Radio Controlled Soaring Digest

December 2017 Vol. 34, No. 12

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Front cover: Dave Garwood flies the new Magnum Models DAW 1-26 over a low sand dune at Cape Cod Bay. Dave's "build-n-fly" review begins on page 5 of this issue.
Photo by Jan Carstanjen of Brewster, Massachusetts.
iPhone 6s, ISO 25, 1/2650 sec., f2.2

Back cover: Gerd Holzner captured this endearing shot at the 2017 GPS-Triangle World Masters. More photos from this event are shared beginning on page 21 of this issue.
Canon EOS 7D, ISO 1600, 1/1600 sec., f13, 170 mm

R/C Soaring Digest

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Managing Editors, Publishers — Bill & Bunny (B^2) Kuhlman

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R/C Soaring Digest (RCSD) is a reader-written monthly publication for the R/C sailplane enthusiast and has been published since January 1984. It is dedicated to sharing technical and educational information. All material contributed must be original and not infringe upon the copyrights of others. It is the policy of *RCSD* to provide accurate information. Please let us know of any error that significantly affects the meaning of a story. Because we encourage new ideas, the content of each article is the opinion of the author and may not necessarily reflect those of *RCSD*. We encourage anyone who wishes to obtain additional information to contact the author.

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RC Soaring Digest is published using Adobe InDesign CS6

In the Air

Wow! Immediately following publication of the 24 page November issue we received a generous number of submissions from our readers. Amazing! Thanks to all who contributed to this edition of *RCSD*!

Our special thanks to Simine Short, editor of *Bungee Cord*, for contributing two information-filled articles which include large amounts of supplemental material. "Ralph Barnaby and the Prüfling Secondary Glider" includes extensive excerpts from Barnaby's 1930 book "Gliders and Gliding," along with additional photos from Simine's personal collection. "No engine landing in a Piper Cub... ...literally" by Robin Reid originally appeared in the Fall 2017, Volume 43 No. 3, *Bungee Cord*. Reprinted in this issue beginning on page 71, the article as presented here features several additional photos provided by Simine which did not appear in the *Bungee Cord* presentation.

Simine Short and Neal Pfeiffer are editors of the English translation of the German classic “Werkstattpraxis für den Bau von Gleit- und Segelflugzeugen” by Hans Jacobs and Herbert Lück. This English language volume, "Workshop Practice," was reviewed here in *RCSD* (Sept. 2016) and is available from the Vintage Sailplane Association <http://www.vintagesailplane.org/>. What a great Christmas gift!

Thanks also to Curtis Suter for the cloud photo which appears as the background to the Contents pages. This photo was shot north of Sheridan Wyoming at 15,000' or so on descent. That's a Cessna 340 wingtip at the bottom left of the image.

Time to build another sailplane!

DAW 1-26 2 meter

Kit review and flight report

Dave Garwood, dave.garwood.518@gmail.com

Three DAW kits 1-26s built over the years by Lou Garwood, Joe Chovan, and Jim Harrigan. Fourth is the Magnum Models kit built by Dave Garwood. This is a New York Slope Dogs certified "Must Have" sailplane.

The Dave's Aircraft Works (DAW) Schweizer 1-26, kit designed in the 1990s by Dave Sanders of Capistrano Beach California, is back in production, now kitted by Larry Blevins at Magnum Models in Knoxville, Tennessee.

In the 1990s Dave Sanders designed a semi-scale Schweizer 1-26 model for slope soaring. He manufactured EPP-foam kits under the business name Dave's Aircraft Works in 1.5 meter and 2-meter wing spans.

The 2-meter version (actual span is 71 inches, or 1.8 meters) became a hit, and a favorite of many slope pilots due to its exceedingly pleasant flying characteristics, including its ability to fly in so many wind speeds and lift conditions. It can hang in 5 MPH wind on a 15-foot Cape Cod dune, as well as cruise above the hawks on a ridge like Francis Peak, 5000 feet over the Great Salt Lake.

Further, being constructed of EPP (expanded polypropylene) foam, it is able to withstand getting beat up in collisions and in bad landings on tough terrain.

The 2-meter 1-26 became a New York Slope Dogs "must have sailplane" in the 1990s when we discovered its impressive ability to fly in highly varied lift conditions, and we liked the toughness of the EPP foam.

When the builder makes split-wing and removable horizontal stabilizer modifications, its ability to pack small makes this plane easy to live with over the long run. Thus modified, it can fit back into its original kit box for shelf storage or slope safari vehicle transport.

There came a time when Dave Sanders stopped making kits, turning his attention to architecture school and playing in a band with his sons. Ed Berris of Sky King RC Productions in Minnesota made the DAW 1-26 kits for a few years, but alas and alack, Sky King stopped production also.

But the affection for the DAW 1-26 design and the desire to have the kits available remained, and now Larry Blevins at Magnum Models has opened a production line for DAW 1-26 kits, and with the Dave Sander's approval has made these improvements to the kit:

1. Carbon fiber tube spars replace the basswood spars to save weight.
2. The Magnum Models ingenious spar joiner design makes it easy to build a split-wing model.
3. The fuselage is shipped split lengthwise for component accessibility during construction.
4. The fuselage has a carbon fiber tube stiffener fuselage installed at the factory.
5. The fuselage has been widened 3/4 inch for appearance, and ease of installing internal gear.
6. The nose has been lengthened one inch, reducing the nose weight needed to balance the airframe. This helps compensate for the heftier, rounder, more scale-looking fuselage.
7. You may order your kit with the rounded tail of early versions (A, B, C models), or the squared-off swept tail of the later versions (D, E models).
8. As with the original design, with split wing and removable-stab modifications by the builder, the completed model fits back into the original shipping box for easy transportation and storage.

DISCLAIMER

Let it be known that I am a personal friend and an old flying buddy with Dave Sanders. I have flown with him at Laguna Niguel and Cajon Summit in California, and he has trekked to the east coast to fly at Mount Greylock, and Cape Cod in Massachusetts.

Further, I am a personal friend and a great admirer of Larry Blevins. We have flown together probably ten times at the Midwest Slope Challenge in Lucas, Kansas. Larry and his wife Darla are core supporters of the MWSC and I cannot thank them enough for their time and treasured contributions to that long-running event. Further, I've been in love with the DAW 1-26 design since about 1995.

Knowing this background, would I exaggerate how extremely groovy this sailplane is? No need to. All you need know is that over the last 20 years, four sailplanes have been nominated for the New York Slope Dogs "Must Have Sailplane" designation and only one was voted in. Most of us will not leave for the slope without a DAW 1-26.

BUILDING

This kit is for builders, those who enjoy their time at the building bench. The Magnum Models kit uses Dave Sanders' original instructions, and Larry Blevins has made the document available on his website so you can see in advance and in detail what you are getting into.

I have built five DAW 1-26s, and this one took me 12.25 hours to build the airframe, and another 5.5 hours for taping and covering, for a total of 17.75 hours for construction and finishing.

For those who have built a "foamie" and are familiar with shaping the EPP foam, installing the control system components, and covering with low-temperature film, there will be no surprises. If this is your first EPP foam model build, you have a project ahead, but chances are you'll succeed, and be happily pleased with your results.

The original instructions do a fine job of explaining how to build the wing halves by mounting the wing spars, mounting the sub trailing edges, sanding the leading edge, applying filament tape, and shaping the ailerons.

Two differences in the Magnum kit from the original DAW kit: carbon fiber tube spars replace the basswood spars, and there is a carbon fiber tube stiffener in the fuselage. The wing cores have been properly cut to receive the CF spars precisely, and the fuselage tube is installed at the factory. The basswood sub-TE is unchanged. I used polyurethane (PU) glue (White Gorilla

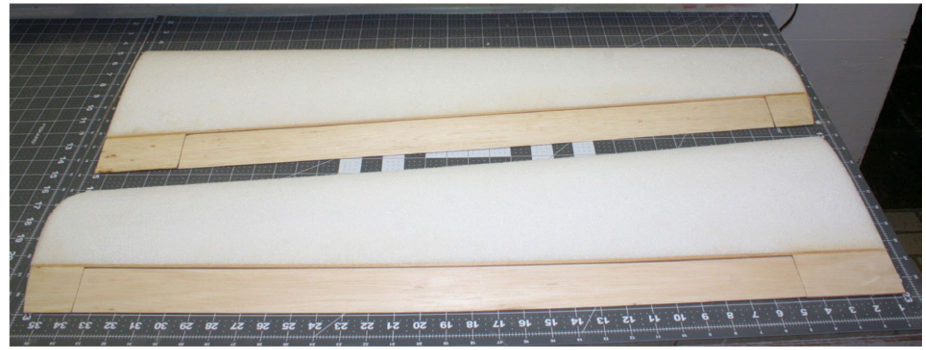
Kit contents: Wing cores expertly hot-wire cut from 1.9 pound EPP foam, shiped in their saddles. Band-sawn 1.9 EPP foam fuselage, shipped split down the middle for access to mounting internal components, and with carbon fiber stiffener tube installed. CF tube spars, flexible snake rudder and elevator pushrods. Carefully selected balsa aileron stock. Vertical and horizontal stabilizer parts and elevator cut from select balsa. Hardware, including special brass tube wing spar joiner, and original DAW 1995 vintage instructions on CD. (NOTE: Instructions now available online; no longer shipped on CD in the kit.)

On board components used in this build: Rudder and elevator servos: Airtronics 94322 standard servos, fitted with Kimbrough #113 Servo Savers. Aileron Servos: Power Up AS3215NG mini servos. JR Charge Switch #JRPA004. Tower Hobbies #TOWM6020 4.8 volt NiCd battery pack. FrSky V8FR-II receiver. Two 3-inch aileron extension cables.

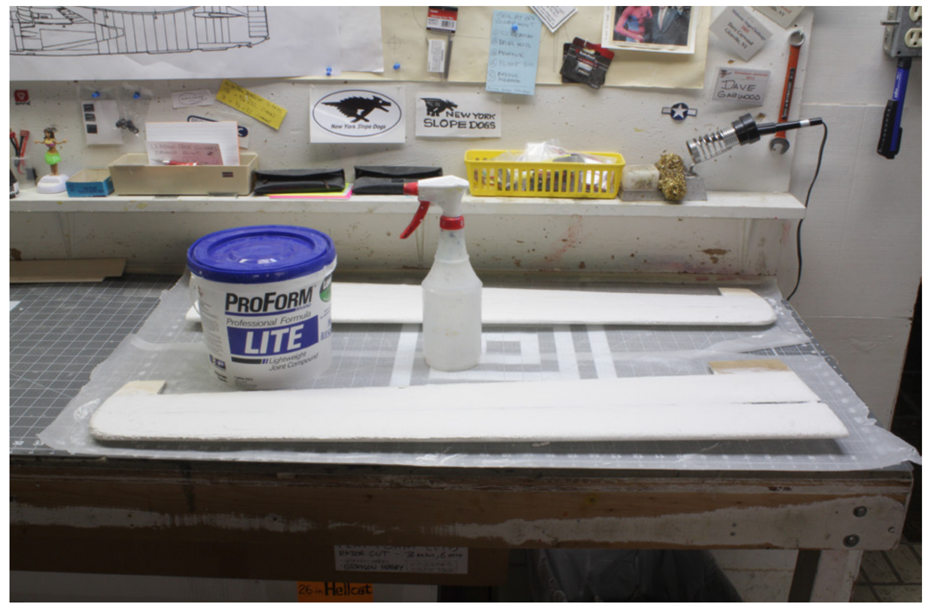
Glue) for both. The PU glue foams up and fills the nooks and crannies in the foam, and it sticks well to both the CF tube spars, and the wood sub-TE parts. I think it's lighter and sticks as well or better than the Goop glue we used in the 1990s.

For aileron servos I used metal-gear mini servos, applied strapping tape, and the wings were ready to cover. Wing construction took me about six hours of bench time with some overnight glue dry time.

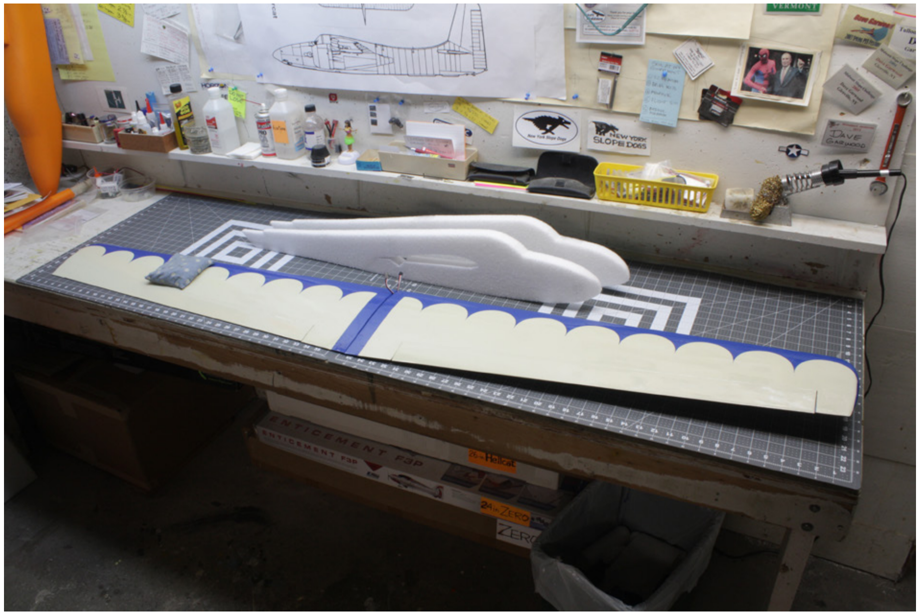
Important tip not in the 1990s instructions: make sure to avoid gluing the six inches of CF spar nearest the root, or centerline of the wing halves. If you build a one-piece wing, you'll glue the special Magnum Models double-brass tube wing joiner in place



Wing construction. Leading edge has been shaped with sanding block. Spars have been glued in their slots, Sub-trailing edge installed, aileron stock sections shaped, cut to length, and mounted to root and tip.



Wing construction. Spars have been glued in their slots. Light spackle applied to make for a smoother surface under the taping and covering. Wetting the foam from a spray bottle slightly liquifies the spackle and improves its adhesion.

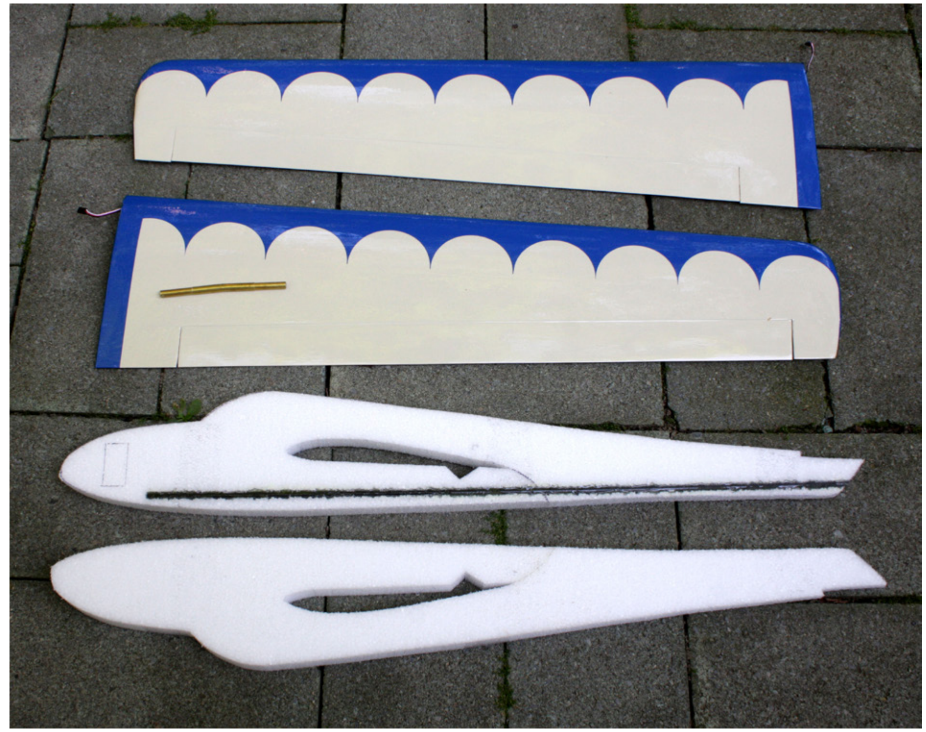


Wing construction completed. Wing halves were built to be separated for ease of storage and transport. Shown here on the bench to check the dihedral angle determined by the Magnum Models brass tube spar joiner fitting. Now ready to work on fuselage construction.

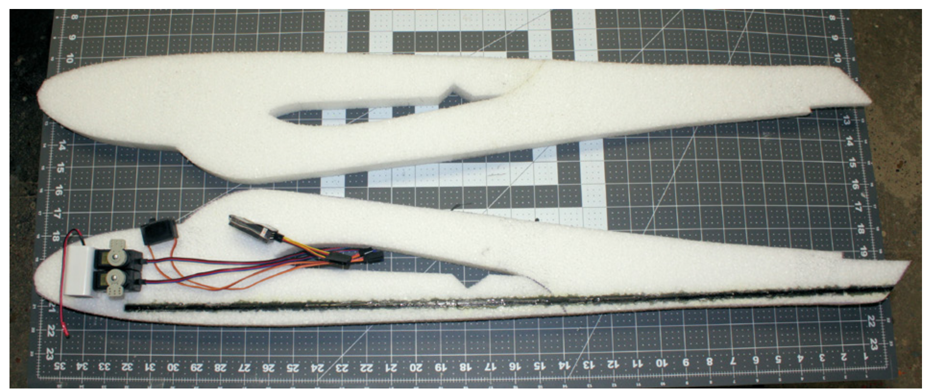
when you join the wing halves. If you build a two-piece wing that special part will remain unglued, to slip into place to join the wings temporarily for flight, and be removed after flight for re-packing back into the transport box.

The fuselage has its blocky basic shape cut at the factory and the CF tube fuselage stiffener installed. The builder locates the on-board components as is convenient, working to keep the weight forward and to provide foam around the components to protect them in a hard landing.

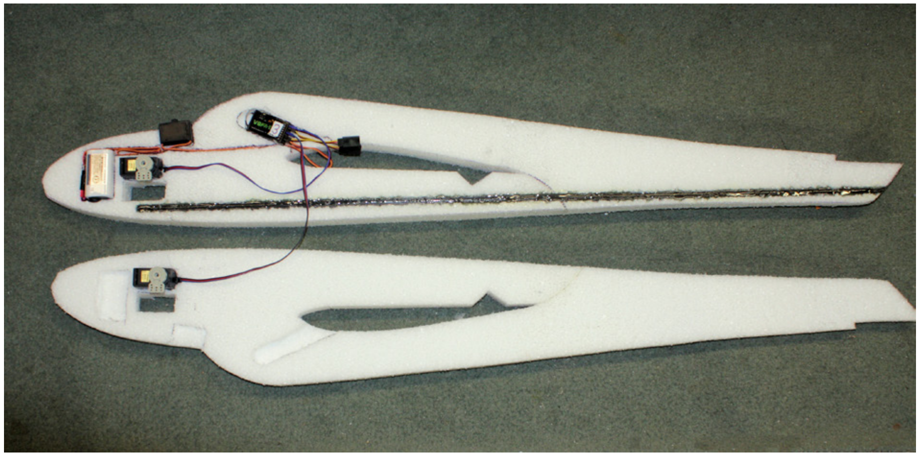
Note that in the original design, the radio and control components are glued in the foam, some quite deeply in the



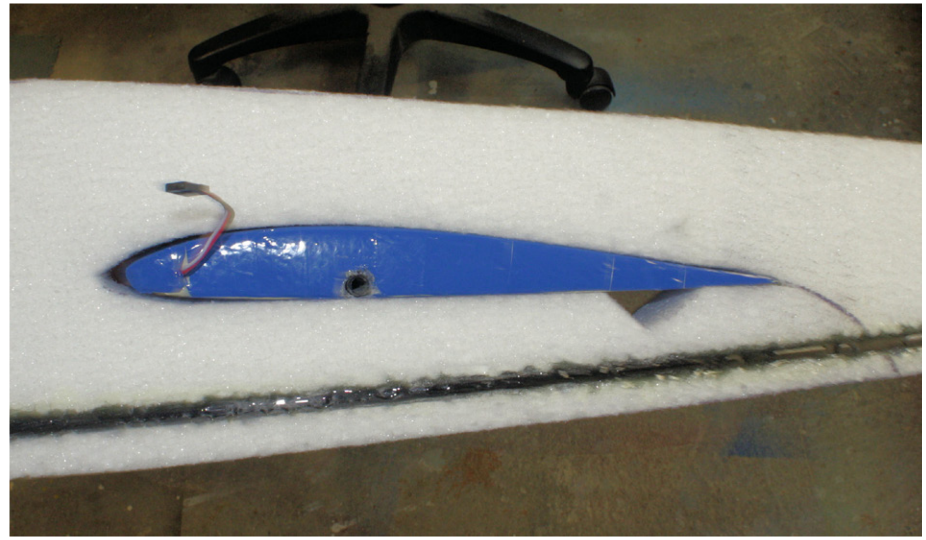
Wing construction completed. this view shows the Magnum Models brass tube spar joiner fitting, and the factory-installed carbon fiber fuselage stiffener tube.



Split fuselage showing trial locations of internal components and the factory-installed carbon fiber fuselage stiffener tube.



Slots have been cut for fuselage components. Note that for this build, the battery, switch, and fuselage servos will be clued in place, as in the original DAW design. This is for toughness, to resist camage from nose-first landings, but it does make for more work if a servor or battery pack needs to be replaced. The receiver will be accessible, sliding in and out of a slot above the wing.



Trial filling of wing half to fuselage half. Two problems noted, which will be taken care of in fuselages made after the initial run. Slot too large. Fixed on this build by installing double-sided servo mount foam, which was covered with the heat shrink covering. V-notch not needed on split-wing version. Fixed on this build by filling the notch with scrap EPP foam.

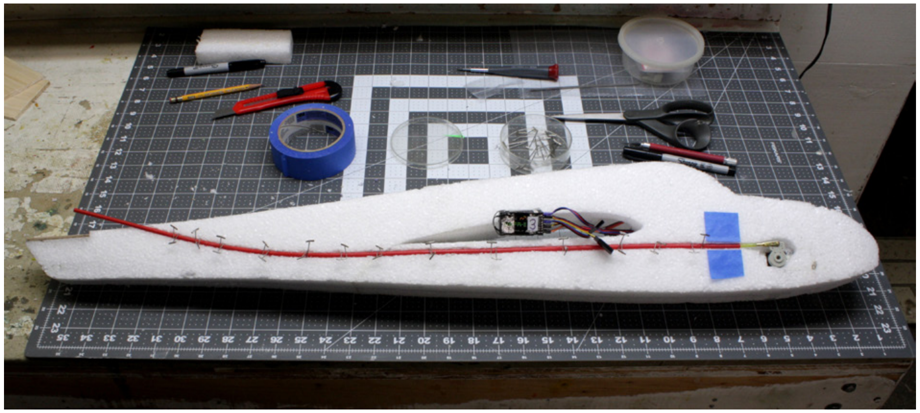
foam, and changing out a stripped servo or a dead battery pack requires some digging.

There has been discussion about methods to make the onboard components more reachable for repairs, but all the methods I have seen involved moving components rearward, say underneath a removable canopy, and thus required more nose weight to balance the airframe. To me this robbed the design of its light air performance, and stole some of the charm of Dave's original design.

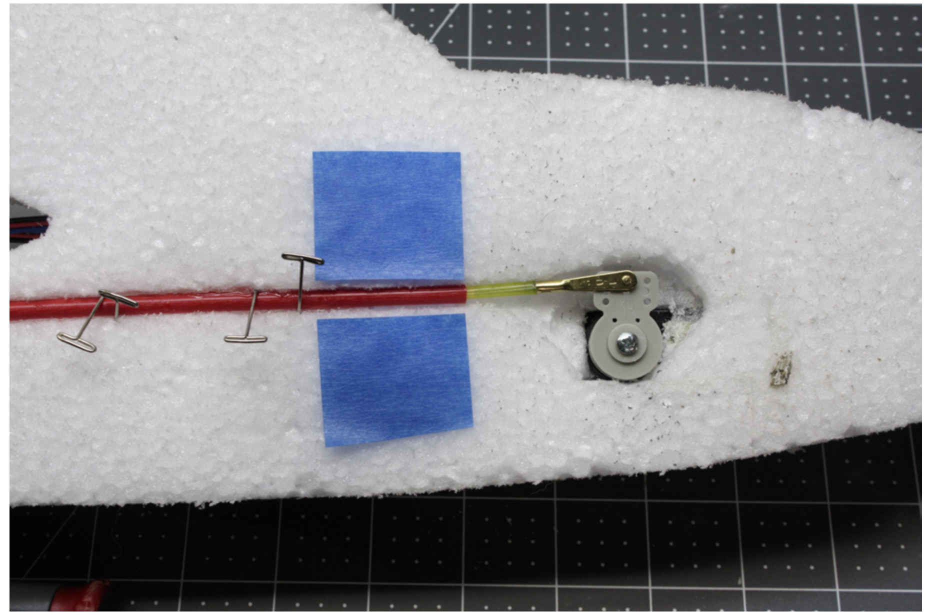
So, for this build I mounted battery, fuselage servos, and on/off switch in the traditional manner. I carved out more space in the fuselage just above the wing so a modern 2.4 receiver can slide in and out of the location where servo extension cables plug into the aileron servos.

There are people working on the problem of making the radio system components more accessible for replacement when needed, and yet not adding too much weight. I believe that when a design for accessible components has been fully developed, you'll be able to see how it's done on the Magnum RC Models website.

I joined my fuselage halves with White Gorilla Glue and let them dry overnight. I shaped the fuselage with a long blade and a sanding block. I added a bit of 1/8 inch plywood to the flat place where the horizontal stabilizer mounts to the fuselage so



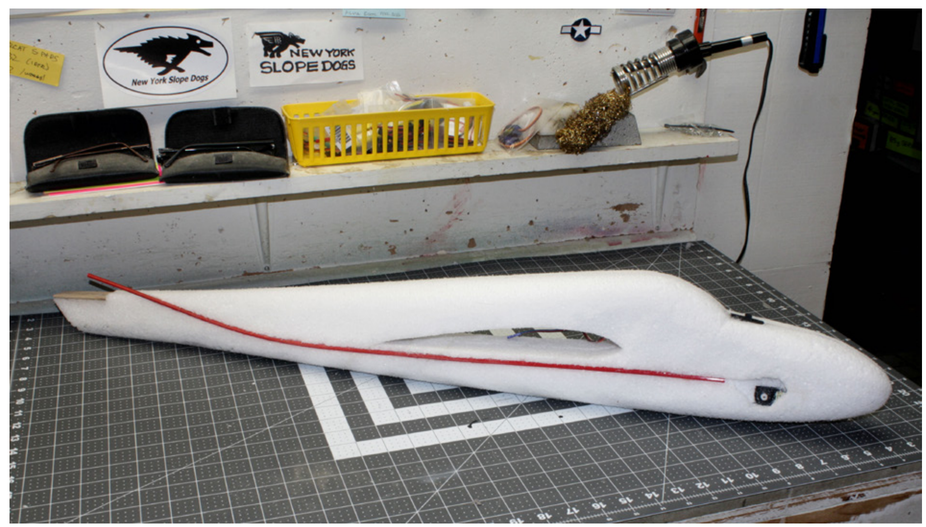
Fuselage construction. On this build, the servos and the control pushrods are mounted just below the fuselage surface, as in the original DAW design. Here they are glued in place with foam glue and pinned in place to dry overnight.



Fuselage construction. Closer view of a servo and control pushrods are mounted just below the fuselage surface, as in the original DAW design. Glue used was Beacon Adhesives Foam-Tac. Blue tape is for fore-and-aft alignment of the servo outer tube, and a "no glue zone" to make sure glue does not get on the inner pushtod.

that the horizontal stab can be attached with bolts. This (along with the two-piece wing modification) allows the horizontal to be removed for stowing the disassembled plane back into its original shipping box. Fuselage construction, including shaping the balsa tail parts took me 6.25 hours.

My wings and fuselage were sprayed with 3M 77 adhesive and taped according to the diagrams in the 1995 instructions, then sprayed again and covered with Hanger-9 UltraCote low-temperature covering film. Since the full-scale Schweizer 1-26 may be the most numerous sailplane flown in the United States today, there are plenty of color schemes to choose from. Taping and covering took me 5.5 hours, and my airframe balanced perfectly in the recommended range without the addition of



Fuselage halves glued together, carved and sanded to shape. In addition to the servo and rudder control pushrod, the mounted on/off switch, and a plywood plate for the removable horizontal stabilizer mount can be seen. Next time, I'll recess the switch.

Construction completed. Airframe covered and sitting pretty on the balance stand. Remarkably, on this build no additional nose weight was needed to balance the model.

Completed Magnum Models DAW Schweizer 1-26 2-meter. Split wing and removable horizontal stabilizer versions. Covered with Hanger-9 Ultracote HANU878 Cream and HANU885 Midnight Blue. N-number markings from Callie Graphics.

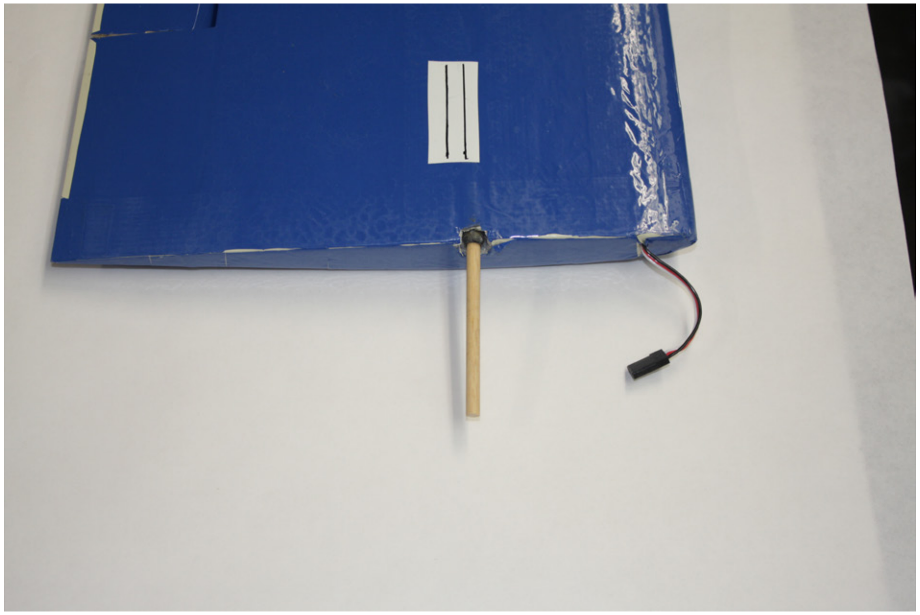
nose weight. My total build time was 17.75 hours, and my ready-to-fly weight is 39.2 ounces, 1111 grams.

FLYING

We had some fine October slope soaring weather on Cape Cod, Massachusetts, and five pilots got to fly the new Magnum RC Models kit over three days on both the Atlantic side and the Bay side of the Cape. Here are remarks from other pilots who flew the plane:

With the supplied Magnum Models brass tube spar joiner fitting, and a home made removable horizontal stabilizer mount, the model fits back into its original shipping box for compact storage and transport.

Twenty years of DAW Schweizer 1-26s. The red one was built in the 1990s from a Dave's Aircraft Works kit. The yellow one built around 2005 from a Sky King Products kit, and the current version from the Magnum RC Models kit. All three are still flying.



Old flying buddy Joe Chovan suggested filling a few inches near the root of the CF wing spar tube with a glued-in dowel to reduce the chances of the CF tube collapsing in a crash. CG range is marked on the white tape.

JAN CARSTANJEN, Brewster, Massachusetts. "It flies better than the original," he said this ten seconds into his flight, before he made his first turn.

JOE CHOVAN, North Syracuse, NY. "Magnum Models has revived a classic. The flight performance is identical as far as I can tell to the original. There are minor updates, the fuselage and tail contour for example, that are sure to be popular. This is again the one slope plane I recommend to all serious slope flyers when asked, "If you could have only one sloper, what would it be?"

BOB BERNARD, Albany, NY: "Want to sell it?" he asked this after flying the plane for less than a minute.

JIM HARRIGAN, Rensselaer, NY: "It is great to have this classic back in production."

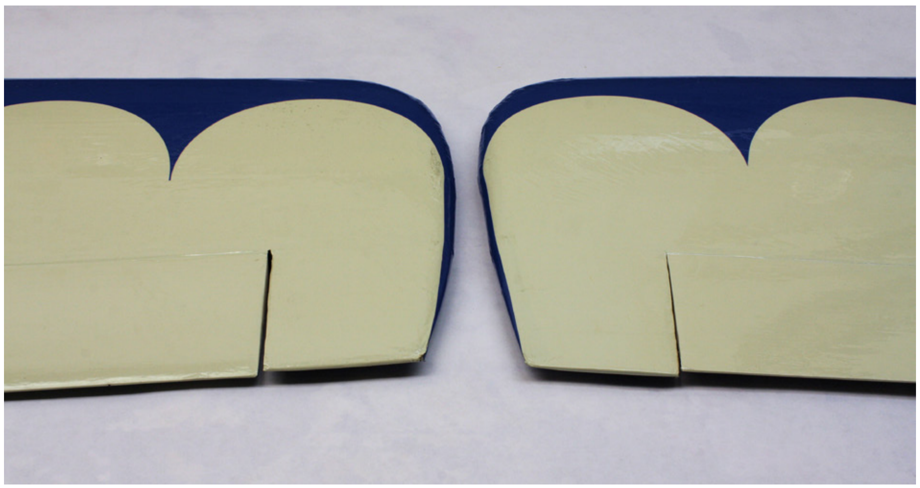
My personal experience is that the Magnum kit is just as nimble, agile, and smooth in flight as the original version. I prefer the early-version rounded tail. We have a winner with this design and with this kit. The audience for this plane will be pleased.

The rudder rounded tail has more surface area than the swept rectangular tail, and it is extremely effective. I limited the rudder travel in the transmitter after a few flights.

This sailplane responds well to mixing a little rudder to accompany aileron input, if that is your preference. The 2-meter

Dave Garwood photo

Magnum Models DAW 1-26 flown at Cape Cod Massachusetts. Photo by Jim Harrigan of Rensselaer, NY.



Wing washout, before (upper) and after (lower). In flight testing, we noticed that in a slow and tight turn the left wing would drop. This was traced to lack of washout in the left wing - a builder error, not a design or manufacturing problem. I had neglected to check wing flatness and wingtip washout after covering the wing halves. It was easily fixed in five minutes with a heat gun. For a sweet-flying sailplane, don't skip this step.

Dave Garwood and Jan Carstanjen with new and old DAW 1-26s at Cape Cod Bay. Photograph by Richard MacNeil of York, Maine.

1-26 can serve as a rudder trainer, in that it flies fine without rudder input, but it responds well, making beautiful coordinated turns when the pilot uses a left thumb for rudder input.

We did notice that on a real slow left turn, the left wing dropped rather suddenly in a tip stall. The airplane recovered quickly by letting the nose drop and picking up speed, the condition was traced to a washout problem. Turned out the right wing has 1/4 inch washOUT, as it should. The left wing had 1/4 inch washIN, a recipe for a tip stall. This was a builder problem, a final assembly step overlooked, and not a design problem. It was fixed in five minutes with a heat gun. Don't let this happen to you. Make sure your wings are perfectly flat after taping and covering or, for extra safety, add ¼ inch (6mm) of washout in order to have a predictable and sweet-flying sailplane.

Photo by Jim Harrigan of Rensselaer, NY.

CONCLUSION

For RC slope pilots who are builders and travelers, this is a “must have” sailplane.

SPECIFICATIONS

Wing Span: 71 inches, 1.8 meters

Wing Area:544 in^2, 35 dm^2

Airfoil:Selig Donovan SD 7037

Length: 39.5 inches, 1003 mm

Weight:34-40 oz., 965-1135 g

Weight (as built): 39.2 oz., 1111 g

Wing Loading:10.3 oz./ft.^{2}, 31 g/dm^2

RESOURCES

Magnum RC Models
www.MagnumRCModels.com

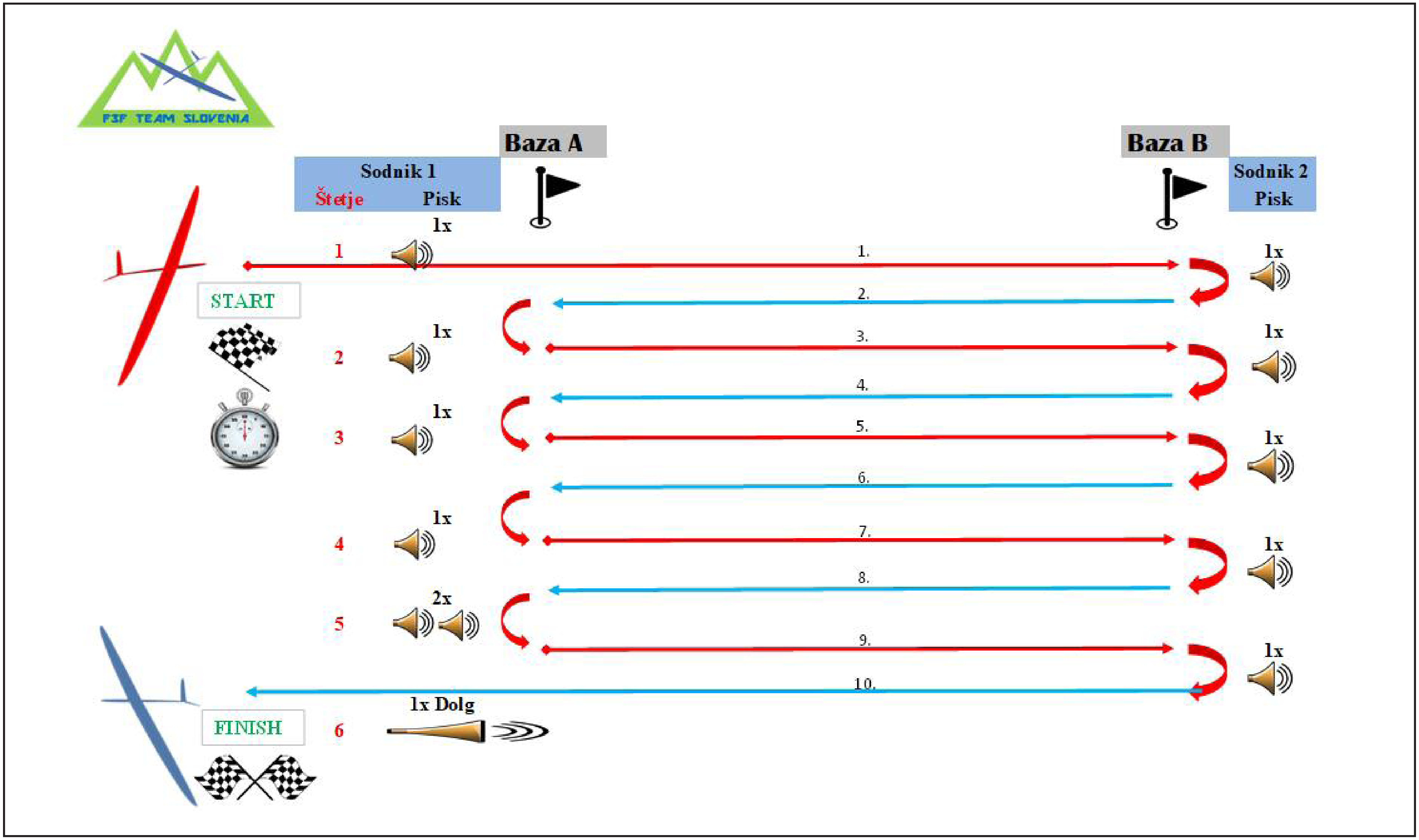
White Gorilla Glue
www.gorillatough.com/white-gorilla-glue

Schweizer SGS 1-26
https://en.wikipedia.org/wiki/Schweizer_SGS_1-26

RC Groups DAW 1-26 announcement thread
The DAW 1-26 2 Meter Is Back!
http://tinyurl.com/y97pve89

Magnum Models DAW 1-26 flown at Cape Cod Massachusetts. Photo by Jim Harrigan of Rensselaer, NY.

F3F Timing Signals



F3F (FAI slope racing) can be initially confusing to the observer. This graphic by Gorazd Pisanec should make the 10-lap course layout and timing system more clear.

Baza = Base
Pisk = Beep

Sodnik = Judge
Dolg = Long (long beep)

Impressive PSS McDonnell Douglas A-4 Skyhawk flown by John Hey at the Great Orme PSSA event April 2017. Built as part of the 2017 PSSA Mass Build from the plans by Phil Cooke, this 1/12th scale 36" span model is finished in the colours of a US Navy A-4E from VA-94 “The Mighty Shrikes” and comes complete with droppable wing stores! (See the front cover of the February 2017 edition of *RCSD*.)

Photo by Phil Cooke

Canon EOS 7D with Canon 100-400L IS lens, ISO 250, 1/1250 sec., f/5.6, 260 mm

RESULTS Class 1:3

Place	Name	Total	Score	Heat 1	Heat 2	Heat 3	Heat 4	Heat 5	Heat 6	Heat 7	Heat 8	Heat 9	Heat 10	Cance
1	Kolb, Philip	8544	1000	1000	~~758~~	1000	1000	985	867	866	826	1000	1000	758
2	Schambeck, Florian	8509	996	1000	758	~~0~~	1000	1000	956	882	1000	1000	913	0
3	Genkinger, Holger	8492	994	1000	~~765~~	907	1000	846	1000	1000	913	1000	826	765
4	Aeberli, Daniel	8249	965	~~765~~	1000	892	901	995	846	1000	789	959	867	765
5	Kunz, Andreas	8000	936	895	762	835	913	1000	1000	862	~~628~~	733	1000	628
6	Maechler, Christoph	7962	932	~~712~~	748	1000	910	905	964	931	739	765	1000	712
7	Siegenthaler, Hg	7930	928	859	1000	926	852	805	1000	882	~~652~~	813	793	652
8	Ruhmer, Manfred	7601	890	635	752	~~524~~	926	827	978	1000	765	805	913	524
9	Ritzmann, Thomas	7568	886	744	803	821	885	815	882	847	895	~~565~~	876	565
10	Pedersen, Thomas Rune	7252	849	579	647	692	895	1000	~~397~~	856	1000	770	813	397

RESULTS SLS (Self Launching Systems)

Place	Name	Total	Score	Heat 1	Heat 2	Heat 3	Heat 4	Heat 5	Heat 6	Heat 7	Heat 8	Heat 9	Heat 10	Cance
1	Kolb, Philip	8746	1000	1000	1000	~~724~~	973	1000	1000	1000	998	925	850	724
2	Müller, Stefan	8515	974	1000	~~326~~	1000	968	765	1000	994	1000	977	811	326
3	Schambeck, Florian	8369	957	810	791	1000	974	1000	1000	931	877	986	~~645~~	645
4	Aeberli, Daniel	8357	956	965	872	898	937	1000	~~777~~	1000	905	913	867	777
5	Ruhmer, Manfred	8344	954	~~545~~	977	973	845	882	952	975	1000	887	853	545
6	Schütz, Thomas	8085	924	854	895	1000	866	~~633~~	818	966	814	872	1000	633
7	Kunz, Andreas	7999	915	789	978	872	867	920	946	862	1000	~~571~~	765	571
8	Maechler, Christoph	7986	913	905	1000	828	971	867	~~733~~	866	810	884	855	733
9	Hofstetter, Jürgen	7850	898	866	767	889	896	996	880	793	905	858	~~729~~	729
10	Nyffenegger, Ueli	7841	897	845	810	824	890	888	785	810	989	1000	~~725~~	725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electronics
T-3DDD


RJ
HB-904


D-KULA
HB-9612


D-7445
RJ


ASW 17s

FLUTTER

Chuck Anderson, chucka12@outlook.com

Some sailplane fliers first experience flutter by watching pieces of their models fluttering down. Most often the pieces are stabs but it can be as severe as watching wing parts flutter down while the fuselage becomes a lawn dart. I have witnessed all of these and experienced most of them.

Searching "flutter" on the internet will bring up several examples of model and full scale flutter. <https://www.rcgroups.com/forums/showthread.php?1464103> is one example of destructive wing flutter of a model sailplane. The slow motion part of the video on page one is very informative and the rest of the thread has some good advice along with some not quite expert advice on wing flutter.

Flutter involves the interaction of aerodynamic, elastic, and inertia forces on structures to produce an unstable oscillation that can result in structural failure of aircraft, buildings, traffic signs, bridges, and model airplanes.

Flutter has been a problem for aircraft since the first power flights. Modern analysis of Langley's Airdrome wing indicated that it probably would have fluttered if it had not failed during launch. Many WWI airplanes experienced flutter, sometimes severe enough to produce structural failure. In those days, flutter testing consisted of flying at high speed and depended on pilot feedback to set flutter limits and maximum flying speed.

Modern flutter testing was founded in 1935 by Von Schlippe. His technique consisted of mechanically vibrating the structure and recording the response amplitude as a function of airspeed. The flutter speed could then be estimated from data obtained at subcritical airspeed. His method is still used with refinements to use computers, improved structural exciters, and modern instrumentation.

While searching for information about the JS1 sailplane for my article on non planar wings (*RCSD*-2013-06), I ran across the flutter analysis of the JS1 Sailplane. Anyone wanting more information about sailplane flutter testing should search "JS1 flutter."

A good history of flutter testing can be found in NASA Technical Memorandum 4720, "A Historical Overview of Flight Flutter Testing."

Even the Space Shuttle underwent flutter analysis. I got my only close up view of the space shuttle when Enterprise was carried to NASA's Huntsville Alabama center for vibration analysis. In 1978, I got a good view of the Enterprise mounted on the 747 Shuttle Carrier while shooting landings at the Redstone Army Airfield.

Wind tunnel flutter testing is very difficult and NASA has a special wind tunnel for flutter testing. The Langley Transonic Dynamics Tunnel (TDT) is a transonic wind tunnel specifically designed to investigating flutter problems of fixed-wing aircraft.

The TDT is a closed-circuit, continuous flow, variable pressure transonic wind tunnel that can test in air or in R-134a. Testing in R-134a has important advantages over testing in air, particularly for aeroelastic models. These advantages include improved full-scale aircraft simulation, higher Reynolds numbers, easier fabrication of scaled models, and reduced tunnel power requirements.

The final flight test for man carrying aircraft is flutter testing, not the power dive so popular in old aviation movies. There are a lot of good videos and stories of glider and aircraft flutter tests on the internet. One of the best is a flutter test of the Airbus A380 on YouTube <https://www.youtube.com/watch?v=s3-g9B6Fgjs>.

The closest I came to flutter testing in my years of conducting wind tunnel tests was testing an actual cruise missile wing in the AEDC 16 ft. transonic wind tunnel.

Normal wind tunnel models are designed with large safety factors to protect valuable tunnel compressors from damage from failed models. When necessary to test actual flight wings, they are instrumented and tested like flutter models.

The cruise missile wing I tested had strain gages and accelerometers to measure stress and motion. The tunnel speed and pressure were slowly increased while closely monitoring the stress and motion of the test wing for signs of flutter. Any indication of flutter resulted in stopping the test using special emergency tunnel shutdown procedures.

My knowledge of aircraft flutter has been of little value for designing my sailplanes so I depend on the advice of real experts in model sailplane design. Blaine Beron-Rawdon, Don Stackhouse, Joe Wurts, and Mark Drela are the modelers I most often turn to for advice on sailplane flutter. I have been saving all their posts on RC Soaring Exchange, *RC Soaring Digest*, and RC Groups for the last 25 years and have a large collection of their posts on sailplane design.

The following is my interpretation of their advice on flutter.

Model sailplane flutter can be divided into surface flutter (wings and tails) or control flutter (ailerons, flaps elevators, rudders, and stabs). Yes, all moving stabs can experience both types of flutter. The rest of this article will concentrate on wing flutter.

The shear center is the point where shear can act without producing a twist. For a typical model wing, the shear center can be consider as the main spar of built up wings or the maximum thickness of molded wings.

To reduce the chances of flutter, minimize weight aft of the shear center and locate heaver items ahead of the shear center whenever possible. Wing servos should be located as far forward as possible and I installed wing servos ahead of the spar when I bagged my own wings

The wing should be torsionally strong and a complete D-tube leading edge is highly recommended for built up wings. Mark Drela's Bubble Dancer is a good example of a built up wing with a carbon fiber spar. I liked it so well I used a simplified version for my LilAn sailplane (*RCSD*-2016-03).

The original Aquila was an example of how not to design a wing to avoid flutter when launching on a winch or strong high start. The original Aquila was designed in 1975 for weak high starts and low power winches. It had top leading edge sheeting and rib cap strips but omitted the bottom leading edge sheeting.

Mark Miller's Aquila encountered wing flutter while practicing for the speed event at the Denver final round of the 1976 FAI team selection. His field modification was to convert the wing to full D-tube leading edge by adding bottom sheeting over the bottom cap strips. This became known as the Miller Mod and Mark used it to win the 1977 F3B World Championship.

Many modelers use multiple piece wings to ease transportation problems and simply tape the panels together. This is contrary to the torsionally rigid requirement and the increased flexibility increases the chances of flutter.

A better solution would be to bolt the panels together and I did that long ago. Best practice gave way to convenience as I went back to tape and used less aggressive zooms. I have considered moving the alignment pin to the leading edge and using wheel collars to clamp the outboard panel to the inboard panel as I do with stabs (*RCSD*-2016-04). The weight of the alignment pin and wheel collar ahead of the torsion center would also reduce the chance of flutter.

The video referenced in the first paragraph shows what can happen when flutter loosens wing tape. Photos 1 and 2 were copied from the video tape. Photo 1 shows that the right outboard panel had separated into two pieces right after failure while the left outboard panel had separated far enough to disengage the alignment pin. Photo 2 shows the left wing as it neared the ground with the outboard panel rotated but still connected to the inboard panel.

The wing skin is a critical part of wing structure. Iron on covering should be ironed to each rib and kept tight. Slack covering is an invitation to flutter so re-shrink as necessary. Strength of the covering material is also important.

In 1978, I scaled my standard class sailplane up to 168 inch wing span to fly in the Great Race cross country event. The wing required five rolls to cover so I used cheaper Econokote and had flutter problems. I recovered the wing with heavier Monokote and flew it in cross country events for the next 20 years.

Blaine Beron-Rawdon recommended moving the wing CG forward by adding weight at the leading edge near the tip to alleviate flutter. Helicopter rotor blades also use heavy leading edges to prevent flutter. The weight doesn't have to be all the way to the tip but it should be at least 2/3 or 3/4 of the way to it. A slightly more extreme solution would be to add a mass balance boom that projects forward from the wing leading edge with a streamlined bulb of lead on the tip.

LilAn 5 was the only sailplane I designed that experienced flutter strong enough to cause structural damage. It fluttered because I didn't follow my own advice ("First Flight" in

Photo 1

Photo 2

RCSD-2014-05). I normally do an easy launch on the first flights of new sailplane until initial trimming is complete. Number 5 was an identical backup to Number 4 that I had been flying for two years so I skipped my normal first flight conservative launch and did a normal full 300 meter launch with a hard zoom. The model pitched down sharply and fluttered violently in the pull-up. The flutter was caused by doing a hard zoom with the stab in high rate.

I stripped the covering off the wing to determine why this particular wing fluttered when the prototype never gave any indication of flutter in full pedal launches during early test flights. The center wing panel had no detectable damage but the outboard wing panel sheeting had many short longitudinal cracks. Wing repairs did not solve the flutter problem so I built another wing and used the damaged wing for flutter experiments.

I laminated ¾ oz bias cut glass cloth to the outboard wing panel leading edge sheeting to add torsional stiffness. That reduced but did not eliminate launch flutter.

I taped 1½" long ¼" steel dowel pins to the leading edge of the outboard wings at the tip dihedral (Photo 3). Adding the weight to the leading edge reduced the flutter to a manageable level but never eliminated it.

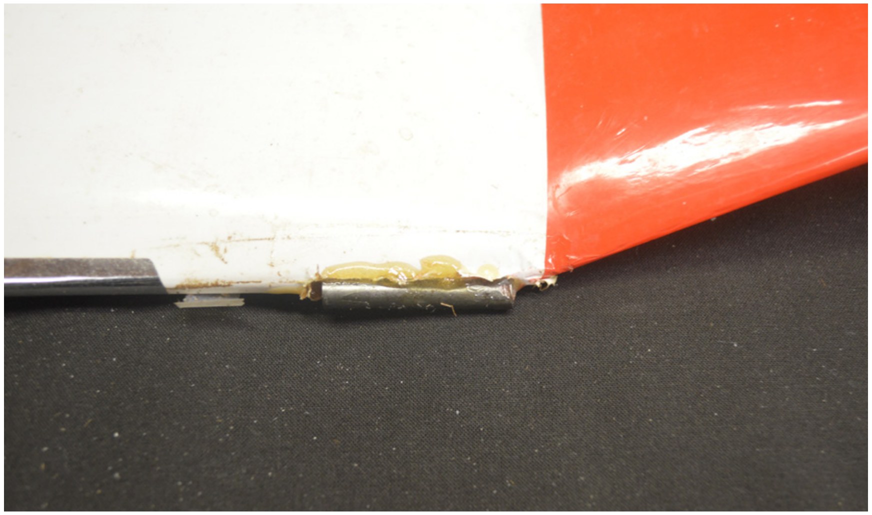


Photo 3

I decided that the center wing probably had internal damage and I still use it on an electric sailplane.

My final fix to the zoom flutter problem was to back off on hard zooms because an easy zoom launches high enough that I have trouble seeing the model well enough to take advantage of the extra altitude gained from a harder zoom.

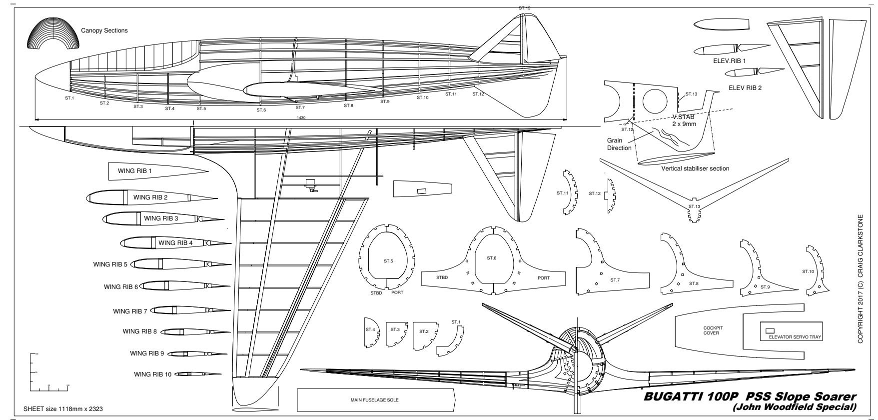
Any wing will flutter if flown fast enough so be careful to control dive speed. The Electric LilAn wing fluttered coming back from a thermal when I forgot this wing had flutter problems.

Wing flutter is a complex subject and can be caused by many factors including control surface flutter. A friend was killed when the wing of his home-built ultralight failed when wing flutter was excited by aileron flutter.

Control surface flutter will be the subject of a future article.

Bugatti 100p
1.5m PSS

Craig Clarkstone



Found on the Balsa Model Aircraft Builders Association FaceBook page < https://www.facebook.com/groups/1510169962560076/>; posted by Craig Clarkstone November 3 2017:

Finally! I uploaded the PSS Bugatti 100p to my Plans page. Sorry for the delay folks! Created especially for my friend John Woodfield. The plans were created in Rhinoceros 3D and are large - 108" X 33".

Bugatti 100p full size plans and build guide at:
<https://www.rcgroups.com/forums/member.php?u=435614>

Video of the Bugatti 100p in flight at:
<https://www.youtube.com/watch?v=CNuOuBuNcoU>

Thermal Training Notes

Marcus Stent, mstent@live.com.au

I put these training notes together to help model glider pilots improve their thermal flying skills.

The topics covered in these notes are:

1. Joe Wurts 3rd Vector.
2. Making the 3rd Vector work - Iterating the air.
3. Weather conditions.
4. Plane signs.
5. Thermalling.
6. Plane setup.
7. Returning from downwind.

1. Joe Wurts 3rd Vector

This concept is used to find thermals in windy conditions. Imagine a streamer being viewed from above. Point A is where the streamer is attached to the pole. Point B is the end of the streamer in the prevailing (no lift) wind. When the streamer moves (due to a thermal influence) the end of the streamer is now at point C. The third Vector is created between point B and point C and points to the thermal.

2. Making the 3rd Vector work - Joe Wurts iterating the air

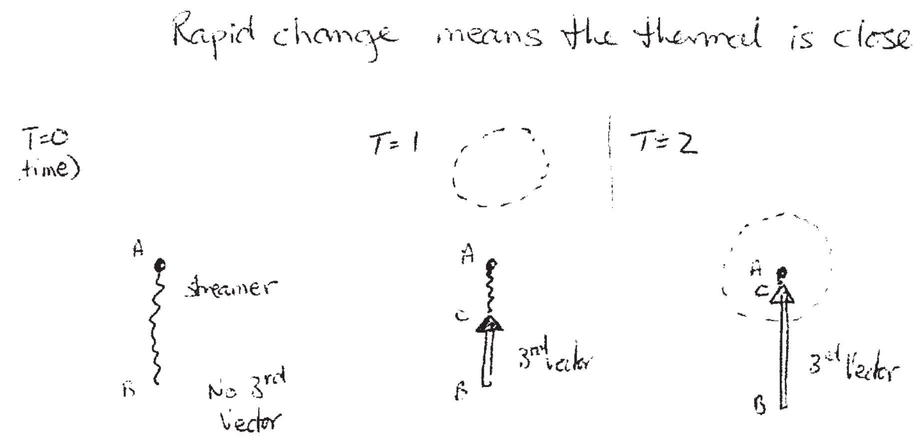
To make the 3’° Vector work you need to be constantly iterating the air (e.g. constantly feeling the wind direction changes and wind strength changes) to get a mental picture of the surrounding air. Do this while you are setting up your plane, fetching a line or talking to other pilots. You will need to learn to multitask and it takes practice.

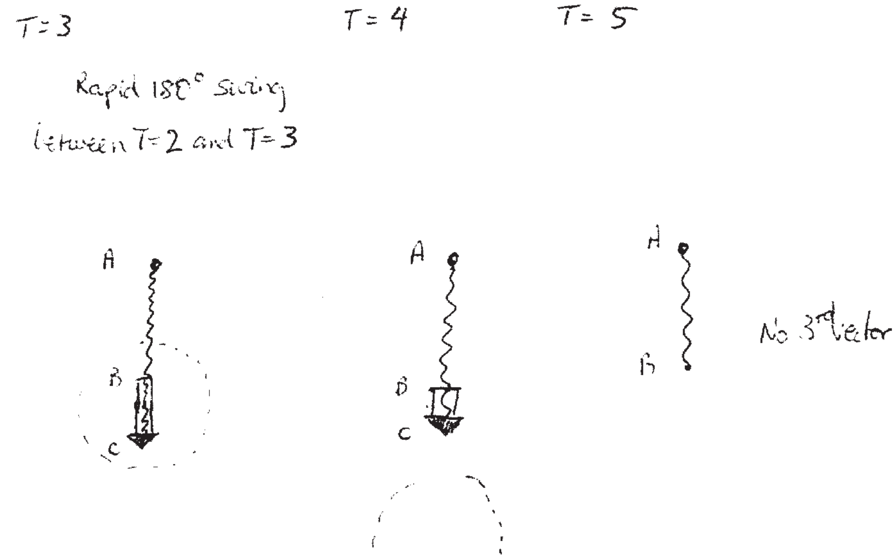
You want to feel a significant change in direction or wind speed over a period of time (min 20-30 seconds) to indicate lift or it can be just local turbulence in the air. The longer the change occurs then the stronger the indication of a thermal. Wind shifts can last several minutes with big thermals.

Every day is different and so it can take time at the start of the day to get a feel for the size and movement of the thermals. You also need to be aware of when the conditions change throughout the day to re-adjust your 3,d Vector and mental picture of the air.

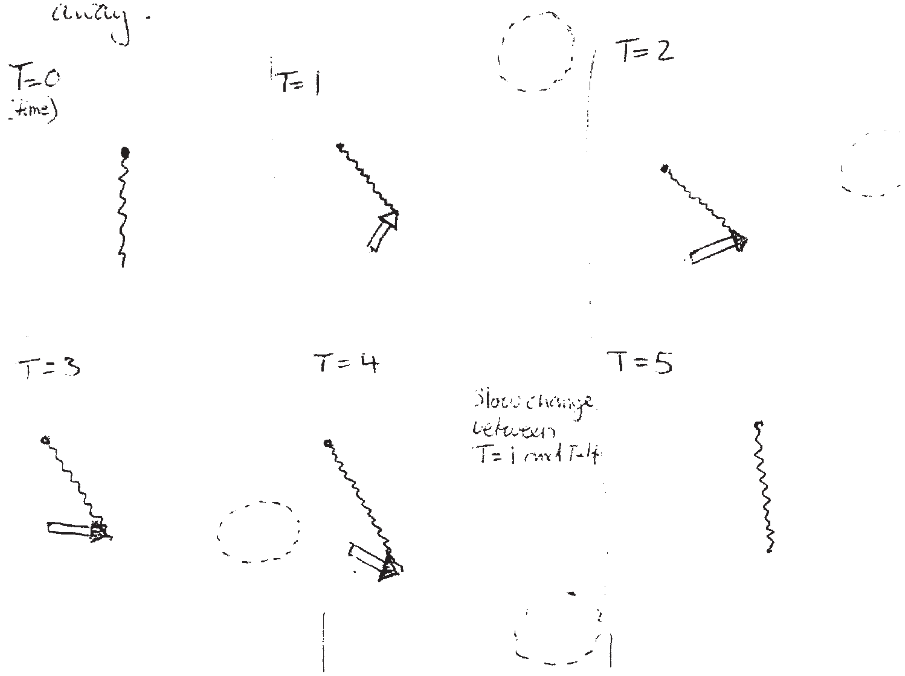
Flying a handlaunch glider is a great way to quickly validate if your reading of the air is correct or if you need to adjust your mental picture.

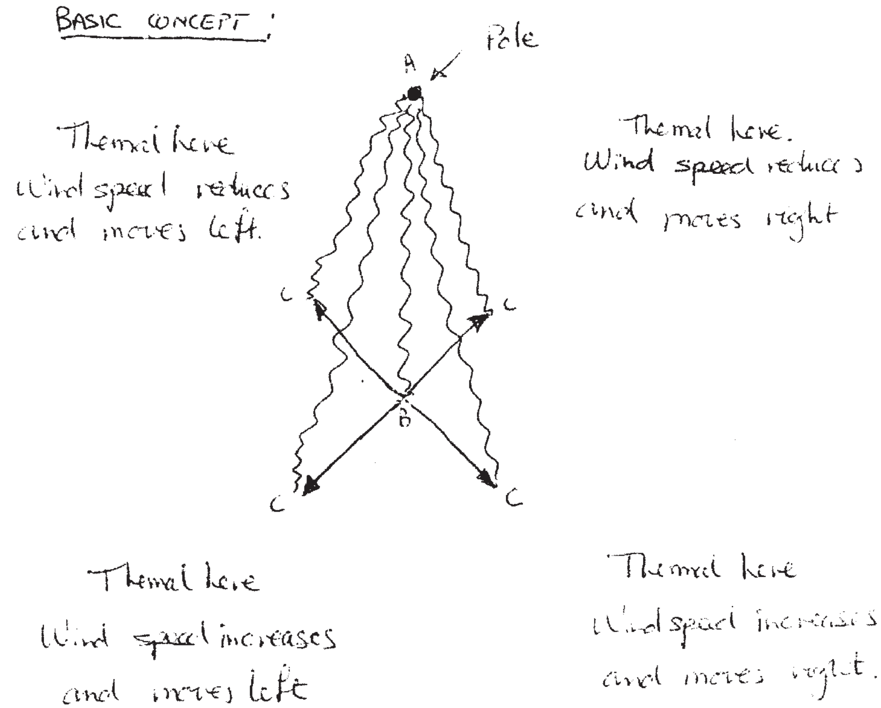
Here are some examples:





A slow change indicates the thermal is further away.





- If the thermal is in front of you the wind decreases. If the thermal is behind you the wind increases

In summary:

- If the 3rd Vector Is large then the thermal is large or very close.
- If the 3rd Vector is small then the lift is weak or it is a long way away.
- If the 3rd Vector changes rapidly then the thermal is close.
- If the 3rd Vector changes slowly then the thermal is far away.

Therefore between the size/strength of the wind shift and the rate/speed the wind shift changes, you can calculate where the lift is. This takes significant practice (a year or more), but once mastered it is a very powerful tool and gives you a big advantage in a competition.

3. Weather Conditions

I think of the air as having 4 basic types of thermal conditions and being aware of them can

change the way you fly in them.

1. Classic column thermals - These are the easiest to pick and you should be aggressive in searching for them and aggressive to punch through the sink on the return leg.

2. Corridors of air - These are more common when it is windy and are caused when the thermal is blown over into horizontal lift downwind from a thermal source. Move sideways to find the lift corridor, sit in the lift for a period of time (sometimes without circling) until it decays (watch closely). Then move sideways to find the next corridor of lift. Sometimes the next corridor can be only 100-200m away and sometimes a lot further (500m+). I call this the Jon Day waffle (multiple peaks and troughs) theory because you actively move from one piece of lift (peak) to the next.

3. Light lift or buoyant air. This is more common on light winters days (like Jerilderie) where you can see planes ‘holding’ better than others. Do not lose height racing to this patch of air because you typical don’t make back the height you lost getting there. Move slowly to the buoyant air, conserving altitude or just move downwind of the plane in buoyant air. The air can often be good at height, but non-existent at lower levels.

4. Inversion layer. This is more common on calmer winter days (like Jerilderie), but not always. This can be where you launch and there is no lift, but when you get to a certain height (e.g.50m) and then you encounter little bubbles of lift. Be careful not to circle in bumps above the inversion layer (they are typically not lift) and then be prepared to work lift when you get below the inversion layer. Also, if your bubble disappears do not waste time finding it again because it has most likely hit the inversion layer and dissipated. Immediately look for other lift as there are often more bubbles of lift a short distance away.

For options 1 and 2 be more in tune with the 3rd vector, be more aggressive and search for air.

For options 3 and 4 be more conservative and do not isolate yourself too far away from the pack as they can be very good lift indicators.

Always assessing the conditions and being able to “change gears” depending on these changes (often a few times a day) is critical to consistent flights and competition success.

There are also other thermal signs (heat sources, trees, birds, clouds, other planes, etc.) to look for when flying so keep assessing the conditions at all times. When searching for lift you should be spending almost as much time assessing the environment around you as you are watching your plane. Joe Wurts and Carl Strautins are good examples of this and are always intently looking around more than they are looking at their plane. This is a good thing to practice.

4. Plane Signs

Let’s say you have launched your plane and are now following the 3rd Vector (or other indicators) towards the thermal, but you still don’t know exactly where the lift is. This is when the plane signs become the most important indicators to finding the thermal and now override ALL other indicators.

Here is what to do:

1. Fly in a dead straight line with absolutely minimal inputs. This way you can see any effects on the plane. You can not see the effects on the plane when you are constantly moving the sticks. Just like feeling the wind shifts on your body or seeing them on the streamer, you can see the effects of the wind shifts (from a thermal) on your plane.

2. Do NOT turn when you think you are at the lift, wait for the plane to indicate lift. Human depth perception is terrible and cannot be trusted. This is the number 1 mistake most pilots make. Wait for the plane to tell you it is in lift or close to lift.

3. If you fly directly away (or towards) yourself and you see the plane crab sideways (the whole plane moves rather than turns) then it can indicate lift close by. Turn in the same direction as the plane starts to move because the plane gets pulled towards the lift, just like a streamer gets pulled towards the lift on the ground. This is my favourite plane sign for finding lift and is highly under rated. Once practiced, you can soon tell the difference between turbulence and lift.

4. If the plane speeds up (or slows down) it can indicate lift is in front (or behind) the plane.

5. If the plane speeds up and gets positive to control, it can be in lift (the lift acts on the tail and lifts the tail because the plane rotates about the C.G and therefore speeds up).

5. Thermalling

Once you have used the combination of ground signs, air signs and plane signs to find the thermal, you now need to optimise your climb rate in the thermal. Generally I start circling as soon as I encounter the lift (this is a Hand Launch hangover because you are often not high enough to explore the thermal) and then I optimise my position in the thermal from there. Sometimes I find exploring the size of a weak thermal can cause me to lose contact with the thermal, especially down low.

To optimise your position in the thermal you must do a constant speed, constant bank circle and watch which side of the circle the plane rises the most. You can then extend the circle slightly in the direction the plane rose on, and then keep circling. I tend to only move half a circle size at a time to avoid the risk of losing contact with the thermal. You want to hunt the core of the thermal over a number of circles.

If you do not do a constant speed, constant bank circle (and it is more like a rollercoaster) then it is impossible to see which side of the circle the thermal is strongest.

Generally when I am thermal:

1. I don't change the direction I am turning in the thermal.

2. I rarely move in a thermal to follow other pilots and just rely on the above technique to centre my thermal.

3. Often, the less pilot interference is in the process the better. Sometime, I just do a constant speed and constant bank circle and let the thermal pull me into the core. This then lets me concentrate on where I am going to go next.

To get a constant bank, constant speed circle you need to set your plane up properly. This takes practice and makes a huge difference to being able to optimise or stay in a thermal.

I modulate the Aileron stick to control my bank angle (as needed) and Elevator stick to modulate the speed. By keeping the speed constant, it means I pull harder on the Elevator (and use more camber) in strong lift and I use less Elevator in weak lift. This optimises my climb rate while keeping my plane at its optimal flying speed for best efficiency.

6. Plane setup

<u>Start with CG</u>

CG primarily determines the stability of the plane. This means how much a gust, turbulence, trim, speed change or stick input effects the plane. The optimal point is between having the plane unstable enough to show lift without losing efficiency from too many control inputs.

First I use the dive test to determine the level of stability I want. Trim the plane for normal slow flight and then dive the plane at 30 degrees and let go of the stick. You want the plane to do a loooong slow pull out. If it pulls out quickly then it is too stable. If it does not pull out it is unstable.

I like a plane more on the unstable side than the stable side of the dive test. I move my CG slowly back to the unstable point (no pullout in the dive test) and then move it forward slightly. I like to know how far back unstable is (and measure it), then I can get a good mental picture of how stable I am relative to this point.

Make sure you adjust your Elevator throw with CG change. This is often overlooked and I have heard pilots say they cannot control their plane at a rearward CG only to find they have huge Elevator throws from when their CG was too far forward. Drop you Elevator rates as your CG goes back. Other settings such as Aileron differential and A-R mix may need to be re-assessed with large CG changes.

I then fine tune my eg over a few months by experimenting. Basically I want my CG as far back as I can get but the plane still returns from a long way down wind in windy turbulent conditions without being unstable (e.g. stays stable when flown fast from downwind). You want a hands off (trimmed) return from downwind with minimal input (e.g. I use 60% of my Elevator throw in speed mode when compared to my thermal mode to prevent my control inputs making the plane look unstable).

Having a plane fly smoothly in this phase of the flight can add significant time to your flight.

Also, I don't change my e.g. for different conditions once I find a nice position. This way I always get the same response to lift no matter how windy or calm it is.

Also, ballast does not change my CG. If my CG is too far forward in the wind then I lose feel for the thermal and I'm not sure if I'm in lift or not. I look for consistent feel, rather than fighting a plane as the stability (CG) changes.

The more consistent the planes response is to lift then the easier it is for me to identify lift.

Mixers

Plane mixer setup is all about being able to do constant speed, constant bank thermal turns in any conditions. Nothing else!

Start by setting your A-F (Aileron to Flap), E-F (Elevator to Flap) and A-R (Aileron to Rudder) mixes to zero. Just Elevator stick controls Elevator, Rudder stick controls Rudder and Aileron stick controls Ailerons. This is because all these mixers create secondary counter effects that make setting up your plane difficult and is the reason most pilots get lost tuning their planes. Set up your mixers in the following order.

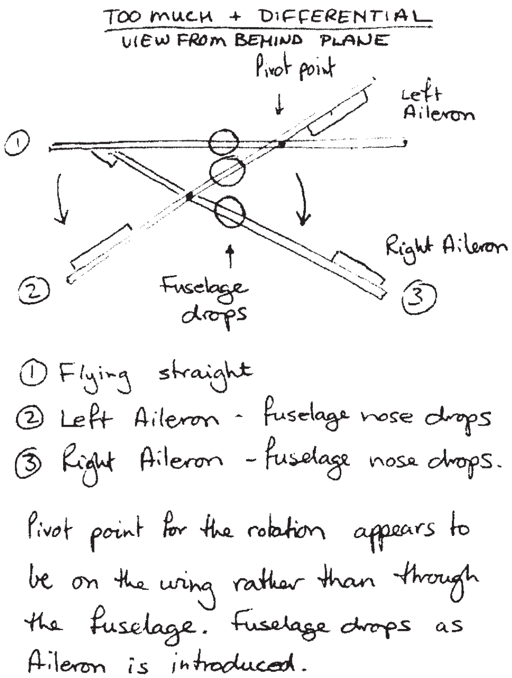
Aileron differential

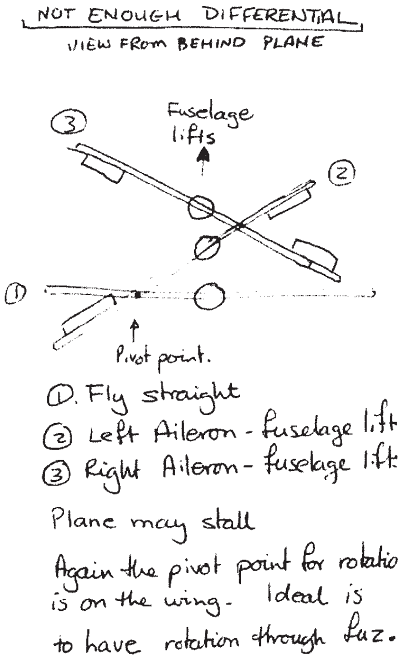
Set your plane up so 0 differential on your Tx means equal up and down throw (1:1 up:down) on your Ailerons and 100% differential on your Tx has 100% up movement and no down (1:0 up:down).

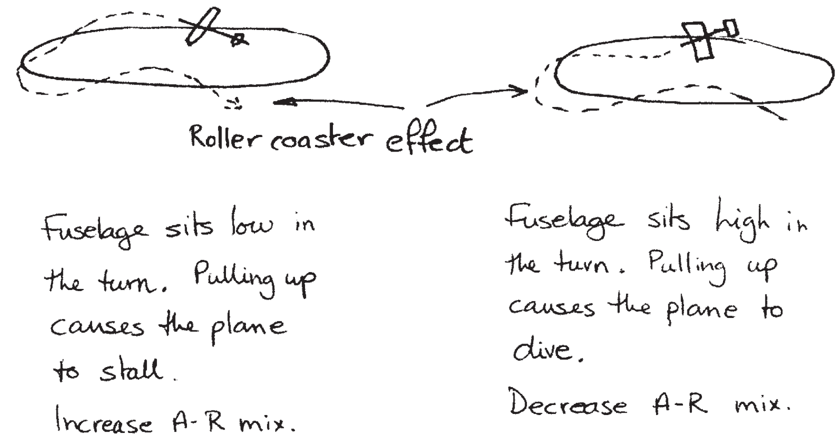
Note, some transmitters use different terminology, so adjust my notes accordingly.

Now fly directly away from yourself and move the Aileron stick slowly side to side. The nose of the plane should not rise or fall as you roll the plane. If the nose rises as you roll then increase differential (more up than down) and if the nose drops when you roll then use less differential (more towards equal up and down). I find most modern planes fly well with between 50% (2:1 up:down) and 75% (4:1 up:down) Aileron differential.

See diagram on next page.







A-R Mix

To determine the correct Aileron to Rudder mix I now fly a smooth thermal circle with just Aileron input (no manual Rudder input) and some Elevator (of course) and watch the attitude of the fuselage/ tail. If the tail sits low in the thermal turn then increase the A-R mix and if the tail sits high in the thermal turn then use less A-R mix. You should get the fuselage to follow the arc of the circle.

The reason this is so important is that if the tail sits low in the turn (no enough A-R mix) then when you pull Elevator to tighten the turn the plane wants to pitch up and stall (and you then get the roller coaster affect). You want to be able to pull on the Elevator and it simply tightens the thermal turn without any pitch up (stall) or down (dive).

A-F Mix

I use a standard 50% A-F mix so the Flaps move half the throw of the Ailerons. It means you use less Aileron throw for the same roll rate (because your Flaps are now helping the roll) and reduces Adverse yaw at the tip of the Ailerons and excessive Aileron drag.

Flap differential (when the Flaps are moving as Ailerons)

Flap differential from the A-F Mix is the single most important mix to get right but because the Flap down wash flows directly over the Elevator and hence effects the pitch of the plane. Therefore Flap differential is ESSENTIAL to get right. It must not make the plane pitch up or down in the turn. Just like Aileron differential, more Flap differential means the nose pitches down and less differential means the nose pitches up. Again, I find most modern planes work well with between 50% (1:1 upidown) and 75% (4:1 up:down) Flap differential, but every plane and pilot combination is different. Because most planes are set up with more Flap down travel than up travel (for brakes) this must be measured on the plane and not taken as a value from the Tx.

E-F Mix

E-F mix is more difficult to explain so for now just set 3mm of down Flap (and the same Aileron) with full up Elevator and leave it there. Do not fly without this mix because it adds a lot of efficiency to the wing and hence the turn. You can reduce the Elevator throw if the plane is now too strong in pitch, but re-check you have 3mm Flap on the E-F mix again, because most Tx's reduce the Flap throw as the Elevator throw reduces.

Other effects

I find that changing the C.6. significantly (greater than 10mm) can change a planes response to the mixers that I have set up, so I have to go through the above mixing setup process again to get the plane flying how I like it.

Practice and refine

Continue to tweak your mixer values until you can get 10 repeatable thermal turns in a row, in any conditions, without stopping or losing shape. All my planes do this without any additional manual Rudder, just Aileron and Elevator stick input, in any conditions. It keeps things simple and lets me concentrate on finding lift rather than trying to do a turn with manual Rudder (that is also hard to see at long distances). This game is about finding and climbing in lift better than your opponent and not about theoretical plane setups. This approach is highly under rated. E.g. I have seen a pilot do 10 perfect turns using a 'manual Rudder' plane setup in calm conditions, but as soon as the pressure of a competition started, they were a fair way away and it was breezy, they struggled to make smooth thermal turns and were immediately at a disadvantage. They ended up fighting their plane rather than spending their time looking for lift.

7. Returning from down wind

You have thermalled out in a big thermal and are now ready to come home.

This is where constantly iterating the wind comes into its own. While you were searching for lift and thermalling away you were still taking constant mental notes of the wind shifts right?

Right!

Constantly iterating the wind tells you three things:

1. Which side of the field is most likely to have lift on it
2. How big the thermal/sink cycle is
3. If there is lift on the way home and where it is likely to be.

This then tells you when, how and where you will return from downwind.

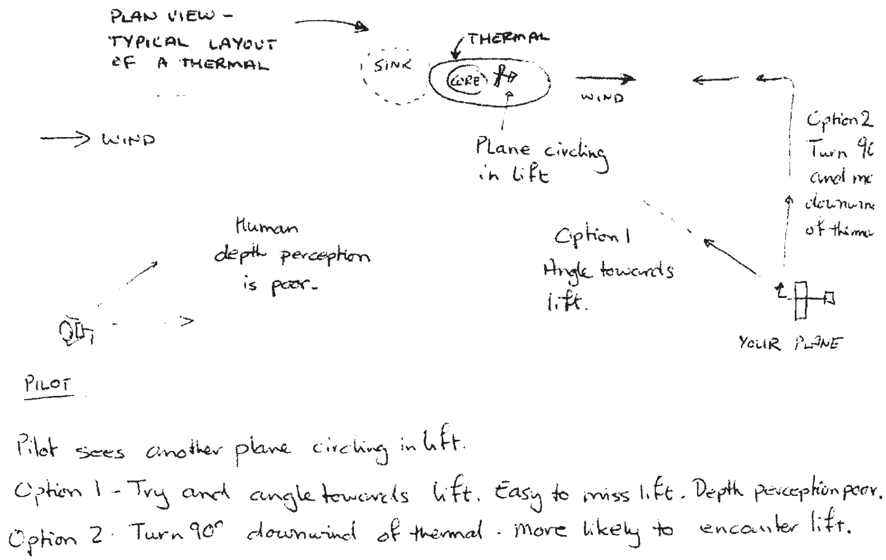
1. If the wind is blowing towards one side of the field or the other, then come back on the side the wind is blowing towards.

2. If there is a single huge sink cycle following your lift (lots of strong cold wind) then take the thermal further than normal, but when you leave the thermal, move sideways a few 100 meters before returning from the thermal and return fast.

3. If you feel a few smaller thermals following your lift then you can leave your thermal earlier than normal and pick up the thermals still coming through. This can also reduce your risk of a land out.

Also, keep a constant eye on all your other thermal signs to help you with your mental picture of the air. Again, this is where having a stable (but not too stable), well-trimmed plane gives you the confidence to take your eyes off it for extended periods of time.

If you see a thermal (e.g. another pilot in lift) upwind of you and you want to move to that air, then do not angle towards the thermal because human depth perception is very poor and it is easy to miss the lift. It is better to turn 90 degrees, move downwind of the thermal and then turn in behind the thermal. It also keeps us away from the sink typically on the upwind side of a thermal.

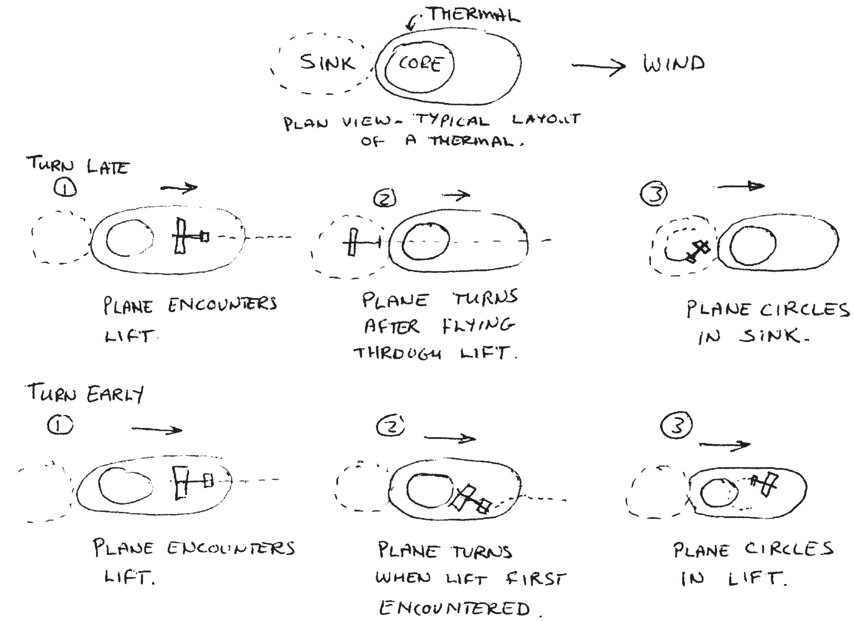


Also, when you do hit the lift on the way home and want to take a turn in it, then turn as soon as you hit the thermal. Do NOT fly through the thermal thinking you will see how big it is because turning after you fly through it means you cannot get back into it. The reason is

1. The thermal moves faster than you think
2. Our human reaction time is slow
3. The plane turning time is slow

These three things mean you are often upwind of the thermal (and in the sink) by the time you complete your turn. This is the number one mistake I see most pilots make.

By turning early, you stay in the lift and can then optimise the core within a few turns. More importantly you stay away from the sink that is often located on the upwind side of the thermal. For this reason, always enter a thermal from the downwind side in any situation.



I hope these notes help you improve your thermal flying. Remember, these notes are the things that I have found worked for me and others may find different techniques work for them, so please experiment, try different ideas and find what works for you.

Good luck and please feel free to ask any questions.

Cheers,

Marcus

CEWAMS
Slopers in the mists

Flying visible airflows

Timberwolf Mountain, October 6-8, 2017

Installment 1 of 2 1/2

Philip Randolph, amphioxus.philip@gmail.com

Warning: Contains more potty humor, potty photographs, and an embellishment on an already astronomically bad pun, and sunspots and moonspots, but all socially constructively related to a community service project by the only two of the twenty-eight CEWAMS who showed up. (Most never do.) Also contains flying gliders in mists and cloud fragments blowing up minor cliffs and steep talus. And memories of a dead mouse in a popcorn oil bottle. Gawrd.

About a hundred miles east of Seattle I stop at Joe Watt Canyon, a grassy bump on the south side of the Kittitas Valley. That's to test a plane.

I'm headed for Timberwolf Mountain, 15 miles east of Mt. Rainier. Which is no place to test a plane. Picture a really steep assemblage of crumbling basalt cliffs and talus fields, with a bit of an almost clear space on the backside, below which is thick forest. A flunked plane test here invites two outcomes: Break it or lose it.

So my plane flunks its test at gentle Joe Watt Canyon, albeit in 25 knot bumpy winds. That lets me know I need to change its decalage. I'll fly something else. In slope-hill classification summary: Testing hills versus sloping destinations.

As I drive up washboard forest service roads a snowstorm of small pine fragments swirls down into the headlights. Eerie. And a clue it is windy.

I get to our favorite Timberwolf campsite about 9 PM. It's a few hundred yards down the ridge from 6391' summit. Chris Erikson has been there a couple hours. He has a fire going.

We two who showed up constitute a whole 23% of vaguely active CEWAMS. By which I don't mean the others aren't still active. It's not like most of us are catatonic or in wheelchairs, quite yet. But most on the list haven't shown up to fly for a few years.

The campsite is twenty yards back from the trees that line the cliff top, where the wind is howling. But the sheer layer is probably a hundred feet above us. Smoke from the fire goes almost straight up. Calm, back here.

On Chris' laptop we watch a truly wild Miyazaki movie, Nausicaä of the Valley of the Wind. It has lots of creatively weird airplanes, botany, and monsters. Chris' eight-year-old got him addicted to Miyazaki flicks. They also stick to old farts.

Saturday morning the winds are still strong. Breakfast. I crawl back into my CR-V for my annual mid morning nap.

Chris Erikson and the Saturday night fire and snow/ Photo by Philip, sensibly standing under the tarp just visible in upper left.

Title page: Philip, 60" Scout Bee, rising mists. Photo by Chris Erikson.

Forgot my binky. Darn. Slept anyway. And then, up top.

Well, first we have a project. Just past the summit there is an old outhouse that leans about 20° downhill. Chris: “Next time we should bring a come-along, straighten it out, and hold it true with plywood.”

But the problem we have ignored for years is that its seat is a 2' square hole. I have brought along a cordless circular saw and drill, a chunk of plywood, and an old plastic toilet seat. We repair it. Very much the opposite of the idiots who apparently built a fire with the top third of the late rather aesthetic Forest Service sign explaining Timberwolf’s elevation.

Top: The outhouse fixer. Elevation 6347’. Photo by Chris Erikson.

Middle: This old thing sported a 2’ square hole. No bodies were observed.

Bottom: An astronomical note. CMEs, sunspots, and moonspots: In the write-up of our trip to observe the solar eclipse I explained that magnetic flux lines around sunspots cause CMEs, “coronal mass ejections,” a polite term for solar flares. Similar lines of force around moonspots create colonal mass ejections when assisted by the device pictured above, boldly installed in a mountain asstronomical non-observatory by Philip and Chris. Photo by Chris Erikson.

And then: Robot Flying time. Oddly, since I last flew my 60" Scout Bee Chevron it had gained a whole bunch of up elevator. Long traverses back in the trees until I hear its beeper.

When I return Chris is flying his 2.6m Phoenix Evo, ailerons and flaps ARF for $110. He covered it with self-adhering laminating film. It has a steel spar. And it is very fast. Absolutely streaking around in the huge lift where west-flowing winds slam into steep ridge face. Chris demonstrates a landing for a couple hunters. Well, it’s sort of a gentle tumble, but the landing zone here is like a crinkled postage stamp.

I try another test flight with Chris tossing the Scout Bee so I can be on the stick from the start. It flares up. I punch it down. Philip: “Can you give my right trim a bunch of down clicks?” It takes over a dozen. And then it flies great.

Philip: “Hey Chris, get your camera. Take shots of diving down into all this mist streaming up the hill.”

Sun glows through the layer of cloud above us, the top of the layer only about 500' up. During breaks we watch a huge layer of cloud this side of the Cascade crest, off in the southwest. Will it come this way?

Bits of cloud, now thick, now wisps, stream up the steep basalt talus face at us. As I dive down into them it gives

Chris and Evo as the clouds thicken.

a sensation of speed like what Howard Hughes pursued with his use of clouds in Hells Angels, 1930. And it's a delightfully unusual experience, to be able to see the air currents in which we fly.

Chris launches his Evo again. It streaks. It is very fast. And agile.

The wisps thicken. Sometimes our planes disappear entirely. We wait for them to complete a half circle, to reappear. We have to stay away from the really thick cloud. We're flying close in front. Then we're searching for air where clouds aren't.

Chris: "It's more clear off to the left."

Eventually I land. Attempt to. Well, I clip a tuft off a pine and helicopter in. No damage.

My aim was off, attempting to catch video on my iPhone. Chris is playing with the sheer layer up behind the ridge. It goes up, so there's lift there.

But he's also whipping the Evo in tight, fast circles, so tight I'm amazed it doesn't snap. And he's getting mild DS bumps off the sheer. Between when he has to try to fish his plane out of cloud. Chris: "Oh darn, darn, okay, there it is."

After a while everything turns to pea soup. Chris lands. Bounces on his aluminum prop spinner, right on parking lot rock. Propellers make poor shock absorbers. I pick it up. The prop still turns. Chris has me hold his plane solidly while he thumbs the throttle. Amazingly it still works.

And it starts to snow, very lightly. I say, "We could set up a tarp."

Chris: "No need. I'm staying dry." Yeah, in these sparse little dry flakes.

We head back to camp. I get the fire going again. It starts to snow, harder.

Chris usually carries a big tarp in his rig. Not this time. I poke around in mine. Without planning for weather, I have a 6' x 9'

Philip, his tarp, and a fire. And then falling snow.


Chris' Evo makes a pass and can barely be seen as it emerges from the clouds.


A closer pass and the Evo can be seen a little more clearly.




tarp I use to hide my tools in the back of my rig. And each of us has about 30' of light rope. We build a shelter off the side of Chris' Forerunner.

I've brought steaks, but Chris has too, marinating for a day. He starts cooking. There is a big downed ponderosa close by. The cordless saw makes it easy to snap off what 4" branches haven't been busted by their fall. I haul in a huge pile of branches.

The snow streams down.

Fude, beers, a big fire.

Flames soar close to one of the ropes that holds our little shelter. Chris: "That's big enough already. It will burn the rope. I didn't know you were such a pyro."

Chris: "Your fire is dying. You're neglecting your fire duties." Gawrd. Micro-fire management.

I move the rope from a tree to a log and pile it high. Chris: "The rope was above head high. Now we'll walk into it." Gawrd.

We watch a Miyazaki movie on Chris' laptop, in which Porco Rosso flies a biplane against a 1930s pirate flying a Schneider Trophy prize winner. A couple gallons of popcorn, but not mouse flavored. (Keep reading...)

Snow streams down. By midnight there is 2". Will it keep snowing through the night? Chris: "We may have to tow each other's rigs out in the morning."

Nope. In the morning, 2" of snow. But we weren't expecting any. Intellicast had predicted a very low probability of measurable precipitation. Absolute luck that we happened to have had a tarp and rope.

Sunday morning, breaking camp, Chris pulls a very dirty sock from inside his food bin. He holds it up by two fingers, looking at it quizzically. "How'd that get in there?" He fishes around until he finds its mate.

Timberwolf campsite sunday morning.

"That's nothing," he reminds me. "Remember when we were down at Wagner?" (That's a peak in north-central Oregon.) "And Melissa and I went fishing in the food bin for the butter-flavored popcorn oil? And found that the summer before a mouse had chewed through the lid, and died in it?"

I recall its fuzzy, popcorn-oil embalmed image.

Philip: "So did you use it for popcorn?"

Chris: "Gawrd."

Sunday is mostly clear, with the lightest of winds up the slope. We throw rocks at an innocent little pine tree, attempting to dislodge snow from its innocent little branches, which is necessary because guys have to be doing something to be able to observe nature.

Sunday, becalmed and clear. Mt. Rainier was probably there all the time.

Hunters show up from time to time, ’scoping out the impending season. Far off to our left there are game trails across snowy talus fields. I’ve seen goat here. Spectacular.

And of the previous day, playing with the mists, each of us agree: “One of our best flying days, ever.”

Stay tuned for next month’s installment, “Slopers in the mists Part Deux: Sam’s Dirty Ridge, November 5, 2017.” Complete with frozen fingers, fog so thick we drove right by the flying site. And snow on the ground making for near whiteout conditions, in which Sanders and Steve egg Philip, “Throw the white one!”

A motorized glider [Aeromot AMT-200S, N856NA, c/n 200.149] prepares to take off from the Shuttle Landing Facility at the Kennedy Space Center. Flying with its engine off, the glider will be positioned above the 14,000-foot level to measure sonic booms created by NASA F/A-18 jets to measure the effects of sonic booms. Several flights a day have been taking place during the week of August 21, 2017 as part of NASA's Sonic Booms in Atmospheric Turbulence, or SonicBAT II, Program. KSC is partnering with the agency's Armstrong Flight Research Center in California, Langley Research Center in Virginia, and Space Florida for a program in which Hornets will take off from the Shuttle Landing Facility and fly at supersonic speeds while agency researchers measure the effects of low-altitude turbulence caused by sonic booms. NASA photo by Bill White.

Original image at <http://tinyurl.com/yd9ubaq4>.

Ralph Barnaby and the Prüfling Secondary Glider

Simine Short, Vintage Sailplane Association, simines@gmail.com


LIEUT. RALPH S. BARNABY

When the American Motorless Aviation Corporation announced the establishment of a glider school at Cape Cod in 1928, the aviation industry immediately began to speculate as to its possibilities. To some it seemed a foolish venture; the glider was a plaything, a fad. Others openly questioned the value of the glider as a means of preliminary flight training. Still others saw great commercial possibilities.

The general public received periodical reports through the press and gradually accepted the glider school as one of the Cape's many attractions, without knowing much about it.

The methods of glider instruction were carefully planned and all launches were made with shock cords. No serious accidents occurred in the few years of operation, though thousands of flights were made. Horses were employed to do the laborious task of hauling the gliders up the grades and also, when feasible, to assist in the launching of the machines.

The school had its Prüfling in the air on many days, flown by many students since early summer 1928. From the sand bluffs on the Atlantic Ocean side where the school was built, the students usually sailed out over the sea, turning onto the beach.

The gliding duration record in the United States was made in 1928 by Peter Hesselbach, flying for 4 hours 5 minutes in the Darmstadt sailplane, which later became the "Chanute" sailplane after being damaged significantly. (See "The Darmstadt D-17 and *Chanute* Sailplanes" by Simine Short in *RCSD* April 2017, pp. 25-39.)

During the 1929 flying season some ninety students took instruction for various periods of time. Among them was Lieut. Ralph Stanton Barnaby of the United States Navy, who, on 18 August 1929, flew for 15 minutes 6 seconds in the Prüfling glider. This flight was the first by an American pilot to exceed Orville Wright's record for motorless flight of 9 minutes, 45 seconds, set at Kitty Hawk, N.C. on 24 October 1911.

The Navy purchased the Prüfling later in 1929 and Barnaby used this ship for launching experiments from the dirigible Los Angeles.

As this glider was covered with cotton and used extensively in the school, the Navy stripped the covering and checked the glider thoroughly prior to attempting a launch procedure, which had not been accomplished or even thought of by anyone else in the past.

We are fortunate that Barnaby documented the restoration project and published his report with many photos in his book "Gliders and Gliding," in 1930. (Title page on opposite page.)

Permission to reprint the photos and the text was given in the late 1980s to the author, Simine Short.

The Prüfling flies over the beach slope at Cape Cod in 1929.

GLIDERS AND GLIDING

Design Principles, Structural Features, and Operation of Gliders and Soaring Planes

By

RALPH STANTON BARNABY

Lieutenant, Construction Corps, United States Navy; Technical Section, Bureau of Aeronautics; M. E.; Member of Materials Subcommittee, N. A. C. A.; First Class Glider Pilot Certificate No. 1, National Aeronautic Association (F. A. I.)

THE RONALD PRESS COMPANY
NEW YORK

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TABLE II. CHARACTERISTICS OF SEVERAL PRIMARY AND SECONDARY GLIDERS

	Detroit Gull, primary Wood construction	*Alfaro PTG-2* Wood construction	*Franklin Eaglet PS-2* Steel tube fuselage Wood wings	*Evans* primary glider Steel tube fuselage, steel ribs and wood spars	*Evans* secondary glider Steel tube fuselage, steel ribs and wood spars	*Baker-McMillen Cadet II* Steel tube fuselage Wood wings	*Cessna* primary glider Wood construction	*Waco* primary glider Steel tube fuselage Wood wings	*Prüfling* secondary glider Wood construction
DIMENSIONS (in ft.):									
Length	17.5	16.0	20.0	18.5	21.5	18.8	…	21.0	18.
Span	34.5	35.0	36.0	34.0	44.0	37.2	35.0	36.0	34.8
Chord	5.0	4.0	5.0	5.0	5.0	…	4.5	5.2	4.9
ASPECT RATIO	6.8	8.7	7.1	6.8	8.8	8.6	7.8	7:0	7.2
AREAS (in sq. ft.):									
Wing (including ailerons)	170.0	140.0	180.0	170.0	220.0	160.0	157.0	184.0	168.0
Ailerons	16.5	…	…	…	…	24.0	…	…	23.0
Rudder	8.0	…	…	…	…	17.0	…	…	6.4
Fin	3.5	…	…	…	…				2.5
Stabilizer	10.0	…	…	…	…	19.0	…	…	12.4
Elevator	14.0	…	…	…	…				10.6
WEIGHTS (in lb.):									
Weight empty	180	145	195	175	225	230	120	175	198
Useful load	170	170	170	170	170	170	170	170	170
Full load	350	315	365	345	395	400	290	345	368
WING LOADING (lb./sq. ft.)	2.1	2.2	2.03	2.03	1.8	2.5	1.85	1.77	2.2
PERFORMANCE:									
Normal gliding speed (m.p.h.)	…	…	28			…	25	…	30
Landing speed (m.p.h.)	12–15	…	15–18	…	…	…	15	…	18–20
Gliding angle	10:1	…	15:1	…	…	15:1	…	…	15:1
Sinking speed (ft./sec.)	…	…	3	…	…	3.5	…	…	3.1

Above: Title page of "Gliders and Gliding" by Ralph Stanton Barnaby.

Upper right: Table II. Characteristics of Several Primary and Secondary Gliders from "Gliders and Gliding."

Right: Members of the American Motorless Aviation Corporation glider school and the Prüfling, 1929.

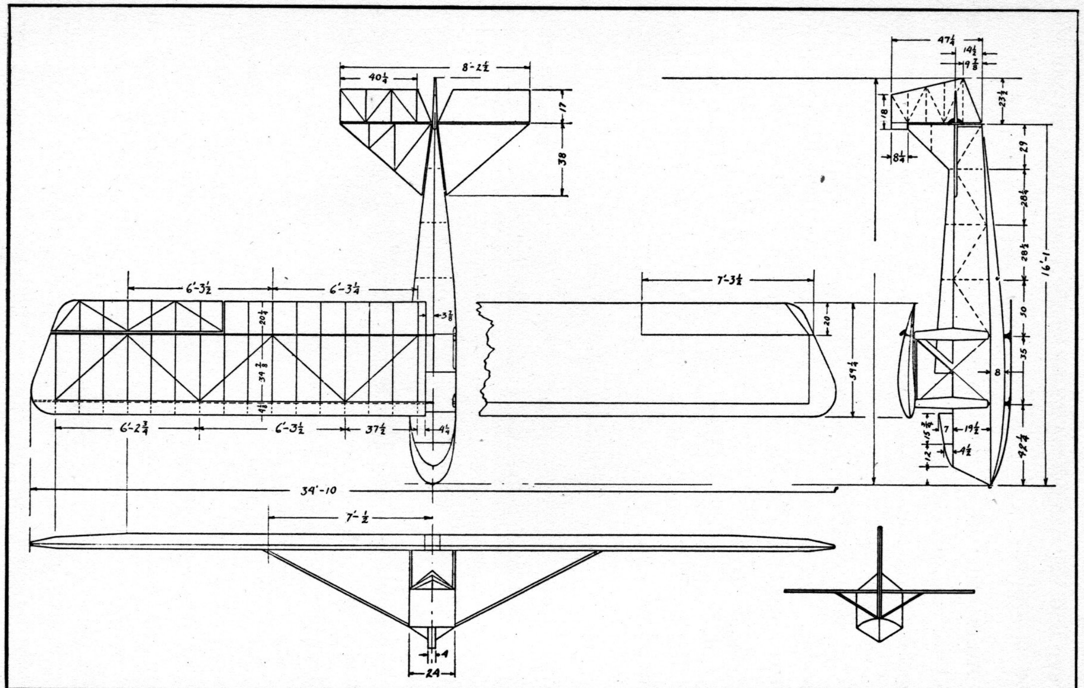
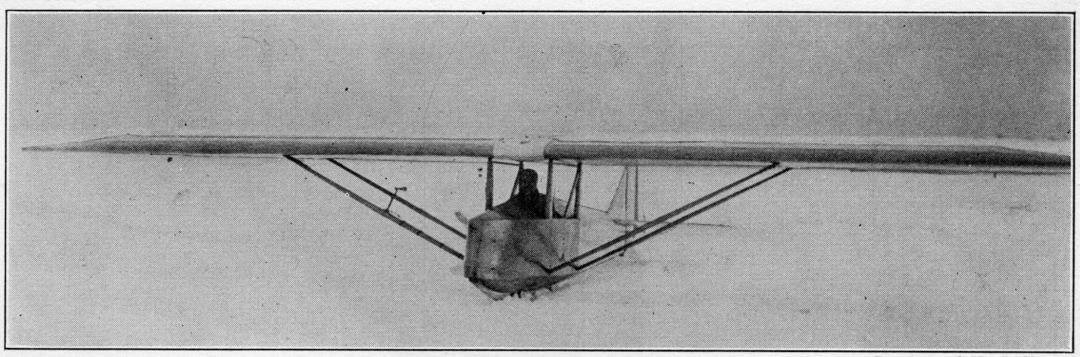


Figure 50. The Three-View Plans of the *Prüfling*



(Courtesy of U. S. Navy)

Plate XIII. The *Prüfling,* a Popular Secondary German Glider

The text and Plate captions on the following pages are taken from Prüfling, a secondary glider ("Gliders and Gliding" pages 103 to 116).

"Figure 50 and Plate XIII (page 28) show a popular German secondary glider, the Priifling. It was in a glider of this type that the author qualified as a soaring pilot at Cape Cod and made the first flight from the Navy Airship Los Angeles.

"Since this type of glider is intended to have a lower sinking velocity than the primary, care has been taken to save weight and reduce resistance wherever possible.

"The general dimensions of the Prüfling are shown in Figure 50. Plates XX to XLIII show details of its construction. The general characteristics of this glider are given in Table II.

"In studying the details of construction of the wings as shown in the illustrations, one of the first refinements to be noted is that the wing spars, instead of being solid spruce as used in most primaries, are built-up box spars with spruce flanges and plywood sides. Of course, wherever fittings are attached, filler blocks are used to make the beam solid at those points.

"Diagonal wooden members are used instead of wires for internal drag and torsion bracing. (See Plates XX, XXI, and XXII.)"

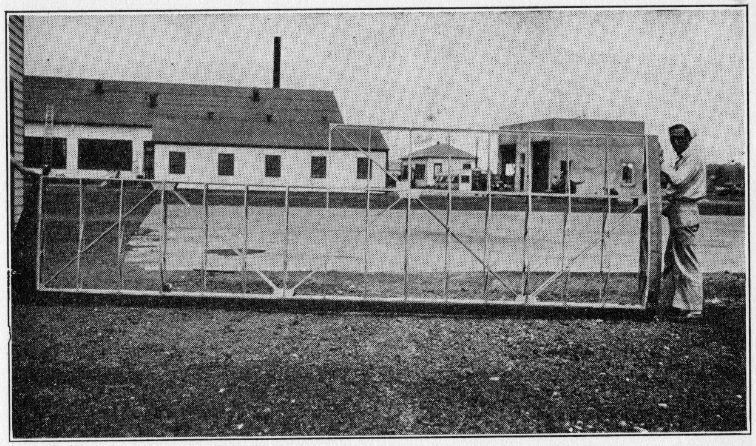


Plate XX. The Prüfling Wing

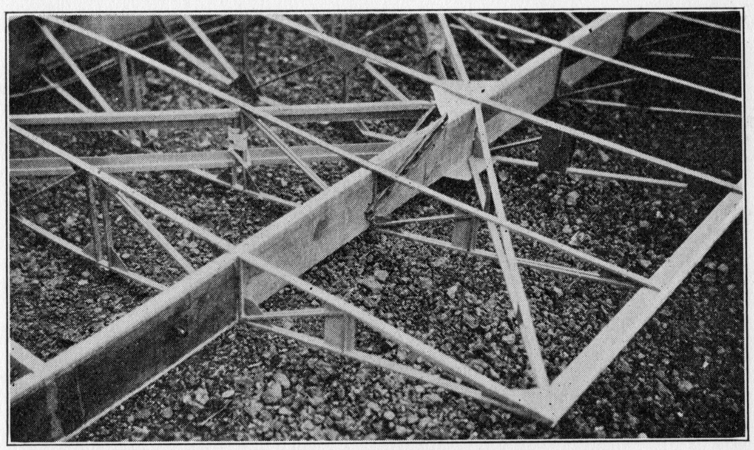


Plate XXI. Detail of Prüfling Wing Showing Aileron Hinge and Rear Strut Attachment

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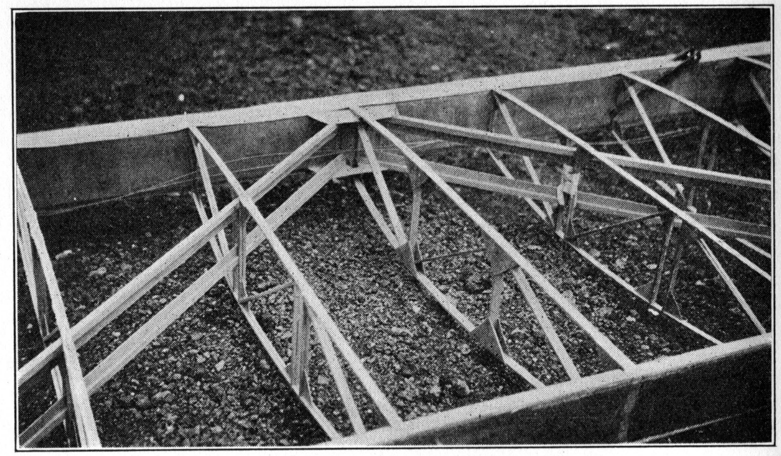

Plate XXII. Detail of Prüfling Drag Bracing

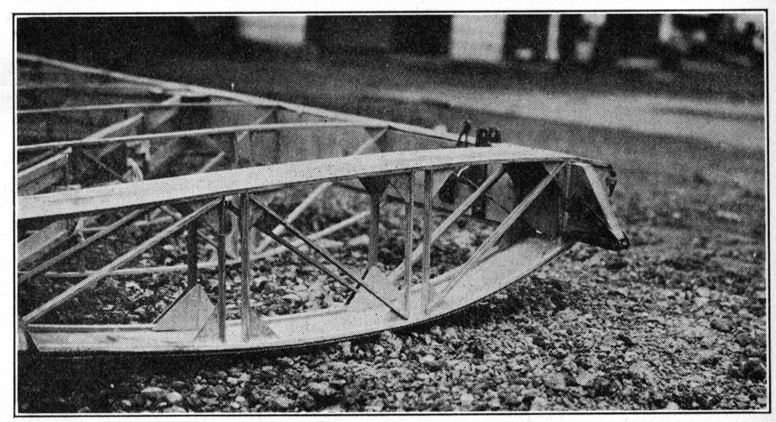

Plate XXIII. Prüfling Front Wing Hinge

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"Plate XXI shows the strut attachment at the tying..."

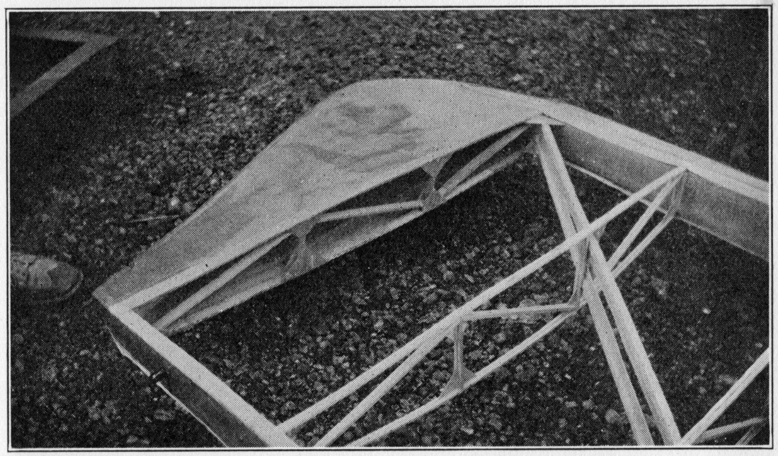

Plate XXIV. Prüfling Wing Tip

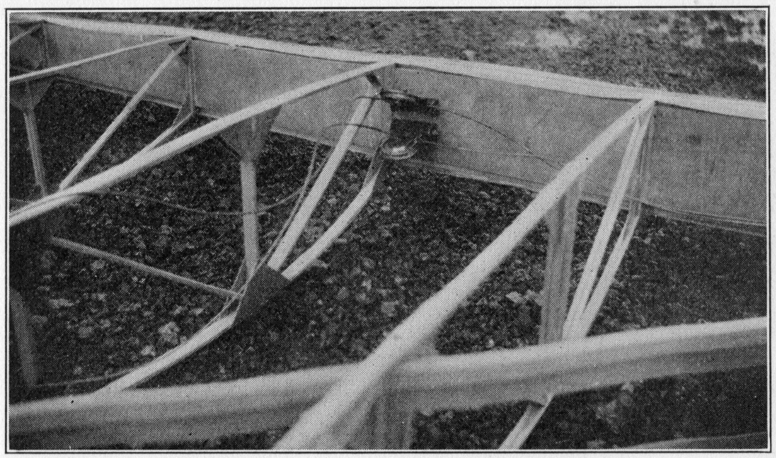

Plate XXV. Aileron Pulleys in Prüfling Wing

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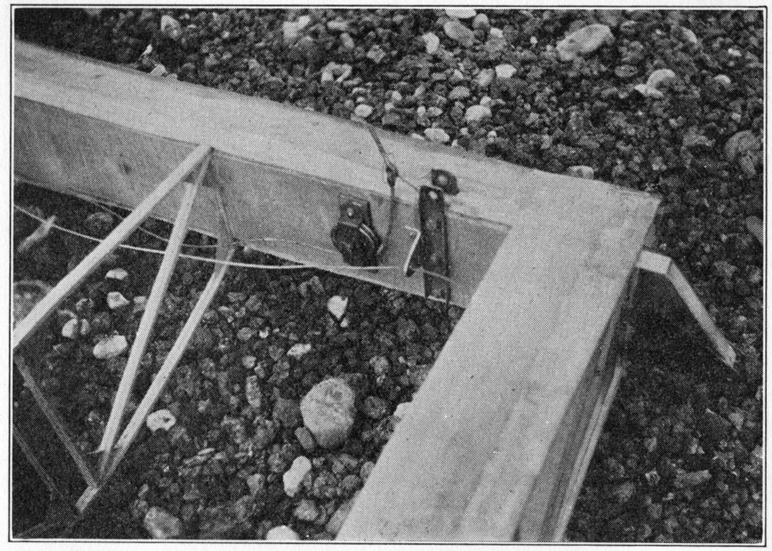

Plate XXVI. Center Section Strut Attachment Fitting and Aileron Pulley in Prüfling Wing

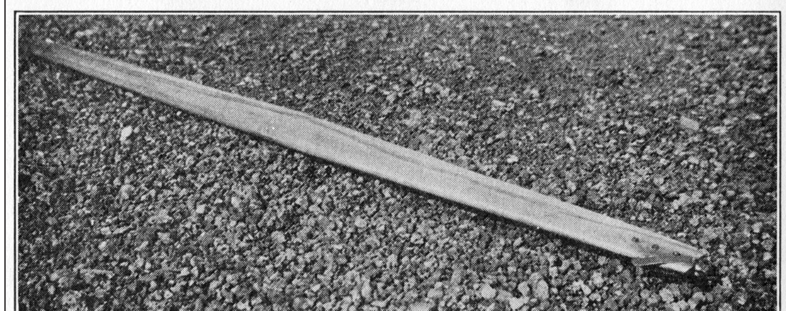

Plate XXVII. Prüfling Streamlined Wing Strut

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"The outboard tip of the wing has been given a curve to improve its efficiency. (See Plate XXIV.)"

"The wings are braced by streamline struts, the only external wires being the diagonal wires in the plane of the struts. Plate XXVII shows the strut."

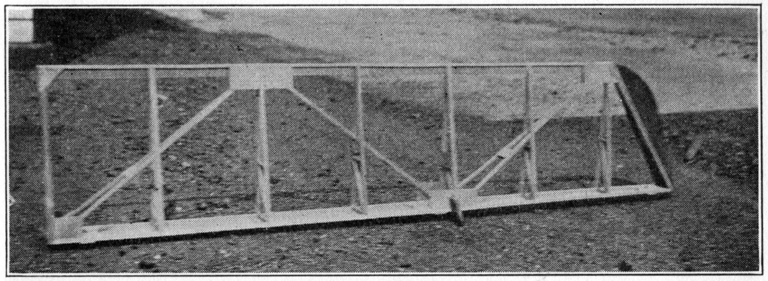

Plate XXVIII. Prüfling Aileron

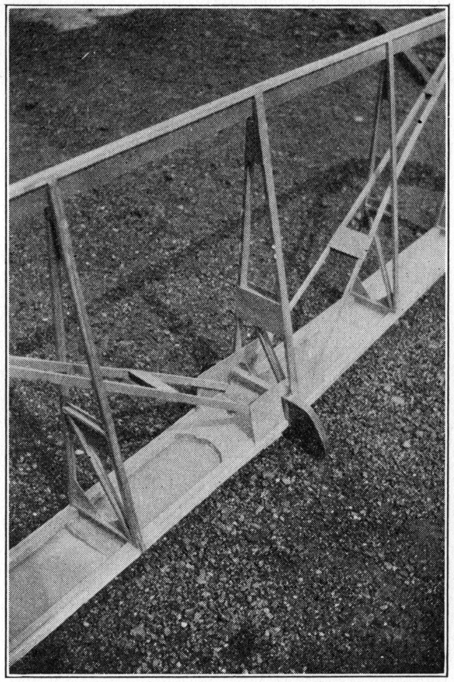

Plate XXIX. Detail of Prüfling Aileron Showing Control Horn

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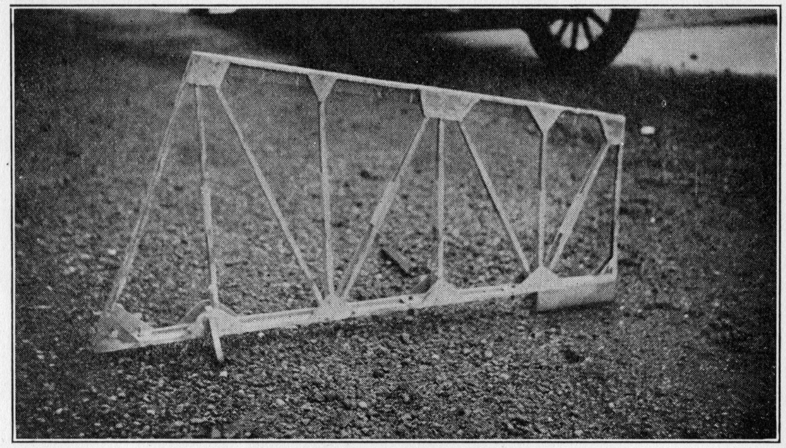

Plate XXX. Prüfling Rudder

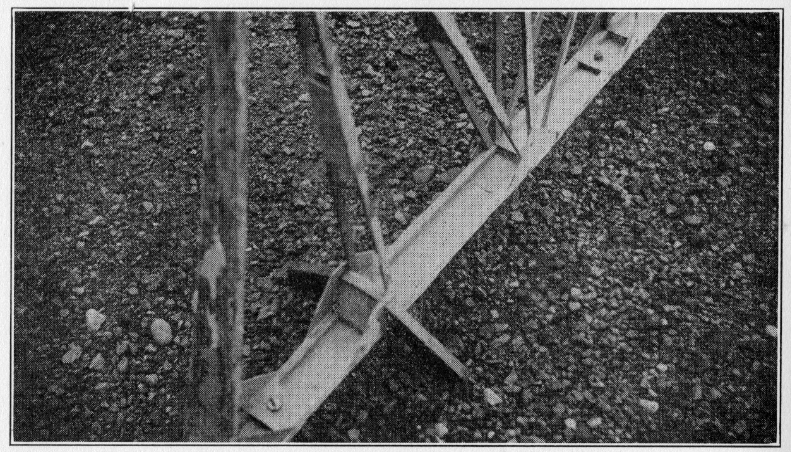

Plate XXXI. Detail of Prüfling Rudder Showing Control-Horn Attachment

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"Plate XXI shows the strut attachment at the tying, and Plate XL the attachments at the fuselage."

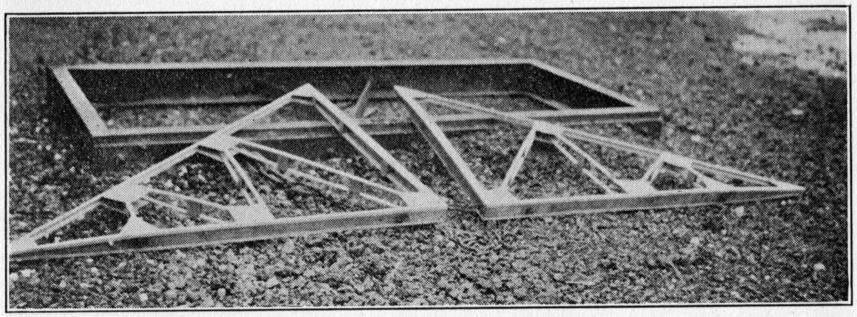

Plate XXXII. Horizontal Stabilizer Surfaces of the Prüfling

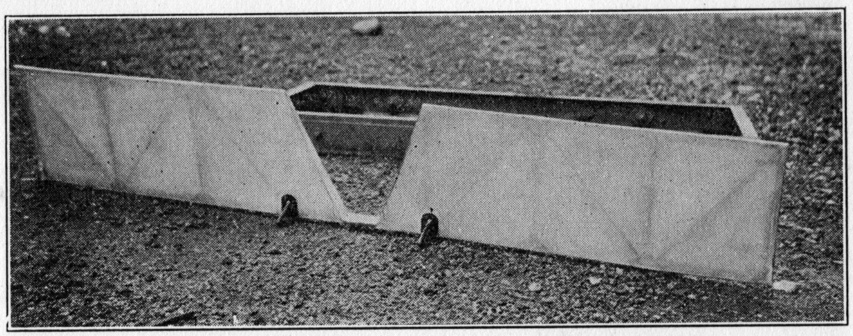

Plate XXXIII. The Prüfling Elevators

111

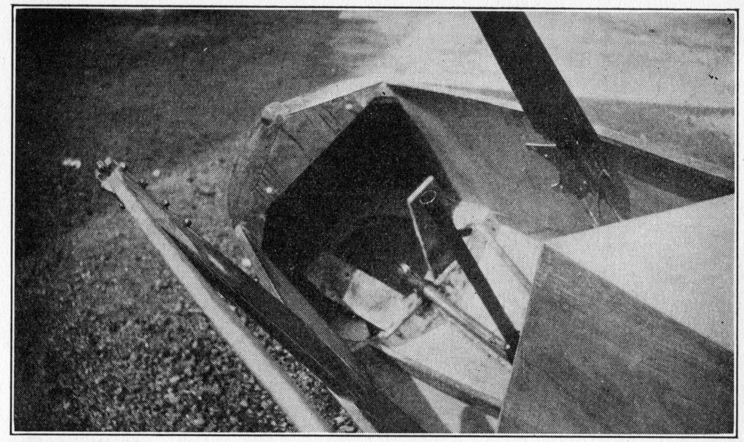

Plate XXXIV. The Prüfling Cockpit with Cover Removed, Showing the Stick and Rudder Pedals

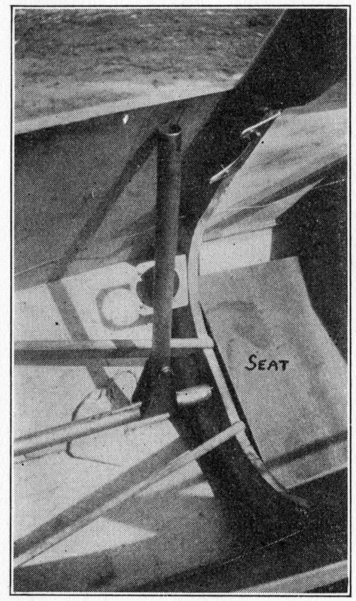

Plate XXXV. Interior of Prüfling Cockpit Showing Seat and Stick, and Instrument Brackets

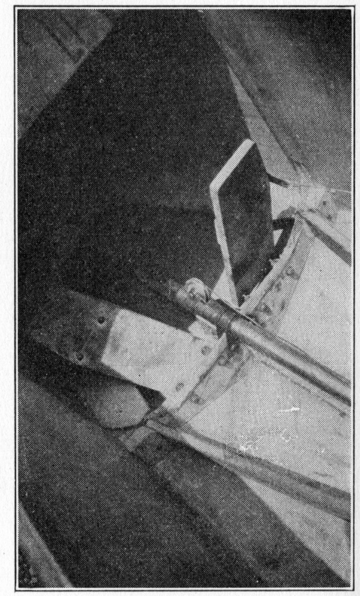

Plate XXXVI. The Prüfling Rudder Pedals

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“Plates XXXV and XXXVI show details of the controls in the cockpit. The rudder pedals which are used in this glider are plainly visible. They hinge at the heel like the pedals of a player-piano.

I”n Plate XXXV, the control stick and the seat may be seen. The diagonal braces spreading apart each side of the stick are foot rails which were added to give the pilot something to stand on in getting from the airship Los Angeles into the seat of the glider. The two metal brackets shown on the right side of the cockpit were put in to hold an altimeter and an air-speed indicator, the two instruments that were used in the flight from the Los Angeles.

“The fuselage sides and top are plywood-covered back to the rear wing struts. The bottom is plywood-covered throughout its entire length. The top and sides from the rear wing struts aft are fabric-covered.

“Attention is invited to the removable piece of cowling over the forward part of the cockpit to permit easier access. Plates XXXVII and XXXVIII show it in place. Plate XXXIV was made with it removed.”

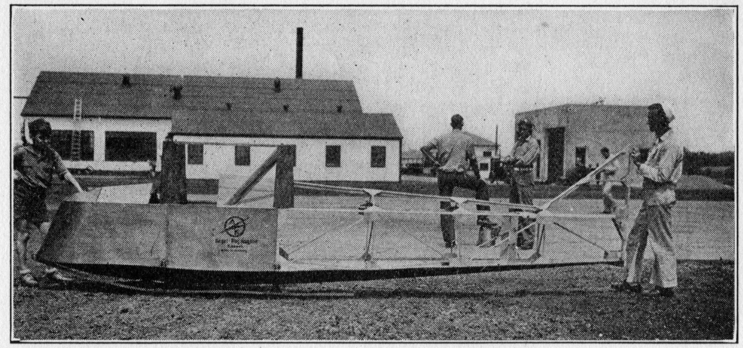

Plate XXXVII. The Prüfling Fuselage

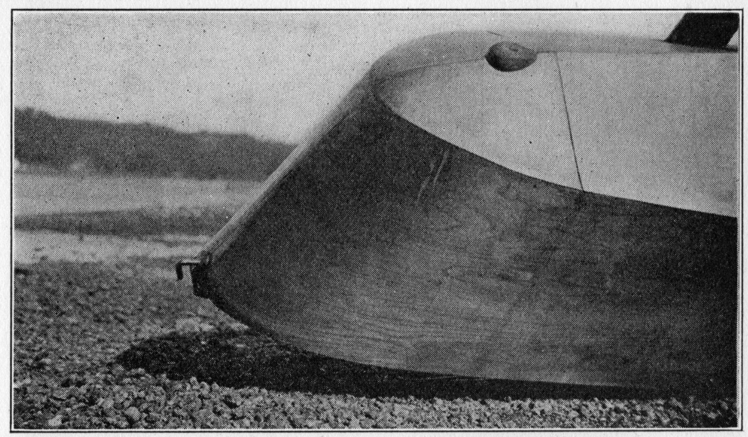

Plate XXXVIII. The Nose of the Prüfling Fuselage, Showing Towing Hook

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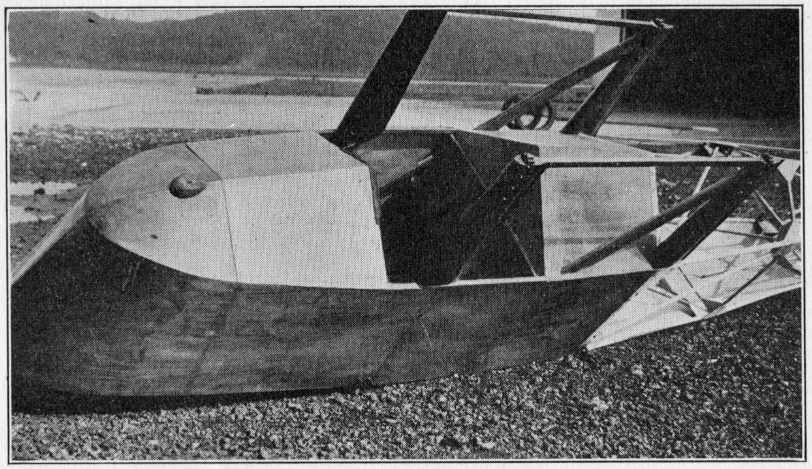


Plate XXXIX. The Prüfling Fuselage, Showing the Removable Cowl Cover in Place, and the Center Section Struts

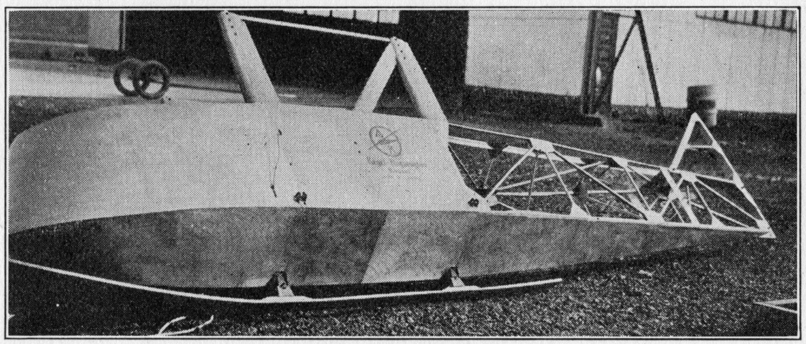


Plate XL. The Bottom of the Prüfling Fuselage, Showing the Attachment of the Skid

114

"... and Plate XL the (strut) attachments at the fuselage. Plate XL shows the attachment of the landing skid. Note the rubber blocks which ease the landing shock."

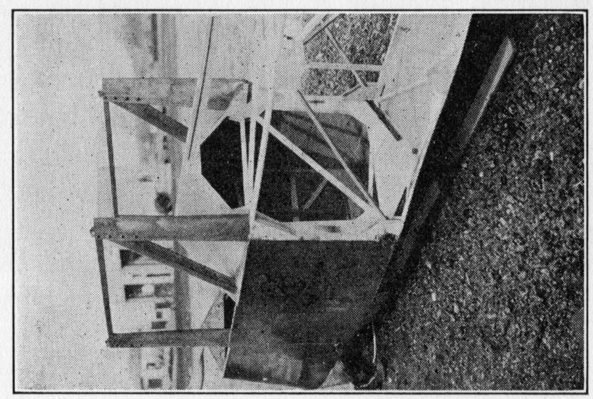


Plate XLI. Details of the Prüfling Fuselage Construction

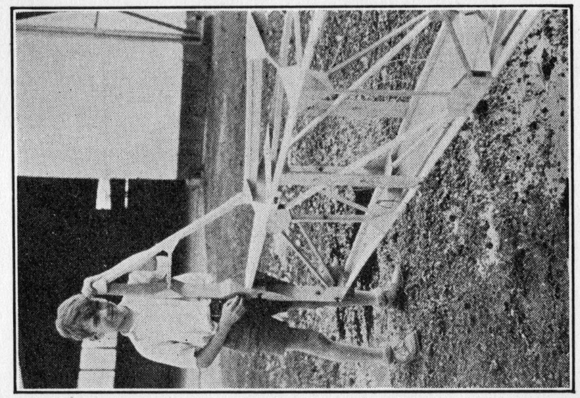


Plate XLII. Details of the After Portion of the Prüfling Fuselage

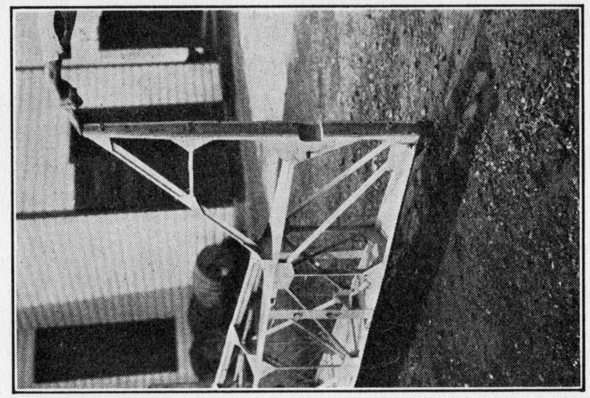


Plate XLIII. The Prüfling Fin and Rudder Post

115

Ralph S. Barnaby autographed photograph. Photograph taken August 1929, autographed while Barnaby was a Captain, USN, Retired.

Prüfling attached to the dirigible Los Angeles. Simine Short Collection.

RCSD

Chemical and Topographical Surface Modifications for Insect Adhesion Mitigation

Synergistic method to reduce insect adhesion on aluminum surfaces

https://technology.nasa.gov//t2media/tops/pdf/LAR-TOPS-183.pdf

NASA Langley Research Center, in collaboration with ATK Space Systems, has developed a method to reduce insect adhesion on metallic substrates, polymeric materials, engineering plastics, and other surfaces. The method topographically modifies a surface using laser ablation patterning followed by chemical modification of the surface. This innovation was originally developed to enhance aircraft laminar flow by preventing insect residue buildup, but the method provides a permanent solution for any application requiring insect adhesion mitigation as well as adhesion prevention of other typical environmental contaminants.

Benefits

- Increased ability to mitigate adhesion of insect residue upon impact compared to currently available solutions in order to significantly reduce laminar flow disruptions
- Surface roughness is not affected by the process
- Permanent insect mitigation solution

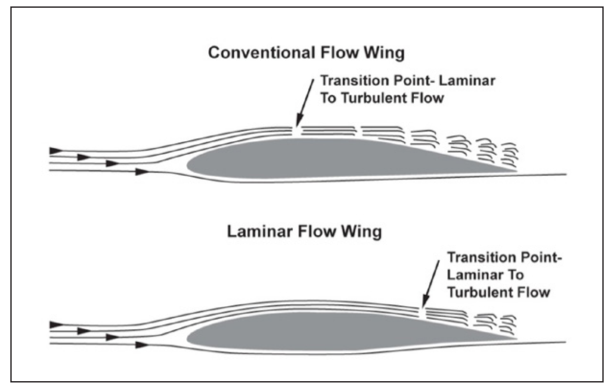
Applications

- Aerospace
- Marine
- Automotive
- Wind Energy

The Technology

The technology is a method of mitigating insect residue adhesion to various surfaces upon insect impact. The process involves topographical modification of the surface using laser ablation patterning followed by chemical modification or particulate inclusion in a polymeric matrix. Laser ablation patterning is performed by a commercially available laser system and the chemical spray deposition is composed of nanometer sized silica particles with a hydrophobic solution (e.g. heptadecafluoro-1,1,2,2-tetrahydrodecyltriethoxysilane) in an aqueous ethanol solution. Both topographic and chemical modification of the substrate is necessary to achieve the desired performance.

Contact us about this technology:
Langley Research Center
Mail Stop 151
Hampton, VA 23681
757-864-1178
LARC-DL-technologygateway@mail.nasa.gov



Insect buildup on wings can disrupt laminar flow

No engine landing in a Piper Cub, literally!

Robin Reid, robinreid@earthlink.net

To quote Jimmy Doolittle "I could never be so lucky again!" I feel truly blessed! Having grown up in an aviation family, I have been fortunate to fly some truly unique airplanes. Those include the Curtiss Jenny, DeHavilland Comet, Howard Pete Racer, Gee Bee model E, Boeing 747 and a host of other cool airplanes!

On my days off from my real job as a 747 first officer and when not running around my home airport like a chicken with my head cut off, my family and I volunteer at the Western Antique Aeroplane and Automobile Museum in Hood River, Oregon.

Founder Terry Brandt and WAAAM have accumulated over 125 flyable aircraft and over 250 antique and classic cars. Luckily, I have gotten to fly a few of those aircraft including some rare gliders.

About four years ago I had the chance to fly with WAAAMs chief pilot Ben Davidson in the museum's just-finished Taylorcraft TG-6 glider.

The TG-6 was restored under the guidance of master restorer Tom Murphy. Having instructed many hours in Taylorcraft L-2's at my mother's flight school, I jumped at the chance to fly the TG-6.

We followed the tow plane up to 3,000 feet, released and proceeded to chase the tow-plane back to Hood River.

As we were turning a close-in base, the tow plane was clearing the runway!

The TG-6 flew very much like an L-2. The only issue noted was a loss of directional stability after landing when we were slowing to a stop.

The TG-6 has two main wheels and brakes, but has large forward cockpit area ahead of the wheels. The front cockpit is where the engine would normally be on an L-2.

We elected to land with a 3 to 4 knot quartering tailwind to get back to the glider staging area. As we were slowing to a stop, the TG-6 decided she wanted to turn into the wind.

Stick was full back and full rudder and some brake were applied but her mind could not be changed and we did a gentle 90° turn into the wind. Right then, Ben and I decided that this was one aircraft that you do not land with any tailwind!

TG-6 photos: Above - Cockpit interior, Marici Reid photo; Upper right - External of cockpit area, Marici Reid photo, Right - Rear quarter view showing large vertical surface, Jim Short photo.

Readying the TG-6. Jim Short photo.

The restored TG-8 on display at WAAAM. Jim Short photo.

Recently the Museum finished the restoration of a Piper TG-8 Cub glider. Tom Murphy had completed most of the major repair work before his retirement from the museum in 2015. The TG-8 sat dormant for a few years while Tom's replacement Jakonah Matson-Bell completed other projects.

Jakonah had trained under restorer extraordinaire, Tim Talen. Even though Jakonah is still in his twenties, his talents rival those of restorers twice his age.

Last year, Jakonah and his crew of volunteers started work again on the TG-8.

One of my local flying buddies, Jon Borchers, along with my two boys and I started helping on the restoration during the Museum's second Saturday work parties. Work progressed quickly.

Originality was maintained with the only deviation being the covering using the Polyfiber process that was generously donated by Consolidated coatings. And new leather seat cushions were obtained from Don Jones at a considerable discount.

Our goal was to fly both the Cub and Taylorcraft gliders at the museum's vintage glider meet on 10 June 2017.

As the dead line drew closer, Jon, the boys and I spent extra days traveling to Hood River to help Jakonah and his crew.

Early in June the Cub was finished and Chuck Wright of the Hillsboro FSDO issued her airworthiness certificate.

TG-8 cockpit. Marici Reid photo.

The TG-8 is towed to position on the flightline. Jim Short photo.

Her weight was within eight pounds of her original weight.

The Wednesday before the event was chosen as a test flight date for the Cub and the museum's Slingsby Petrel glider that was also waiting a post-restoration test flight.

Having arrived early in the day, along with Ben and crew we proceeded to prep all the gliders we intended to fly on Saturday. Towards afternoon we started thinking about test flights.

About this time Ben asked me if I wanted to test fly the Cub. I jumped at the chance!


The TG-8 is moved into position on the flightline in front of the TG-6. Jim Short photos.

Terry Brandt and Jerry Wenger (Petrel donor) decided that my wife, Marici Reid, would test fly the Petrel, who had flown gliders since she was sixteen, accumulating much experience in vintage gliders. Also her weight was much more appropriate then Ben's or mine!

With all checks complete, the gliders were towed from the museum to near the end of the runway. Ben then brought the Piper Pawnee tow-plane into position for the Cub's test flight.

As we were waiting, the wind had come up to about fourteen knots and the Cub started bobbing around like a cork in the ocean. It was apparent that the Cub was more "tippy" on the gear then the Taylorcraft.

With tow plane ready, I proceed to slither into the front cockpit. Luckily I had on my thin flying shoes but still needed to remove the front back seat cushion. Definitely a little tighter then the normally tight front seat of a J-3.

The Cub glider uses the throttle as the tow release and a release check was performed. With rope hooked up, canopy closed and all checks complete, it was time to get the show on the road; I waggled the Cub's rudder. Ben signaled back and started the takeoff roll.

Having rolled only about fifteen feet the Cub wanted to fly and the right wing started to rise, so I lowered the wing while easing the stick forward and held her on the ground to get a little more speed.

The TG-8 on tow. Jim Short photo.

The controls by this time were nice and solid and I lifted off. With the Pawnee in a stable climb, the Cub had no trouble staying in position. The only unnerving part, I had to put my throttle hand under my leg so that I would not inadvertently pull the tow release!

At four thousand feet I released and started feeling her out. Steep turns, wingovers, slow flight and stalls were pure J-3.

A try of the spoilers showed that they were adequate but not overly effective. Sink rate worked out to about seven hundred feet per minute. After only about three and a half minutes since release I was down to about fifteen hundred feet and started setting up for the landing.

Check list was completed (not much to check there) and I passed the end of the runway at about seven hundred feet. The Cub glider was settling like a typical Cub at about sixty miles per hour and about half spoilers.

Knowing I had a stiff breeze for landing, I turned base a little early. Boy was I glad I did! Her penetration was pitiful! I closed the spoilers and dropped the nose to get a better lift over drag ratio.

Established back on path I was able to continue the rest of the approach with half spoilers to a normal Cub-like wheel landing, just much lower with the 800/4's axle bolted to the bottom of the fuselage.

With the stiff wind, ground roll was less than two hundred feet. A successful no engine landing in a Piper Cub!!

The following Saturday at the Vintage Glider event, Ben and I flew a photo shoot with the two TGs and this time I was back in the Taylorcraft.

The first big difference that came to mind was how much easier the Taylorcraft was to get into. With two Pawnee tow planes, the two TGs were lined up side by side and we launched.

The Cub was airborne about fifty feet shorter than the Taylorcraft. We proceeded to climb up to four thousand feet to give us some time to form up on Colin Gyenes in the Fournier RF-5 motor glider, our camera plane.

With both of us released, we quickly formed up and started a left 360 with me on the outside. Once we were stable I needed to crack just a touch of spoiler to match the Cub's descent. After about three 360s Lyle Jansma in the camera plane had his pictures and it was time to enter the pattern.

The wind was blowing about twelve knots so I kept my base turn in close. The spoilers on the Taylorcraft were much more effective than the Cub's. Landing was much like the Cub with a slightly faster touch down speed.

With a little extra speed on the touch down, I did a nice controlled 180° turn up onto the taxiway to be in position to stage for another flight!

The TG-8 on tow. Martin Chorley photo.

TG-8 on final. Jim Short photo

Both TGs had pluses and minuses. The Taylorcraft has better room and more effective spoilers. The hand holds on the wing tips of the Taylorcraft aid in ground handling.

The Cub on the other hand felt a little more directionally stable and I think the Cub would perform a little better with three people on board. The first time I flew the Taylorcraft with Ben, we got airborne about the same time as the tow plane.

So which one is my favorite? The one I am flying at the time!

Thank you Terry, Judy, Ben, Jakonah and all the great people at WAAAM that have put trust in me to fly some of their wonderful aircraft. Can't wait till they get an Aeronca TG-5!

RC Soaring Digest thanks Simine Short, Editor of *Bungee Cord*, the journal of the Vintage Sailplane Association, for allowing this reprint and providing additional photos which were not included within the article as originally published.

Bungee Cord
The Voice of the Vintage Sailplane Association

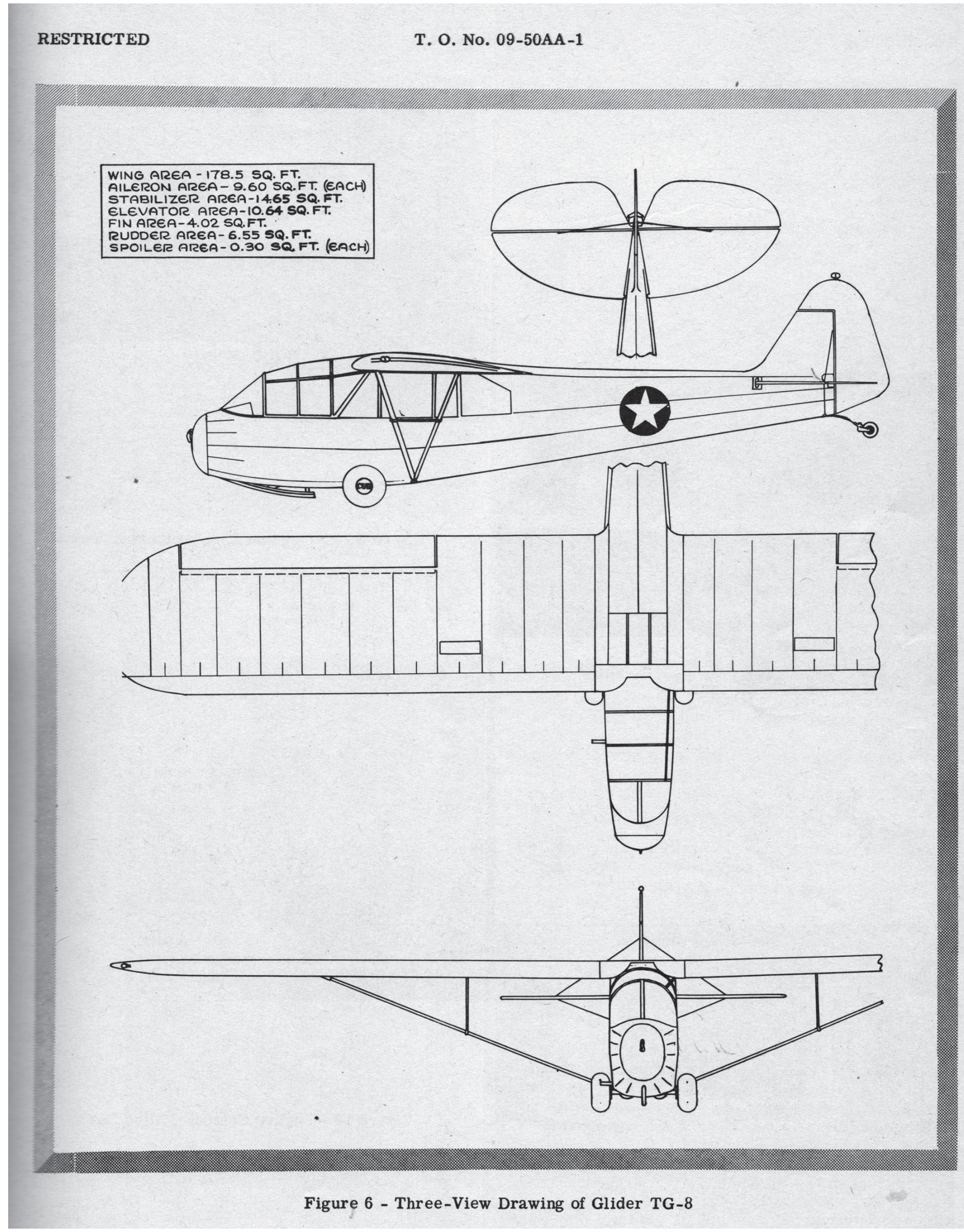


Figure 6 - Three-View Drawing of Glider TG-8

How to achieve a straight square edge

Scott Keller, Balsa Model Aircraft Builders Association FaceBook page, <http://tinyurl.com/y9bbg6zx>

Here's one of my secret weapon homemade tools to make life easy and build precisely!

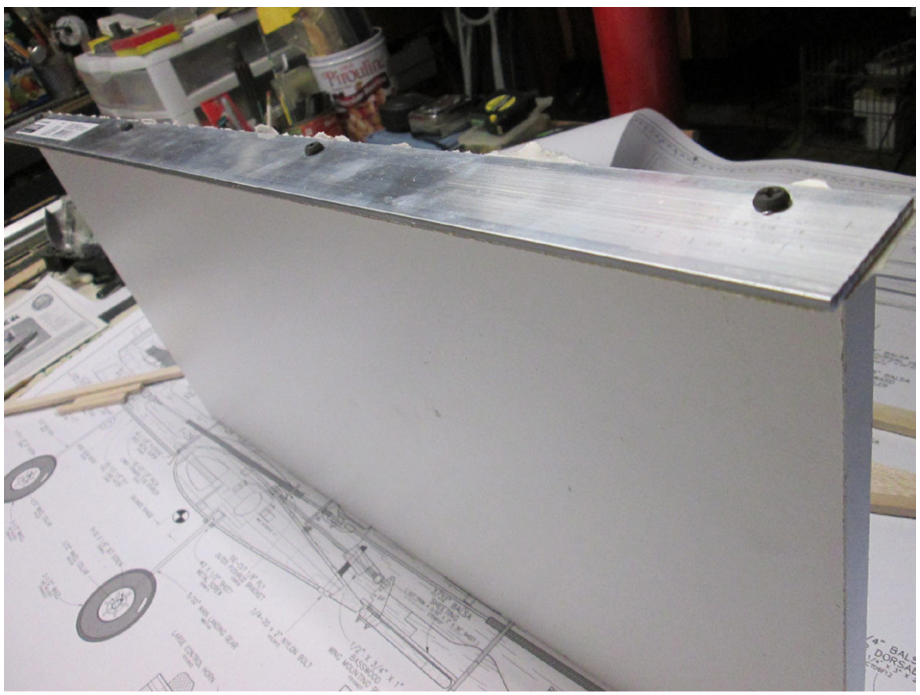
It's for squaring up edges, sheets, etc., anywhere you want a perfect STRAIGHT SQUARE EDGE.

I have a few in different lengths and where this tool really shines is doing edges on 1/16" wing sheeting BEFORE joining.

The photos should be self explanatory on how to build one.

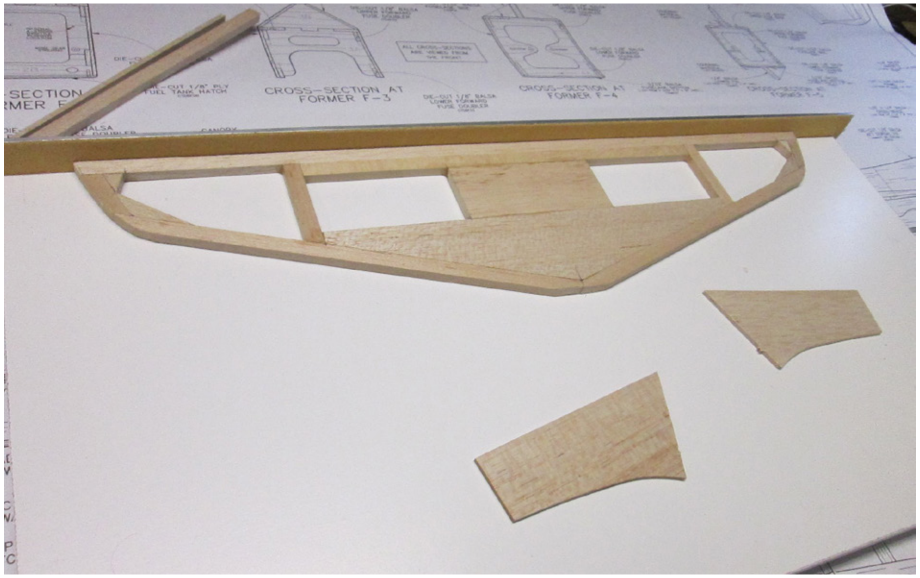
You can see the picture of the two small pieces I did. Left is squared, right isn't.

It's a great easy to make tool !

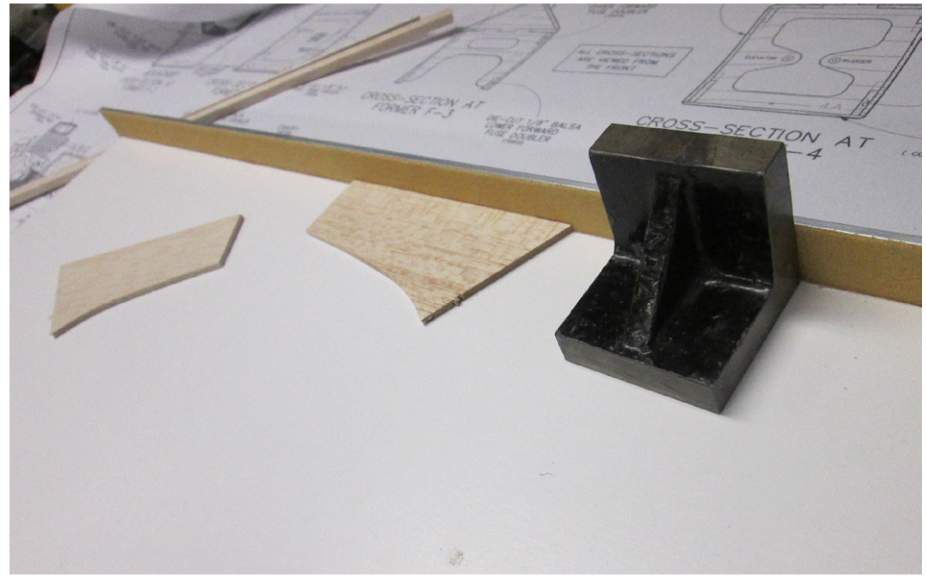


With the base on its edge, you can see how the metal sheet is attached with three screws.

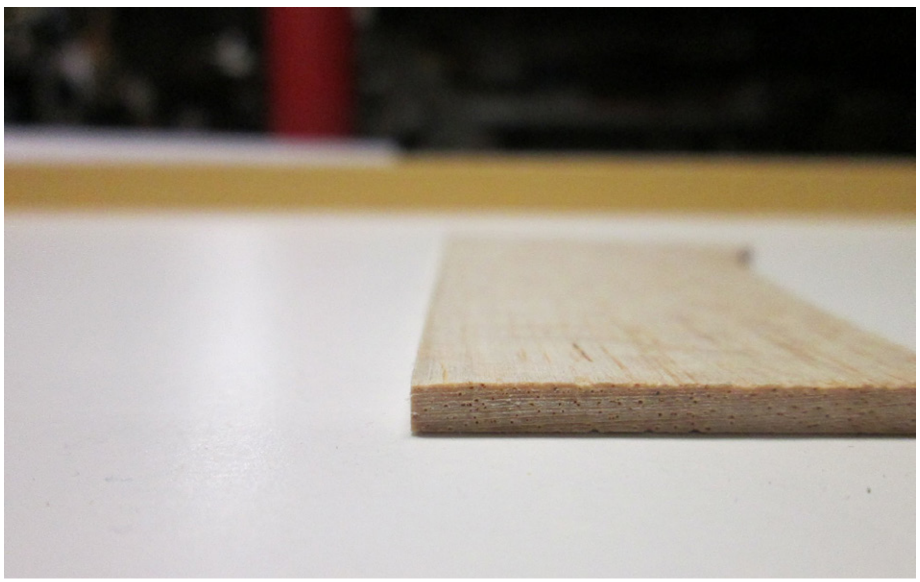
The base bottom has rubber "feet" to aid in stability on the work table.



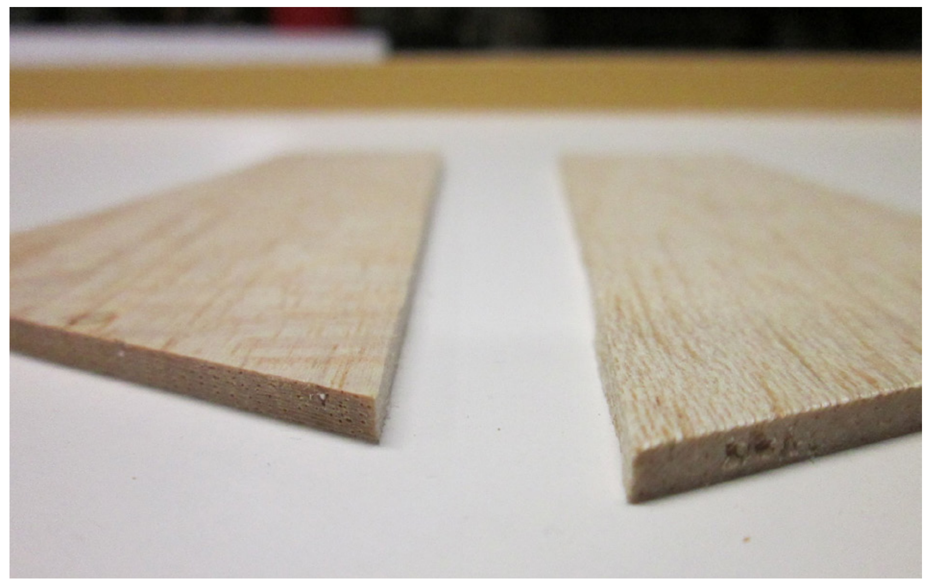
The metal edge, with sandpaper attached, is square to the base and perfectly straight.



Here you can see the metal edge is at 90 degrees to the base, making the sanding of straight square edges a breeze.



Here's the edge of a small piece of balsa sheet after sanding. It has a nice square and straight edge, perfect for gluing.



And here we see the sanded edge (L) compared to a raw cut edge (R). Quite a difference!

Restoring a 1975 Hobie Hawk

I've wanted a Hobie Hawk since 1975... ...Now I have one!

Paul Naton, http:// http://www.radiocarbonart.com

<http://www.hobiehawk.com/HistPhotos/MANaug1974_s.jpg>

I first saw the Hobie Hawk glider advertised in the surfing and sailing magazines I was reading when I was fifteen, that's way back in 1975.

I had always wanted to try RC airplanes since I was a little kid, but I didn't have the money and didn't know any adult R/C pilots willing to get me started. I never imagined that 42 years later I'd be producing professional instructional videos about R/C soaring and flying high performance all-carbon electric launch gliders.

Being a California kid, I knew of the legendary status of designer Hobie Alter, both from his surfing innovations and his famous Hobie Cat sailboats. By '75 when the Hobie Hawk was released, I was a crack junior sailor and already had many hours on Hobie 12's,14's and 16's on our local lake and San Francisco Bay.

Even though sailing was my sport focus, I'd see those Hobie Hawk ads and even though I knew zero about R/C, I really wanted to have one and learn to fly it. I figured if Hobie Alter designed it, it must be the best available.

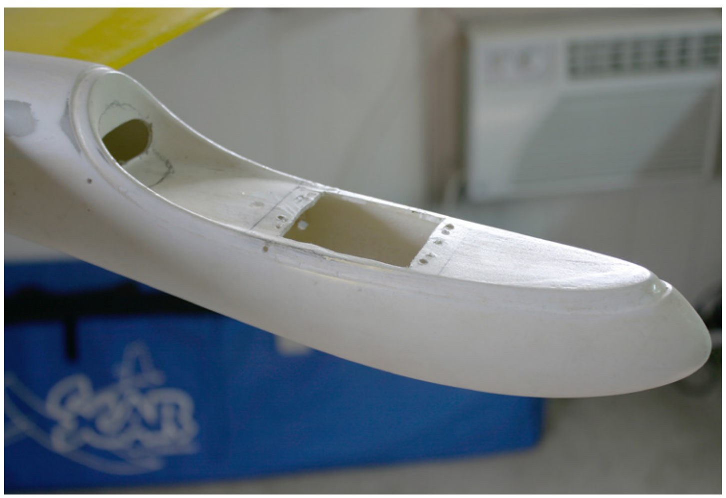
As of this year, I've been flying R/C gliders for 29 years, and I've got a nice collection of thermal and slope planes, but a vintage Hawk wasn't on my acquisition list. I'd seen Hobies come up for sale on RC groups and wondered why they were going for such high prices. They still looked great and so Californian, but I still wasn't in the market for a 40+ year old R/E design.

A few months ago I got an unexpected call from a local flyer who was moving and selling off some of his large glider fleet. He had an original Hobie Hawk for sale for only a hundred bucks, was I interested?

I didn't even think of negotiating the price down as I knew used Hobie's were going for premium prices especially if they were in good original condition as this one was. Sold! (A Hawk ARF without radio gear was $129.00 back in the mid '70s.)

The plane will be completely disassembled and the covering stripped from all surfaces. After over 40 years of service there is bound to be hidden damage and wear. The fuse will be repainted and all new radio gear installed.

The fuse has plenty of wear and tear and some screw holes will have to be filled and faired over. The original wing rod tube was missing so that will have to be replaced.



The fuse front is roto-moulded plastic so you have to be careful when gluing and painting this material. I'll need to fabricate a servo tray as mini servos will be used instead of the big standard size ones initially installed.

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Jim bought his Hawk new in 1975, so it's an original Hobie-built unit. He flew this Hobie off the dunes and bluffs of Alaska as he was stationed in the Aleutian Islands for a few years. He then took the glider to Southern California and flew a few contests as well as countless mellow slope soaring sessions along the California coast.

Jim takes care of his planes, and

while there were some minor cosmetic and mechanical issues, the airframe was in remarkable shape for 42 years of operation.

The unique fiberglass and ABS fuselage needs a few repairs and a repaint, I'll do it in classic white.

The wings are nearly flawless, though some winglets were added at the last re-cover, and I'm hoping the stock plastic tips are still attached.

The tails are also in top shape, just needing a re-cover and some de-lam fixes.

Yellow is my least favorite glider color so the wings and tails will get new red transparent Monokote.

There's a missing main wing rod tube and some other damaged and missing parts but nothing I can't handle.

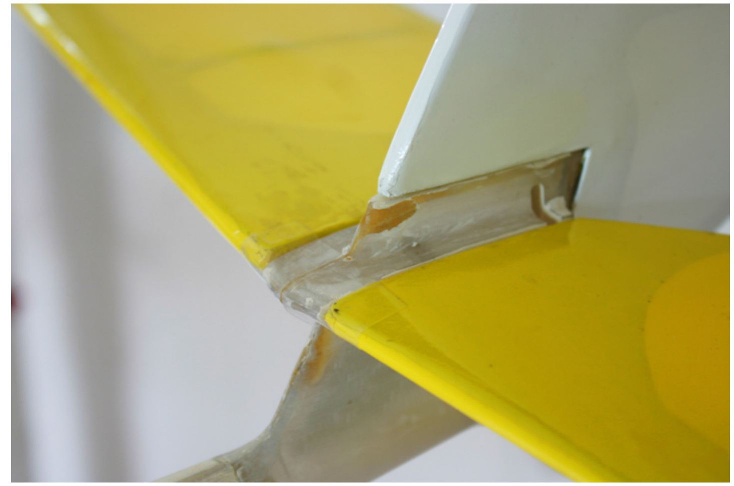
I'm not interested in doing an OEM restoration. I want this Hobie upgraded to current technology so I've selected some nice MKS digital servos to move the surfaces, the radio will be a Spektrum 7020 DSMX receiver to be powered by an Eneloop AAA 4S pack connected to a Zepsus magnetic switch.

I figure about 20 hours of labor (optimistic!) ought to get her in the air.

I've been scouring the web for Hobie info and I've now found some replacement parts and a new canopy to finish out the restoration. I just love the retro fuselage look and the elliptical wing dihedral. This will be the first R/E glider I've owned since 2001, and hope to have it flying in the fall of 2017.

The restoration process itself will be described in detail in a future issue of *RC Soaring Digest*.

To learn airframe building, repair and refinishing skills, visit my website at <http://www.radiocarbonart.com> and browse my large library of professionally produced how-to videos on all aspects of R/C soaring.



The fins are in good shape though they will be stripped and checked for internal damage. The tail piece is ABS plastic but standard fillers and paint should work just fine.

Some wood winglets were added to both wings in an attempt to improve handling. These will be removed and standard stock tips added.

What's New Mk2

Looking for a wood F5J machine to compete with the moulded 'ships?

Brian Austin, b_austin@talktalk.net

Spanning 3.8 m and weighing in at 1.7kg, the What's New Mk2 is a large airframe which uses a Hacker A20-6 with a 4.4:1 planetary gear box driving a 16" x 10" folding prop. Power is supplied by a 3-cell 2200mAh LiPo through a Kontronik Jazz 55 Amp ESC coupled with a Castle Creations 10 Amp UBEC. Hyperion DS09AMD servos power the rudder and elevator while MKS servos power the flaps.

Full size plans as a PDF file can be purchased directly from Brian. Quite a bit has been published on the RC Groups site under Watts New <http://tinyurl.com/ybl8le4o>.

What's New Mk2 landing in foggy conditions, Essex, UK. Photo by Bill Stocks.

Slope Soaring Candidate

Sukhoi T-50 /Su-57

T-50 is the Sukhoi internal designation for the Su-57, a product of a Russian Air Force program (PAK FA) to develop a fifth generation fighter. The aircraft will be the first stealth aircraft in the Russian military. The Su-57 is being developed to eventually replace the MiG-29 and Su-27.

The prototype first flew on January 29, 2010, and nine numbers have undergone flight testing, the most recent being in August 2017. Deliveries to the Russian Air Force are scheduled to begin in 2018. It is expected to have a 35 year service life.

The T-50 airframe incorporates composite materials to a wide extent, making up approximately 25% of the total aircraft weight.

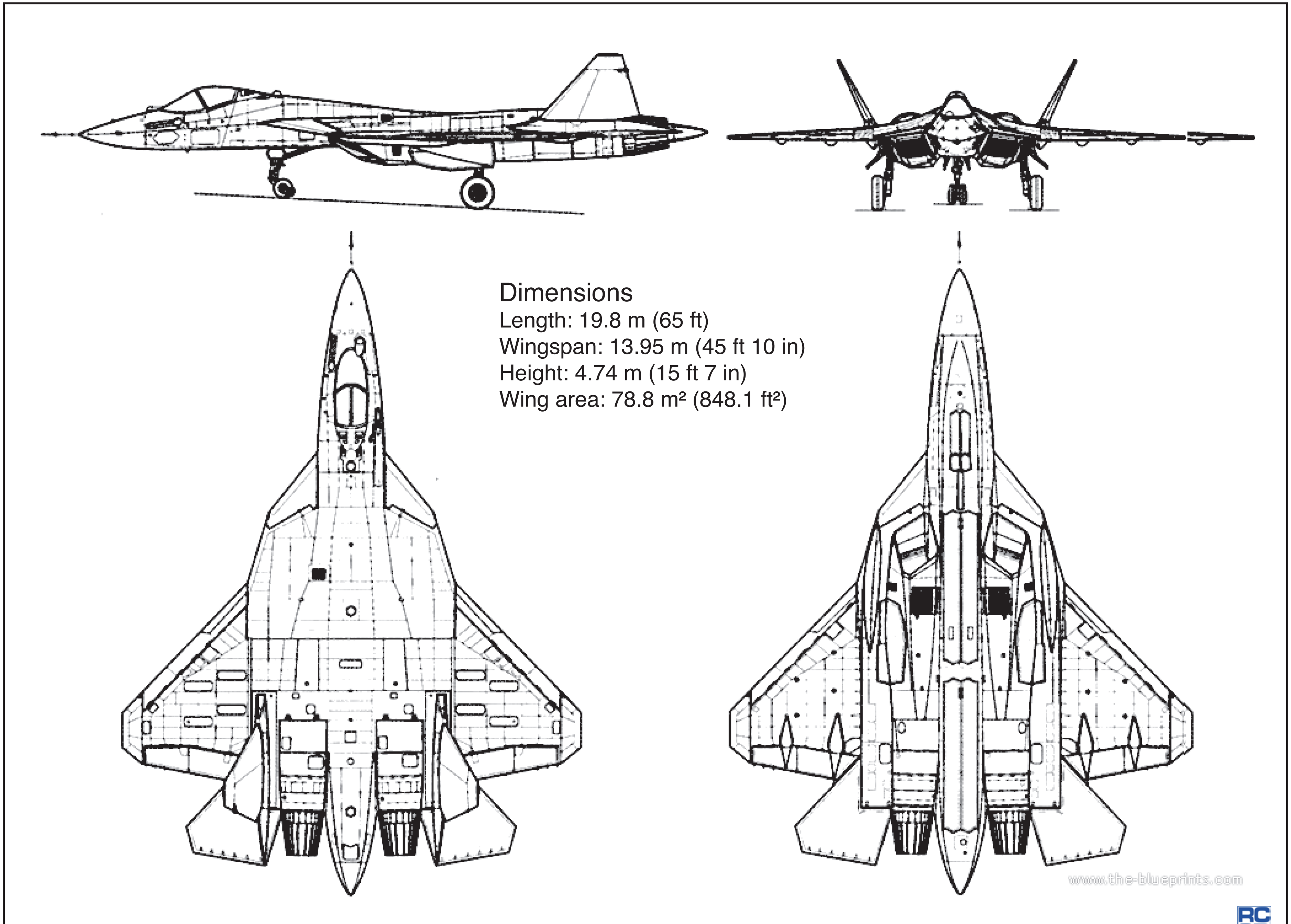
Sukhoi classifies this aircraft has having a blended wing-body. The horizontal stabilizers (stabilators) and vertical surfaces are all-moving, with the vertical surfaces being able to act as air brakes. The design also includes vectored thrust and leading edge vortex controllers (LEVCONs).

Rumors have circulated that the Su-57 or a variant thereof will be purchased by the Republic of South Korea, and there will be a joint venture with India to produce an export version which may be sold to Viet Nam.

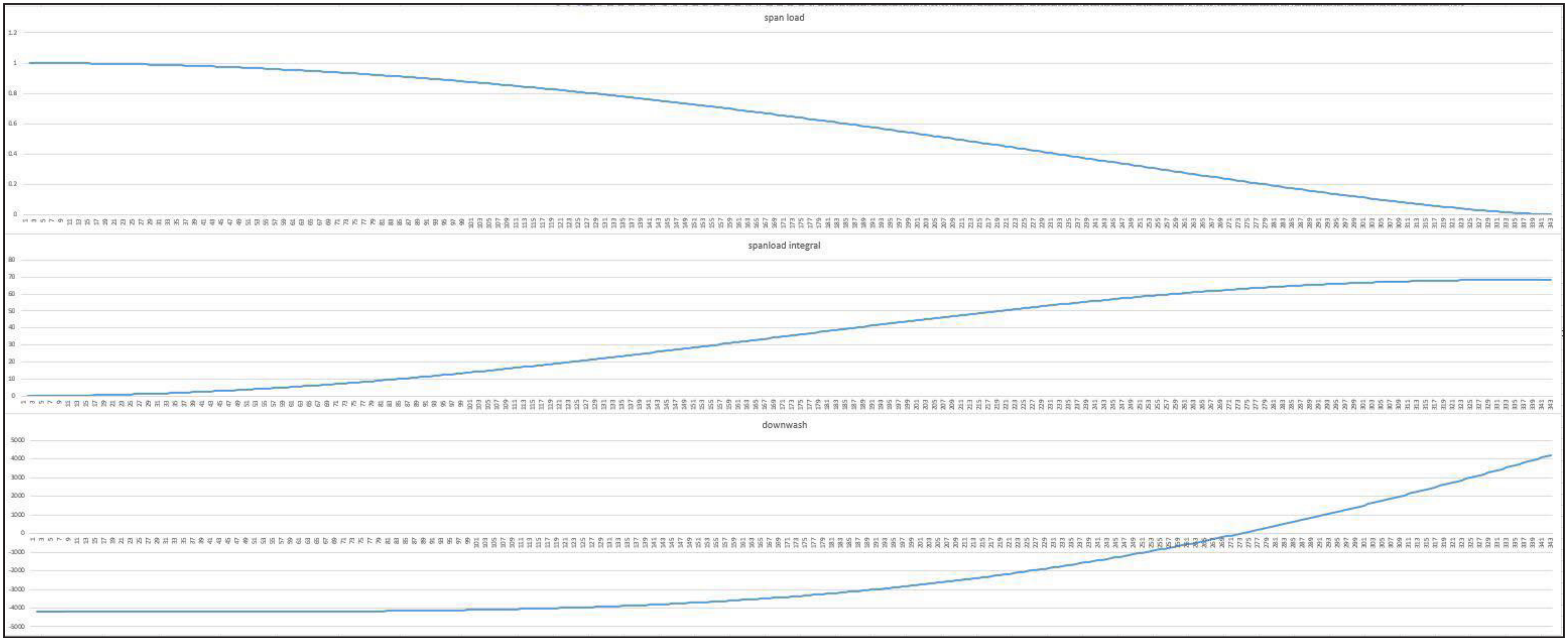
A proposed naval variant will have folding wings and stabilators and a two-seat version is also planned.

https://upload.wikimedia.org/wikipedia/commons/0/0a/Sukhoi_T-50_Beltyukov.jpg

https://upload.wikimedia.org/wikipedia/commons/0/01/Sukhoi_T-50_Pichugin.jpg


Dimensions
Length: 19.8 m (65 ft)
Wingspan: 13.95 m (45 ft 10 in)
Height: 4.74 m (15 ft 7 in)
Wing area: 78.8 m² (848.1 ft²)
www.the-blueprints.com

PRANDTL P3c Downwash



Al Bowers, Associate Director for Research, NASA Dryden Flight Research Center, via his FaceBook page

This is just WAY cool! If you integrate the spanload twice, you get the downwash! Just like Prandtl's 1933 paper! So awesome!!!

The wake is very dramatically different than wingletted or elliptical spanloads. Those have relatively constant downwash across the span (winglets have a step down in their wash, even though vertical). Prandtl's 1933 spanload has a fully 3D downwash. Once I understood what Prandtl was doing, it made all the difference in the world to me.

This is a fully 3D integrated spanload/wake, and it is the optimal aero solution for a given structure. For any amount of structure, this is the minimum drag. This is why I've gone down this path.

See also:
RCSD January 2014, p.3, Editorial
RCSD February 2017, pp. 45-49, On the 'Wing...
RCSD March 2017, pp. 28-29 On the 'Wing...

P-51B Drag Studies, 1945

Excerpts from National Advisory Committee for Aeronautics Wartime Report ACR No. 4K02, Correlation of the Drag Characteristics of a P-51B Airplane Obtained from High-speed Wind-tunnel and Flight Tests, by James M. Nissen, Burnett L. Gadeberg, and William T. Hamilton, Ames Aeronautical Laboratory, Moffett Field, California. Published February 1945.

Summary

In order to obtain a correlation of drag data from wind tunnel and flight tests at high Mach numbers, a P-51B airplane, with the propeller removed, was tested in flight as Mach numbers up to 0.755, and the results were compared with wind-tunnel tests of a 1/3-scale model of the airplane.

The test results show that the drag characteristics of the P-51B airplane can be predicted with satisfactory accuracy from tests in the 16-foot wind tunnel of the Ames Aeronautical Laboratory at both high and low Mach numbers. It is considered that this result is not unique with this airplane.

Flight Investigation

Tests

In order to determine the drag coefficient of the airplane (Figure 1) at high Mach numbers in a configuration that would lend itself to direct correlation with wind-tunnel tests, the airplane (without propeller) was towed to high altitude by a Northrop P-61A airplane, when the pilot of the P-51B airplane released the tow. The airplane was then dived to high Mach numbers and at the completion of the dive was landed on the surface of a dry lake.

In order to obtain the high Mach numbers at a safe altitude, the airplane was approximately 28,000 feet pressure altitude for the third flight in which a mach number of 0.755 was obtained.

During the dives the radiator-scoop flap was locked in the flush position at all times.

Three dives were made successfully higher Mach numbers, but on the fourth attempt a forced landing was necessitated soon after take-off due to an unexplained, premature release of the tow cable from the tow plane. The forced landing damaged the P-51B airplane beyond repair, and hence terminated this set of tests.

Wind-tunnel Investigation

Description of Apparatus

The model tests were conducted in the Ames 16-foot high-speed wind tunnel. This wind tunnel is of the single-return, closed-throat type and has a circular cross section throughout its length. ... With the model mounted in the wind tunnel, test Mach numbers as high as 0.825 were reached. The turbulence level in the 16-foot wind tunnel is very low, approaching closely that of wind tunnels designed especially to have low turbulence.

The model as tested (Figure 17) represented to 1/3-scale the P-51B airplane, even to details such as radiator-scoop-flap setting, stabilizer angle, plugging of the carburetor scoop, service pitot-static head, radio mast, airspeed booms, temperature boom, and antenna.

Wind-Tunnel-Test Results

The variation of drag coefficient with lift coefficient and Mach number is presented in figures 21, 22, and 23. The Reynolds number of the model tests, based on an average chord of 2.169 feet, varied from 4,500,000 to 8,300,000. The measurements of the forces on the model are believed to be accurate to with one-half of 1 percent, hence the data are about as accurate as the corrections to the data allow. The tunnel-wall and model-constriction corrections are necessarily of a theoretical nature, but are in general small, relative to the measured forces, amounting to less than 4 percent at 0.80 Mach number and low values of lift coefficient.

Comparison of flight and wind-tunnel results

The data of figures 9, 10, 11, and 22 have been collected in figures 23 and 24 to provide a direct comparison between the flight and wind-tunnel results. The test points shown in figure 24 are the drag coefficients determined from the flight tests, and the unbroken line is the drag coefficient from the wind-tunnel tests selected at the lift coefficient (including the pull-out) of the flight data at that particular Mach number.

During the pull-outs, all of which occurred above the Mach number of drag divergence, the flight-test data show definitely higher drag coefficients which, presumably, would be due to the increased lift coefficient. The wind-tunnel-test data at comparable lift coefficients and Mach numbers, however, showed but negligibly higher values.

Conclusions

2. During the pull-outs from dives, all of which occurred above the Mach numbers of drag divergence, the airplane drag coefficients were higher than was indicated by the wind-tunnel results for the corresponding lift coefficients. This result may be an effect of Reynolds number, an effect of the increased wing-surface waviness occasioned during the pull-outs, or a hysteresis effect which causes the separation due to the shock to persist during the pull-out.

Illustrations from ACR No. 4K02:

Figure 1, 3-view of North American P-51B
Figure 17, 3-view of 1/3 scale model of P-51B
Figures 2 and 3, P-51B and tow-release detail
Figures 4 and 9
Figures 10 and 11
Figure 21
Figure 22
Figure 23
Figure 24

Additional photos from NACA historical archive:

NACA A-5862, 1:3 scale model in the Ames 16-foot wind-tunnel.
NACA AAL-5863, 1:3 scale model in the Ames 16-foot wind-tunnel.
NACA A-6373, P-51B aircraft showing towline connection.
NACA A-6374, P-61A airplane showing towline connection.
NACA A-6371, overview P-51B tow set-up with Northrop P-61A aircraft.
NACA A-6372, overview P-51B tow set-up with Northrop P-61A aircraft.

Our sincere thanks to Jeff Rankin-Lowe <siriusproductions@sympatico.ca> for the NACA Report information and additional photos which he posted to the MilAirPics Yahoo! Group.

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ACR No. 4K02 has been placed on the *RCSD* web site:
<http://www.rcsoaringdigest.com/Supplements/ACR No 4K02.pdf>.

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NACA ACR No. 4K02 Fig. 1

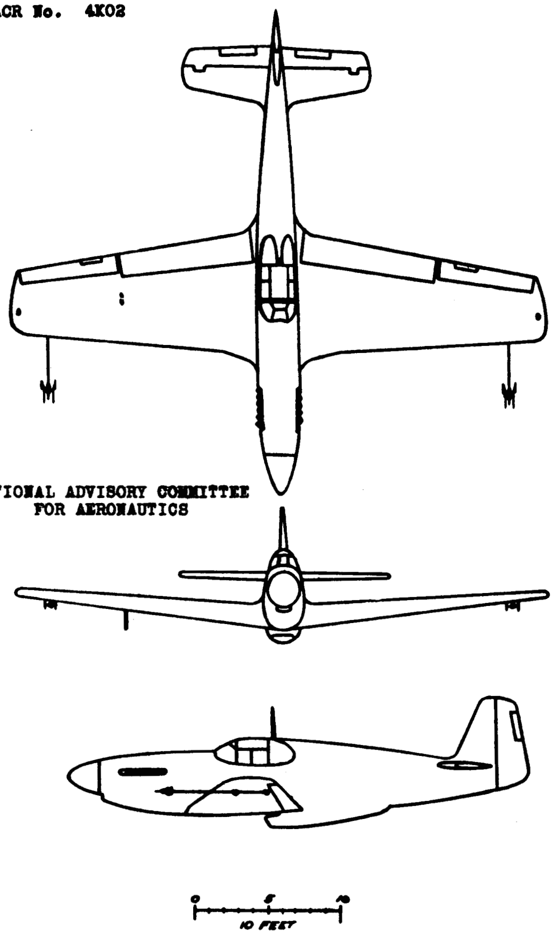

FIGURE 1.– THREE-VIEW DRAWING OF THE NORTH AMERICAN P-51B-1-NA AIRPLANE.

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NACA ACR No. 4K02 Fig. 17

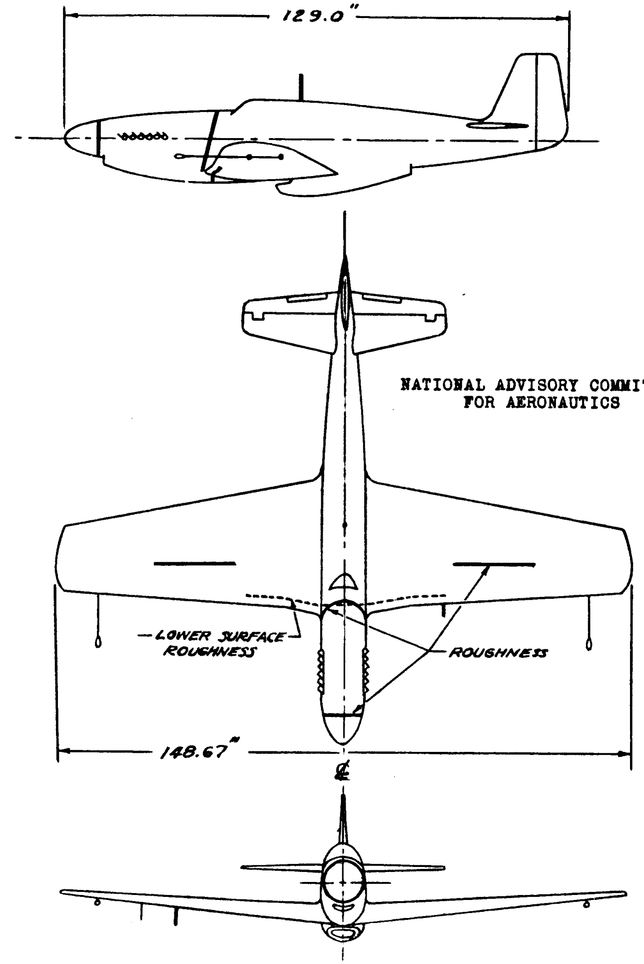

FIGURE 17.– THREE-VIEW DRAWING OF THE $\frac{1}{3}$-SCALE MODEL OF THE P-51B AIRPLANE.

NACA ACR No. 4K02 Figs. 2,3

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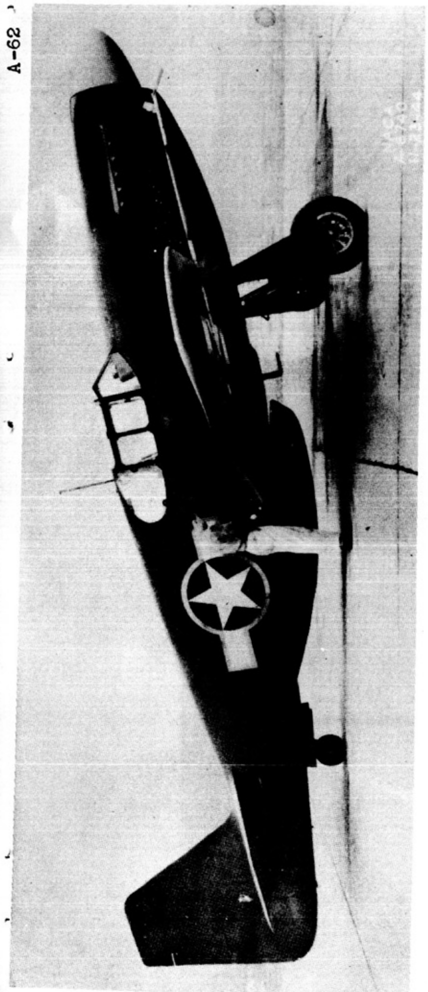

Figure 2.- North American P-51B-1-NA airplane as instrumented for flight tests.

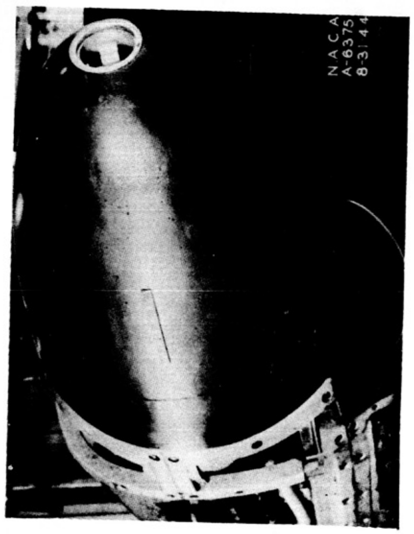

Figure 3.- Installation of tow-release mechanism and spinner on the North American P-51B-1-NA airplane.

NACA ACR No. 4K02 Figs. 4,9

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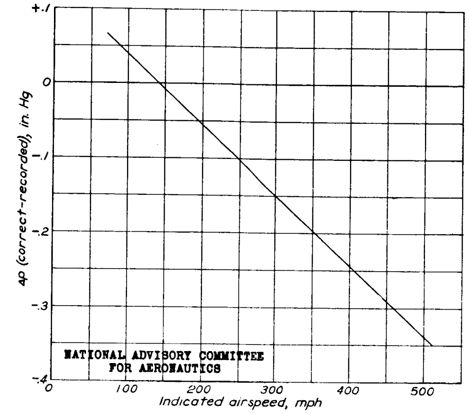

Figure 4.- Recorded-static-position-error correction, North American P-51B-1-NA airplane.

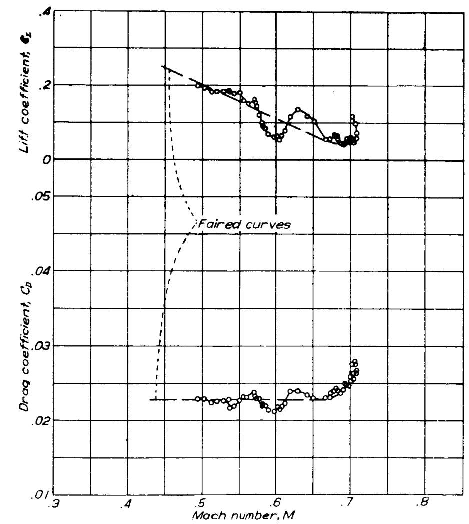

Figure 9.- Variation of lift and drag coefficients with Mach number during a dive from 25,000 feet, propeller off, most dust on airplane, flight 108. North American P-51B-1-NA airplane.

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NACA ACR No. 4K02 Figs. 10,11

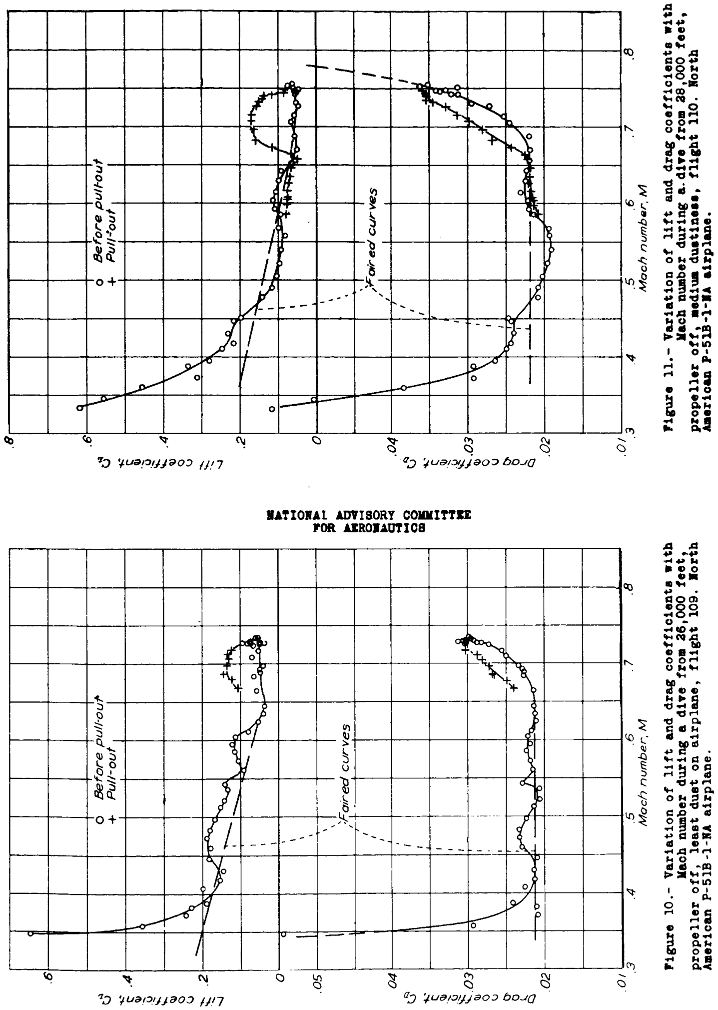

Figure 11.- Variation of lift and drag coefficients with Mach number during a dive from 28,000 feet, propeller off, medium dustiness, flight 110. North American P-51B-1-NA airplane.

Figure 10.- Variation of lift and drag coefficients with Mach number during a dive from 28,000 feet, propeller off, least dust on airplane, flight 109. North American P-51B-1-NA airplane.

NACA ACR No. 4K02 Fig. 21

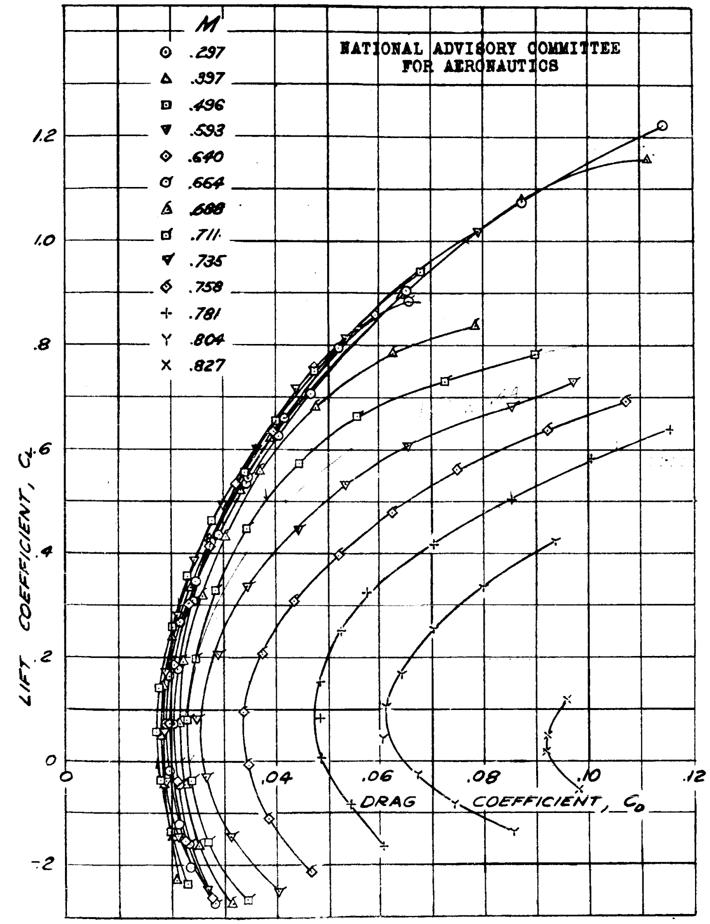

FIGURE 21.— VARIATION OF DRAG COEFFICIENT WITH LIFT COEFFICIENT AT SEVERAL MACH NUMBERS FOR THE P-51B AIRPLANE MODEL.

t/c ≅ 14%

NACA ACR No. 4K02

Fig. 22

A-62

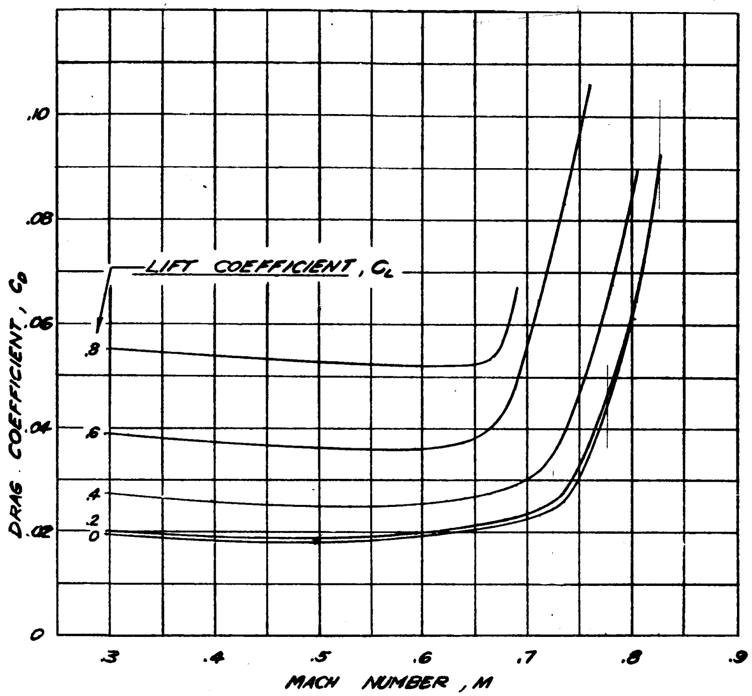

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FIGURE 22.– VARIATION OF DRAG COEFFICIENT WITH MACH NUMBER AT SEVERAL VALUES OF LIFT COEFFICIENT FOR THE P-51B AIRPLANE MODEL.

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Fig. 23

A-62

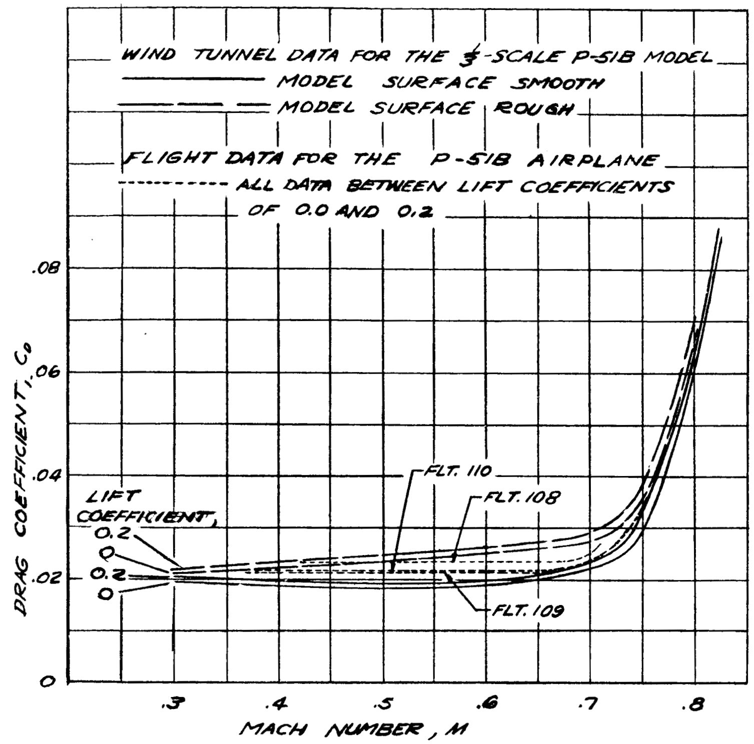

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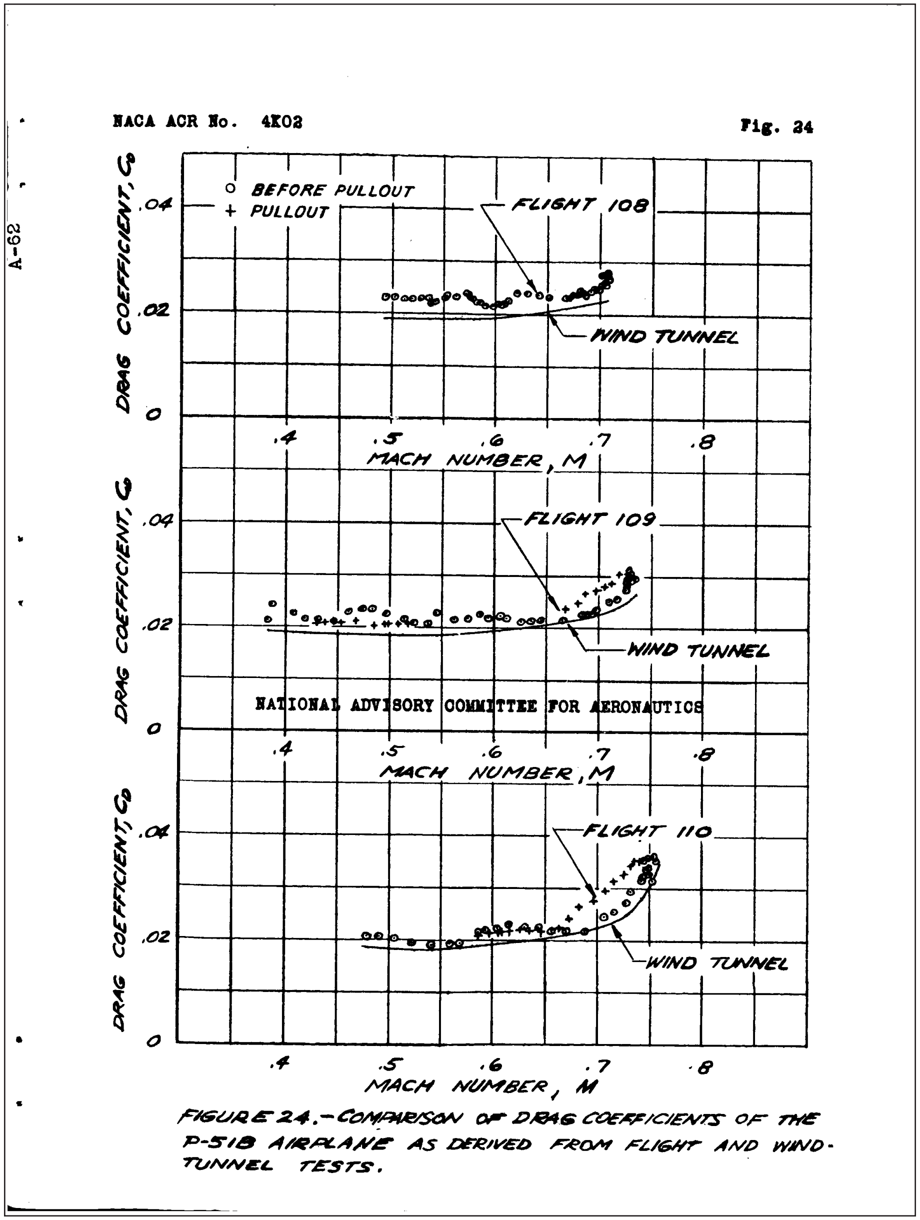
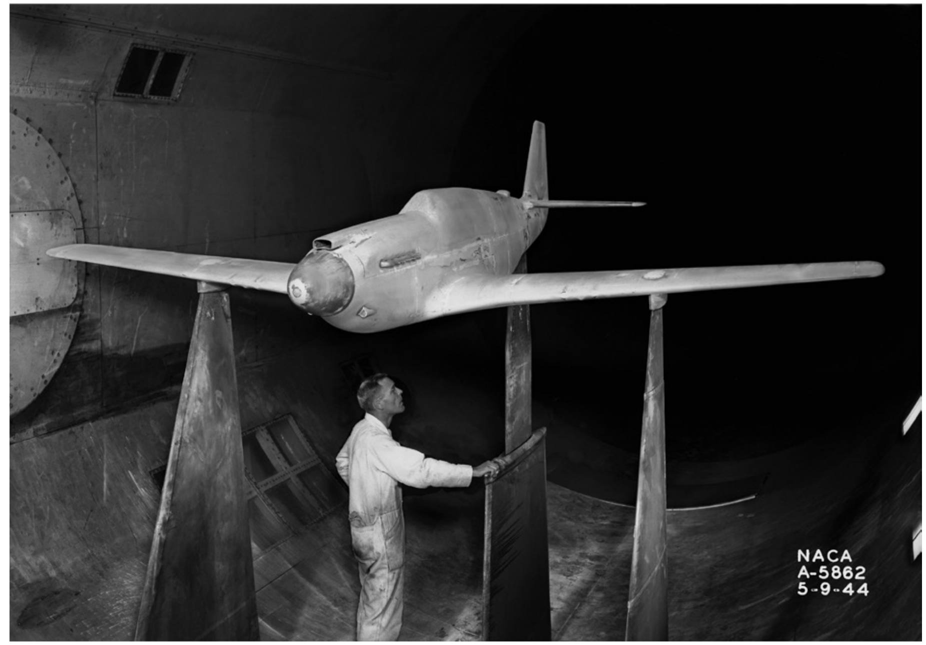
FIGURE 23.– COMPARISON OF DRAG COEFFICIENTS OF THE P-51B MODEL WITH ITS SURFACES SMOOTH AND ROUGH WITH THE DRAG COEFFICIENTS OF THE P-51B AIRPLANE.

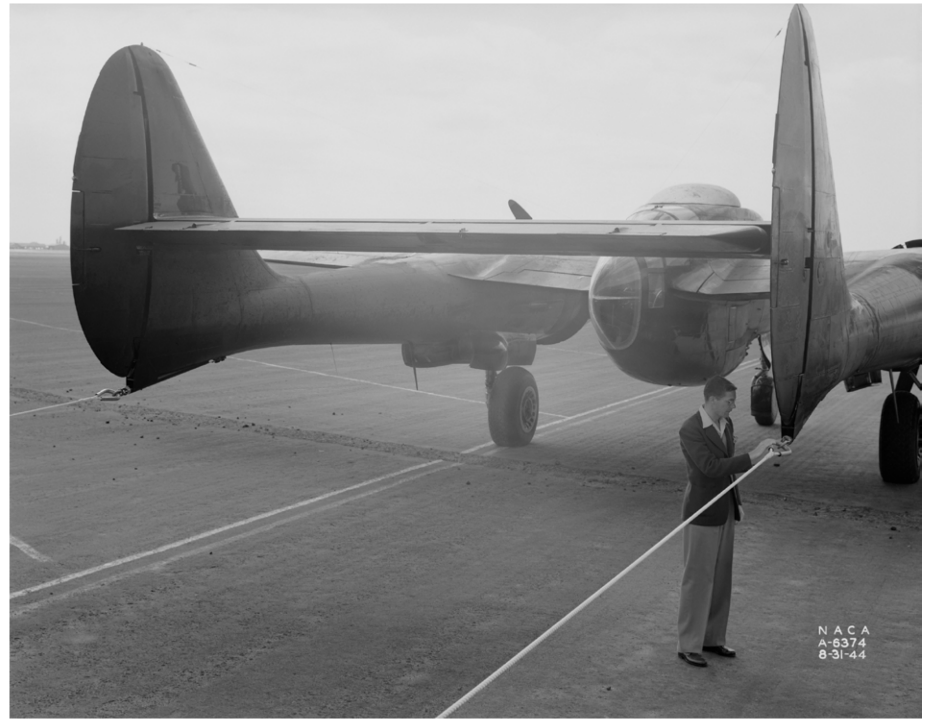




https://images-assets.nasa.gov/image/ARC-1944-AAL-5862/ARC-1944-AAL-5862~orig.jpg

https://images-assets.nasa.gov/image/ARC-1944-AAL-5863/ARC-1944-AAL-5863~orig.jpg

https://images-assets.nasa.gov/image/ARC-1944-AAL-6373/ARC-1944-AAL-6373~orig.jpg



https://images-assets.nasa.gov/image/ARC-1944-AA-6374/ARC-1944-AA-6374~orig.jpg

Above: https://images-assets.nasa.gov/image/ARC-1944-AAL-6372/ARC-1944-AAL-6372~orig.jpg

Opposite below: https://images-assets.nasa.gov/image/ARC-1944-AAL-6371/ARC-1944-AAL-6371~orig.jpg


Solstice Flight
Finding Magic Lift On The First Day Of Summer
Launch: 8:21
Launch Hgt: 170m
Land: 8:54 - 33 min.
Glider: Euphoria V2
June 21 - 2017
Latitude: 40.95
Longitude: -76.88
Sunset 8:42 - 20:42
euphoria

I had an amazing 33 minute late evening 2017 Summer Solstice flight with my F5J Euphoria V2.

Launched at a very late 8:21 p.m EST to about 170 meters over my local field in central Pennsylvania not expecting a very long flight. Cracked my one and only Guinness Stout tall-boy at 8:22 exactly, trimmed the Euphoria for minimum sink, and sat back in my folding camp chair to enjoy the celestial start to summer.

At the top of the launch there were some initial clues that something magical was going on with the air. While absolutely dead calm and cooling on the surface, there was a glass smooth West wind up at my launch altitude and I first just pointed my nose right into it.

I down trimmed just enough to penetrate the flow, and the Euphoria began to climb slowly in camber setting one.

Once upwind a few hundred more meters, I felt still better energy, and I just weaved a bit cross wind left and right, finding more smooth lift and subtle riffles of lift which eventually took me up to about 300 meters.

I dared not turn, but I didn't need to, I wasn't covering a whole lot of ground upwind and I could easily see the plane's attitude against the glowing sunset.

At 8:45, the sun was well behind the mountains now and the ground air was cooling off rapidly, but I could still see the big black silhouette of the Euphoria well enough to try to extend this ridiculous flight as long as possible.

At about 30 minutes into the flight, I could feel the conditions suddenly change, the upper level breeze got shifty and slackened, and the glider didn't want to turn any more and felt dead on pitch. Last call, the lift bar was closing.

I finished the last warmish swigs of my stout and milked another few minutes of flight time over my now really dark field and then set up for my traditional hand catch.

Total flight time was about 33 minutes with no thermal turns or even thermals for that matter.

I know what was creating the lift, do you?

This flight was not an example of a classic 'glass off' late day heat release scenario, though this may have played a small part in creating the weird lift conditions.

Since the lower altitudes had very little air movement, the ground layer cooled a bit more rapidly than the layers at 200m and above.

The day's gradient breeze was still warm and active aloft, and less dense than the building inversion below it.

The warmer moving air was bouncing over the thicker lower layer, causing upward air deflections and eddies which I was able to use to gain altitude.

As the sun set and the lower layers cooled further, the air at the altitude I was at quickly stabilized, suppressing the wind and thus any mechanically generated upward currents. You could feel the lack of positive lift in how the plane behaved, it suddenly felt like you were flying in sink between thermal cycles.

I've often experienced unusual lift conditions around dusk and you should experiment with flying later in the day after the expected thermal activity has disappeared.

You'll learn a lot about the importance of flying smoothly and just maybe experience the magic of unexpected evening 'magic' lift.

Paul Naton, pnaton@ptd.net
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http://glidefast.typepad.com/
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