No. 368 MARCH 2017

T.W.I.T.T. NEWSLETTER

A neat photo of a Mitchell U-2 in the air obtained from the Yahoo Groups archives. Not sure who owns it or if it is still active.

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

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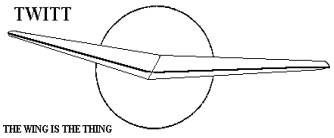

THE WING IS THE THING (T.W.I.T.T.)

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.

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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

For those of you who have been tracking Al Bowers projects related to Prandtl's theories you will be interested in his new revelations starting on page 2. He published this through the Nurflugel group that elicited a few responses from some of the more active members. If you have anything to add to the discussion in included Al's contact information so you can speak up. Please copy TWITT (twitt@pobox.com) so we can include it in the newsletter in case Al doesn't share it through Nurflugel.

Also in this issue is a short article by Al Backstrom on taking a fresh look at ultra light airplanes. It was originally published in Sport Aviation in April 1973. I am not sure if I have re-published it in the past but didn't want to take the time to research back issues since I am sure someone will remind me when reading it again.

I hope many of you are having success in getting back in the air at your local flying field now that we are moving into the soaring season. For me the weather has not been cooperating with a weird sequence of rain that has keep the glider club runway too soggy for the tow plane of safely operate. Just about when it gets dried out during the week, the rain comes on the weekend or early in the week without enough drying time for the upcoming weekend. Hopefully this will correct itself in the near future so I can get back in the air after a long hiatus.

Andy

LETTERS TO THE EDITOR

(ed. - The following exchange came through the Nurflugel bulletin board link and is up to date as of our publishing date. I am sure more comments will appear as Al goes out to other groups with his new thoughts on Prandtl.)

You have no idea how hard it is for me to say that. Follow me through here…

"The lift distribution is not elliptical, but rather it corresponds more to that of sharp-tipped wings." –L Prandtl, 1933

Based on this statement I have been saying that we could achieve Prandtl's 1933 spanload with planform alone. This is wrong. In fact, it is not possible.

This was not a case of Prandtl having an incomplete understanding of the 1933 spanload solution.

This was a case of Prandtl having in incorrect understanding of the 1933 spanload solution.

-after this point are my thoughts about this subject alone. Both the ideas and errors after this point belong solely to me. –AHB-

Going back to Prandtl's 1933 spanload and the statement that we can achieve that spanload with planform alone. It's clear this is what Prandtl was thinking at this point. This is what Prandtl was thinking when he wrote that last sentence. It is clear by what he wrote. He mentions only planform, and there is no mention of twist or camber. But if one builds the wing to conform to the spanload using only planform you would find you would immediately fail.

The reason for this is the downwash-upwash.

Using only planform to match the spanload, you made a fundamental assumption, that the planform was directly proportional to the lift (or circulation). But this is true only for an elliptical spanload. The new spanload does not have the constant downwash, and so the concept of a constant downwash (a "uniform airflow") does not exist in the new spanload. We have a twisted flow field. Because of this downwash at the center and upwash at the tips the induced angle of attack means that there would we less lift at the center and more lift at the tips with the new spanload, so the planform would necessarily require an excess of chord at the center and proportionately less chord at the tips to achieve the needed spanload. Couple this with the required lift or circulation and the tips immediately become excessively overloaded. It is impossible to ahieve the new spanload with planform alone. In fact there is a minimum necessary twist needed (a "critical twist") to make the planform and the lift distribution and the lift coefficient distribution and indeed the whole design viable.

Prandtl did not understand this.

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"soar with eagles…"

I can feel your disappointment, Al but this is one of the cases in human history that are part of theoretical and practical development. As you know, even Einstein's theory of relativity has been discovered to be partially incorrect. I think it is very honest on your part to tell us about this.

BTW, I have been involved in ground effect craft for over 30 years and I do not know why, in universities and aeronautical institutions, only the concept of span-dominated GE is taught, which is far less important than the one of chord (MAC)-dominated GE for the stability, distance from the surface and performance of such craft.

I feel as progress and development in any science or industry are kept from didactic curriculums, instead of been implemented.

Cordially

Bruno De Michelis

But isn't this how science works? To find errors in older work of older people, try to correct them, develop new ideas about it and create the next level of understanding?

I was always told that finding errors is good. Compare it to *not* finding the errors!

Newton has failed, Einstein has failed, apparently Prandtl has failed, maybe you have failed and will fail -

that's science, but never be shy to fail and to call an error an error.

I have found two errors in my own (much smaller) work just yesterday, and it feels good.

Just my 2 cents.

Joachim Bergmeyer

P.S. Is this a showstopper to your current work, or does it just mean you have to change direction a bit?

Are you trying to create better airplanes or are you trying to show that Prandtl was correct in all he wrote? I guess that Prandtl was more concerned about airplanes.

Al, I fell in that trap :)

I thought that it is possible to design BSLD with planform alone. I was inspired by seagull's wings shape. They are narrower at the root then at the some 40-50% half span. This reminded me of circulation distribution of BSLD since the top peak is not at the root and thought that there something there.It looked logical that you can do it with planform alone. I then modified my excel sheet for designing BSLD wing and tried to achieve it with planform only. After bannging head against the wall for some time I figured out what downwash graph was showing me all the time... you can't do it. Felt stupid but happy, adventure never ends :)

Cheers,

Marko Stamenovic

No not a showstopper at all. Being familiar with Reimar's work, I followed the same thought process. Rule 1: always proceed from what you know.

As for Prandtl, I had never encountered an error in Prandtl's work prior to this. My feeling is that he did the math exactly correct. But his relative inexperience with actual aircraft prevented him from understanding the application correctly.

Al

I agree, Al. I think it is always better to build a series of flying models, increasing their dimension from 1/6 to 1/2 of the full size aircraft, to find if there are problems. This is what I have always done and do. Up to now, I only had 2 surprises out of 208 models.

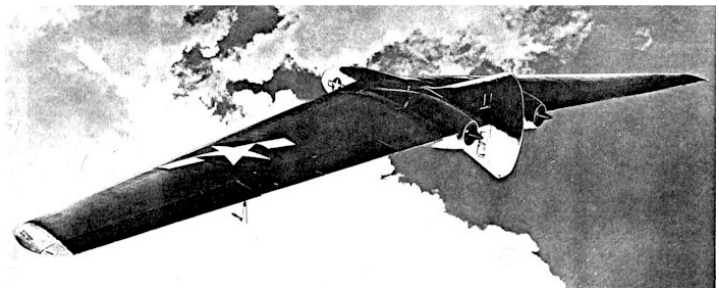
Bruno

==========

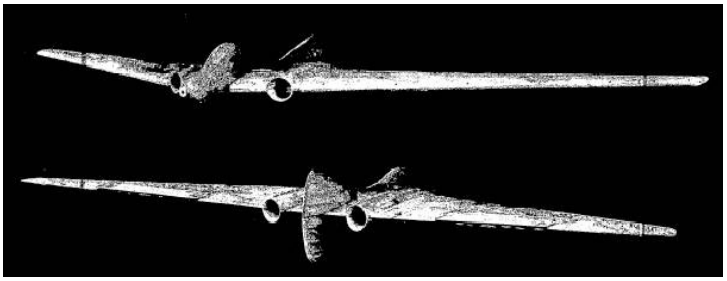
I recently became aware of the Interstate XBDR Assault Drone, below are 3 links to info on it.

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

The Interstate XBDR was a design for an assault drone - an early television-guided missile - powered by two jet engines, that was designed by the Interstate Aircraft and Engineering Corporation during the latter stages of the Second World War for use by the United States Navy. Wind tunnel tests of a scale model were conducted, however no full-scale examples of the aircraft were built before the project was cancelled.



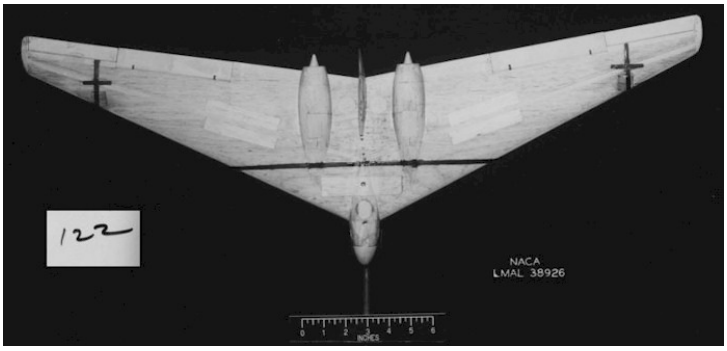
Artist's concept of the XBDR-1 in-flight.



1/17-scale wind tunnel models of the XBDR-1 with alternative intakes

http://www.secretprojects.co.uk/forum/index.php/topic,10838.15.html?PHPSESSID=amm22pufktg5p5dpbp0v29qib2

https://crgis.ndc.nasa.gov/historic/20-Foot_Spin_Tunnel_(645)_Models_and_Tests_N-Z#XBDR-1



Bill

Mitchell Wing Threads

Guys

Wondering why some of the leading edge foam in my U-2 kit have a taper (see picture)...Or look in my U2 folder.

Herb

(ed. – Based on other pictures I have seen these appear to be the leading edge foam rib that would have a taper due to the wing layout.)

I do not wish to appear insensitive, but the MW, wing picture indicates a taper.

Think about building a balsa wood RC sailplane before building your MW ???

Curt

I have just recently built the wings for a J3 Kitten and have a set of wings to build for an Airbike

At 73, I have a bit more trouble with visualization .. is my excuse...

I rather thought the build pictures did indicate a taper...I have the plans but not any sort of build manual...

This kit was factory made and the foam seems all precut...

I did build a balsa glider back in 2002...just before you were born...:-)

Herb

(ed. – I have included a couple of pictures I found in the Yahoo Groups photo archives. Not sure who the aircraft belong to due the limited information attached to the photos. I find it interesting more U-2s have been or are being build in foreign countries.)

Let's Take A Fresh Look At Ultra Light Airplanes

By Al Backstrom (EAA 1162)

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IN WATCHING EAA action from almost the beginning, it seems that we have come just past a half cycle. Most early homebuilts were adaptations of the simple light plane designs of the twenties and thirties modified for a 65 horsepower engine. From this we have evolved to sophisticated airplanes that rival the complexity of current production aircraft of the same weight. I would not argue that these are not good airplanes but some of us in EAA should look into the possibilities of really flyable ultra light airplanes. These airplane designs should be based on currently available materials and equipment and not another rehash of what has been done in the past. I do not mean to detract from any of the excellent efforts in this line, such as the PL-4, but I feel that these are only a good start in the right direction.

I think we have a need for airplanes that can be built for a nominal cost and that can be operated economically. At best our airplanes of today can be described in one word — expensive. We should also be thinking of the future airplane and operating costs. With our current energy shortage, taxes, and inflation it is not unreasonable to expect that we may be paying a dollar a gallon for aviation fuel before long. For the same reasons we cannot expect the cost of buying or building an airplane of current design to do anything but go up.

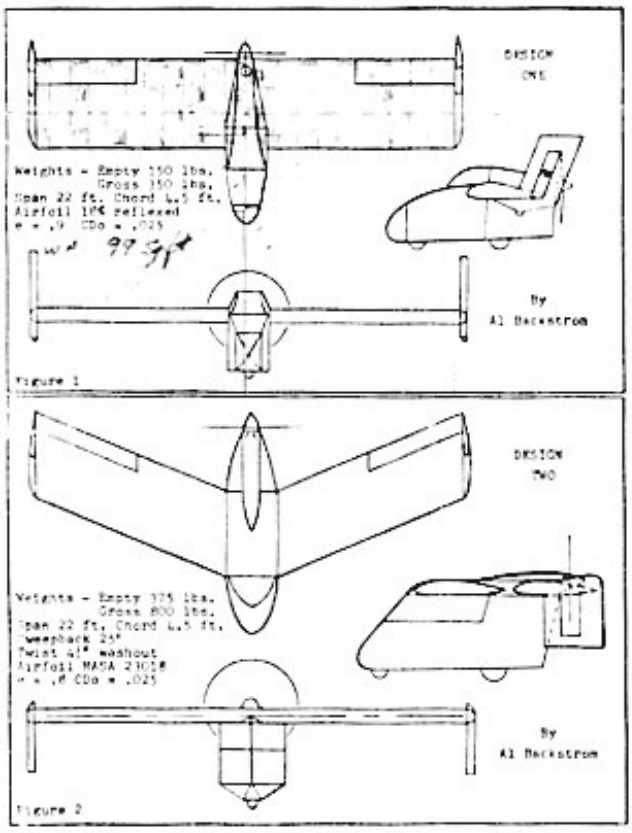
To achieve an airplane that is low in initial cost and operating expense it is necessary to look at a finesse approach rather than the brute force method often used in the past. Airplanes built on this approach must have:

1. Minimum weight — all materials for construction are basically purchased on a dollars per pound basis.

2. Low aerodynamic drag — except that unnecessary weight should not be sacrificed to reduce drag.

The end result of these two difficult objectives will be airplanes that will fly well on minimum power.

Let's see how we might obtain these objectives with items that are available today. In trying to obtain a low weight it must be remembered that any unnecessary weight added has a magnifying effect on the final gross weight of the airplane. The largest single item in the empty weight of a small airplane is the engine. Low powered and low weight aircraft engines are not available. Automotive engine conversions are excessively heavy for the power, except possibly the VW. Fortunately, there are available some two cycle air cooled engines built for go carts and snowmobiles that offer good power to weight ratios. These engines do have high specific fuel consumptions when compared to a good four cycle engine, but their low weight should allow a smaller lighter airframe so that the end product would favor these engines. Hopefully, the Wankels for snowmobiles may offer a better compromise in a few years.



A light weight airframe must be built from high quality materials. For our purposes this means aircraft structural materials. These are not cheap so let's look at how to minimize the quantity of material. This can be done by making parts serve more than one function where this is possible. All unnecessary parts must be eliminated. You might look at it by thinking "if it ain't there, I don't have to build it, it has no weight and no drag". The readily available light weight construction materials today are aluminum sheet, steel tubing, and dacron fabric. A steel tube fuselage of minimum tube size and a few fairing strips covered with dacron fabric is very light. Sheet metal wings and tail surfaces can be kept light by using fabric covering where strength is not required. Wing spar weight can be kept low by nesting bent angles for spar caps. The angle sections can be nested for the required root strength and individual angles cut off outboard as the wing bending load reduces.

(Continued on Next Page)

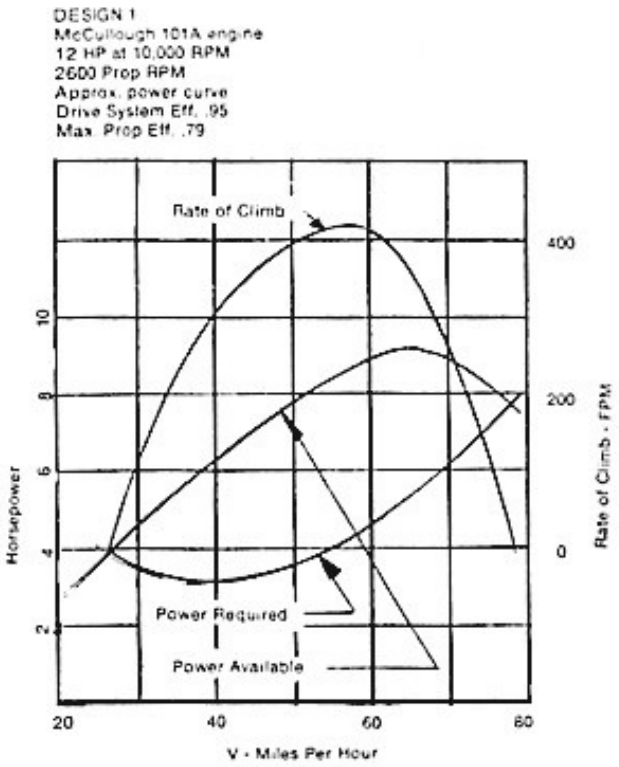


Figure 3

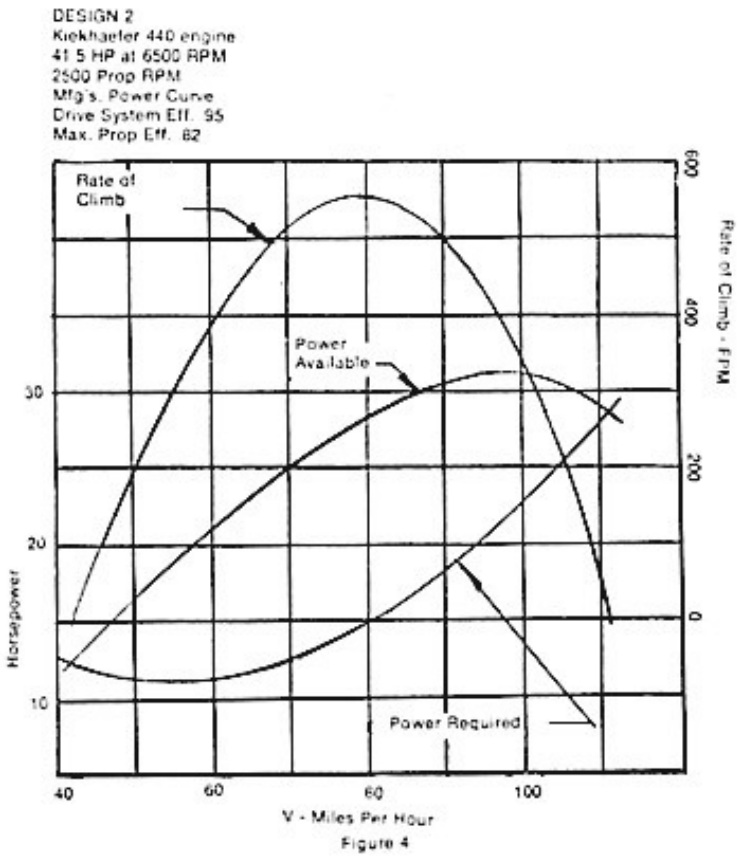


Figure 4

ULTRA LIGHT AIRPLANES . . .

(Continued from Preceding Page)

Well, we have some sketchy ideas on keeping the airplane weight down but we still have the drag problem. It will be of little use to build a light airframe and then use all the power available trying to drag it up to flying speed. Put your helmet and goggles back in the closet, and forget the wind whistling in the struts and wires. Drag items such as these can't be tolerated in an airplane that is to fly well on low power. What we can look at since we won't be Mach critical is thick cantilever surfaces. We can also resume the approach of leaving off what we can fly without and making parts serve more than one function.

These rudimentary thoughts mean nothing unless they can be expanded to buildable airplanes. To illustrate what might be done I have made two design studies. The airplanes both rely heavily on my sailplane experience and a mild conviction not to get too confused by previous ultra light designs. Let's call them simply Design 1 (single place) and Design 2 (two place). The aerodynamic configuration of Design 1 is from my Plank sailplanes. The engine is the McCullouch 101A with installation details similar to Mr. Hovey's Whing Ding. Just to keep things even on the borrowed ideas, Design 2 uses the aerodynamic configuration developed by Mr. Waterman on his Aerobile and the engine installation is based on one I am designing for a single place Plank using the Kiekhaefer Aeromarine 440.

The structure of both designs is intended to be mixed, as discussed earlier, with steel tubing pods, sheet metal wings and fins. Bonding and riveting of the sheet metal would be used. The landing gear is the permanently retracted sailplane type with a steerable nose gear. I have flown this arrangement on the Nelson Hummingbird powered sailplane and it works very well once you get accustomed to taxiing with a wing down. The ground handling is like a tricycle gear. The wheels and tires would be industrial units with an external band brake on the main wheel.

The control system uses elevons for pitch and roll control. Directional control is provided by drag rudders on the tip fins. The tip fins should provide some end plate effect for increasing the effective aspect ratio in addition to being required for stability.

Both designs are intended for sailplane type disassembly so that they can be stored at home in the garage when not being flown. Naturally the designs are compromises. The constant section wings give a weight and drag penalty but they are easier to build. The abrupt corners on the pods are not the lowest drag shape but they will be light and relatively easy to build. The single cylinder engine on Design 1 was left exposed for cooling and simplicity. Since the Kiekhaefer 440 has an integral cooling fan, a buried installation was used on Design 2. The two design studies wound up the same size because Design 1 has only 12 horsepower and almost a 30-1 power to weight ratio. Design 2 has a 20-1 power to weight ratio so a higher wing loading could be used.

The designs and performance information are shown in figures 1 through 4. Performance calculations were made using simplified methods so they can be considered to have an accuracy of plus 0 and minus 10%. The power available curves were based on the efficiency obtainable from a conventional fixed pitch wood propeller.

Even taking 10% off the performance shown it appears that really flyable low cost airplanes can be built. Those of us in EAA who are experimental or development minded should try the ultra light approach.

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

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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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