards, Salut +

Jose Gros-Aymerich
E-28033 Madrid, Spain

(ed. – While no one questioned the lack of an image, I thought the part about looking for opinions and information on the construction technique worth including in the letter.)

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

Serge Krauss, Jr. skrauss@earthlink.net
3114 Edgehill Road
Cleveland Hts., OH 44118 (216) 321-5743

VIDEOS AND AUDIO TAPES

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

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
Add: $ 2.00 for foreign postage

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
Add: $1.50 for foreign postage

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.

Cost : $10.00 postage paid in US
$15.00 foreign orders

FLYING WING SALES

BLUEPRINTS – Available for the Mitchell Wing Model U-2 Superwing Experimental motor glider and the B-10 Ultralight motor glider. These two aircraft were designed by Don Mitchell and are considered by many to be the finest flying wing airplanes available. The complete drawings, which include instructions, constructions photos and a flight manual cost $140, postage paid. Add $15 for foreign shipping.

U.S. Pacific (559) 834-9107
8104 S. Cherry Avenue mitchellwing@earthlink.net
San Bruno, CA 93725 http://home.earthlink.net/~mitchellwing/

COMPANION AVIATION PUBLICATIONS

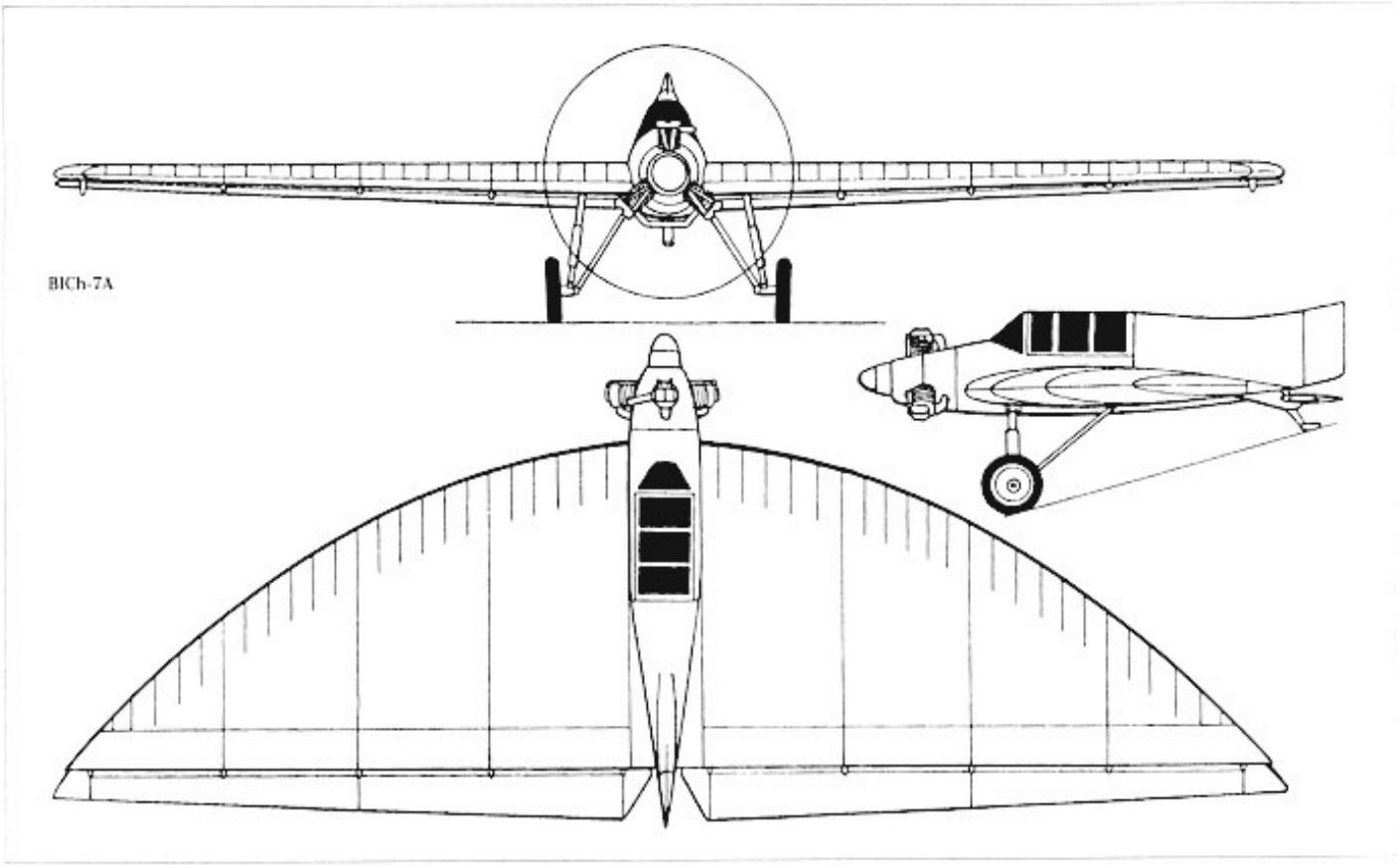
EXPERIMENTAL SOARING ASSOCIATION

The purpose of ESA is to foster progress in sailplane design and construction, which will produce the highest return in performance and safety for a given investment by the builder. They encourage innovation and builder cooperation as a means of achieving their goal. Membership Dues: (payable in U.S. currency)

United States	$20 /yr
Canada (Air Mail)	$25 /yr
All Other Countries (Air Mail)	$35 /yr
Electronic	$10 /yr
U.S. Students	Free if full time student as defined by SSA)

Make checks payable to: Experimental Soaring Association, & mail to Murry Rozansky, Treasurer, 23165 Smith Road, Chatsworth, CA 91311.

BICh-7A



BICh-7A

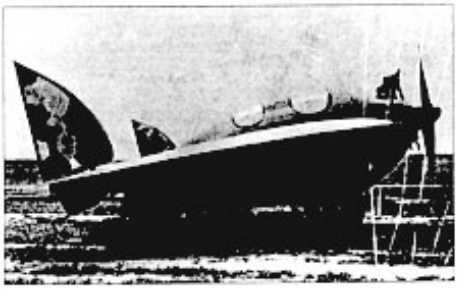
Purpose: To improve BICh-7, the next stage beyond BICh-3.
Design Bureau: B I Cheranovskii.

BICh followed his Type 3 with the impressive BICh-5 bomber, powered by two BMW VI engines, but never obtained funds to build it. In 1929 he flew the BICh-7, almost a 1.5-scale repeat of BICh-3 with two seats in tandem. The problem was that he replaced the central tail by rudders (without fixed fins) on the wingtips, and the result was almost uncontrollable. He modified the aircraft into the BICh-7A, but was so busy with the BICh-11 and other projects that the improved aircraft did not fly until 1932. Apart from returning to a central fin and rudder he replaced the centreline wheel and wingtip skids by a conventional landing gear. The BICh-7A gradually became an outstanding aircraft. Testing was done mainly by N P Blagin (later infamous for colliding with the monster Maksim Gorkii), and he kept modifying the elevators and ailerons until the aircraft was to his satisfaction.

This larger 'parabola-wing' aircraft was again made of wood, veneer and fabric, with various metal parts including the conventional divided rubber-sprung main landing gears and tailskid. The tandem cockpits were enclosed, which in 1932 was unusual. The engine was a 100hp Bristol Lucifer, and one of the unsolvable problems was that the Lucifer was notorious for the violence of the firing strokes from its three cylinders, which in some aircraft (so far as we know, not including the BICh-7A) caused structural failure of its mountings.

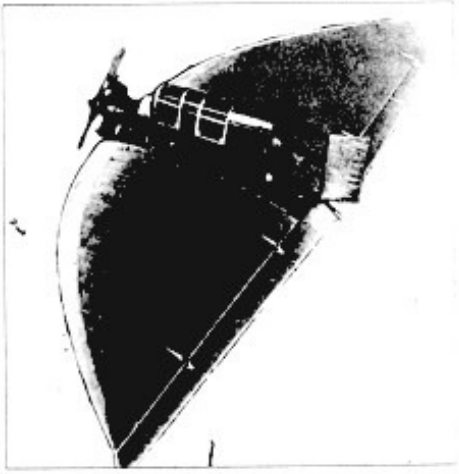
This aircraft appears to have become an unqualified success, appearing at many airshows over several years.

Dimensions		
Span	12.5 m	41 ft
Length	4.95 m	16 ft 3 in
Wing area	34.6 m²	372 ft²
Weights (BICh-7)		
Empty	612 kg	1,349 lb
Fuel/oil	93 kg	205 lb
Loaded	865 kg	1,907 lb
(BICh-7A)		
Empty	627 kg	1,382 lb
Fuel/oil	93 kg	205 lb
Loaded	880 kg	1,940 lb
Performance		
Maximum speed	165 km/h	102.5 mph
Range	350 km	217 miles
Landing speed	70 km/h	43.5 mph



BICh-7

BICh-7A



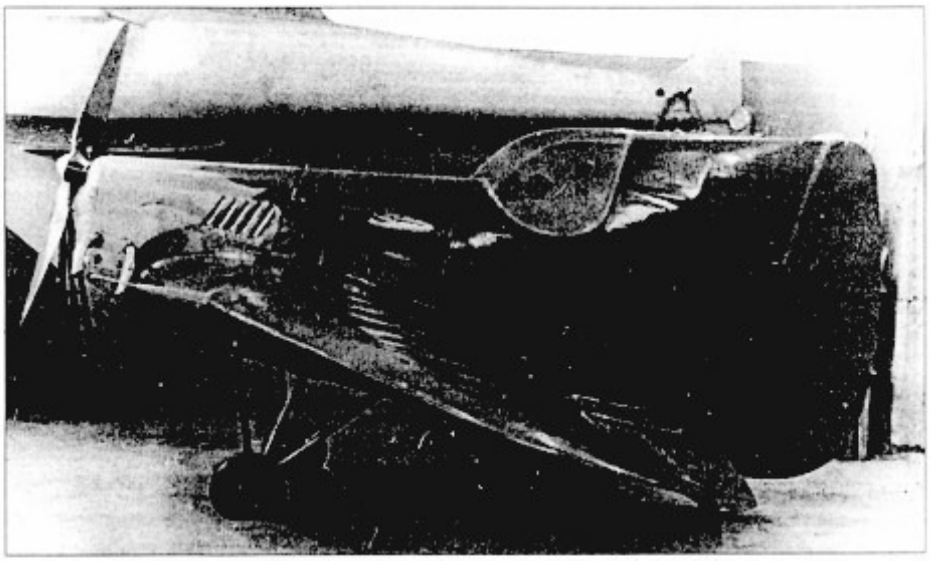
BICh-20 Pionyer

Purpose: To test a small sporting aircraft of tailless design.
Design bureau: B I Cheranovskii.

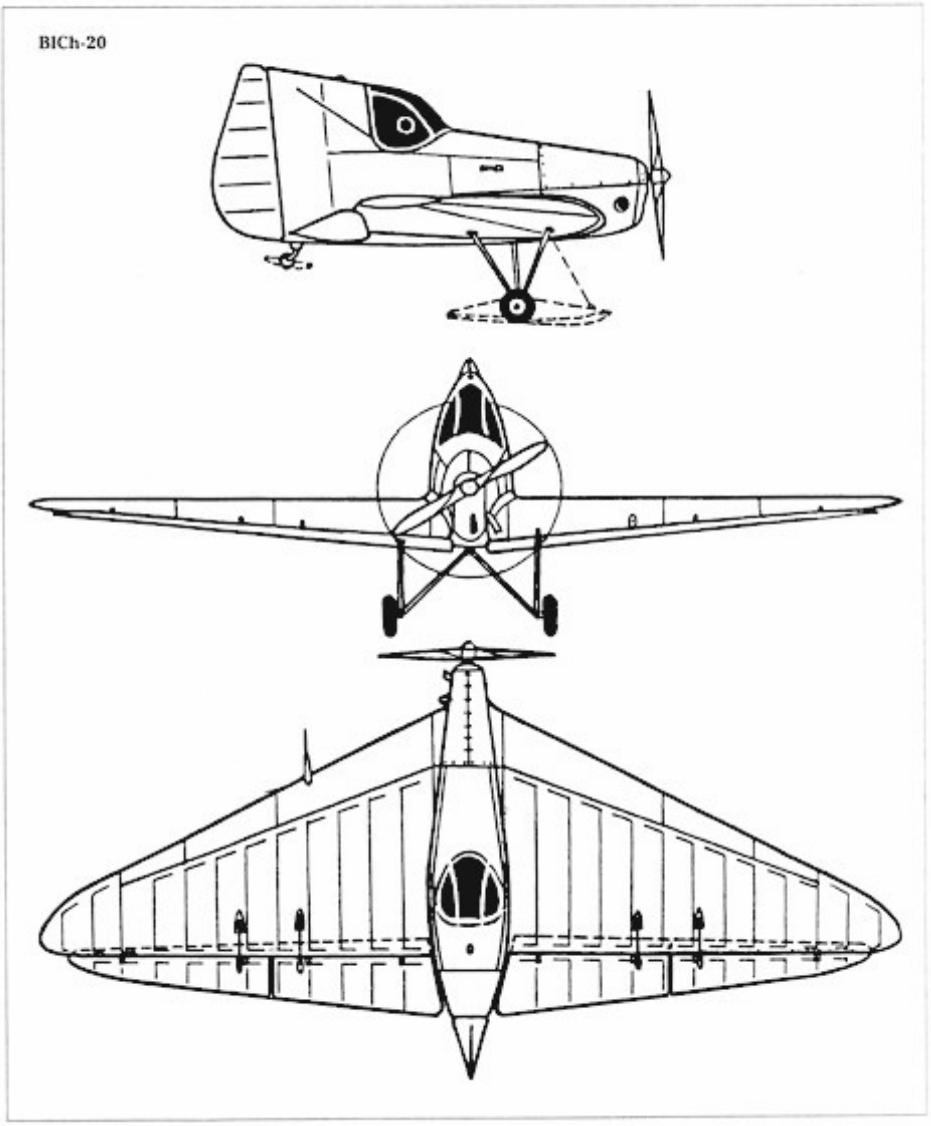
This attractive little machine was rolled out on skis in late 1937 and first flown in 1938. Later in that year it was fitted with a more powerful engine, and with wheel landing gear. Extensive testing, which included sustained turns at about 35° bank at different heights, showed that the BICh-20 was stable and controllable, and also could land very slowly.

This aircraft was again a wooden structure, with ply over the leading edge and the vestigial fuselage. The wing marked a further change in aerodynamic form: having started with 'parabola' designs, Cheranovskii switched to delta (triangular) shapes, and with the BICh-20 adopted a more common form with straight taper, mainly on the leading edge. Trailing-edge controls comprised inboard elevators and outboard ailerons, with prominent operating levers. To enter the cockpit the pilot hinged over to one side the top of the fuselage and integral Plexiglas canopy which formed the leading edge of the fin. The aircraft was completed with Cheranovskii's ancient British 18hp Blackburne engine, in a metal cowling, and with sprung ski landing gear. It was later fitted with wheels, including a tailwheel, and a 20hp French Aubier-Dunne engine.

All known records suggest that this aircraft was completely successful.



BICh-20 Pionyer (Pioneer).



Dimensions		
Span	6.9 m	22 ft 8 in
Length, original	3.5 m	11 ft 6 in
re-engined	3.56 m	11 ft 8¼ in
Wing area	9.0 m²	97 ft²
Weights		
Empty, original	176 kg	388 lb
re-engined	181 kg	399 lb
Loaded, original	280 kg	617 lb
re-engined	287 kg	633 lb
Performance		
Maximum speed, original	160 km/h	99 mph
re-engined	166 km/h	103 mph
Service ceiling	4,000 m	13,120 ft
Range	320 km	199 miles
Landing speed	49 km/h	30 mph

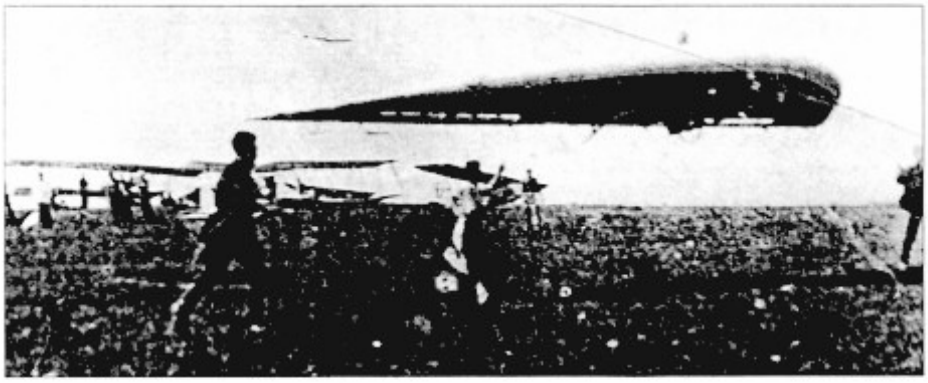
BICh-3

Purpose: To test previously invented 'parabola wing' in a powered aircraft
Design Bureau: Not an OKB but a private individual, Boris Ivanovich Cheranovskii (1896-1960). Throughout his life he scratched around for funds to build and test his succession of 30 types of gliders and powered aircraft, all of 'tailless' configuration.

In 1924 Cheranovskii tested his BICh-1 'Parabola' glider and the refined BICh-2, which demonstrated 'normal longitudinal stability and controllability and is considered to have been the world's first successful flying wing'. In 1926 he followed with the BICh-3, which was almost the BICh-2 fitted with an engine. Cheranovskii's gliders had been flown at the All-Union meetings at Koktebel, Crimea, but most of the flying of his first aeroplane was done by B N Kudrin (later famous) in Moscow.

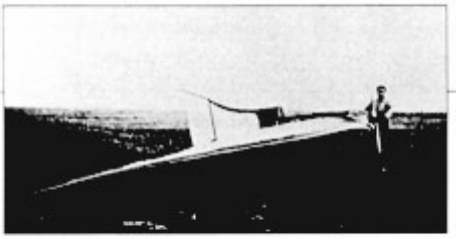
The BICh-3 was a basically simple aircraft, constructed of wood with thin ply skin over the leading edge, inboard upper surface and landing-gear trousers, and fabric elsewhere. The BICh-2 had flown without a rudder (it was better with one) since turning was achieved by the ailerons. With the BICh-3 the addition of an engine required a vestigial fuselage with a fin and rudder. The main controls remained the trailing-edge elevators and ailerons, operated by rods and bellcranks and hung on inset balanced hinges. The engine was a Blackburne Tomtit, an inverted V-twin of 698 cc rated at 18hp. Skids were provided under the tail and outer wings.

Kudrin described the BICh-3 as 'not very stable, but controllable'. It was sufficiently successful to lead to the many successors.



Dimensions		
Span	9.5 m	31 ft 2 in
Length	3.5 m	11 ft 6 in
Wing area	20.0 m²	215 ft²
Weights		
Empty	140 kg	309 lb
Fuel/oil	10 kg	22 lb
Loaded	230 kg	507 lb
Performance		
Max speed, not recorded		
Landing speed	40 km/h	25 mph

No other data.



Above: **BICh-1.**

Left: **Cheranovskii with BICh-3.**

BICh-3

MAI-62 and MAI-63

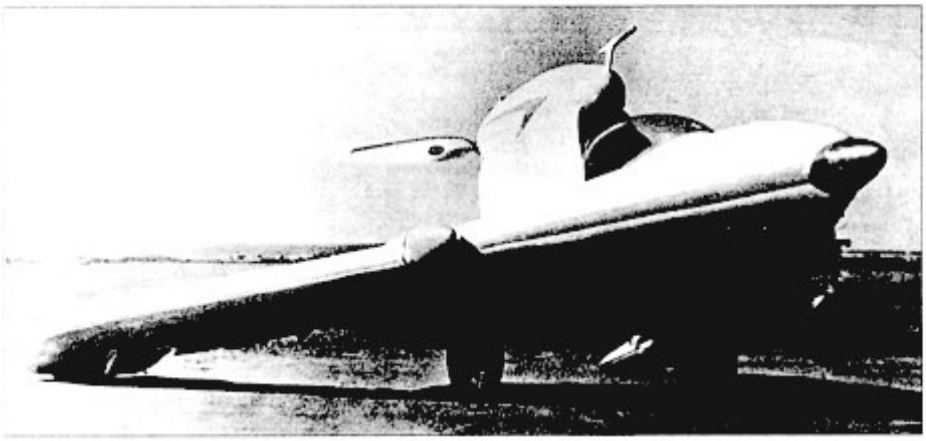
Purpose: To investigate light flying-wing aircraft.
Design Bureau: Moscow Aviation Institute.

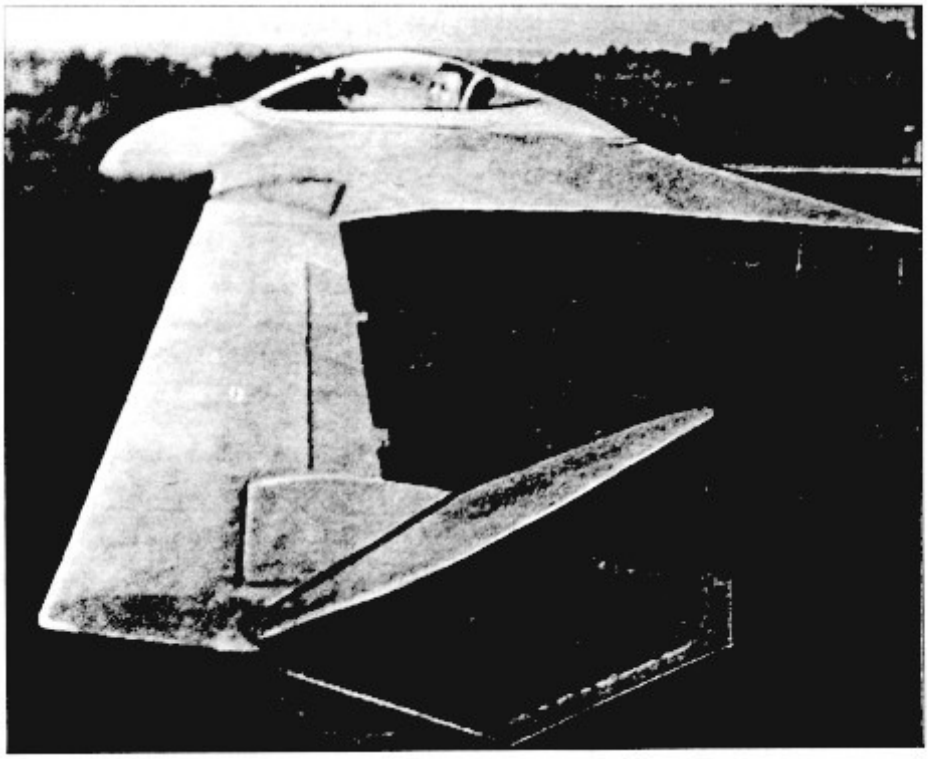
In 1958 the academic faculty of the Institute decided to carry out a major investigation into LK (Letayushcheye Krylo, flying wing) aircraft. The programme began with the LK-MAI glider and the MAI-59 ultralight, but these remained on the drawing board. Extensive tunnel testing of models led to a configuration with a broad diamond or lozenge-shaped centre section and swept outer panels which at their tips turned back (sweepback 90°) to terminate in surfaces doubling as airbrakes and as elevons. The MAI-62 was designed and built in 1961-62, but it was not flown until in 1965 A I Pietsukh attempted a take-off. During the long run the engine seriously overheated and ran intermittently, and the take-off was abandoned. The MAI-63 glider followed in 1963, first flown in 1964 by A I Pietsukh. In 1965 an engine was fitted, to produce the MAI-63M, but again the engine proved 'unsteady' and the aircraft never flew in this form.

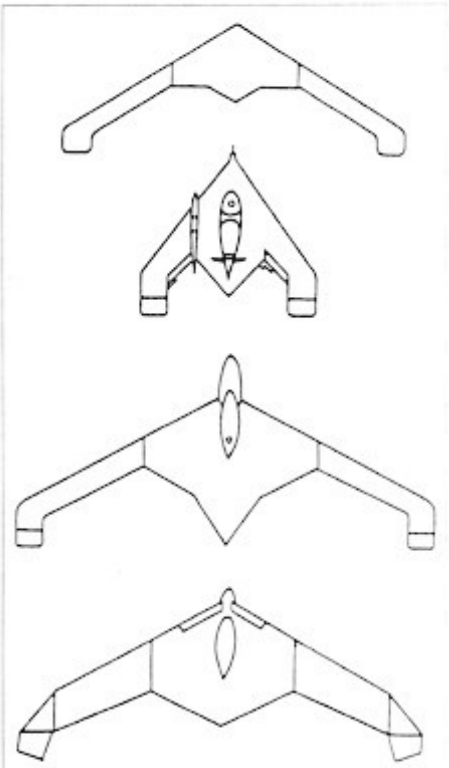
Both the MAI-62 and MAI-63 were made almost entirely of wood, with birch ply veneer covering. Both had a single-seat cockpit with a sideways-hinged canopy, cable-operated wingtip elevons which could split into upper and lower halves to act as airbrakes, and fixed nosewheel landing gear. The MAI-62 was powered by a Khirt air-cooled engine of 80hp driving a two-blade pusher propeller. The years 1962-65 were spent tinkering with the details of the wings, which had a leading-edge sweep of 45° (shown in drawings as 50°), adding or subtracting various fences, inboard flaps, trim tabs and servo tabs. Released photographs carefully avoided showing these surfaces. The MAI-63 had a much greater span, with leading-edge sweep reduced to 25°, and two different forms of split tip airbrakes supplemented by constant-chord hinged trailing edges to the main wing. The engine of the MAI-63M was a VP-760, rated at 23hp.

One is left wondering whether the failure of these aircraft to fly was really due to the engine or to doubts about their controllability.

Below left: **MAI-62.**
Bottom: **MAI-63.**







Development of the MAI 'LK' series

Dimensions MAI-62

Span	5.0 m	16 ft 4½ in
length	5.0 m	16 ft 4½ in
wing area	6.0 m²	64.6 ft²
Weight empty	250 kg	551 lb
loaded	380 kg	838 lb

Performance not measured.

Dimensions MAI-63M

Span	12.6 m	41 ft 4 in
length not recorded;		
wing area	9.0 m²	96.9 ft²

Weight and performance data not recorded.