No. 393 JUNE 2019

T.W.I.T.T. NEWSLETTER

The Northrop N9M in flight. Unfortunately it has crashed and the pilot killed. See inside for more information and links to reports.

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

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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

E-Mail: twitt@pobox.com
Internet: http://www.twitt.org
Members only section: ID – **20issues10**
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Subscription Rates: $20 per year (US)
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$33 per year foreign electronic

Information Packages: $3.00 ($4 foreign)
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Gatherings are held on the third Saturday of every odd numbered month, 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

My apologizes for not including the N9M crash in last months' issue. I have included some information this month and you can do your own Internet searches to learn more.

https://www.military.com/video/wwii-era-northrop-n9m-flying-wing-crashes-prison-yard

Not much else to report this month. I am always looking for material so please send what you are working on.

Andy

LETTERS TO THE EDITOR

Nurflugel Thread

I was going through the internet looking for info on leading edge slots used on swept back wings. When I came to the Northrop N9M I read that it had crashed killing the pilot and destroying the aircraft. That was a shock. This accident happened on 22 April 2019 and I did not see or hear of it on the news. Apparently, there were no witnesses to describe the final moments. The crash occurred 10 minutes after takeoff. The FAA is currently investigating the accident.

On U-tube there is a video from the cockpit taken from an earlier flight. I noted that the pilot was using a lot of aileron input without seemingly getting much roll response. All the flights I watched always showed the N9M making gentle turns and never any attempt to do even a mild wingover. I wonder what its flying characteristics were.

My Flying Plank glider had similar type control system, that is, it had elevons and tip drag rudders. I flew it for seven years and logged over 100 hours. It had respectable performance (L/D of 28) but the aileron adverse yaw was strong and very annoying. I suspect it was the same on the N9M and on the B-1B bomber. I finally licked the adverse yaw in my Pioneer 3 by going to a swept forward tapered wing and using narrow ailerons with differential.

Anyway, if anyone knows more about the N9M crash please share it with the group.

Jim Marske

Multiple witnesses located near the accident site reported observing the airplane flying on a north eastern heading at a low altitude when it performed a “barrel roll.” Several witnesses reported that after the maneuver, the airplane “wobbled [from] side to side” before the airplane’s canopy separated. Shortly after, the airplane entered a steep right turn, and descended into the ground in a nose low attitude.

Controllability of the aircraft was never great to begin with, and it seems questionable that an experienced pilot would have tried such a maneuver with so little altitude to spare. There is no word when the NTSB will release its final report, but these investigations can take a year or more.

https://oppositelock.kinja.com/ntsb-releases-initial-findings-in-crash-of-northrop-n-9-1834513724

(ed. - Continuation of last months' letters.)

Larry,

There is a lot of discussion on https://www.homebuiltairplanes.com/forums/ website on wings for tail-less aircraft. If you have not cruised the website, I suggest you do. I have "Tail-Less Aircraft Design" a book coming in the mail...someday soon, I hope. I will go thru it and let you know what I think. I have download a bunch of stuff on wing design. I'll try too list in the next few days.

I am interested in your design, because I am looking at doing something close to the Ford 15P with a V-tail, and information is interesting.

Regards,

Norm Parmley

I think 2000lbs of trust would be way more than adequate. With 2000lbs a C150 could accelerate straight up (1600# GTOW).. However Larry, the bigger question is not what your static thrust is but rather your thrust at speed. If you can sustain 1000lbs at 100knts then you may have something workable. If however, your thrust drops sharply as the speed builds you may have a fantastic 0-50knt machine that doesn’t have the required thrust for sustained flight.

As I recall ducted fans are notorious for their drop in ‘top end thrust’ vs a longer unducted prop. There was a guy who built a long Ez with a ducted fan (prop?) who flew it extensively but then discarded it as he just couldn’t match the performance of a standard prop w/out the duct. As I recall it hit a wall at 130knts, but my memory isn’t what it used to be.. I could be wrong. I believe his name was Mick Perry (or Mike Perry?). A Google search should turn up the details.

J. Johnson

Very good lesson on Aerodynamics, Propulsion and Wing features, I wonder if several small electric fans would overcome some of the issues described in the comment, there are many industrial electric fans for sale, it could be used in an stepwise way, disconnecting those not needed, and with an small fence or flap, having it out of airflow, to reduce drag, the attached image, form the booklet by Hovey, no longer available, as far as I know, Zenith Aviation Books left no heirs, was interesting to me.

Fuel use of turbines is a good remark, turbines have decent fuel economy in the top rpm range, full load, it is not rare that a Boeing turbine, around 130 HP, is offered for sale in eBay.com, but as load is reduced, fuel consumption of turbines increase to enter bad range, I wonder if installation in a 'Trompe' way (See Wikipedia) would be advantageous, probably, at least it will be good from a point of view of noise and thermal print.

The concept could be tested at a mockup scale with the existent model airplane turbines, there are several in the 20 kg thrust range, prices around $3'000 or less, but fuel economy is terrible for a non-toy use, around 1 kg/ kg thrust/ hr or worse.

You know, French had a Cri-Cri homebuilt airplane flying with 2 of it. How reliable are these turbines? Are repairs feasible and cheap enough?

Do it resist non-interrupted operation? For how many hours? Observations?
Thanks. Regards. Salut +

Jose Gros-Aymerich
E-28033 Madrid, Spain

Correction to my posting yesterday, the weight of a Merlin or Allison is not a ton and a half, they're about half that, around three quarters of a ton, or about 1500 pounds. That's dry. When you add the weights of coolant, radiators, accessories, oil and oil tankage (and they need lots of it), and then the weight of your ducted fan system and the power train to connect the two, your total power plant weight would get pretty horrendous. A ton and a half might not be all that far off.

That 300 pound WIlliams turbofan is starting to look pretty good, until you start to include fuel weight and cost (both initial and operating).

If you want to go with electric power, the energy density of batteries is still far worse than for chemical combustion, so the weight is still going to be outlandish for a 2-seat airplane, and the poor efficiency of a ducted fan is going to make the required battery size even bigger.

It appears to me that the idea of 2000 pounds thrust needs to be revisited. Why do you need that much for a 2-seat airplane? If it's really that high, it suggests that the plane has very poor aerodynamic efficiency and/or horrible weight. Some effort on improving aerodynamic and structural efficiency might be a very good investment.

Don Stackhouse

Spanload Summary

- Prandtl/Munk (1914)
  Elliptical
  Constrained only by span and lift
  Downwash: y = c
- Prandtl/Horten/Jones (1932)
  Bell shaped
  Constrained by lift and bending moment
  Downwash: y = bx + c
- Klein/Viswanathan (1975)
  Modified bell shape
  Constrained by lift, moment and shear (minimum structure)
  Downwash: y = ax + bx + c
- Whitcomb (1975)
  Winglets
- Summarized by Jones (1979)

2

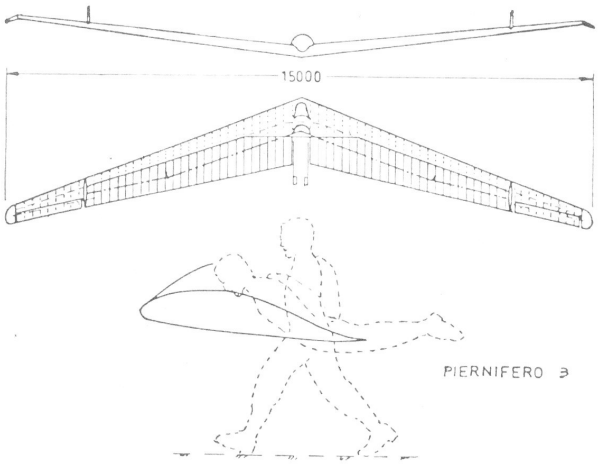
- Bell is 4-6% more efficient for same structural weight

Bird Flight Model

- Minimum Structure
- Maximum Performance
- Flight Mechanics
- Empirical Evidence

Horten H Xc Example

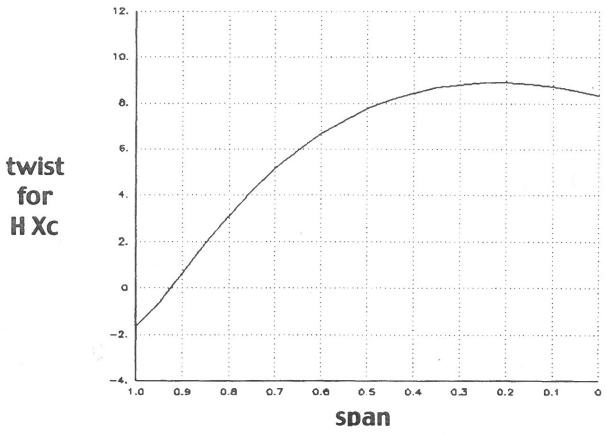
- Horten H Xc
  footlaunched
  ultralight sailplane
  1950

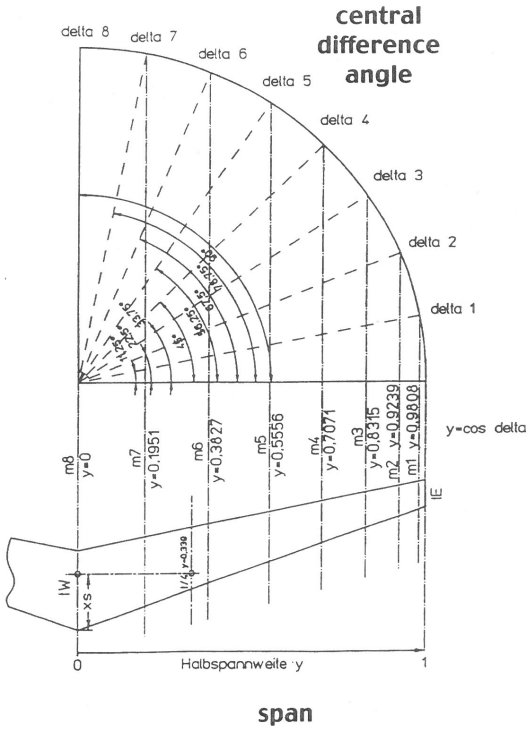


Skizze der H X c mit 15 Meter Spannweite. (Zeichnung Jan Scott)

Calculation Method

- Taper
- Twist
- Control Surface Deflections
- Central Difference Angle

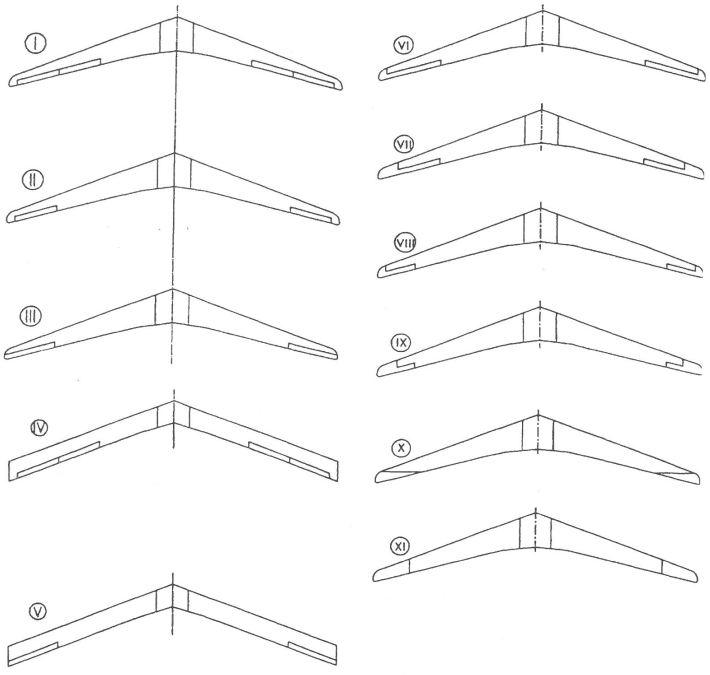




Dr Edward Udens' Results

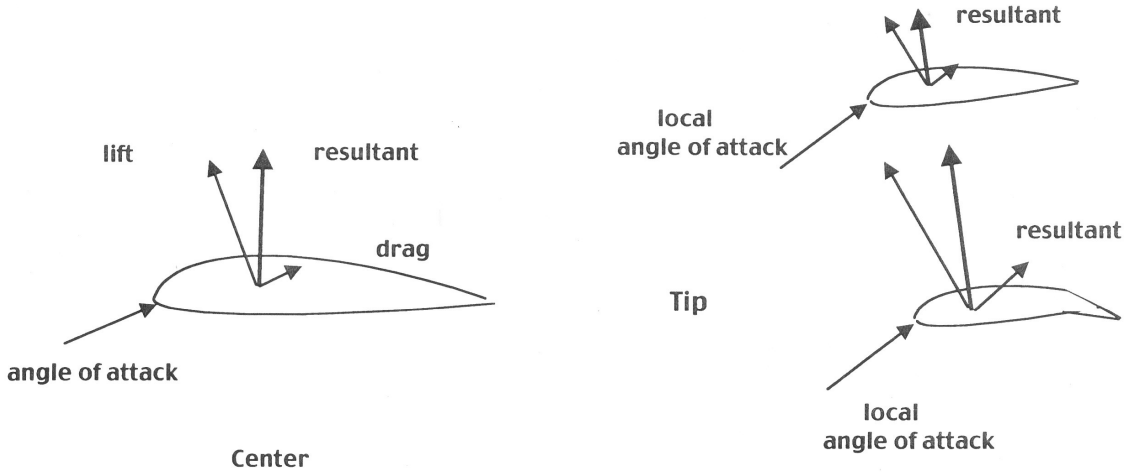
- Spanload and Induced Drag
- Elevon Configurations
- Induced Yawing Moments

Elevon Config	Cnδa	Spanload
I	-.002070	bell
II	.001556	bell
III	.002788	bell
IV	-.019060	elliptical
V	-.015730	elliptical
VI	.001942	bell
VII	.002823	bell
VIII	.004529	bell
IX	.005408	bell
X	.004132	bell
XI	.005455	bell



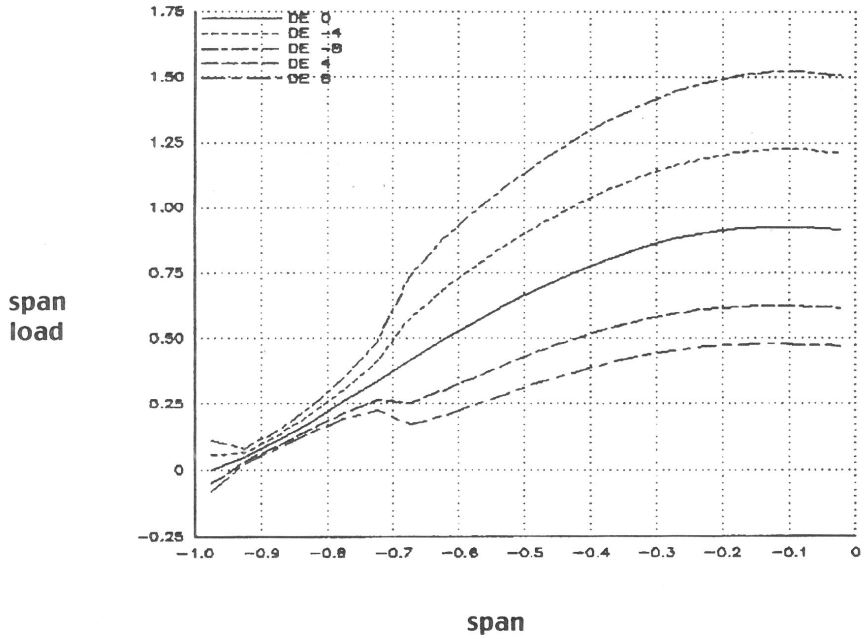
Horten H Xc Wing Analysis

- Vortex Lattice Analysis
- Spanloads (longitudinal & lateral-directional) - trim & asymmetrical roll
- Proverse/Adverse Induced Yawing Moments
  handling qualities
- Force Vectors on Tips - twist, elevon deflections, & upwash
- 320 Panels: 40 spanwise & 8 chordwise



Symmetrical Spanloads

- Elevon Trim
- CG Location



AVAILABLE PLANS & REFERENCE MATERIAL

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.

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