No. 363 SEPTEMBER 2016

T.W.I.T.T. NEWSLETTER

This Flying Wing Was 3D-Printed From Plastic Dust In a Day. Embraced by industry titans like Boeing and amateur R/C enthusiasts alike, 3D printing never been adopted more aggressively than in the aerospace industry. Source: http://gizmodo.com/this-3d-printed-flying-wing-forms-from-plastic-dust-in-1648957366

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.

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TWITT 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 thanks to Jason Wentworth who helped get this issue out almost on time by his contribution of a mass of information relating to Jim Marske's early designs. It filled much of this issue that was behind in publishing due to my trip to the ESA Western Workshop over the Labor Day weekend at Tehachapi. It was a great gathering of aviation enthusiasts talking about a great variety of subjects.

Al Bowers gave an update on the NASA intern program that is continuing research on the Prandtl lift distribution flying wing model and a little on one of the prototype Mars wings that will gather data and then crash. He also gave the group a surprise when he had Erich Chase bring and assemble his full scale Prandtl wing that he is planning on having flying in the coming weeks. I hope to get Al to provide more details but you can see the wing on page 6.

Our Phil Barnes gave a talk on “Principles of Fast and Efficient Electric Flight” that was well received. I am sure Phil will give us a synopsis of the information along with the pertinent charts and illustrations.

So I suggest you mark you 2017 electronic calendar to attend the workshop over Labor Day weekend. You will find it very interesting, don't need to be a member of ESA and you will meet some very great people who share flying with you.

Andy

LETTERS TO THE EDITOR

(ed. – In July Jason Wentworth provided this extensive piece on variations to the Marske XM-1 design but I had other things to include in the then current issue. So here it is and I will try to include some of the images in the links he provides. My thanks for all the work he did in researching and presenting this for our TWITTT members.)

Hello Andy,

Although it was his first effort, and his first iteration in a designing process that led to today's Pioneer III tailless sailplane, Jim Marske's XM-1 design has much potential even now. (Below I have included links to several websites containing information, photographs, and drawings on/of the XM-1, including flying scale models of it.) Also:

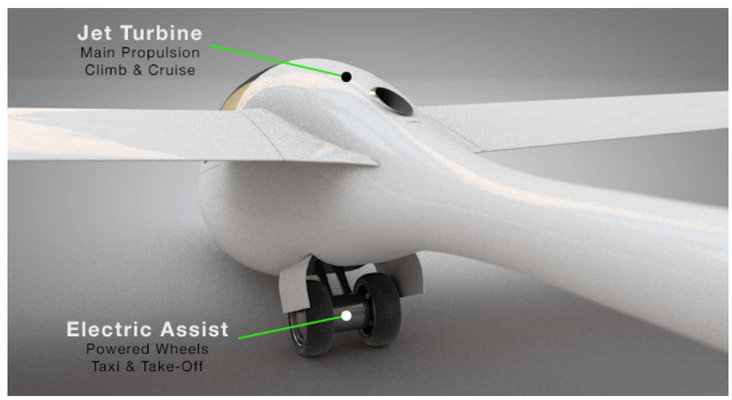
Looking at this design (in both its XM-1B version with dual wingtip vertical stabilizers, and its XM-1D version with a single fuselage-mounted vertical stabilizer), I see numerous possibilities for it. These include:

[1] A refined design (buildable in either the XM-1B or XM-1D configuration) that would be a simple homebuilt sailplane. A more modern reflexed airfoil section (the XM-1 used a 14% Fauvel section) would provide better pitch damping and a better L/D ratio (the original XM-1's 24.1:1 glide ratio wasn't shabby at all!), and its constant-chord "Hershey Bar" wing would be easy to construct. Also, its wings' relatively low—for a sailplane—9:1 aspect ratio and short span (38' 1") would make them durable and easy to transport and store, for an updated, removable-wings version of this glider. The pod fuselage could be shaped as it was in the original XM-1B and XM-1D, or it could be simplified to the rectangular cross-section (with rounded corners, but no compound curves) form that has been used in many sailplanes, such as the Slingsby Swallow and the Backstrom Plank. Multiple construction methods could be employed—conventional wood-and-fabric, wood planked, the foam-and-fiberglass structure pioneered by Burt Rutan's Varieze homebuilt canard pusher, modern composites such as carbon fiber and/or Kevlar, or a judicious combination of these types of construction.

[2] An electric motorglider variant of [1]. To avoid the more stringent FAA requirements that are applied to aircraft that are capable of taking off under their own power, this variant could use a brushless "sustainer" electric motor, with an (optionally folding, for lower drag) pusher propeller. While such sustainer-powered motorgliders (the sustainer powerplant can also be a reciprocating engine or even a gas turbine engine) require a conventional winch, bungee, automobile tow, or airplane tow launch, there is a way around this problem, which the designers of the turbojet-sustainer GloWfly sailplane (see:

https://www.google.com/#q=glowfly+glider)

are implementing. GloWfly's tiny (producing just 88 pounds of thrust!) centrifugal compressor turbojet engine isn't capable of providing self-launch capability, but the glider's brushless DC motor-driven main landing gear wheels, working in concert with the turbojet, *do* enable GloWfly to take off by itself (the motor-driven wheels also enable GloWfly to taxi unassisted, which is another advantage for a sailplane). Now:



A motorglider variant of the updated XM-1B/XM-1D could also utilize such a hybrid system for self-launching and even self-taxiing. While it too could use a small turbojet engine, a brushless motor-driven pusher propeller would be a cheaper airborne sustainer propulsion option (several sailplanes already use FES—Forward Electric Sustainer—tractor propeller systems, see:

https://www.google.com/#q=Forward+Electric+Sustainer+glider).

The XM-1B could have a brushless motor and a pusher propeller (which could have folding blades) installed at the rear of the pod fuselage. For the XM-1D variant, the (non-folding) pusher propeller could rotate in a narrow gap between the movable rudder and the fixed portion of the vertical stabilizer; the sustainer engine-powered version of the Haig Minibat sailplane also used this pusher propeller arrangement

(see:

https://www.google.com/#q=Haig+Minibat+glider).

[3] A foot-launchable variant of the XM-1B/XM-1D. Such a craft would have to be very lightweight in order to be lifted and run with by its pilot, so composite construction would be most useful in this case. The Swift and SwiftLight (see:

https://www.google.com/#q=Swift+foot-launched+glider)

swept-wing tailless foot-launched sailplanes (which are also available in self-launching, powered versions) show what is possible in this growing sector. A foot-launched variant of the XM-1B/XM-1D could provide greater pilot comfort and protection (including normal-posture seating), and its plank planform would make it easier to handle on the ground. If need be, a movable ballast mass (not necessarily inert, perhaps a battery pack, or a container of water ballast for slope soaring, etc.) could be moved fore and aft on rails or on a rod, to provide an optimum Center of Gravity. For foot-launching (with or without a self-launching engine or electric motor installed—this glider could use any of the propulsion options described in [2] above), this ballast mass could be positioned forward, then be moved rearward to compensate for the changing location and mass distribution of the pilot's body, as s/he swung up into the normal seated position after being in a standing position for the takeoff. "Bomb bay"-type doors in the floor of the fuselage (which would be open to enable the pilot to run during takeoff) would close and latch after the pilot had swung upward into the seated position after takeoff; the door-closing and latching could be done either manually or automatically (be means of springs and/or servos). A higher-performance (but less comfortable) variant of the foot-launched XM-1B/XM-1D could have a much narrower, torpedo-like pod fuselage, inside which the pilot would lie in a prone position.

[4] The basic XM-1B/XM-1D configuration could be used for a planetary mission aerobot, for exploring other worlds which possess atmospheres (Mars, Venus, Titan, Jupiter, Saturn, Uranus, and Neptune). Its low aspect ratio wings would facilitate the use of folding wings, which would enable such aerobots to be packaged inside the same types of atmospheric entry aeroshell heat shields that have been used by past and current planetary and satellite (Titan) landers and atmospheric probes. Not having a full-length fuselage (which would also have to be folded for installation inside the aeroshell, then unfold and latch during deployment following atmospheric entry) would greatly simplify—and make more reliable—such aerobots, which must successfully unfold and lock their folded wing panels in just a few seconds while dangling from a parachute-suspended aeroshell back cover, then separate and start flying. Depending on the specific aerobot mission requirements and the destination world's atmospheric characteristics, either powered aerobots (using an electric motor or a hydrazine catalyzed decomposition-powered piston engine turning a pusher propeller) or purely sailplane aerobots could be used. Sailplane aerobots would be

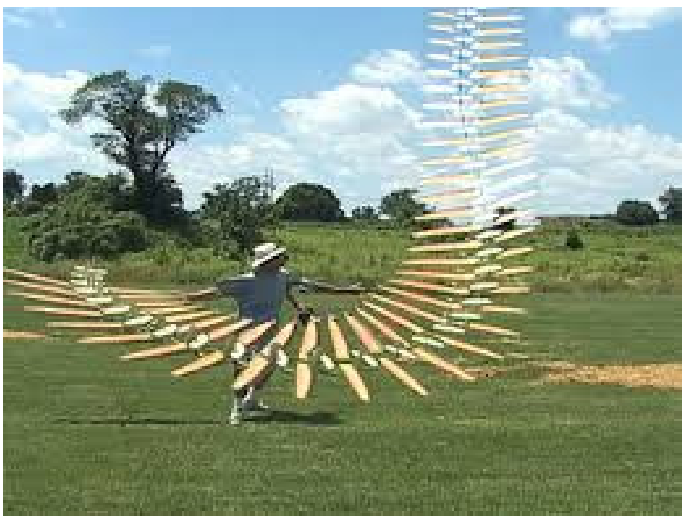
best suited for use on terrestrial-type (solid) worlds such as Mars, Venus, and Titan, where differential solar heating of the surface and winds flowing over the variable-height surface topography produces thermals, slope lift, and—downwind from hills and mountains—wave lift and dynamic lift (Mars' wave lift conditions are so widespread and prominent that they were visible in cloud photographs taken in the early 1970s by Mariner 9, the first spacecraft to orbit the Red Planet).

[5] Flying scale models of the XM-1B and XM-1D (F/F [Free-Flight] as well as R/C [Radio-Control]). R/C models of the XM-1B and XM-1D would also lend themselves well to the new DLG (Discus Launch Glider, see:

https://en.wikipedia.org/wiki/Discus_Launch_Glider

and

https://www.google.com/#q=Discus+Launch+glider)



method of launching, in which the flyer holds the glider by a wingtip (or by a peg near a wingtip, in larger DLGs) and spins around like a discus thrower to impart the launching energy to the glider. The straight and relatively—for a glider—short-span, low aspect ratio wings of the XM-1B and XM-1D would give scale DLG versions of them ample strength and stiffness, which are advantages for discus launching. At least one R/C scale model (not a DLG type; the small, "scratch-built" foam model used conventional hand launching) of the XM-1D has been built and flown—a link to a video of it is included below. Plans for larger, wooden-framed XM-1B and XM-1D R/C scale models have also been created, by French and German modelers, and links to these are also included below.

The XM-1B and XM-1D (with thoughtful model design, scale models of both variants could even be converted back and forth from one to the other, as the modeler desired) would also make great RTF (Ready-To-Fly), BNF (Bind-aNd-Fly), and PNF (Plug-aNd-Fly [also called PNP, "Plug-aNd-Play"]) R/C scale models. The R/C glider manufacturers could make these scale XM-1B/XM-1D models out of molded EPP (Expanded Polypropylene) foam, optionally with the pod fuselage being made of blow-molded polystyrene or ABS plastic instead of EPP foam. Below are several XM-1B and XM-1D website links:

Marske XM-1 Wikipedia article:

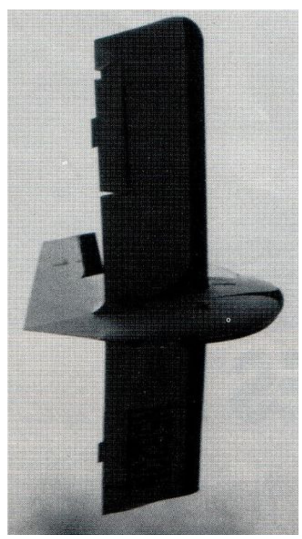
https://en.wikipedia.org/wiki/Marske_XM-1

Marske XM-1B photo:

https://en.wikipedia.org/wiki/Marske_XM-1#/media/File:Marske_XM-1_N5823N.jpg

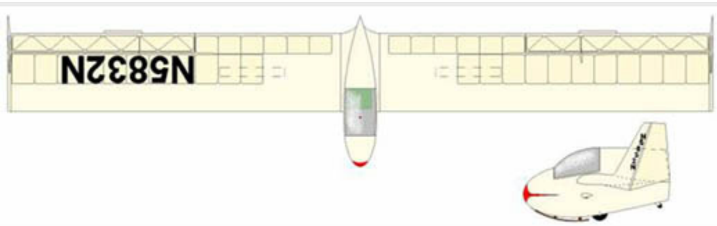
Marske XM-1D photo:

https://en.wikipedia.org/wiki/Marske_XM-1#/media/File:Marske_XM-1D_N5823N.jpg



XM-1B (including flying scale models) links:

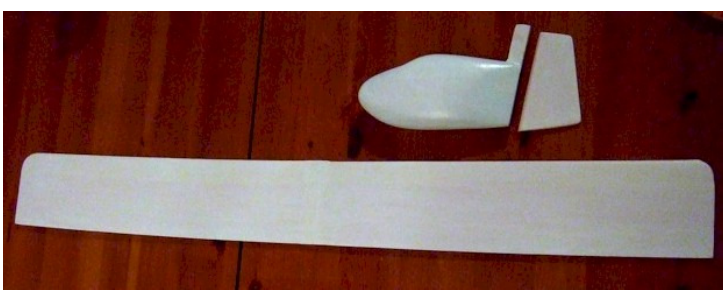
http://www.j2mcl-planeurs.net/dbj2mcl/planeurs-machines/planeur-fiche_0int.php?code=3323



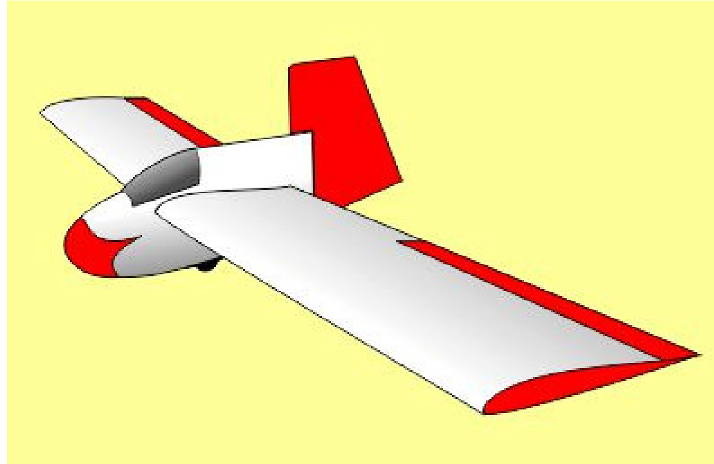
http://www.j2mcl-planeurs.net/dbj2mcl/planeurs-machines/planeur-fiche_0int.php?code=1975

XM-1D (including flying scale models) links:

http://www.rcgroups.com/forums/showthread.php?t=2071367 (XM-1D scale model flight video is on page 2 of this rcgroups thread)



http://www.rc-network.de/forum/showthread.php/256386-Marske-XM1-Ein-vorbild%C3%A4hnliches-Brett-mit-2-83-oder-3-75m-Spannweite.



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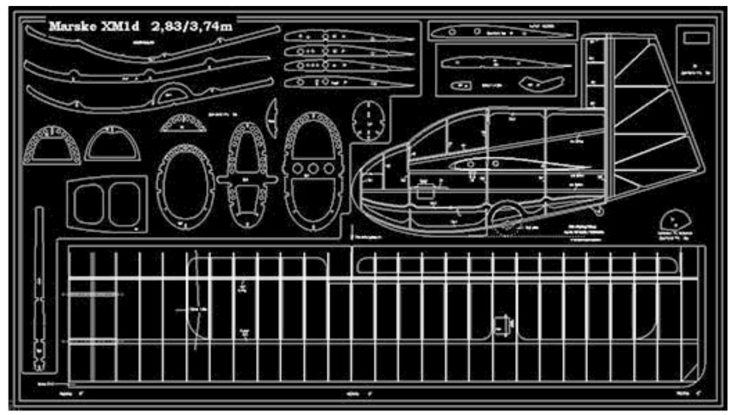
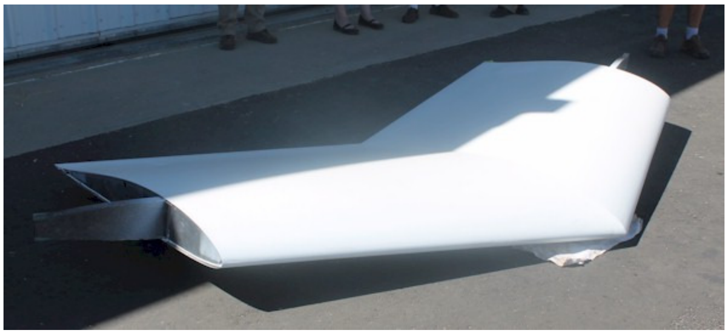


http://www.j2mcl-planeurs.net/dbj2mcl/planeurs-machines/planeur-fiche_0int.php?code=3325

I hope this material will be helpful.

J. Jason Wentworth

(ed. – Labor Day weekend was the 2016 ESA Western Workshop that had a surprise by Al Bowers that I am sure most of you would be very interested in as the project matures. I am hoping Al will provide us with the details behind this Prandtl inspired flying wing being built by Erich Chase. For basics the center section and two wing panels weigh about 40 pounds each and it will be flown from a cage mounted from stations below the center section.)



Center section transported in the bed of a pickup.

Complete wing that shows the degree of twist built into the wing panels.

Al Bowers (left) and Erich Chase answering questions.

Nurflugel Thread

(ed. – This is the follow-on to a thread started in the July issue on page 3.)

All I can say is that Al Bowers told me that pushers are more stable.

Keep that brain spawning wings,

Koen Van de Kerckhove

Only so long as the prop is turning. Always target slightly positive directional stability through twist and side area so when it's unpowered and the added stability of the turning prop is not there you are still controllable.

Kirk Sutton

True. If a propeller is behind the center of gravity, it has a stabilizing effect in both yaw and pitch.

Marc de Piolenc

Well, sort of. What matters is whether the prop is in front of or behind the C/G.

Many of you are familiar with the term "P-factor";, the turning moment a prop makes if its shaft is not parallel to the incoming airflow. For example, a right-handed prop tries to yaw the plane to the left when the nose is up during climb, which is why we have to hold some right rudder on climb. This is because the angles of attack on the two sides of the prop disk, and more importantly the airspeeds relative to the blades on the two halves of the prop disk are not the same. The "downward-moving" blade (the right half of the disk in our example) sees an increase in airspeed, increasing its lift, while the upward-moving blade on the left half of the disk sees a decrease in airspeed, decreasing its lift. This causes the right half of the prop to make more thrust than the left, causing the prop to try to yaw the plane to the left.

However, when higher airspeeds cause an increase in lift, they also increase something else. DRAG. That blade on the right half of the disk makes more drag than the one on the left , and the difference between the two causes a net force parallel to the plane of the disk that tries to pull the nose up.

So, whenever you feed the air into the prop at an angle, it causes a force parallel to the prop disk, perpendicular to the prop shaft, in the same direction as the tilt in the inflow.

Now, in the case of a typical single-engine airplane with the prop on the nose (ahead of the C/G), if you pull the nose up, this "in-plane"; force is trying to pull the nos even further upwards, which is destabilizing.

Conversely, if you have the prop behind the C/G (and note, what matters is that it's behind the C/G, NOT whether it's a pusher or tractor, a tractor prop on a pod mounted on the tail would still have the same effect), and you pull the nose up, the upward in-plane force from the prop will be trying to pull the tail upwards (and the nose down), which increases stability.

In effect, a prop acts like a combination horizontal and vertical fin, wherever it's mounted on the plane. If that happens to be behind the C/G, it helps stability; if it's in front of the C/G, it hurts stability. Whether the details of that mounting fall into the "pusher" or Tractor" category is irrelevant, it's entirely about where it is relative to the C/G.

When Northrop converted the prop-driven XB-35 to the jet-powered YB-49, they had to add four vertical fins, one at each engine. Part of this was to replace the vertical fin effects of the prop shaft housings, but another part of that was to replace the vertical fin effects of the props themselves.

Don Stackhouse

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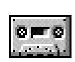

(ed. – These videos are also now available on DVD, at the buyer's choice.)

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

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

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

Cost: $10.00 postage paid
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 Paul MacCready's presentation on March 21,1998, covering his experiences with flying wings and how flying wings occur in nature. Tape includes Aerovironment's "Doing More With Much Less", and the presentations by Rudy Opitz, Dez George-Falvy and Jim Marske at the 1997 Flying Wing Symposiums at Harris Hill, plus some other miscellaneous "stuff".

Cost: $8.00 postage paid in US
Add: $2.00 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

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