

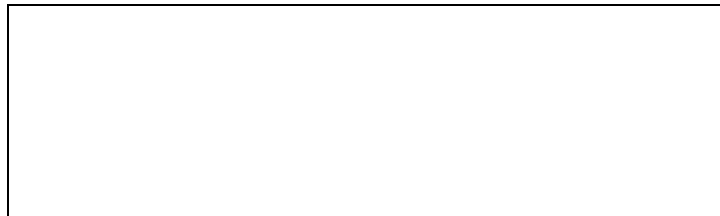
T.W.I.T.T. NEWSLETTER



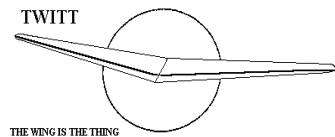
Klingberg Wing x 2: Built from Klingberg plans blown up twice. Source: <http://www.chrisgood.com/uav/airframe/prototypes.html>

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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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

This month's newsletter will be primarily dedicated to the memory of our long time member and friend Bruce Carmichael. As some of you already know from my recent e-mail, Bruce passed away on August 4th with his family at his side.

Between information provided by the aviation community, many of his friends and a little Internet searching I have put together biographical and historic information about Bruce that should be shared with out members. I have also used this in the August issue of Sailplane Builder since Bruce was an integral part of both associations. So some of this will be duplicative for those of you subscribing to both newsletters.

As you will see Bruce had a varied and interesting career and was involved in a myriad of projects from the sea to the sky. He wrote a number of books on homebuilding and specifically on laminar flow. We are not sure at this point in time whether they will continue to be available for sale and/or who would be responsible for additional printings if the need arose. I will keep you informed as I learn more on this subject.

Bruce was a once in a lifetime gem and will be sorely missed. Gavin Slater and myself attended his memorial service on behalf of TWITT and expressed our condolences to the family. It was a very nice service and reflected well on Bruce's life and accomplishments.

Bruce H. Carmichael
January 20, 1924 – August 4, 2015

On August 8th, Murry Rozansky told us he had been notified that Bruce Carmichael had passed away peacefully on August 4th with his family by his side. There was a memorial service for him on August 15th that was attended by Murry, Al Bowers, Gavin Slater, Doug and Floyd Fronius, and myself representing the SHA/ESA aspect of Bruce's life.



Since I posted the initial announcement to the various aviation mailing lists I have received a number of long and short messages about that individual's memories of Bruce and how it impacted their lives. For me I will always remember his proud claim of being the only designer/builder with "all charts, no parts".

Bruce gave the Barnaby Lecture in 2000 and was awarded the OSTIV Plaque with Klemperer Award in 2014 presented to him at the 2014 SSA Convention in Reno, Nevada. He was the owner of a Schweizer SGS 1-26A and holds "C" Badge #1074.

At his retirement party, Bruce paraphrased the lines of a 1960 folksong, "Clouds":

*I've looked at flow from both sides now.
 It's mostly turbulent, but still somehow,
 It's the laminar cases that I recall and,
 The quest for them has been a ball.*

Bruce H. Carmichael was raised in the upper peninsula of Michigan, to a mining family. He was introduced to technology at a very early age. He received his Bachelors Degree in Aero Engineering from the University of Michigan in 1944.

Following Naval Service in World War II, he spent over 40 years in industry, working as an applied aerospace and hydrodynamic engineer, specializing in drag reduction with emphasis on both natural and artificially stabilized laminar flow. He assisted leaders in the field such as Dr. August Raspet, Dr. Werner Pfenninger and Dr. Max Kramer.

Bruce has extensive experimental experience in low and high-speed flight test, low turbulence wind tunnels, water tunnels, towing basins, deep lakes, and the ocean. He served as Aerodynamics Chairman for the SSA and has been the Sailplane Homebuilders



Association (SHA) President for three terms. He has published technical papers for *Soaring*, *Swiss Aero Review*, *Technical Soaring*, *Sail plane Builder*, *Sport Aviation*, *Kitplanes*, the *TWITT Newsletter* and *French Experimental*.

Bruce participated in the transfer of laminar drag reduction technology from the sailplane community to advanced power planes. Bruce authored a unique technical book "Personal Aircraft Drag Reduction" and also one on ultralight and light self-launching sailplanes. He owned and flew a Schweizer 1-26 sailplane in the 1950s and 1960s.

Bruce is married and has three grown children, and one grandchild. Hobbies outside of soaring include mountain hiking and aviation history.

(<http://www.reactionresearch.com/aircraft/carmichaelbio.htm>)

Bruce worked in the aero team at Vought on the F8U Cutlass and he was proud that the aircraft was first to sustain Mach 0.9 in level flight.

Among his many publications on soaring flight are "What Price Performance" (1954), "...One Foot per Second Sinking Speed," (1962), and "Key Developments in the Evolution of Soaring" (1998). Bruce collaborated with leading visionaries, to name just one: Dr. Paul MacCready.

Phil Barnes

This biography was prepared by Al Bowers and others and submitted to OSTIV. My thanks to Bertha Ryan for providing this great write-up.

Bruce Carmichael is known as a “*Master of Low Speed Aerodynamics and an All-Around Good Fellow.*”

He has earned the affectionate cognomen of “Mr. Low Speed Aerodynamics,” having made low Reynolds number fluid flows the object of his life's work. An aviation enthusiast since 1928, he earned his Bachelor of Science degree in Aeronautical Engineering at the University of Michigan in 1944, study under Prof. Edgar Lesher. He worked for Chance Vought and Goodyear Aircraft as an Applied Aerodynamic Engineer.

Later he joined the late Dr. August Raspet's team at Mississippi State College conducting flight research on boundary layer control, continuing that work under Dr. Werner Pfenninger at Northrop. Before retiring from North American Rockwell, he worked on low drag underwater vehicles with Dr. Max Kramer.

His 43-year career has been split between analytical and experimental work in both hydro- and aerodynamics. It included test programs in low-turbulence wind tunnels, in flight, in water tunnels, water basins, deep lakes and the ocean. The emphasis throughout was on laminar flow, both natural and suction-stabilized, and on the aerodynamics of the critical Reynolds Number regime.

Bruce Carmichael has lectured at Cal Tech, USC and MIT. He has been featured speaker at National Soaring Conventions, Experimental Aircraft Association conventions and Sailplane Homebuilders Association (now the Experimental Sailplane Association) workshops. His work has been published in the IAS Journal, various NASA Contractor Reports, Northrop and Rockwell reports, *Soaring* magazine, *Technical Soaring*, O.S.T.I.V. Publications, *Sailplane Builder*, National Free Flight Symposium journals, *Sport Aviation*, *Kitplanes*, *Contact* magazine and the French magazine *Experimental*. He describes himself as a “ham-handed model airplane builder and sailplane pilot.”

The OSTIV Plaque with Klemperer Award honors a person for the most noteworthy scientific and/or technical contribution to soaring flight in recent years. The citation accompanying the award reads as follows:

For his many significant contributions to soaring technology in laminar flow research, scholarly papers, popular articles, books and seminars in recent years.

He has made information on laminar flow research, design and practical operation from more than forty years of industry and personal experience available to a wide audience through his many scholarly papers, popular magazine articles and books on ultralight gliders, sailplanes, motorgliders and personal aircraft drag reduction. In addition, he has planned, organized and conducted dozens of seminars and conferences on soaring technology which have introduced many interested people to the science and culture of soaring. He has inspired and motivated several generations of soaring enthusiasts.

(ed. – Some people were inquiring about Margie since she had not accompanied Bruce to the last few ESA Workshops he attended as he turned over his duties to Al Bowers. She was not at the memorial service on August 15th due to health issues. I found the picture on the next page on the genealogy site shown here. They were a devoted couple so it is fitting to include “their” picture.



<http://tharpgenealogy.com/getperson.php?personID=10274&tree=THARP>

(ed. – A variation of this message was read by Bruce's daughter Georgia at the memorial service.)

I became a fan of Bruce's from my introduction to soaring in the late 50s, and he has been a great friend and mentor ever since. He was a large part of inspiring me to attend Mississippi State U, and that

knowledge and those contacts are with me still. We will ever be indebted to him with his collection of self published books, collecting the seminal thinking on aerodynamic subjects. I hope someone, perhaps TWIT, should obtain the rights and keep them going to inspire future aero thinkers.

One is known by his friends, and Bruce was sought out by MacCready, Roncz, Rutan, Bowers, Raspet, Marske, Hall, Backstrom, Neimi, Schreder, Culver, Wittman and so many other similar minded thinkers. He was the keeper of a droll wit, and loved shaggy dog stories. Early in the 50s, he settled in Capistrano Beach to be between the major aircraft companies in SD and LA. With the boom and bust cycles that beset our industry, that midway locale was a wise choice as talented professionals chased jobs up and down the coast. As a result, carpools evolved from Capistrano Beach to where the employment was that year. One of his less well circulated books was a collection of those tales, which were ideal to while away highway hours.

He had a kit built Schweizer 1-26 which he flew around SoCal until he and a Pratt-Read had mid-air incident. The larger PR got away with minimal damage, but the fin and rudder of the Schweizer was folded over. Luckily, Bruce managed to get down safely, but flew seldom thereafter. We'd kid that the incident encouraged his interest in tailless craft.

Bruce and first wife Georgie stayed with us in DC, and often were my hosts in Capistrano Beach. Bruce remarked that somehow I'd show up unexpectedly at the right times ... in mid-80s to pick him up from heart bypass in LA to return him home, the evening of Georgie's passing, and just as he'd injured an ankle to take him to get it repaired. I missed this occasion.

We'll all miss his infectious grin and amazing ability to draw out obscure references that were always on point for the occasion or application. Thank you Bruce for shaping my life.

Bob Storck

Sorry to hear about this. This was one of the most approachable of all the aeronautical "greats" that I had the pleasure of meeting when living in southern California.

The only story I know is the one he told about himself, about how he discovered that he had manic-depressive syndrome (now bipolar syndrome), and the

immense change it made in his life when he checked with a doctor and got it treated. All that from passing a bookstore.

Marc de Piolenc

This is sad. I didn't know Bruce well. I only had the opportunity to talk to him a couple of times. Once at a T.W.I.T.T. meeting, IIRC after Stefanie Brochocki's presentation, he brought his car around to the hangar door and opened the trunk. We were all standing around in small groups and suddenly a large group formed around the back of his car. I assumed he had a model so I wandered over to take a look. Well it wasn't a model. It was much better! Bruce drove around with a trunk full of magic. Books, glorious self published books. And he was trading these priceless objects for scraps of ugly green paper. A few years ago I heard that he had destroyed his flying wing project, MOBA and I knew that he didn't think he had very many years left. I am richer for having met Bruce Carmichael.

Norm Masters

Bruce was foundational in the hang gliding renaissance movement. Quietly. Softly. But integral. His influence in Richard Miller's path, many others, and myself form part of Bruce's aerodynamics and hydrodynamics life. My first hang glider flight was with Bruce present and partnering on a hill in San Clemente, CA, near his home. His story is invited in part in this topic thread.

His honors have been many and are invited to be noted in this topic thread. Jack Lambie and Bruce were close friends. Bruce's son Doug Carmichael carried and flew the jib-sailed HG at the first Otto Meet in 1971; a photo of such reached then the front page of the *Los Angeles Times*. Bruce attended many hang glider meetings and listened carefully; his expertise was in deep technical aerodynamic matters. He worked some professionally in hydrodynamic kiting; he and I shared talk about such. He was an early member of Self-Soar Association, Otto member, and consultant on ultralight and man-powered projects.

Bruce just passed at age 91 years .. Wow! Thank you, Bruce, for your life, for you!

<http://www.ushawks.org/forum/viewtopic.php?f=22&t=2061&p=13496>

Joe Faust



LETTERS TO THE EDITOR

Thanks for forwarding the sad news. I may make it this Saturday for his celebration of life.

If you get a reply from Karl Sanders "out of the blue" about this, would you mind sending me his e-mail? All these years I've tried to connect with him without success.

Hope all is well with you.

Phil Burgers

(ed. – I included this in the letters section since Phil was asking a question that didn't really fit in Bruce's dedication. If anyone out there has information about Karl, it would be greatly appreciated. I imagine he has passed away some time ago, but you never know since people are living longer now.)

WUFI is a event to celebrate the 40th anniversary of Ultralights. We try to have a captain in each country to answer questions by local pilots who want to join the event. Sorry, my German is really bad.

The event is non-profit. It is just organized to make the birthday of ultralights not go by unnoticed. You can read here more about the event. I can tell you that you will have not much work to be a captain. Just answer when there is a question in German. Here is the English info page:

<http://www.daytonultralights.com/wufi-.html>

Here is a video to get you in the mood.

<https://www.youtube.com/watch?v=ODm6n3YvSvY>

If you could translate the little text in our 1 minute video, i could even make a German video for you.

(ed. – More on this from the Nurflugel messages.)

During Oshkosh i noticed the absence of ultralights. Not hard to understand ...we miss the range to get there. So, i got the idea. Why not share instead of the same airstrip, why not share the same sky??? It is all happening on 10-11 October 2015. WUFI stands for World Ultralight Fly In. We will try to organize it each

year on the second weekend of October.

Fly that day in your ultralight at the same time as others do all over the world. A kind of sharing of the same sky. We can video tape it and send the best parts of the video to me (i still need to find out how, but i will manage). I will explain how you edit your video in a soon to be made tutorial.

Goal: showing the rest of the world that flying is still accessible to the men of the street. It is not just for the very rich, it is also for the plumber, the postman, the hairdresser, ...

We will make a site soon about it, so you can register where you want to fly, at what hour and with what type of ultralight (good info if you want to form packs with others of the neighborhood, airspeed should be about the same).

Please, don't make it a protest march. It should be a positive message.

Just a few rules:1) it is for ultralights only. Hangglider or paragliders are also allowed.2) post pictures or video of your flight on the later mentioned site. We try to make a large overview of this world event.3) no commercial material may be posted
Later i will post more info about the details. We are very willing to hear good ideas about this event. All help is welcome.

PS. Help spreading the word.

PS. Soon you will find a website about the WUFI 2015 event. Probably on Facebook. Google might lead you to the form to join the event. Give us two weeks time to set that up.

I hope somebody can help us.

Keep that brain sp ...euh ...focussed on the WUFI-event,

Koen Van de Kerckhove
nestofdragons@hotmail.com

The Mid-Atlantic Air Museum has found the Arup S2 and is planning to roster it.

Norm Masters

See picture on next page.



Aviation Week has done an article on the Prandtl-M team's work.

Hope you can read this, but I think it's behind a paywall:

http://aviationweek.com/technology/nasa-studying-flying-wing-mars-aircraft?NL=AW-19&Issue=AW-19_20150727_AW-19_145&sfvc4enews=42&cl=article_1_b&utm_rid=CPEN1000000906965&utm_campaign=3292&utm_medium=email&elq2=7b940ead23b64e738bc85731dba74874

(ed. – If this doesn't work try the following from the NASA site.

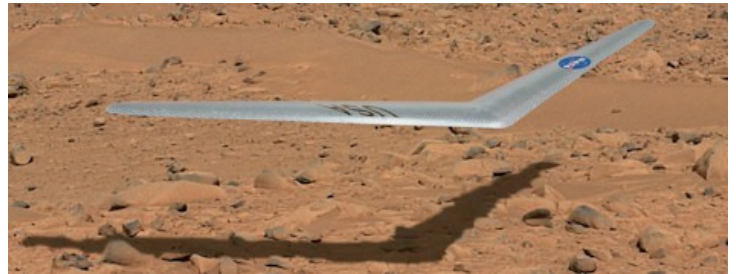
http://www.nasa.gov/centers/armstrong/features/mars_airplane.html

In short, the Prandtl-M team of Al Bowers and associates are proposing cubesat deployments of 2' flying wings - traveling at 400 MPH in the Martian atmosphere.

Is that cool, or what?

Congrats to the team for definitely thinking outside of the box!

Douglas Bullard



Source: NASA web site noted above.

Doug,

Thanks for the kind words. The idea kind of exploded on its own. The first press release went out in over 40 languages, and showed up in many magazines as well as Engadget, the Verge, and Gizmag.

Flying on Mars, what a concept...

Some days, I LOVE my job!

Al *(who sent the following text from Aviation Week)*

NASA Studying Flying-Wing Mars Aircraft

A small unmanned aircraft that would deploy from a cubesat released by a Mars lander as it enters the planet's atmosphere is being studied by NASA's Armstrong Flight Research Center. The flying-wing UAV could reconnoiter for future landing sites as it descends to the Martian surface.

The Prandtl-M unmanned aircraft is a new direction for research into an old configuration at NASA Armstrong. The design is named after German engineer Ludwig Prandtl, who developed many of the key theories of aerodynamics.

The name is also an acronym and Prandtl-M stands for Preliminary Research Aerodynamic Design to Land on Mars. This is an outgrowth of Armstrong's Primary Research for an Aerodynamic Design to Lower Drag, or Prandtl-D, a project to study a tailless flying-wing configuration inspired by Prandtl's work.

Using subscale radio-controlled models, the project set out to prove Prandtl's theory that adverse yawing of an aircraft in a turn could be overcome with wingtip

aerodynamics alone, without requiring vertical tails or rudders.

Adverse yaw occurs when an aircraft rolls. One wing generates more lift, but also more lift-induced drag, causing the nose to yaw in the direction opposite to the turn. This is overcome by adding a rudder. But flying wings are most aerodynamically efficient when they are tailless.

Prandtl developed the theory that an elliptical span load, or lift distribution on a wing, minimized the drag induced by wingtip vortices. He later calculated that, if wingspan was not constrained, a bell-shaped lift distribution would produce the least induced drag.

A bell-shaped span load changes the lift distribution toward the tips of the wing and can convert adverse yaw to proverse yaw, so when the aircraft rolls and one wing generates more lift, it also produces "induced thrust" that yaws the nose in the direction of the turn.

The work was funded by NASA Headquarters' education budget and summer interns at Armstrong were assigned to the project, for which the center built two 12-ft.-span, 15-lb. radio-controlled models of a tailless flying wing "Prandtl-D1 and-D2" to prove adverse yaw could be overcome aerodynamically.

NASA is now getting ready to fly a larger model, Prandtl-D3, with a 25-ft. span and weighing 40-50 lb., depending on payload. 'We hope to fly in three to four weeks,' says Al Bowers, Armstrong chief scientist and program manager for Prandtl-D and Prandtl-M.

As a result of the model flights, there's a big surprise coming, we think we have figured out how birds maneuver and turn without tails. Bowers says. Germany's Horten brothers, Reimar and Walter, used Prandtl's bell-shaped span load in their series of tailless flying wings, but were never able to close the design.

Earlier this year, Bowers says, NASA Armstrong engineer Dave Berger came up with the idea of deploying a Mars aircraft from a cubesat. "After the Curiosity rover touched down, the first thing it did was dump 27 kg (60 lb.) of tungsten on the surface. So why not carry cubesats as ballast?" he asks.

The 2-ft.-span UAV would be stored rolled up inside a 12 X 4-in. cubesat that would be released from the aeroshell carrying a rover to the surface of Mars. After

deployment from the cubesat, the 2.6-lb. Vehicle weighing 1 lb. in Mars's gravity would fly for about 10 min., covering 25 mi. before gliding down to land.

In Mars' thin atmosphere, the UAV would fly at 400 mph, or Mach 0.6, and "survey a fairly large area," says Bowers. The aircraft would send back high-resolution photographic maps to help NASA assess the suitability of potential landing sites for future astronaut missions to the red planet.

The Prandtl-M project began in March, with funding from NASA's Flight Opportunities program. Plans this year call for a prototype to be dropped from a balloon at 85,000 ft., simulating Mars's atmosphere, to test the autopilot and carrying a small science payload, either a mapping camera or high-altitude radiometer.

"Next year we will package the aircraft into a cubesat container and take it to 115,000 ft. on a balloon," says Bowers. The container will be dropped and Prandtl-M will deploy from the cubesat, unfold, and fly for up to 5 hr. as it glides back to a landing at the launch site.

A third mission is being discussed for 2017. The cubesat would be launched on a sounding rocket to 450,000 ft. and released to fall back into the atmosphere. At 110,000-115,000 ft. the aircraft would deploy from the cubesat as if it was over the surface of Mars.

"If the Prandtl-M completes a 450,000-ft. drop, then I think the project stands a very good chance of being able to go to NASA Headquarters and say we would like permission to ride to Mars with one of the rovers," says Bowers. The next mission opportunity is in 2022-24.

Bowers, meanwhile, says his long-term goal remains to work out how to apply the aerodynamically efficient Prandtl-D tailless flying-wing configuration to a large-scale blended wing-body airliner. "We have not done the work yet, but we have some ideas," he says. "It would just be a wing, no verticals at all."

Graham Warwick
warwick@aviationweek.com
