THE WITTMAN TAILWIND

Aircraft Spruce & Specialty Co. SINCE 1965

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AIRCRAFT SPRUCE & SPECIALTY CO.

SINCE 1965

Worldwide Distributor of Aircraft Parts and Pilot Supplies

Dear Sport Aviation Enthusiast,

Thank you for your request for the Wittman Tailwind Information Pack. Introduced at the first EAA Fly-In back in 1953, the Tailwind has maintained popularity amongst aircraft homebuilders over the past four decades because of its simplicity, ease of construction, and outstanding performance. The Tailwind is an economical, high wing, two-seat, taildragger design which is built from traditional building materials of steel tubing, spruce wood, and is fabric covered. Using engines from 85 to 135 hp, the Wittman Tailwind is fun to build and a joy to fly.

Steve Wittman designed the Tailwind as one in a series of aircraft that produced high speed on low horsepower. One of the leaders of the golden age of air racing, Wittman also achieved fame through his designs and piloting of Chief Oshkosh, Buster, Bonzo, and the Buttercup design.

The Tailwind is a true homebuilders' classic, and Aircraft Spruce & Specialty Company is honored to have the opportunity to keep the plans alive. Steve Wittman was an aviation pioneer whose incredible vision and piloting talents were legendary, and his spirit will live on as homebuilders around the world continue to build his fine aircraft.

Aircraft Spruce & Specialty Company acquired the design rights to the Wittman Tailwind from the Wittman estate in January 1996 and currently offers plans and materials kits for the Tailwind and the Olds V-8 Engine Conversion. We invite you to join the hundreds of builders and pilots of the Wittman Tailwind and order your plans and kits today. Aircraft Spruce & Specialty Company looks forward to serving you throughout your homebuilt project.

Sincerely,

Jim Irwin
President

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WITTMAN TAILWIND LICENSE AGREEMENT

For and in consideration of the sum of $____________ Aircraft Spruce & Specialty Co. of Corona, California, does agree to extend to ____ the right to build one Wittman Tailwind, said airplane to bear serial number ________________. Aircraft Spruce & Specialty Co. further agrees to supply one set of construction drawings and an illustrated parts catalog.

Your Customer order number is:

____

This section to be signed by Aircraft Spruce representative

By ________________________________

Title ______________________________

Date ______________________________

I, ________________________________ address ________________________________

____

do agree to the conditions set forth above and in consideration thereof I further agree that said drawings, instructions, and manuals will remain the property of Aircraft Spruce & Specialty Co., and specifically agree to the following:

A. I will build one airplane only from these drawings and manuals and that said aircraft will conform to the specifications set forth in these drawings and manuals.

B. I will not allow another party the use of these drawings and manuals to build a second airplane or part thereof.

C. I will not transfer these drawings to another party without prior approval of Aircraft Spruce & Specialty Co.

D. I will not allow these drawings, manuals or instructions to be duplicated.

E. I will not use or permit the use of these drawings in the design, construction or manufacture of another aircraft.

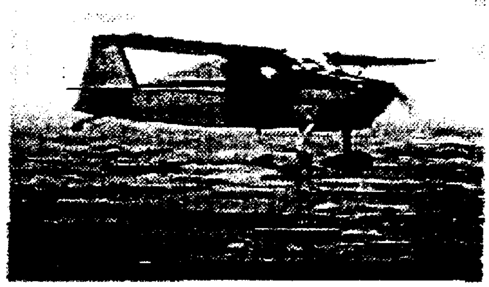
It is further agreed and I understand that Aircraft Spruce & Specialty makes no warranty, expressed or implied, as to the quality or the safety of this airplane. The buyer understands that no warranty, express or implied, is being given by the Seller or the Buyer as to the accuracy, airworthiness, suitability or flyability of the Plans or the aircraft or engine to be built with the Plans or that the airplane or engine once built is able to be licensed by the Federal Aviation Agency. The Buyer of the Plans shall accept full legal responsibility for the construction, licensing, flight or operation of the aircraft or engine and hold totally and completely harmless from any legal liability or damages whatsoever the principals, owners and employees of Aircraft Spruce and Specialty Company and the Estates of Sylvester J. (Steve) Wittman and Paula M. Wittman and their beneficiaries and trusts that they may have set up for the distribution of their estates (including the trustees thereof and the personal representatives). Further understand that any aircraft or engine constructed with the Plans shall only be built and operated in strict compliance with the Federal Air Regulations promulgated by the Federal Aviation Agency. Buyer of Plans also acknowledges that these plans were prepared in the early 1950's by Steve Wittman and Aircraft Spruce & Specialty Co. makes no guarantees as to their accuracy or currency. It is also agreed that while Aircraft Spruce will try to direct any questions regarding the Plans and construction to experienced builders, Aircraft Spruce itself cannot provide any technical builder support on the Tailwind or Engine Conversion. All subsequent buyers, heirs, successors, or assigns are also bound by all terms of this agreement.

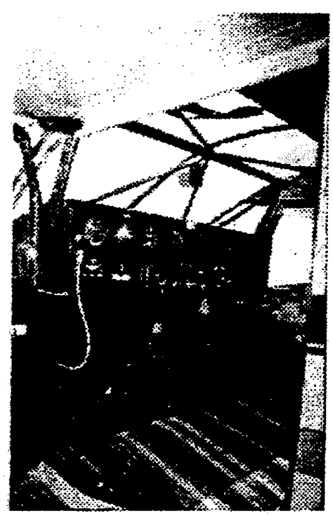
Work Ph. ________________	Signed ________________
Home Ph. ________________	Date ________________
FAX ________________	Witness ________________
E-Mail ________________	Address ________________

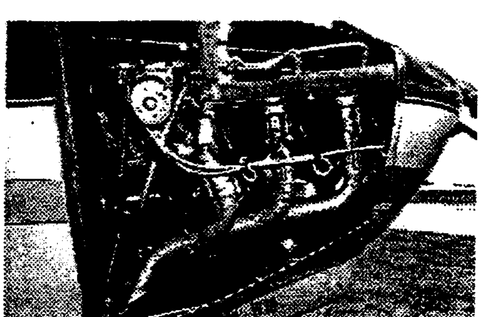
Inasmuch as Aircraft Spruce & Specialty Co. has no opportunity to supervise the manufacture, installation or maintenance of the parts supplied by it, nor any opportunity to participate in the design or manufacture of the various certificated and homebuilt aircraft in which its parts are utilized, the purchaser by placing this order and accepting said merchandise from Aircraft Spruce & Specialty Co. agrees that all materials purchased will be solely at purchasers risk and that purchaser will indemnify and hold Aircraft Spruce & Specialty Co. , its owners and employees, free and harmless from all loss, liability or damage resulting from claims bought by reasons of any alleged failure or defect of any part or parts supplied by Aircraft Spruce & Specialty Co.

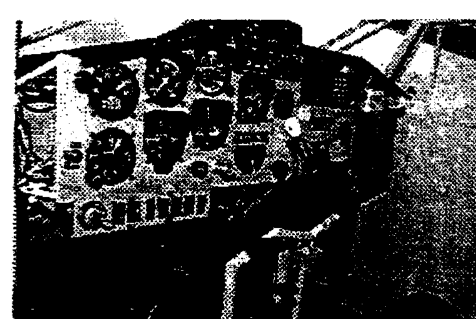
This form must be mailed back to Aircraft Spruce in order to process an order for plans.

THE WITTMAN TAILWIND









WITTMAN TAILWIND

Mac McKenna's Tailwind By Jack Cox

Permission granted to reprint from EAA/Sport Aviation, September 1993

The Wittman Tailwind was a very important milestone in the history of the modern homebuilt movement, which dates from September of 1952 when the still current homebuilt regulations went into effect. The Tailwind was the first homebuilt certified by the CAA to carry a "non-revenue passenger." This was a significant development because it took the homebuilt out of the strictly "toy" category and gave it just enough utility to make it attractive to a far wider audience.

That utility was just what Steve Wittman had in mind when he designed the Tailwind.

It all began in the mid-1930's when the Cub, Aeronca and Taylorcraft began taking aviation by storm. The Great Depression had all but killed off lightplane manufacturing because few could afford to own or pour gasoline through the big ol' biplanes that had been the standard of the lightplane world since the late '20s when Lucky Lindy had turned everyone's attention to the sky. The little Aeroncas, Taylor E-2's, and Model A Taylorcrafts changed all that, however. They were cheap enough to buy and operate that an FBO could rent them out at a price people could afford occasionally, so they quickly became the most numerous types of airplanes at every airport. Veteran pilots who had come up on the OX-5 and radial engine biplanes sneered down their noses at what they called the "flivvers" and vowed to quit flying before they would lower themselves to the level of such "kites," but those who had been priced out of flying embraced them with enthusiasm. Even when the Continental A-50 and its competitors came along in the late '30s to up the performance of the flivvers considerably, there was still resistance to the Cub-types from the older heads, but the newly instituted Civilian Pilot Training Programs snapped them up in unprecedented numbers. The little ol' flivvers would go on to train more pilots than any other type of air plane in history.

Steve Wittman was one of the experienced pilots who looked at the flivvers and found them lacking . . . but not in the way most had. The majority of the helmet and goggles crowd disliked them because of their light wing loadings . . . many, in fact, were down right afraid of them, especially in any wind and turbulence. That didn't bother Steve; his complaint, as might have been expected from a famous air racer, was that they were so slow.

Unnecessarily slow, in his view.

Steve had already built several racers by this time and had some definite ideas on what made airplanes go faster, so as he looked over the flivvers, he could readily see areas where great improvement could be made. These thoughts soon crystallized into a design of his own: a light 2-place airplane that retained the simplicity, good flying qualities, short field capability and economy of the flivvers, yet had much better performance using the same engines. That design became the Buttercup, of course, which, indeed, could blow the doors off the fastest Taylorcraft or Luscombe. Steve came within an eyelash of seeing Fairchild put the Buttercup into production but, alas, World War II came along to squash the deal . . . and deprive succeeding generations of what would have been the best little airplane to come out of the flivver era.

The Buttercup did serve a useful purpose, however. It had already functioned as the test bed for Steve's patented leaf spring landing gear, the rights to which were sold to Cessna in time for the gear to show up on the postwar 190/195's, 120/140's and 170's, and there would be more to come. In the late '40s Buttercup would be used to develop Steve's patented tapered rod landing gear, a simple but very effective leading edge slat system . . . and it would serve as the jumping off place for his next design, the Tailwind.

Following World War II, a new class of small racers had been created, initially centered around the use of the Continental C-85 engine. Steve pulled his old pre-war Greve Trophy racer, Chief Oshkosh, out of the rafters, rebuilt it as a "midget" or "Goodyear" racer (after the race sponsor), renamed it "Buster" and sent his protege, Bill Brennand, off to Cleveland. It looked like so much fun, however, that he quickly built himself a new one, used the name of his now retired pre-war Unlimited, "Bonzo," and went racing again, himself. Throughout the late '40s, Bill and Steve were the scourges of the midget air racing world, winning a lot more than their share of the races at Cleveland, Miami and elsewhere. The lightweight Wittman racers were almost always the first to the scatter pylon, and the rest of pack had to play catch-up all the way to the checkered flag. Usually they didn't.

Keeping Buster and Bonzo serviced was a relatively easy task, but did require a third airplane to carry parts and tools . . . and everyone's baggage. This task usually fell to Buttercup, with Steve's wife, Dorothy, often doing the flying. With its wide cabin and large luggage space behind the seat, Buttercup was well suited as a parts hauler, but even with a cruise of 130 mph or so, it was really too slow for the racers. Necessity was indeed the mother of all of Steve's inventions, so it was predictable that his mind began putting the elements together that would result in a new, considerably faster cross country cruiser. Since Buttercup had so much that was good about it, there was no reason to abandon it entirely, so the task really became one of making it a faster airplane. The simple, strong, easily repaired steel tube structure and tapered rod landing gear would remain, as would an easy to build, inexpensive wood wing. To cut down on drag . . . and the important point here is that this was strictly a drag reduction exercise because the same size engine would be used . . . Steve pulled down the height of the cabin just a bit to lower the frontal area, he used every trick he had learned in racing ahead of the firewall to reduce the cooling drag and he built a smaller, thinner wing. The result was a direct descendent of the Buttercup, but a completely new airplane, N5747N, which was originally called the "Flying Carpet." Both of them exist today. Steve still owns and flies Buttercup, and the Flying Carpet now belongs to the EAA Aviation Foundation and hangs in the terminal of the Wittman Regional Airport in Oshkosh in Steve's honor.

The Flying Carpet turned out to be a terrific little airplane, with a cruise of 150 mph on its 85 Continental . . . and that was without wheel pants. Max speed was an astounding 185 mph. It had an empty weight of 700 lbs. and a gross of 1,250, which meant it could haul about anything short of uranium the doors could be closed on . . . with a wing area of just 83.5 sq. ft. (The span was 20' 11" and the wing loading was 15 pounds per square foot at gross.) No lead sled, either, it stalled a little short of 60 mph and had no nasty habits of any kind. Paved airports were few and far between in the late '40s and early '50s, so the Flying Carpet had been intended from the beginning to operate off dirt and grass. Its small wheels were practical for such runway surfaces because of the tapered rod landing gear, which flexed in all directions on rough surfaces.

The docile stall characteristics and short field capability of the airplane were a real puzzle to most who saw it in the early '50s. "How can an airplane with this tiny wing stall so slowly, and why doesn't it have vicious stall characteristics?" they asked . . . and Steve just smiled. When pressed, he would invite his inquisitors to look at the top surface of the fuselage and tell him what they saw; then he would tell them that was the "secret" to the airplane's good manners and performance - but few understood or believed him. What he was pointing out was the airfoil shape of the top of the wide fuselage, and what he was trying to impart was the fact that it was producing a lot of lift, in a very beneficial manner. For those who showed sufficient interest, Steve would take them for a ride and demonstrate the almost odd ability of the airplane to simply hang on and on at a high angle of attack, shaking like a wet dog but never falling off on a wing or doing anything of an untoward nature.

"If it's not the fuselage at work, then you tell me what it is," Steve would say. . . and no one has successfully challenged his hypothesis to this day.

By another quirk of fate, the Flying Carpet was flown the first time in January of 1953 . . . the very same month the little group of Milwaukee area enthusiasts led by Paul Poberezny met to form what would become the Experimental Aircraft Association. Steve heard about the group, joined and began flying his little speedster down from Oshkosh . . . at night . . . to attend the monthly meetings. To merely say he and the airplane were sensations would be the understatement of our generation. The reason we call the 1930's the "golden age of air racing" is that during that decade, aviation was the cutting edge of progress. The atomic bomb, the jet engine, the space program, the computer chip were all still in the future. The world was between great wars with their dashing fighter aces, so air racing was the most dramatic and heroic form of aviation . . . and the most visible. With the depression to end all depressions ravaging the nation, life was pretty drab and dismal for a generation that could wistfully recall the fun and excitement of the Roaring Twenties. Diversion was needed, heroes were longed for . . and they were provided by promoters like the Henderson brothers who produced the great National Air Races. These were gigantic events, as large as Oshkosh in many respects and even better known to the general public. The races were broadcast live on network radio to the entire nation, were front page stories in all the leading newspapers and they were featured in movie theater newsreels just days after they were over. The race pilots were superstars of the day, their names and faces as recognizable as movie stars and crooners.

Imagine, then, the awe of the original group of EAAers when Steve Wittman chose to sit among them in their meetings. Steve Wittman, the daring pilot who outran Roscoe Turner and all the rest of them in the legendary Thompson Trophy race until the engine of his little homebuilt overheated or the mags began breaking down on him . . . the celebrity who had been interviewed on national radio and heard by millions . . . the hero they had idolized because he was a "little guy" who had made himself a great success by his own efforts rather than with the money of a big sponsor.

Besides Steve, himself, there was tremendous interest in the tiny red with gray trim airplane he flew to the meetings. EAA'ers immediately grasped the significance of the design: an airplane that required a minimum of skills to build, that was affordable, both to build and operate . . . and yet was about as fast as the most expensive and powerful factory airplanes on the market. Only two questions remained to restrain everyone from kidnapping Steve and forcing him to draw up a set of plans: Could the average pilot really handle such a hot looking little race bred airplane . . . and would the CAA approve the carrying of passengers in a homebuilt? The CAA answered the second question when Maintenance Inspector Tony Maugeri signed off on a series of flight tests conducted by Steve in December of 1953, making the Flying Carpet the first homebuilt to be approved for the carriage of non-revenue passengers. The first question was answered when Steve was finally able to take EAA'ers for rides so they could see for themselves how easily the airplane handled.

Then, of course, the pressure was really on! Steve was badgered from all sides for drawings and, finally, he relented and made them available . . . but only after designing and testing an even more forgiving wing. (Interestingly, the new wing was 14 inches shorter than the original wing.)

In one respect EAA'ers have always been the same, which is evidenced by the fact that the first question Steve received after he began shipping plans was, "Can I use a bigger motor?" Knowing he couldn't hold back the hot rodders, Steve built a second airplane, N9052C, in the mid-'50s . . . the name had become "Tailwind" by this time . . . powered by a 125 hp Lycoming O-290D. To everyone's surprise, except Steve's, the airplane was only marginally faster than the 85 hp prototype. The extra weight essentially cancelled out the extra power and little was gained, which simply proved how efficient the airplane was in its original form. It didn't matter, however. Over the following four decades, homebuilders would proceed to stuff every engine one could imagine into a Tailwind even if the results proved to be hardly worth the added effort and expense. This was the typically American hot rod syndrome at work and it probably didn't occur to most that they were going against the grain of almost everything Steve had originally striven for in the design: efficiency and economy. And in any case, they didn't care. They loved their Tailwinds. They were relatively inexpensive, they were easy to build and maintain, they were easy to fly and they were fast. What more could you want?

Even Steve got caught up in the horsepower race. He installed a 160 hp Lycoming 0-320 in one of his Tailwinds in the late '50s and even had a tricycle gear on it for a time. The 6 cylinder 0-300 Continental (145 hp) became a favorite with Steve and many of his builders (and still is today), and one of his best known projects has been his inverted Olds V-8 powered Tailwind, which is kept at his home in Ocala, FL today and is flown almost daily during the winter half of the year he spends there. When he moved to Florida a number of years ago, Steve decided he needed an airplane capable of making the Oshkosh to Ocala flight non-stop and proceeded to design what is essentially a larger Tailwind powered by a 225 hp Continental. Actually a completely new airplane, with a new airfoil and a different adaptation of his old leaf spring landing gear, the O & O Special ("Oshkosh to Ocala" . . . or just the opposite when he's heading north) has proven to be just as remarkable as his earlier designs, including his racers. Despite its power and weight, it is perhaps the most docile of all his designs.

Despite the many variations of the Tailwind . . . Steve has constantly updated it over the years . . . there are still those who prefer the original concept of efficiency on low power.

WITTMAN TAILWIND W10
AIRCRAFT PERFORMANCE REPORT

by
Comparative Aircraft Flight Efficiency, Inc.
A non-profit, all volunteer, tax-exempt educational foundation
Co-sponsored and Funded by the
EXPERIMENTAL AIRCRAFT ASSOCIATION

Overview

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Permission granted to reprint from Sport Aviation, June, 1994.

The Wittman Tailwind is an historic aircraft design. It first flew in 1953, a few weeks before the birth of the Experimental Aircraft Association. It demonstrated exceptional flight efficiency, incorporating a number of aerodynamic design features which Steve Wittman had gleaned from his extensive air racing experience. Prospective homebuilders at that time were both incredulous and inspired by the Tailwind. It was the stuff of which dreams were made and can be credited with helping the fledgling EAA to grow. Jack Cox's excellent history of the Tailwind was published in the September 1993 issue of Sport Aviation.

Steve Wittman and his original Tailwind were called upon by the CAA to serve as the testbed for establishing G load limits for homebuilts. Steve, with parachute, performed the high speed dives and pullups with a Polaroid camera aimed at the G meter. The Tailwind was also the first homebuilt certified by the CAA for carrying non-revenue passengers.

Dr. August Raspet, a professor of aeronautics at Mississippi State University, conducted an elaborate drag polar evaluation of the Tailwind by towing a propeller-less example to 10,000' altitude with a 450 BHP Stearman, releasing it as a glider, and measuring its gliding sink rate at known weights but differing air speeds. This work, published in 1956, confirmed the Tailwind's remarkably low drag coefficient.

The CAFE Foundation, 1993 recipient of the Thirty Third August Raspet Memorial Award, felt it was particularly appropriate that the latest version of the Tailwind, the W10, be the subject of this Aircraft Performance Report, wherein a new zero thrust glide testing method is used to evaluate its drag characteristics.

Direct comparisons of the drag characteristics of this Tailwind with the one tested by Professor Raspet, unfortunately, are not pure due to the evolution of the design since 1956. The earlier version had no wheel pants, a shorter fuselage, stabilizer end plates, no spinner, a shorter span, shorter landing gear, a different cooling and exhaust system, different wing tips, 350 lb less gross weight and a different airfoil.

The W10 version was longer than the W8 in having 5.5" longer chord in its tail surfaces. It also had slightly taller landing gear to accommodate the larger engines.

As is our practice in selecting aircraft for testing, we consulted the designer, Steve Wittman, for his recommendation as to the current best representative of the W-10 Tailwind. He offered a list of those who had purchased W10 plans, and several were contacted. The most outstanding candidate was Jim Clement of Merrimac, Wisconsin. Jim used a week's vacation and flew to the CAFE Aircraft Performance Evaluation Center in Santa Rosa via Albuquerque, arriving on 3-3-94.

C.J. Stephens flew his subjective flight test evaluation the following afternoon, on 3-4-94, after the aircraft had been drained of all fuel and an empty weight c.g. had been obtained.

The next 36 hours were spent by a crew of 7 CAFE Board Members installing the DAD, CAFE Barograph, camcorder and all the attendant sensors.

Five performance evaluation flights were conducted on 3-6-94, beginning at 5:40 AM. Multiple attempts were required to obtain usable zero thrust data. That evening, the test equipment was removed and the aircraft was returned to original condition. The following morning, Jim departed in his Tailwind homeward to Wisconsin.

Tailwind N6168X is not "stock". It has 1 ft less span, 4 sq ft less wing area and the firewall was moved 2 inches forward from the cabin to provide greater leg room. The door openings are 2" wider on their aft edges than the standard plans. This aircraft has a custom modified Sterba propeller on a 4" prop extension. The wingtips are of the latest design, which Steve Wittman claims improves the performance significantly. The wingtip lights are concealed in custom-built flush lens covers. The wheel pants are also customized to reduce drag.

FLIGHT TEST METHODS

This flight test was conducted using equipment and techniques as described in the May 1994 issue of Sport Aviation.

Takeoff distance was measured at a weight of 1431.9 lb by observers stationed at 100 ft intervals along a 1° downhill runway into an 17 kt head wind.

Maximum level speeds at altitude were obtained in smooth air with the CAFE Barograph using full throttle with mixture leaned for best power, and are compensated for the known flat plate drag due to the barograph wing cuffs with 4' boom (.09 sq ft).

Rates of climb are computed based upon the calculated geometric altitude change which would obtain on a standard day at the recorded aircraft weights.

A 1 G clean stall was performed from level flight with less than 18" of manifold pressure and less than 1750 RPM, using a 1 kt per second deceleration. The stall was then repeated using full flaps.

The zero thrust glide information is considered an approximation on this aircraft due to post-frontal atmospheric disturbances and technical problems in detecting the zero thrust crank position amidst the .011" endplay of this engine. The flat plate drag equivalent for this aircraft is deemed accurate to plus or minus .1 sq ft .

Confidence values were applied to the data points before curve fitting the drag polar to the glide data. Consideration was given to the flat plate drag value implied by the low altitude Vmax demonstrated by this aircraft, 211.7 mph TAS. During that speed run, the aircraft was still accelerating strongly when it reached its 200 mph redline IAS. At that point the pilot terminated the run because the CAFE Foundation test program is confined to the normal operational envelope of the aircraft.

The high altitude cruise speeds of this Tailwind would imply that it is capable of 220 mph at sea level. The owner has reported near 220 mph IAS in level flight at 2900 RPM at low altitude. With 16.2 gph at 2828 rpm, our test implies 180 BHP at .54 bsfc. This stock Lycoming 0-320 BIB (nominally 160 BHP) had accumulated 80 hours since overhaul. It had a crossover type exhaust system and showed extremely stiff compression when hand turning the propeller. A "dipstick" tool was used to check this engine's piston height at TDC. The height was identical to the known stock piston height value on Steve Barnes' 0-320 BIB, confirming that normal compression pistons were in use.

The Vetter Digital Acquisition Device (DAD) was used to record engine parameters. PropTach rpm's are plus or minus 1 RPM. Fuel flows were calibrated to better than .5% accuracy. Noise levels were measured on a TES1350 Digital Sound Meter placed adjacent to the pilot's right ear with a forward facing microphone.

All altitudes are accurate to plus or minus 1 ft . CAFE Barograph airspeeds are CAS, obtained with the pitot-static source positioned 51.4" forward of wing L.E. and 72.5" outboard of the propeller diameter. A chart comparing CAS to the aircraft's airspeed indicator readings is provided at the end of this report. The IAS errors at low speeds are presumed to be due to the placement of N6168X's static port on the midline of the fuselage belly 4' forward of the rudder trailing edge.

Test equipment totaled 57 Lb including barograph #2 and pitot missile #2, computer, camcorder, DAD, fuel pump and batteries. The 1 amp barograph heater was powered from the wingtip light wire, while barograph data reached the cockpit via an .5" x .003" copper foil adhesive applied at the 60% chord on the bottom wingskin.

The CAFE Scale was used to determine all aircraft weights. The takeoff weight and c.g. were determined for each of the 7 flights. Practical loading considerations precluded flights at extreme forward c.g.'s. Weighing after each flight allowed an accurate calibration of the DAD's fuel totalizer and gph.

The DAD, camcorder and barograph clocks were all synchronized just prior to each flight.

The graph above was obtained in accordance with the zero thrust glide method developed by CAFE Board Member Jack Norris working with his partner, Dr. Andrew B. Bauer. A zero thrust sensor, installed on the engine crankcase so as to detect fore-aft movement of the crankshaft during flight, senses the transition point from tractoring to windmilling, i.e., the zero thrust condition. At zero thrust, the propeller effectively becomes "invisible" and the aircraft becomes a "pure" glider. The wing cuff-mounted CAFE Barograph accurately records time, airspeed and sink rate while gliding in the zero thrust condition. Synchronized recording of fuel flow, computed instantaneous aircraft weight, RPM, and incline angle of the crankshaft at each different airspeed, yields data, which, when corrected for crankshaft incline vector, can be entered into the following formula:

W x Sink Rate = Drag x TAS

Where W = instantaneous aircraft weight, Lbs.
TAS = true airspeed in feet per second
Sink Rate is in feet per second
and Drag is in pounds.

The "J" shaped curve is a plot of calibrated indicated airspeed (CAS) at gross weight versus drag and is called the aircraft's "drag polar". The drag polar, wingspan, wing area, gross weight and r, the air density at sea level, provide the information needed for the calculated results above. The term Carson's speed refers to the excellent paper, "Fuel Efficiency of Small Aircraft", (AIAA-80-1847, 1980) by Professor Bud Carson of the U.S. Naval Academy, which, using prior work by Gabrielli and von Karman, defines this speed, as the maximum speed per unit of fuel burned. Carson's speed can be calculated as 1.316 times the speed for maximum lift to drag ratio, which, in turn, is 1.316 times the speed for minimum power and minimum sink rate. Carson's speed is also defined as the tangent point on a line which is tangent to the drag polar and passes through the origin.

The lowest point on the drag polar is the point of minimum drag and this occurs at 104 mph CAS, which is the speed for maximum lift to drag ratio. The value of 2.03 sq ft, the drag area from the parasite drag equation in the legend above, is here deemed accurate to plus or minus .1 sq ft.

FLYING QUALITIES EVALUATION
TAILWIND N6168X
By C.J. Stephens

INTRODUCTION

During the period March 3rd through 7th, 1994 the CAFE Foundation completed a thorough evaluation of Jim Clement's Tailwind, N6168X. The first flight of the series was my subjective evaluation of the stability and handling qualities in addition to the airplane's general accommodations.

PREFLIGHT INSPECTION

I had not flown a Tailwind prior to this evaluation. At first look it was a very impressive airplane. The wings had an extremely smooth, clean appearance with no bumps, antennae or other objects to interrupt the airflow. The entire wing surface, with as nice a finish as I have ever seen, was hindered only by the single wing strut attach point. Even the wingtip lights were faired in with smooth precision. It was obvious that the builder was extremely conscientious during its construction. The aircraft was only recently completed and had logged only 80 hours of flying time.

The aircraft was fueled and ballasted to 18.2% MAC c.g. at the maximum allowable gross weight. The CAFE doctrine of not exceeding any specified limit or previously demonstrated capability was followed throughout the series of test flights.

Like many pilots, I have seen this square-looking plane over the years and given it little attention since it lacked the rounded lines which one associates with modern high performance aircraft. The outwardly box-like appearance of the design belied its actual performance. The preflight inspection quickly showed that Jim Clement had done an excellent job of keeping the plane simple, just as intended by the designer. He had carefully avoided the installation of unnecessary equipment.

The instrument panel contained a basic set of instruments plus a turn coordinator that could be switched on if needed. The radios were limited to an intercom, VHF comm and a loran. All were quality equipment and worked perfectly throughout the period of the evaluation.

The fuel filler spout was located externally in the forward right lower corner of the windshield. The fuel quantity could be easily checked by dipstick and the cap security could be seen even from the cockpit. All 33 gallons of fuel were in one tank located forward of and below the instrument panel. A short fuel line and one on/off valve controlled the fuel flow. Big tank, short line, and an on/off... now that is a simple fuel system. One could argue against the safety aspect of having a large fuel tank in the cockpit, however, it is difficult to dispute the principle that simplicity, when dealing with fuel management, is a major design priority.

I am 5'-10" weighing 170 lbs and I found the cockpit to have adequate room. During some of the test flights I was accompanied by an engineer of about my size. It was 'snug' but not uncomfortable. Another CAFE test pilot who is 6'-3" found his head just in contact with the overhead structure. His leg room was also at a minimum even though the seat did allow for some adjustment fore and aft.

A large cabin door, located on each side, opened widely. No boarding steps seemed necessary and the wing strut attachment was well forward and out of the way. Entrance to and egress from the cockpit were unhampered, requiring only one large step to slide into the cockpit seats. The seats were comfortable, providing good support in the proper places. Even the longer flights produced no discomfort. Very nice shoulder harnesses were provided for both the pilot and the passenger.

The 0-320 started quickly on every start using only the accelerator pump for priming. The field of view while on the ground is somewhat limited with the high nose position typical in tailwheel aircraft. There is a need to stretch to see over the nose, but depending on your sitting height, full view of the taxiway is available to within 150' in front of the plane. Field of view up and to the left or right (as in clearing prior to takeoff at an uncontrolled airport) is restricted and less than desirable. By raising slightly in my seat, my field of view was good enough so there was no need to use S turns to taxi.

The short wings made taxiing in tight places quite easy. The tailwheel was steerable, but not full swiveling, and very effective for ground operations. The brakes were excellent and were used to assist during the tight turns on the ground. The plane could pivot at about the wing tip by using rudder, brake and some power.

Ground handling without the engine running was easily accomplished by manually picking up the 50 Lb. tail and pivoting the plane to the desired position. This was even done several times with two people in the cockpit when moving it on and off the scales, although it required two people to raise the tail with a full payload aboard.

In keeping with the simplicity theme, no parking brake was installed, nor were any cowl flaps. The magneto switch was located on the far left of the instrument panel. This was inconvenient. On tailwheeled airplanes in which the throttle is in the right hand and the stick must be held back during the run-up, the magneto switch should be accessible to the right hand.

The pitch trim, located under the seat, was very nice. It had friction washers to hold the setting and it loaded a tension spring against the elevators by use of a small lever. I used the setting recommended by the builder for takeoff, which was done by feel, and was easy to operate.

The roll trim annoyed me at first. It involved a sliding washer fit on a tube which loaded a spring against the right aileron rod behind the passenger seat. It took some practice to fully understand and operate this system. The initial tendency was to work it backwards. It was, however, a simple device and light in weight. With enough practice one could adequately trim the plane in roll.

A conventional vernier throttle was installed. This is not my preference of throttle types especially if the flying includes a lot of power changes or formation flying Vernier throttles, however, are very nice on cross country flights.

FIRST FLIGHT IMPRESSIONS

As I taxied the Tailwind onto the runway for my first flight I was eager to see what it held in store. There was a 7 knot direct headwind.

The control stick was floor-mounted just forward of the seats in the center of the cockpit. The top of the center stick curled to the left over the pilots right thigh and downward so as to create the conventional feel of holding a stick that was directly between your legs. It worked very well except that it took a little practice to find a neutral aileron position.

The radio transmit button was on the end of the stick, pointed downward at the floor. It presented no problem as long as you knew where to find it. Since it was not visible from the normal sitting position, you could look in all normal places and never find it. The aircraft accelerated rapidly due to the high power to weight ratio. Directional control was very quick initially during the takeoff roll, but once the tail wheel came off the ground, it was less sensitive. Very light stick forces were obvious right from liftoff. These were more noticeable in pitch than roll.

Liftoff occurred naturally at an indicated 65 mph. Initially with 2400 RPM and 28.3" manifold pressure, it was climbing at an impressive indicated 1600 fpm Even though stick forces were light, it was easy to hold a constant 120 mph IAS.

The owner had recommended leaning the mixture during the climb. This was done, although, with no CHT installed, it was only "best guess" and experience to achieve a workable mixture setting.

With the small size of the plane and the relatively high power, P-factor was noticeable but was easy to control with a light application of rudder. During the climb it was necessary to briefly level off at 4500' to fly out from under a cloud shelf. At 2550 rpm at 4500' the cockpit airspeed indicator went right to 180 mph. The noise level in the aircraft at this point was substantial, and demanded the 20 db noise protection provided by my headset.

The location of the wing root leading edge is well forward and slightly above the pilot's visual line of sight from a normal sitting position. During turns this obstructed the pilot's view. It was more noticeable in a left turn than a right turn. As the bank is increased the large window above the pilot can be used to see what is ahead in the turn, so that with greater than 40 degrees of bank, a full field of view is again available. During shallow bank turns I felt a little uncomfortable with the limited view and would compensate by occasionally raising the wing to look under, or, increase the bank to look out the top window. Due to the limited amount of horizon in view, there may be an increased possibility of spatial disorientation while flying in reduced visibility conditions.

ACCOMMODATIONS

During several subsequent flights the humidity was high and windshield fogging occurred. The cabin was very well sealed and afforded little natural airflow, which kept it nice and warm but allowed for the accumulation of the condensation. With a handkerchief, some of the accumulation could be removed, but without unstrapping, most of the windshield was just too far away to reach. Two small vents from the engine compartment had been installed to help the fog problem, but had been capped off for the trip to Santa Rosa. The cabin heater worked very well. There was a very simple cuff around the exhaust manifold which could be controlled with an on/off valve on the instrument panel. Turning the heater up to full volume helped some with defogging the wind shield.

The only gyro was a turn coordinator that was switched so it could be left off when it was unneeded. No yaw trim system was installed.

A small flap was installed on the aircraft with a three position manual extension system. The first two notches of flaps were easy to use, however quite a twist of the body was required to get the handle far enough aft to catch the last notch. The forces of flap extension/retraction were light.

STATIC LONGITUDINAL STABILITY

The aircraft was trimmed for 120 mph at 8500' to evaluate the speed stability. A hand-held stick force gauge was used to measure the elevator stick force. Without re-trimming, the stick force was measured every 10 mph over the entire range from 80 mph to 180 mph. The resulting stick force gradient is plotted on the graph in Figure 1. The results show a change of only 1.45 lb stick force over the entire speed range. This amount of stick force is considered extremely light. An inexperienced pilot may find it difficult to fly with so little feedback. The pilot must rely on other inputs such as the indicators to control pitch accurately. A temporary lack of attention, even by a more experienced pilot, could result in a dangerous loss of airspeed control.

DYNAMIC STABILITY

Pitch doublets, first down then up were introduced to evaluate the natural damping qualities of the airplane. Both stick-free and stick-fixed methods across the full speed range were evaluated. The results showed dead beat response; that is no overshoot or oscillatory tendency was observed. Displacing the airplane in yaw and roll to explore the Dutch roll tendencies also showed quick damping with no tendency to persist. Thus, even though the stick forces are very light the plane exhibits excellent natural dynamic stability qualities.

SPIRAL STABILITY

The aircraft was trimmed for level flight at 130 mph and bank was established at 15 degrees, first right then left, to determine if it would over bank or level out on its own. The aircraft held the bank angle exactly during these maneuvers. It seemed as if it were connected to an automatic pilot. After completing nearly 360 degree turns the test was ended, noting the absolute neutrality of the spiral stability.

ROLL DUE TO YAW

With the aircraft in trim at 100 mph stick forces to maintain level flight were measured in roll with first 1/2, then with full rudder deflection. Approximately 1.5 lb of force was required in each direction with 1/2 rudder displacement. With full right rudder a 5 lb left aileron force was required and with full left rudder a 4.5 lb right aileron force was required to keep the plane in level flight. Considering the otherwise very light stick forces of this plane, these values show a very strong dihedral effect. To further explore the dihedral effect, a 45 degree bank was established. Then, with rudder alone, the wings were leveled keeping the ailerons neutral. This airplane exhibited, without a doubt, the fastest rate of roll that I have seen in a straight winged airplane using rudder only. This tendency was consistent in both directions at all airspeeds explored. This strong roll due to yaw may be caused by the tapered wing tip design since the wings have no geometric dihedral.

ROLL PERFORMANCE

Full deflection aileron maneuvers were examined to measure both the roll rate and stick force. In one G flight, the time required to change bank angle from 45 degrees in one direction to 45 degrees in the other, including the acceleration, was measured. Roll rates of 47 degrees per second at 120 mph, and 45 degrees per second at 100 mph were observed in both directions. The stick forces steadily increased with greater deflection up to 9 lb at full displacement. This amount of natural feedback, though light, blends well with the very light elevator force. It would prove undesirable to fly if the ailerons were heavy and the elevators very light.

Adverse yaw was evaluated by using aileron only to establish a bank, then observing the yaw displacement/hesitation. The Tailwind showed mild adverse yaw in that it would only yaw about 5 degrees and hesitate slightly before starting the turn.

MANEUVERING PERFORMANCE

Maneuvering performance was evaluated at 120 mph at 2 and 3 G's. The results were 4.5 lb and 7 lb of elevator stick force, respectively. Full flap maneuvering at 87 mph produced a stick force of 4.0 lb No overshooting tendencies or stick force lightening were observed during any of the maneuvers. These stick forces were consistent with the very light stick forces noted during other phases of the evaluation. Though enjoyable to fly the Tailwind requires a gentle hand.

STALLS

It was fascinating to perform the stall evaluation in this airplane. The stall test flight had been loaded to maximum allowable gross weight. The actual stall would occur with the airspeed indicator's needle dropping to below 41 mph. Later flights with the CAFE Barograph showed a large error in the low-speed accuracy of the cockpit airspeed indicator.

There was a very pleasant and mild aerodynamic buffet with onset 4-5 mph above stall, and it increased to the point of stall. Power setting was not a factor in the stalls since low power settings were used to decelerate at about 1 mph per second. All stalls broke straight ahead with neither wing wanting to stall ahead of the other. Recovery occurred with the slightest bit of power or relaxation of stick back pressure. All recoveries resulted in less than 100 feet of altitude loss.

TRIM AUTHORITY

The aircraft could be trimmed to level flight at all airspeeds from Vne down to 86 mph. I would consider this to be good trim authority. Roll trim was adequate.

APPROACH AND LANDING

During the flight it became evident that careful planning was required to set up a proper approach to the airfield. The plane was clean, fast and did not give up airspeed easily.

My first arrival on the base leg position was about where I thought it should be but as I got closer it became evident that a slip would be necessary. A moderate slip was called for to correct for my slight miscalculation of glide angle. By holding 100 mph, an excellent glide angle for a power off approach was established.

The light wooden propeller allowed quick response of the engine to all power applications. With even the smallest of amount of power applied, the glide range became deceptively long. My first landings were wheel landings and caused no appreciable problems as long as the flare speed was about 80 mph. Any excess speed would set up conditions likely to cause porpoising in a normal wheel landing.

On subsequent flights, three-point landings were explored. The plane handles very nicely in these provided the tail wheel is the first to contact the runway. The positive steering of the tail wheel helps with the directional control immediately upon touchdown. Braking and post flight operations were straight forward.

CONCLUSIONS

This Tailwind, by keeping the extras to a minimum and doing quality construction, is a simple, inexpensive plane with excellent performance. N6168X, as we evaluated it, contained only equipment essential for safe, efficient flight. The flying qualities were brisk and light.

Inexperienced pilots should be cautioned about the light stick force gradient of the Tailwind. As with most high wings, the restricted field of view due to the wing roots is a negative factor when considering this design. However, the plane exhibits brisk control, rapid climb rate and high speed. It can carry two average-sized people a long distance quickly and in good comfort using very little fuel. This makes it well suited as a personal VFR cross-country aircraft. After my first flight, it is my responsibility to decide if this airplane is an acceptable candidate to proceed with a full CAFE evaluation. It seemed like an outstanding choice.

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ABOUT THE BUILDER

Jim Clement has built 3 Tailwinds and feels that this one, with its 160 hp Lycoming, is his best. He just sold his Continental 0-300 powered version in April, 1994.

Jim learned to fly in a J-4 Cub in 1957 during high school, when he lost his drivers license! He first met Steve Wittman in 1962 while involved in Formula 1 air racing. Jim raced and served as crew member at many races. He specialized in building fiberglass cowls for Cassutt racers.

N6168X was built in only 11 months and for only $12,000 including the engine. Jim says, "You can do it for that ($12,000) if you build every piece yourself." During that time, Jim's auto body business was largely set aside in favor of building this airplane. A few of the months were spent entirely on aircraft building, with the day starting at 6 AM and finishing at 10 PM. Jim credits his wife, who also works full time for Rayovac, with a sizable contribution to the building of this aircraft.

The Tailwind is a plans-built aircraft, and in several areas, Jim made modifications to suit his needs. For example, he shortened the span 1 ft in order to have a higher cruise speed and moved the firewall forward 2 " for more legroom. He used reduced inlet and outlet areas on his custom cowl, copies of which are now available from Edge Concepts.

This aircraft is a showplane. Jim's career in auto refinishing has equipped him with exceptional skill in painting and fabrication, and this is evident everywhere on N6168X.

FUTURE TESTS

The CAFE Foundation is now formulating its calendar for flight testing other aircraft. The primary criteria for testing are that they be representative examples of popular, currently available designs. An Aircraft Performance Report will be published in Sport Aviation on each tested aircraft. This is an excellent opportunity for the owner to obtain detailed insights into his or her aircraft, and provides a service to EAAer's who may be considering building that design. EAA generously funds this flight test program.

DESIGNER'S COMMENTS By STEVE WITTMAN

In general, I enjoyed and agree with this report. There are a few details that should be addressed, however. First, the Tailwind does not rely upon differential braking for ground steering. It has a steerable tailwheel. Second, the test pilot's assumption that a square-sided fuselage is slower than a rounded or oval one is mistaken because the interference drag at the wing's juncture with a rounded fuselage is greater than with a square one . . . excepting mid-fuselage wing junctures, which I have used in racing.

The newer wingtips I have been using in recent years do not improve the ability to lift a wing with rudder; they actually worsened it slightly. The tips were intended to improve the climb, glide and high altitude performance, and my flight testing proved this to be the case. I had expected at least a small decrease in cruise and top speed at low altitude, but to my pleasant surprise, the indicated speed was about the same as before. The new tips have a slight dihedral effect due to their bottom surfaces sloping upward. The Tailwind has always been a good rudder airplane. On cross countries, I seldom touch the stick and just fly with rudder.

The light forces on the controls are by design. I worked at achieving that and I like the plane much better with the light forces. Most pilots like it after 10 to 15 hours of flying. It is manageable, too. I taught my wife to fly in my Tailwind recently. There is quite a bit of stick travel, which makes the light forces manageable.

IMPORTANT NOTICE

The purpose of this report is to provide to prospective buyers of homebuilt aircraft a body of information that can help them select the type of aircraft that is best for their needs. These report may aid in estimating the incremental gains in performance or flying qualities that result from the applications of various types of aircraft modifications to a given aircraft design. It must be emphasized that this information is not intended to serve as a Pilot's Operating Handbook for the operation of any aircraft.

Every effort has been made to obtain the most accurate information possible. The data are presented as measured and are subject to errors from a variety of sources. The flying qualities evaluation represents the opinion of the reporting test pilot.

AKNOWLEDGEMENTS

The CAFE Foundation gratefully acknowledges the assistance of Jim Clement, Steve Wittman, Dan Madden, Steve Barnes, Anne Seeley, EAA Chapter 124, the Sonoma County Airport FAA Control Tower Staff and the several helpful people in the engineering department at Lycoming.

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THE OLDS ENGINE

Putting the circa 1960-63 Oldsmobile aluminum block V-8 in a Tailwind was not Steve's idea in the beginning. His good friend Arden Hjelle - whose own Tailwind, N117A, was EAA Grand Champion homebuilt in 1970 - gets the credit. Arden had a lot of speed shop experience with the Olds and felt it had potential as an aircraft engine. He would do all the machining and set up the engine if Steve would install it and test it in a Tailwind. Steve has a lot of respect for Arden's abilities, so eventually an agreement was worked out between the two and work began.

Actually, Arden caught Steve at the right time because he had been wanting to build a new Tailwind, any way, to try some new ideas he had for improving the design. So, as Arden turned to the engine, Steve began cutting 4130 tubing.

The design philosophy behind the engine was to keep it simple . . . to come up with an aircraft conversion that was as stock as possible and, thus, as inexpensive as possible for others who might want a similar engine at some future time. Propeller reduction was never considered - the engine would be inverted, turned around (from auto use) and the propeller would be driven directly through a foot long, solid extension shaft. A fixed metal propeller would be used. With the engine turned around incidentally, it would turn the "right" way (counter clockwise), allowing the use of standard propellers.

The internals - crankshaft, rods, pistons, cam and other valve train components - are stock. Although a weight penalty is incurred, the stock manifold system is also retained, due to the fact that it contains water passages that are a part of the engine's cooling system. The radiator is a specially constructed unit made for Steve by Wally Carlberg of Minneapolis. It is mounted flat on top of the engine, with cooling air entering the scoop just below the spinner, washing up and around the engine, through the radiator and out through louvers in the top of the cowling. This warm air blows back on the windshield and acts as a nice defroster, but does not heat up the cabin. The radiator has a capacity just slightly less than the Olds automotive unit. A one quart expansion tank is also incorporated in the system. This entire set-up has been trouble-free from the start and provides more than adequate cooling through the entire operating range - extended ground running included. Steve runs 100% Prestone, year round.

With the engine mounted upside down, obviously the oil system had to be changed. The old oil pan was replaced with an aluminum plate bulged up just enough to clear the throw of the crankshaft. Oil is contained in a long, narrow tank that extends across the rear of the engine and is actually supported by the drain pipes that run into the heads. The tank holds just over 5 quarts. The normal flow pattern of the oil through the engine has been modified to provide proper lubrication in the inverted position. This really did not amount to much, according to Steve - just tapping into the galleries in a few places and providing new drains for the main bearings. At any rate, this system has also been trouble free. Only aircraft oil is used.

The standard automotive ignition system has been replaced by a capacitive discharge system Steve obtained from Carl Kiekhaefer . . . a unit developed for use in off-shore racing boats. It works fine, but spark plugs have been a problem. At about 60 hours or so they begin breaking down and no one, including the manufacturers, can determine exactly why. Steve has tried both aircraft and automotive plugs, but all start breaking down at about the same intervals. While they are functioning properly, auto plugs seem to perform just as well as the aircraft plugs - so for the sake of economy, he now runs the auto plugs exclusively and changes at 50 hours. They are enclosed in metal cans for shielding.

The most persistent development problem throughout the life of the project has, in fact, been shielding of the ignition. It has turned out to be a series of pesky little things rather than a single major problem and, at last, all have been ironed out.

The engine is fitted with a Stromberg aircraft carburetor - right off a Continental C-85. Steve says it is too small, costing him about an inch of manifold pressure. He is presently looking for a carb from an 0-290 Lycoming which he thinks will be about right for the Olds.

Steve runs a variety of fuels. At home he uses auto fuel, as he has in all his aircraft for the past 40 years or more. Since the engine has a compression ratio of 10.25 to 1, he started off with Premium. This ran O.K., so later he tried a mixture of Premium and Regular and, ultimately, just Regular. Surprisingly, all work fine. No detonation has been experienced, probably because the engine is not being worked very hard in its new role as an aircraft powerplant. When he is flying cross-country, Steve always buys 100 octane at airports. (Yes, most automotive Regular has a higher octane rating [Motor Method] than 80 octane aircraft fuel.)

N37SW holds 46 gallons of fuel in the main nose tank and has a 10 gallon reserve tank under the baggage compartment floor. At between 6 and 7 gallons per hour, this bird has long legs.

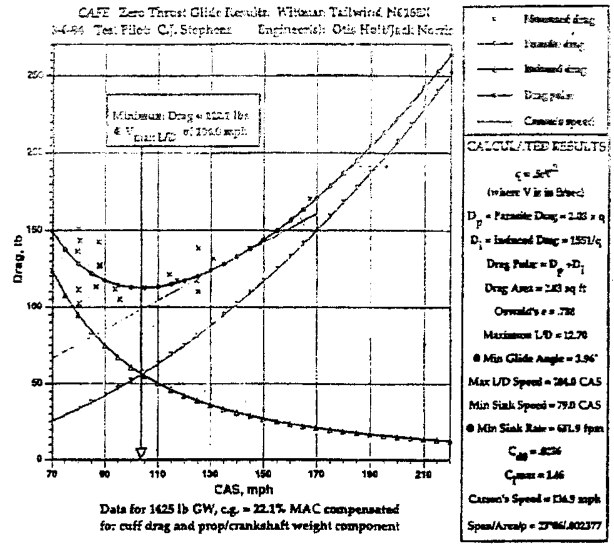
The Olds as it is installed in the Tailwind weighs 335 pounds, minus the exhaust system and propeller. It is fitted with the auto starter, lightened just a bit; the alternator is a 35 amp Bosch snowmobile unit. A great surprise to all who see the installation for the first time is the fact that the engine is mounted rigidly to the airframe - metal-to-metal. No rubber pucks, shock pads or whatnot. The mount has tabs through which cylinder head bolts are run - period. Unconventional, but the engine is very smooth through its full operating range, as I have already stated. Steve mounted the big Curtiss D-12 in Bonzo in a similar fashion and led the Thompson Trophy race a number of times, so I think it's safe to say he has a modicum of experience on which to work.

The propeller is right off a Cessna 150—but has been cut down to 62 inches in length (diameter) and has been repitched to 48 inches. Steve has also reached into his bag of racing tricks to do some minor but very beneficial reshaping of the area near the hub . . . but these are things in Steve's head and instincts and really can't be put on paper. It's one of those things that make his Tailwind just a little faster than yours . . . no matter how hard you try.

V-8 Conversion Plans are not available at this time.

DESIGNER
Steve Wittman

OWNER/BUILDER N6168X
Jim Clement



DESIGNER'S INFORMATION

Cost of plans	$180
Plans sold to date	1064
Number completed	approx. 375
Estimated hours to build, basic	2500-3500
Prototype first flew, date	Spring, 1953
Normal empty weight, with 0-320	840-880 Ib
Design gross weight, with 0-320	1425 Ib
Advice to builders:	Recreational spins not advise;, if in spin, "turn it loose"; avoid aft c.g.'s beyond 28% MAC; W10 wingtips are very worthwhile, keep it simple and lightweight.

CAFE FOUNDATION DATA N6168X

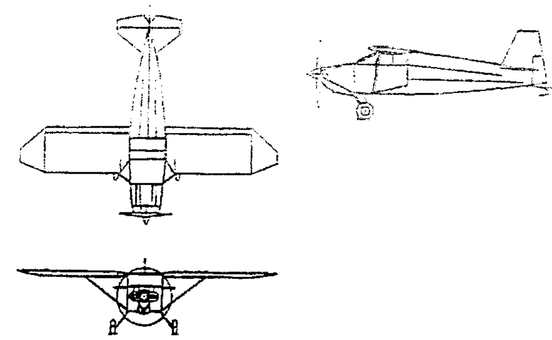
Wingspan	23 ft (plans = 24 ft)
Wing chord, root/root rib of wingtip	49.3/47.3 in
Wing area	86 sq ft (plans = 90 sq ft)
Wing loading, 1425 Ib/86 sq ft	16.6 Ib/sq ft
Power loading, 1425 Ib/160 hp	8.9 Ib/hp
Span loading, 1425 Ib/Z3 ft	61.95 Ib/ft
Airfoil, main wing	Custom modified by Wittman
Airfoil, design lift coefficient	NA
Airfoil, thickness to chord ratio	~ .105
Aspect ratio, 23 ft x 23 ft/86 sq ft	6.15
Wing incidence	0°
Thrust line incidence, crankshaft	0°
Wing dihedral	0°
Wing taper ratio, root/tip	.96
WinR twist or washout	0°
Steering	Differential braking, swiveling tail wheel
Landing gear	Tailwheel, spring steel, wheel pants
Horizontal stabilizer: span/area	74 in/9.38 sq ft
Horizontal stabilizer chord: root/tip	28.25 in/8.25 in
Elevator: total span/area	74 in/4.95 sq ft
Elevator chord: root/tip	12.5 in/6.75 in
Vertical stabilizer: span/area incl. rudder	48 in/12.66 sq ft
Vertical stabilizer chord: root/tip	48 in/20 in
Rudder: average span/area	27.75 in/2.4 sq ft
Rudder chord: top/bottom	9 in/16 in
Ailerons: span/chord, each	35 in/5.25 in
Flaps: span/chord, each	57 in/6.1 in
Tail incidence	NA
Total length	20 ft 6.75 in (plans = 19 ft 6 in)
Height, static with full fuel	5:4 ft
Minimum turning circle	Estimated 50 ft
Main gear track	70 in
Wheelbase, nose gear to main gear	15 ft 4 in
Acceleration Limits	NA

AIRSPEEDS PER OWNER'S P.O.H. IAS

Never exceed, V_{ne}	174 kt/200 mph
Maneuvering, V_a	130 kt/150 mph
Best rate of climb, V_y	104 kt/120 mph
Best angle of climb, V_x	NA

Stall, clean at 1300 lb GW, V_S*	*55 kt/63 mph
Stall, landing, 1300 lb GW, V_{SO}*	*48 kt/55 mph
Flap Speed, V_f	91 kt/105 mph

* Compare to CAFE MEASURED PERFORMANCE.



CAFE TEST SUMMARY

Vmax Cruise	216.9 mph
Drag area	2.03 sq ft
Rate of Climb	1423 fpm
Stall Speed	66 mph
Useful Load	549 lb
Building Time	2,000 hr

CAFE MEASURED PERFORMANCE

Propeller static RPM, 28.3 in Hg M.P.	2280 RPM
Takeoff distance, 1431.9 lb, 120' MSL	700 ft @ 73° F with 19 mph headwind
Liftoff speed, per barograph data, CAS	66 kt/76 mph
Touchdown speed, barograph, CAS	64 kt/74 mph
Rate of climb, 2500-3500 ft, Std Day, V_y	1423 fpm
Rate of climb, 9500-10,500 ft, Std Day, V_y	948 fpm
Cabin Noise, climb/max cruise	109.0/107.5 dba, slow
Stall speed, V_{S1}, clean, 1 G, CAS	61.4 kt/70.6 mph@1396lb
Stall speed, V_{SO}, landing, 1 G, CAS	57.3 kt/65.9 mph@1395lb
Vc @ 6,952' dens/2809 RPM/F.T./ 9.2 gph/TAS**	187.7 kt/215.9 mph@1409lb
Vc @ 8,666' dens/2784 RPM/ F.T./ 11.8 gph/TAS	188.6 kt/216.9 mph@1400lb
Vc @ 10,832' dens/2724 RPM/F.T./11.6 gph/TAS	183.7 kt/211.3 mph@1415lb
Vmax~ 1186'dens/2828RPM/F.T./16.2gph/TAS	*184kt/211.7mph@1417lb

**F.T. = full throttle.

* denotes speed at Vne, where it was still accelerating. Estimated Vmax = 218 mph.

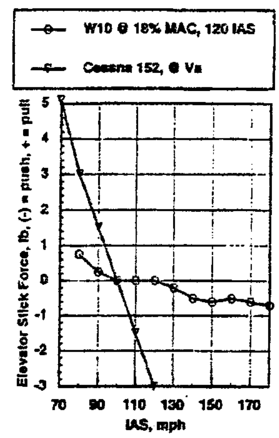


Figure 1.
Static Longitudinal Stability
(Stick force gradient)

Panel IAS	Barograph CAS
41	66
48	67
50	68
55	70
60	72
65	76
70	80
80	87
90	94
100	103
110	113
120	123
130	132
140	141
160	162
182	186
187	191
200	202

ROLL RATE, degrees/sec.

Speed. IAS	Va	1.3 Vso
Tailwind W10	47	45
Cessna 152	47	34

Panel Altitude	Barograph Alt.
1000	992
2000	2022
3000	3031
4000	4025
5000	5030
6000	6050
7000	7041
8000	8050
9000	9087

WITTMAN TAILWIND N6168X

EstimatedCost: $12,000 for parts/materials/engine
Estimated hours to build: 2000 hours in 11 months
Completion date: Oct. 12. 1993

SPECIFIATIONS N6168X

Empty weight, no oil/gross weight	862.9 lb/14Z5 lb
Payload with full fuel	350 lb
Useful load	549 lb
ENGINE:	
Engine make, model	Lycoming, 0-320 BIB
Engine horsepower	160 BHP
Engine TBO	2000 hr
Engine RPM, maximum	2700 RPM
Man. Pressure, maximum	29 in Hg
Turbine Inlet, maximum	NA
Cyl head temp., maximum	500° F
Oil pressure range	25-100 psi
Oil temp., maximum	245°F
Fuel pressure, range	.5-8.0 psi
Weight of prop/spinner/crank	57.2 lb
Induction system	MA4-SPA carb, bottom mount
Induction inlet	4.9 sq in
Exhaust system	2 into 1 crossover, stainless, exit nozzles
Oil capacity, type	8 qt, 15W-50
Ignition system	Bendix magneto S4LN20
Cooling system	Pitot inlets, downdraft
Cooling inlet	37.5 sq in
Cooling outlet	36 sq in
PROPELLER:	Fixed pitch

Make	Ed Sterba, with custom graphite tips
Material	Maple, 5 laminations
Diameter/pitch @ 75% span	68 x 74 in
Prop extension, length	4 in
Prop ground clearance, full fuel	13 in
Spinner diameter	11.375 in
Electrical system	40 amp alternator
Fuel system	1 tank in forward fuselage, gravity
Fuel type	91 octane
Fuel capacity	198.6 lb/33.1 US gal
Fuel unusable	1 oz
Braking system	Cleveland discs, single caliper
Flight control system	Dual center sticks, push-pull tubes, rudder cables
Hydraulic system	NA
Tire size, main/tail	5:00 x 5, 6" tailwheel
CABIN DIMENSIONS:	
Seats	2
Cabin entry	left and right side doors
Width at hips	36.5 in
Width at shoulders	37 in
Height, seat to headliner	35.25 in
Baggage capacity/size	80 lb/ Z6L x 36W x Z5H
Baggage door size	None
Approved maneuvers:	NA
CENTER OF GRAVITY:	
Range, % MAC	14% to Z8% MAC
Range, in. from datum	68.5 in to 75.4 in
Empty weight c.g., by CAFE	68.77 in
From datum location	forward tip of spinner
Main landing gear moment arm	57.4 in
Taukwheel moment arm	243.75 in
Fuel tank moment arm	57.4 in
Front seat occupants moment arm	84 in

TAILWIND PARTS LISTS

The following kits and lists of parts contained therein are provided as a courtesy by Aircraft Spruce & Specialty Co.. Builders are encouraged to sit down with their plans and decide what parts they actually need and the quantities and cutting instructions for those parts. Call Aircraft Spruce for current pricing on these kits and parts. These lists and kits are in no way implied as being exhaustive.

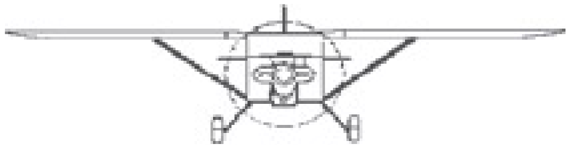
03-15800 Tailwind 4130 Tube Kit (Call for current price)

Part Number	Description	O.D. & Thickness	Qty (Ft.)
03-01200	4130 Steel Tube	3/8 x .035	50
03-01500	4130 Steel Tube	3/8 x .065	1
03-02000	4130 Steel Tube	7/16 x .065	1
03-02400	4130 Steel Tube	1/2 x .035	100
03-02500	4130 Steel Tube	1/2 x .049	8
03-02700	4130 Steel Tube	1/2 x .065	3
03-03600	4130 Steel Tube	5/8 x .035	90
03-03700	4130 Steel Tube	5/8 x .049	10
03-03800	4130 Steel Tube	5/8 x .058	14
03-03900	4130 Steel Tube	5/8 x .065	1
03-04300	4130 Steel Tube	3/4 x .035	60
03-04400	4130 Steel Tube	3/4 x .049	2
03-04500	4130 Steel Tube	3/4 x .058	25
03-05300	4130 Steel Tube	7/8 x .035	23
03-05400	4130 Steel Tube	7/8 x .049	16
03-05500	4130 Steel Tube	7/8 x .058	1
03-05600	4130 Steel Tube	7/8 x .065	1
03-06100	4130 Steel Tube	1 x .035	7
03-06300	4130 Steel Tube	1 x .058	2
03-06400	4130 Steel Tube	1 x .065	1
03-06900	4130 Steel Tube	1-1/8 x .035	1
03-07200	4130 Steel Tube	1-1/8 x .065	3
03-07500	4130 Steel Tube	1-1/4 x .035	24
03-08400	4130 Steel Tube	1-3/8 x .065	1
03-09100	4130 Steel Tube	1-1/2 x .065	3
03-09700	4130 Steel Tube	1-5/8 x .065	1
03-06200	4130 Steel Tube	1 x .049	4
03-11800	4130 Streamline Tube	2.360 x 1.000 x .049	12

02-06500	Wittman Tailwind Complete Kit		(Call for current price)
	(Includes wood for all wood wing tip)		
	Front Spar	Qty. 2	1-1/4" x 5" x 11"
	Rear Spar	Qty. 2	1" x 2" x 10'3"
	Leading Edge Nose	Qty. 2	3/8" x 1-1/2" x 9'
	Leading Edge Rib Filler	Qty. 1	1/2" x 1-1/4" x 6'
	Leading Edge Filler	Qty. 2	1/2" x 1-1/2" x 6'
	Rd Nose Leading Edge	Qty. 2	1/2" x 1-1/4" x 8'
	Leading Edge	Qty. 1	3/8" x 1-1/4" x 6'
	Trailing Edge	Qty. 1	1/2" x 1-1/4" x 6'
	Aileron Flap Blocks	Qty. 1	1/2" x 1-1/2" x 6'
	Trailing Edge Rib Filler	Qty. 1	1/2" x 1" x 6"
	Front Spar Filler Blocks	Qty. 11	1/4" x 1-1/4" x 3'
	Rib Corner Blocks	Qty. 15	1/2" x 1/2" x 4'
	Ribstock (Capstrip)	Qty. 90	1/4" x 1/2" x 4'
	Aileron False Spar	Qty. 2	3/8" x 1-1/2" x 9'
	Wingtip	Qty. 2	1/2" x 1-1/4" x 2'

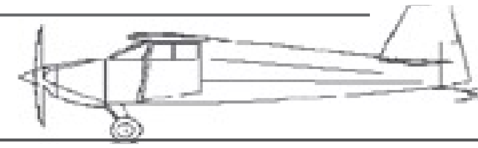
02-08500 **Wittman Tailwind Spar Kit** **(Call for current price)**

02-00122	**Tailwind Plywood Kit**		**(Includes wood for all wood wing tip)**
	Dom. Mahogany Plywood	Qty. 1	1/16" x 4' x 4'
	Dom. Birch Plywood	Qty. 1	12" x 24" x 1/16"
	Dom. Birch Plywood	Qty. 1	12" x 24" x 3/16"
	Dom. Mahogany Plywood	Qty. 1	1/16" x 4' x 8'
	Dom. Mahogany Plywood	Qty. 5	3/32" x 4' x 8'



Tailwind Times

A Quarterly Newsletter Dedicated to the Builder and Enthusiast



Is there anything prettier than these two photos? One of Buttercup in a perfect sky and one of excellent craftsmanship by Gary Knapp.

In This Issue:

from the cockpit...

This issue might be called the Buttercup Issue or the Earl Luce issue as he contributed so much of the content. Thanks Earl, for the great articles! Thanks, too, to Aaron King Jr. for continuing his fascinating series of the life and accomplishments of Steve Wittman. Dave Conrad wrote about glassing the wing a subject never before covered in the TT. When I published my first issue of the Tailwind Times, I worried about having enough subjects to write about. This issue, number 16, is overflowing with new information and the list of subjects we want to cover just keeps getting longer. A real treat is the gallery of photos of Gary Knapp's W-10. I find his workmanship inspiring. I am sure you will agree.

I was going to write about building a scaled up Tailwind with a roomier cabin, but some of the data I wanted to use did not come in time. That article is now slated for the next issue. Dave Conrad will be back next issue to write about finishing the wing to a high standard. We also have in hand several very fine articles that were intended for this issue but we just ran out of space. These include articles covering construction of the horizontal stab, and a good description of Jim Clement's method of firewall construction. After reading it, I am thinking of building yet another firewall, sigh, for my project.

I hope you enjoy this issue.

Jerry

Tailwind Times
A Quarterly Publication
by J-Wind Designs
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Subscriptions:
$16 US, $20 foreign. Annual renewal date of June 1

Back Issues:
Back issues are available at $4 each US and $5 foreign

Production:
Tailwind Times is digitally composed on Macintosh computers using Adobe InDesign and Photoshop software.

WARNING: I am not an aeronautical engineer, a machinist, a certified welder or a draftsman. In these areas I am just a hobbyist. My statements and recommendations reflect what works for me at the present time, but certainly are not the final word. There is always more to know and better ways of doing things .....Jerry Hey

Strictly Personal

by Jerry Hey

We all know the Tailwind is a super performer, the most bang for the buck, and I think the most beautiful airplane in its class. However, the Tailwind cannot be enjoyed by a "large" portion of the aviation community because, well, they are large. A scaled up version of the Tailwind can be made. It has been done successfully more than once. Of course, as the dimensions increase, the performance drops off. Never-the-less, if the W-10 is just too small, then a bigger version is still a lot better than any alternative.

What got me interested in this topic is my own poorly designed body. While I am only 5'9" tall, my shoulders are very broad. In the W-8 cabin, I take up more than my half of the space, a lot more. Anyone who wants to ride with me will have to be of narrow design. The Clement style W-10 with the kicked out doors is a lot roomier. I have occupied the right seat with a number of full sized pilots. It was tight, but we were having fun.

Thinking back over the wonderful times I have had when flying family and friends, just sharing with them the joy of flight, does not take much time. These moments have been nearly nonexistent. The fact is my wife gets air sick and would rather ride a horse. Most of my friends have planes of their own, so when we flew together, it was usually one man to a plane. Of the 350 hours in my log book only 16 were with a passenger. Hmmm?

What if I just put one seat in there, and had all that space for myself?

I was joking when I broached this to my wife. Her enthusiastic endorsement was hard to take as a compliment. But she loves me and wants me to have whatever I want, so I propped a couple of planks on either side of the flap handle and crawled in the fuselage to see what sitting in the center would be like. A half hour later, I was still setting there. The dreaming had become planning.

The next day, I cut out the old seat supports and set up a seat in the center; cut the pilot's extension off the stick; moved the flap handle to the right side; cut out the pilot's right and passenger's left rudder pedals. I was going to build a new set of rudder pedals, but sitting in the centered seat with my feet on the two outside pedals, I came to the conclusion the position was ideal. Using the two outside pedals leaves room to fully stretch the legs out straight in between them. I welded the left rudder pedal to the axle and installed the master cylinder. All this did not take very long. I crawled back in and it was PERFECT.

Here's Looking At You, Steve

by Aaron King, Jr.

Steve Wittman

Earl Luce's magnificent "Buttercup" replica brings back many stories and thoughts of this amazing little airplane. As mentioned in a previous issue of Tailwind Times, Steve built Buttercup in 1937 because he felt the production aircraft of that era didn't have the performance they should have. He, of course, was right and built a plane that out performed all the current production models in that weight and horsepower class. Something many aviation historians don't know is that Wittman's Buttercup came very close to being a commercially produced airplane. Steve and some business associates in Oshkosh discussed a commercial venture building Buttercup. He flew the airplane to Washington, D.C. to visit with the C.A.A. and get information needed for commercial aircraft production. On the way back to Oshkosh, the mountains west of Washington were "clobbered in" as Witt would say, and the closest airport to land was Hagerstown, Maryland, the home of Fairchild Aircraft.

As usual when he landed, Buttercup drew a crowd of spectators including many Fairchild people. Some were engineers and the chief test pilot, and they all wanted to know how fast it was. Witt looked around and saw Fairchild 24's with 175 horsepower Ranger engines and 145 horsepower Warners and a new experimental plan called the PT-19 (low wing trainer). He said, "well, faster than anything you got here."

These were fighting words, and they said, "prove it." Steve said, "get the fastest thing you got, and lets go out." He quickly proved his point causing the the test pilot and engineers to go get Fairchild's president to see Buttercup. Witt stayed at Hagerstown several days while they thoroughly went over the plane and left with a financial deposit from Fairchild to explore the possibility of manufacturing the plane. Fairchild thought the landing gear (steel slab) looked too weak (to the public), and wanted the 3/8 inch slab changed to 1/2 inch. They had Witt, back at Oshkosh, make up two gears; one to install on Buttercup and the other for drop tests. The also wanted to change the original 50 horsepower Lycoming engine to a 65 horsepower Continental engine.

After several visits to Fairchild, they got very interested in building Buttercup. The landing gear, with the C.A.A. inspectors there, successfully passed the 18 inch drop tests. Fairchild then said lets put a 75 horsepower Continental in it and make it a three place. Steve and a Fairchild wood expert built a mockup of a three place cabin, and they all set to go into production. This was 1939, however, and suddenly the military came in and said we need Fairchild to build trainers for the Army Air Corps. At the same time Steve got very busy in Oshkosh at his flying service training pre-military pilots in the CPT program. The combination of these two factors ended the possibility of making Buttercup a popular commercially built private plane. Mr. Gallagher, Fairchilds' president at the time of the project, died during World War II, and after the war Steve had no further contacts with Fairchild. He tried selling he landing gear to other manufacturers but got nowhere. As Steve said,"it didn't come from their engineering department, so it was no good." Later, of course, he did sell it to Cessna, and it became the most popular landing gear in aviation history. That, however, is another story.

So Buttercup remained one of a kind until Earl Luce built his beautiful copy and made plans available. The original Wittman Buttercup is on exhibit in the Wittman Hangar at Pioneer Airport at EAA- Oshkosh.

Calendar

West Coast Tailwind Fly In
Date and Location not yet available.
Contact Dave McGaw: 916-806-6360
dmagaw@att.net
or
Fred Weaver: mytyweav@flash.net for more info.

SAA Fly In
June 11-13, 2004
Urbana, Illinois
Expect to see many Tallwinds.
Tailwind Forum

Baraboo- the week before Oshkosh
July 24-26, 2004
Nothing but Tailwinds. A very good time.

Oshkosh EAA Fly In
July 27 to Aug 2, 2004

Glassing the Wings

by Dave Conrad

My experience with epoxy glass lay-ups started several years ago building canoes. I used West System and, as I recall, 6 oz deck cloth and a layer of "S" glass. I enjoyed working with these products and turned out two really nice canoes. I have to admit I don't consider myself an expert by any means, but experienced and interested enough to look forward to the next epoxy glass project.

I met The Tailwind gang at Oshkosh several years ago and after talking with Jim C. he told me of his technique laying up 1.4 oz. glass cloth with West System epoxy. I have to say one of the things I looked forward to on this project was wing construction using this process.

Before applying the cloth I squeegeed a very thin coat of West into the wing skins to act as a sanding sealer. I then sanded with 240 to take off the wood stubble.

Let's get started!

I covered the top panels first bringing the 1.4 oz. cloth around the leading edge but not quite to the bottom sheeting. My thought was covering the seam would be easier on a curved surface and by covering the top first, the bottom cloth would wrap around to the top and be out of eyesight.

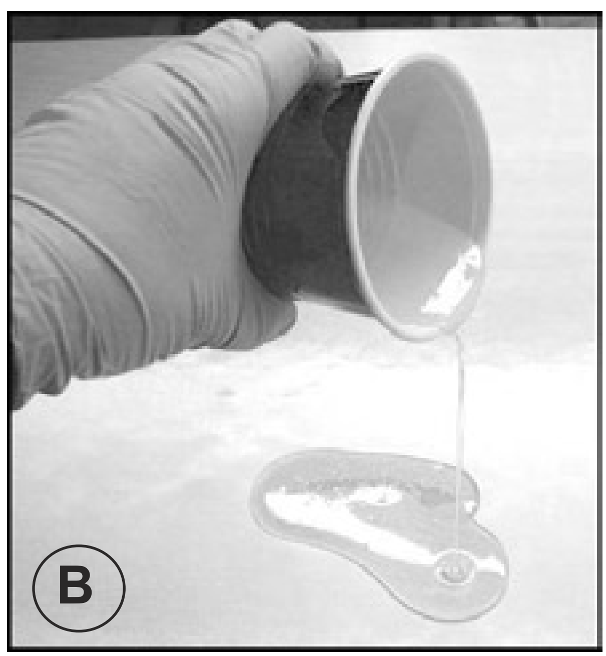
I called a friend (fellow boat builder) Todd Uecker to help me out. We measured and cut the fabric and glued it all down in just over an hour. The rest of the panels I felt confident enough to do by myself and had no problems.

I have the West pumps set for measuring out the epoxy and would highly recommend purchasing them rather than weighing or using some other system of measure.

Start by rolling out the cloth and cutting about 4" extra on each end of the wing. Line up as straight as possible with the leading edge and leave enough there to make the wrap around to the sheeting on the other side (Figure A). Leave the trailing edge alone for now.

With clean hands smooth the fabric. The nice non-fray factory edge of the cloth is on the leading edge and the cut edge will be hidden by the aileron and flap. I mixed a "six squirt mix" of epoxy into a cup. According to information given to me by Todd the boat friend, 90 seconds is optimum mixing time for small batches. That was learned at a West System seminar.

Pour some of the glue on the center of the wing panel and let it set a few seconds, you'll see it soak into the cloth (Figure B). Using a squeegee, carefully spread the epoxy without moving the cloth. When you have the first 3 ot 4 sq. ft. of cloth soaked up it will stay in place by itself. Work the mixture



Now work the wing tip and wing root with the brush and trim as needed. Inspect your work and come back in 8 to 10 hours to re coat.

West System will chemically bond coats if you don't let it sit too long. If you let it sit a day or two between coats you'll have a mechanical bond. I prefer the chemical bond. I applied a total of 3 coats of West over the cloth.

After drying for a week I wet sanded with 220 paper and now consider the wings ready for primer and paint.

out very thin. The last thing you want to happen is have the cloth "float" in the resin. The six squirt mix covered half of the panel.

Take a clean cup and mix another six squirt batch and keep going, always working from the center to the root and tip. Now that the flat surfaces are all squeegeed out we can do the trailing edge (Figure C).

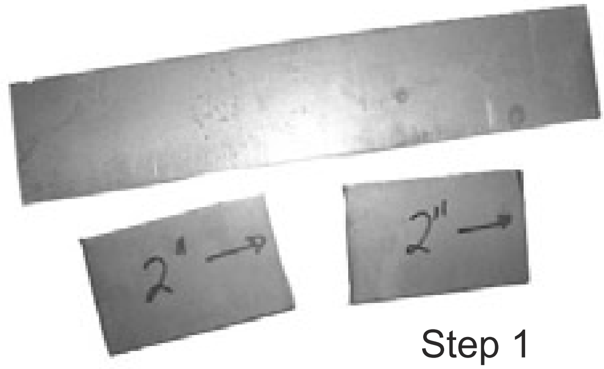
Cut the cloth off even with the sheeting on the other side. Take a brush and epoxy coat the aileron spar and sheeting overhang. You can dab the cloth into the epoxy as you go. To insure a tight bond to the sheeting overhang area I covered some triangle stock with plastic packaging tape and carefully tacked them in place to keep everything tight.

Wing/Fuselage Attach Fittings

by Earl Luce

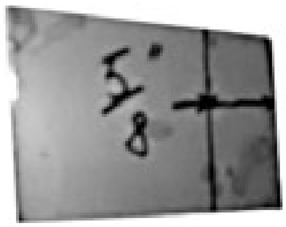
This is the procedure that I use for making the wing/fuselage attach fittings for the Tailwind (and the Buttercup):

1. Start with 1 1/4" wide strips cut from .063, 4130 flat stock. From the strip, cut two 2" pieces (a little long for the bending).



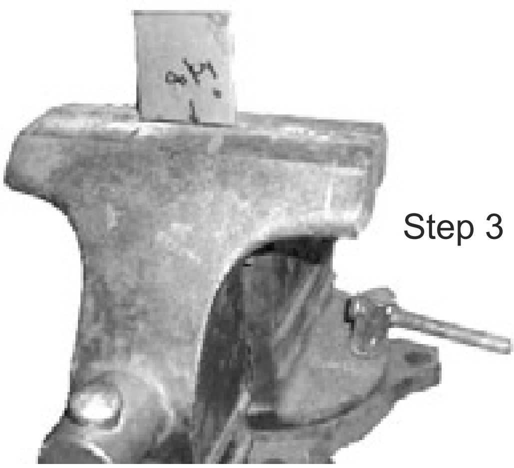
Step 1

2. Measure up 5/8".

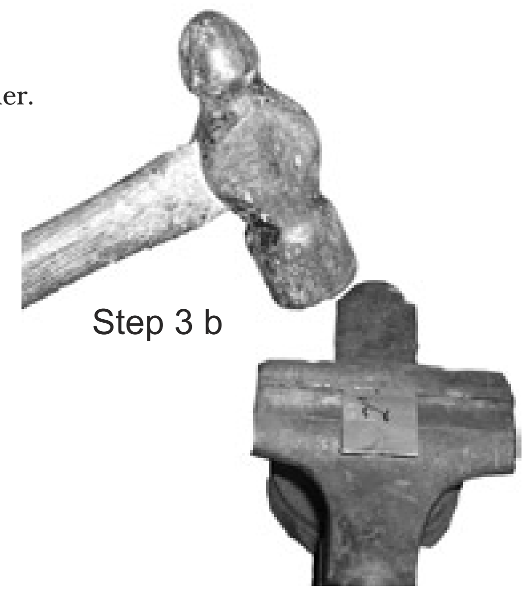


Step 2

3. At the 5/8" mark, put in a vise and bend over using a hammer.

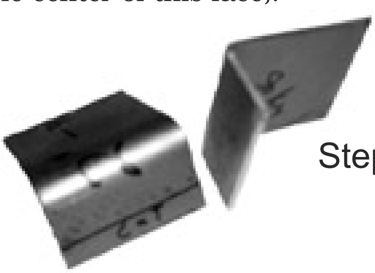


Step 3 a

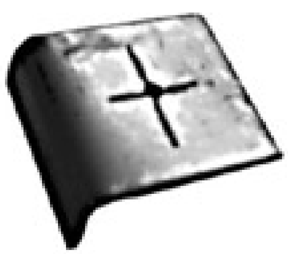


Step 3 b

4. Take 1 fitting and drill an 1/8" pilot hole 5/8" up from the raw end and 5/8" in from the side (the hole is in the center of this face).



Step 4



5. Stand the pieces up and place them back to back

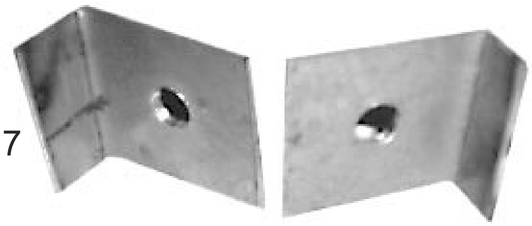
Step 5

6. Hold them together with the vise grips. Drill through the 2nd part of the fitting with 1/8" pilot hole

Step 6

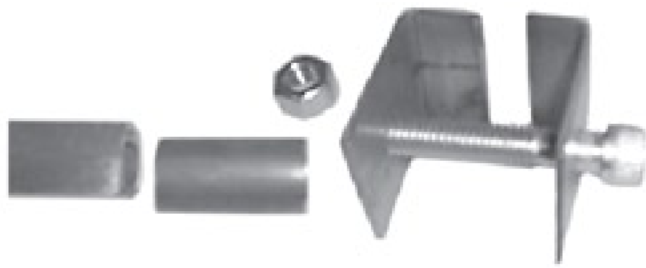
7. While still in the vise grips, drill the finished bolt hole - usually 3/8" for the front attach fitting and 5/16" for the aft attach fitting.

Step 7

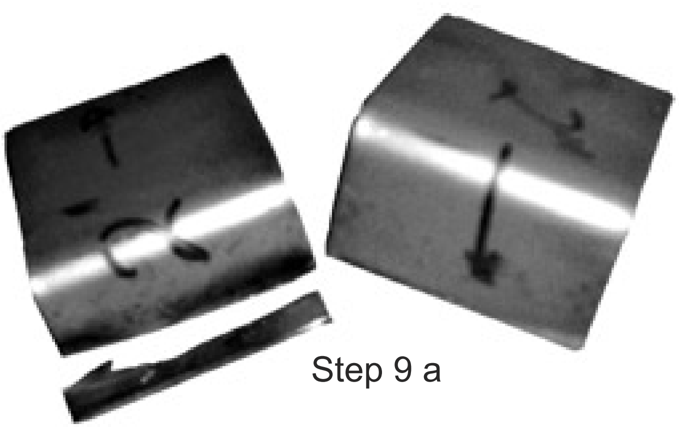


8. Cut a spacer from 1/2" x .049 tubing - a 1/4" shorter than desired (for the front fitting 1 1/4") outside dimensions - the extra 1/4" will be up from using the 4 pieces of .063)

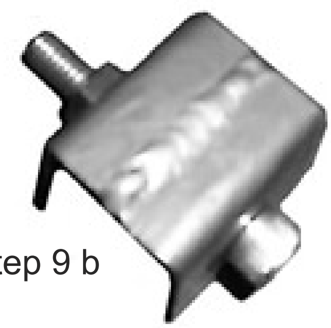
Step 8



9. Cut the excess piece of the fitting (the pieces have been cut a little long for the bending, above) so when the 2 halves come together it will be a close fit. Install the bushing and the bolt and weld the back side.



Step 9 a



Step 9 b

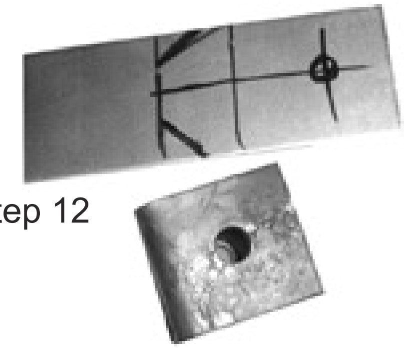
10. Now tack weld the bushing in - full welding will cause distortion and blistering at his point.

Step 10

11. Remove bolt

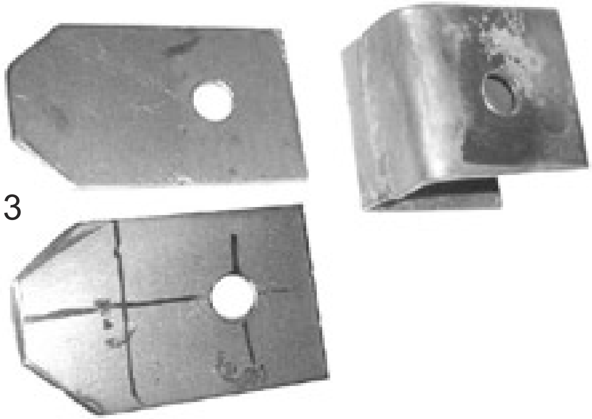
Step 11

12. Cut 2 pieces 2 1/4” long for the outside of the fitting.



Step 12

13. Prepare the 2 pieces as below. Cut the corners off the back side and drill holes to match bracket.



Step 13

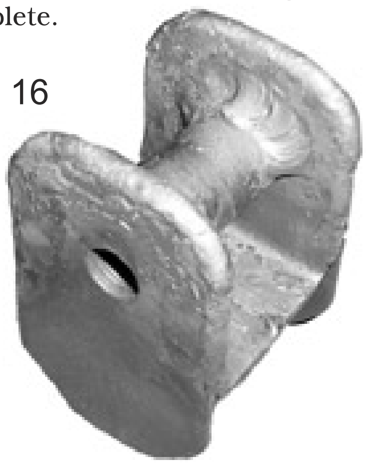
14. Bolt the 2 halves together as shown - one on each side of the bracket and secure with the bolt - now it is ready for welding.

Step 14

15. Weld both sides and both fronts - not the corners, for you want the wing to be able to rotate up and down around the bolt/tube without binding.

Step15

16. Cut the corners on a 45 degree angle and then round them and weld complete.

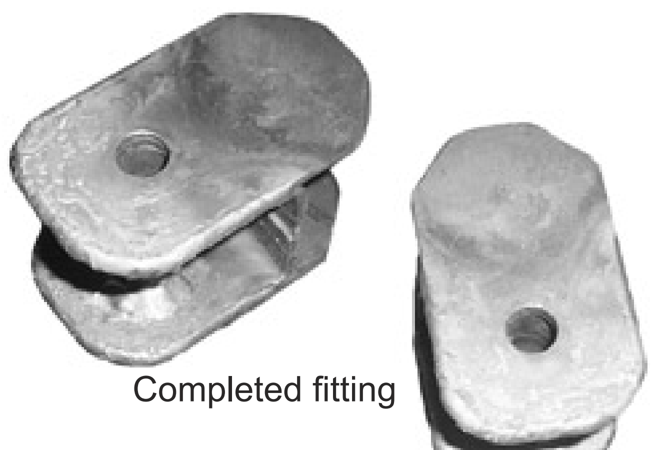


Step 16

17. Here is the completed wing/fuselage fitting.

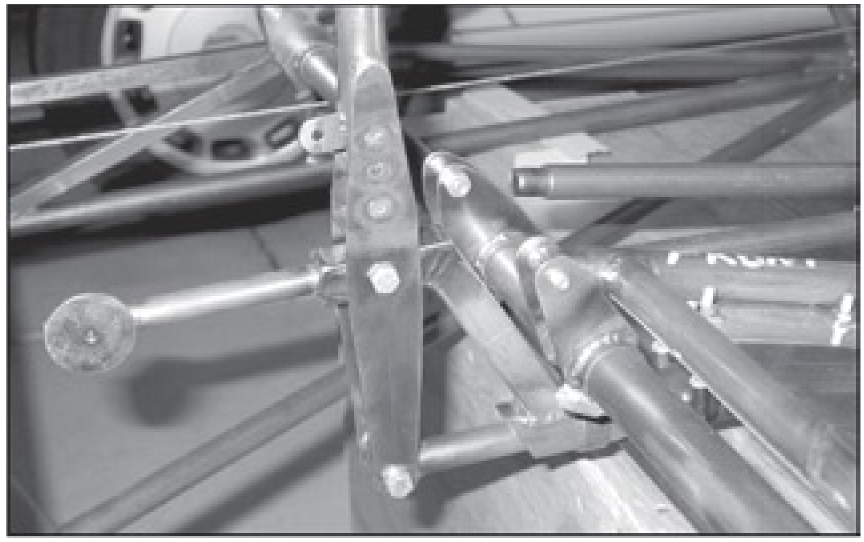
Now that this fitting is built and attached to the fuselage, you can make the wing attach fittings from these, as patterns, for a perfect fit, by reversing the process used to make this part.

The only thing I do is to put a thin piece of shim stock between the 2 fittings to take the place of the paint used on the air frame.

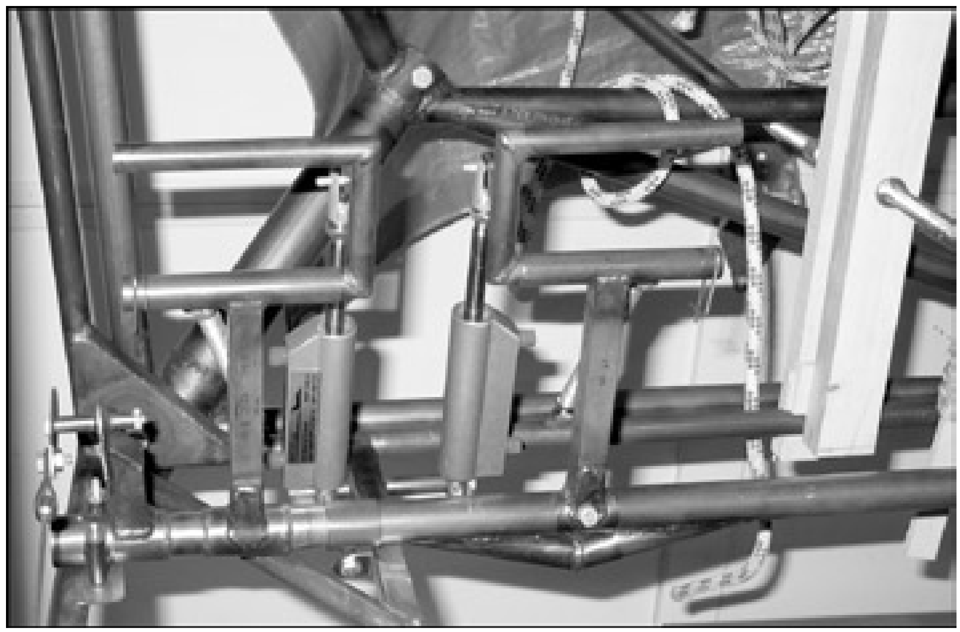


Completed fitting

Gary Knapp's W-10 Project



Look at this beautiful workmanship. Two things stand out: First, while being faithful to the W-10 design, Gary has found his own solutions in many details. A close study of the photographs will yield some nice surprises. Second, look at the outstanding TIG welding. You know immediately this work was done by a master. However, the truth is, Gary never TIG welded before tackling this project. He bought a machine and practiced. By trial and error he came up with a system that he felt confidence in. Every person contemplating building a Tailwind and worring about the welding can follow his example. Someone else might do it a bit differently but the consistent high quality welds are proof that what Gary does works very well. Here is his set up:



Machine: Lincoln Square Wave 175.

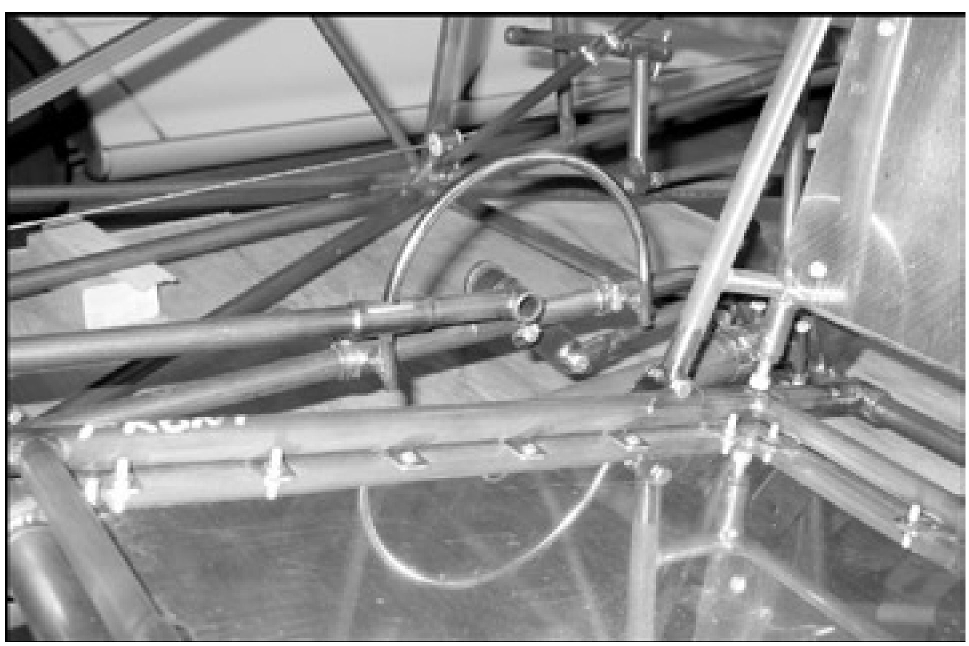
Torch: Flex torch w/Gas Lens (125 amp flex head with 25 ft superflex cable www.tigdepot.com)

Tugsten: 1/16 2% Thoriated

Argon: 10 CFM

Rod: ER70S2 x .045 dia. Fish mouths with bench grinder.

Preheat every weld with propane torch



GOODS & SERVICES

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Two packets available:
Packet #1: General Tailwind construction. 60 photos and several drawings....$55.00
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If you are building the tri-gear you will need both sets.
S3298 Fox Hill Rd. — (608) 356-3590
Baraboo, WI. 53913 — Please call after 7:00 pm.

WHEEL PANTS
Tailwind wheel pants....$175
Sam & Patty James — (863) 675-4493
Fiberglass Aircraft Parts
12185 Schooner Ln, SW
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Larry Vetterman — (303) 932-0561
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I am offering wing kits for the W10. The wing is all wood. It includes the finished spar, rib jigs, cap strip, pre-cut gussets, fixtures for the flap and aileron, and covering plywood.
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WITTMAN TAILWIND ON THE INTERNET

Building and Flying the Tailwind:
www.j-winddesigns.com
~~~~~~~~~~~~
Tailwind Forum:
Go here for Tailwind discussion
TailwindForum-subscribe@yahoogroups.com
~~~~~~~~~~~~~
For a List of Tailwind Projects:
R.J. Hardin
146 W. 5th St.
Salida, CO 81201
gatsby@amigo.net

ROTARY LINKS

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Tailwind/Rotary
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CLASSIFIED ADS DISCONTINUED

Publishing only four times each year makes the classified ads impractical so we have decided to discontinue them. The goods and services ads are not affected.
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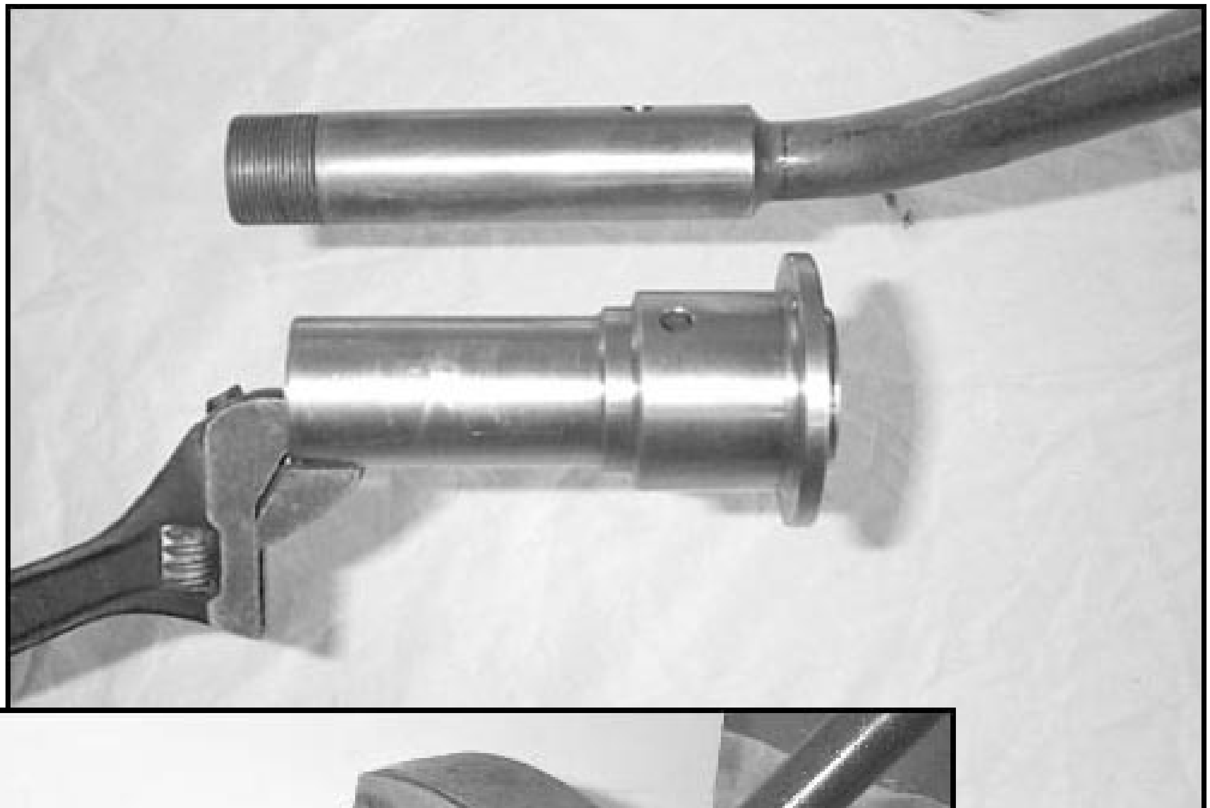
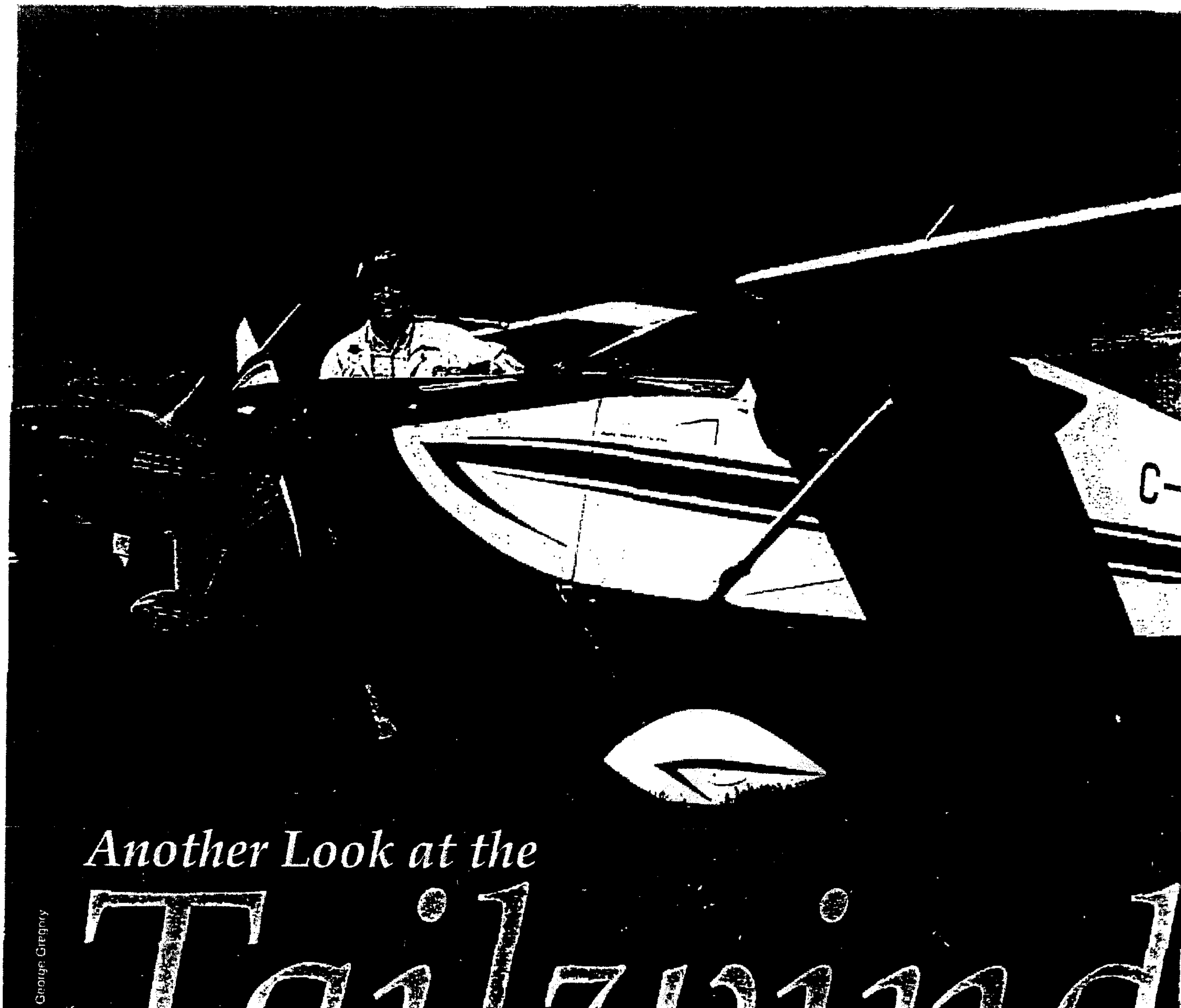
We are pleased the Buttercup Page will be a regular feature in the Tailwind Times. Here you will find builder's tips and flight reports. For plans, call Earl at 585-637-5768.

The Buttercup Page ~ News and Building Tips from Earl Luce

Look at what one of my customers did to put bigger tires on the Buttercup . I think a few TW people might want to do this.



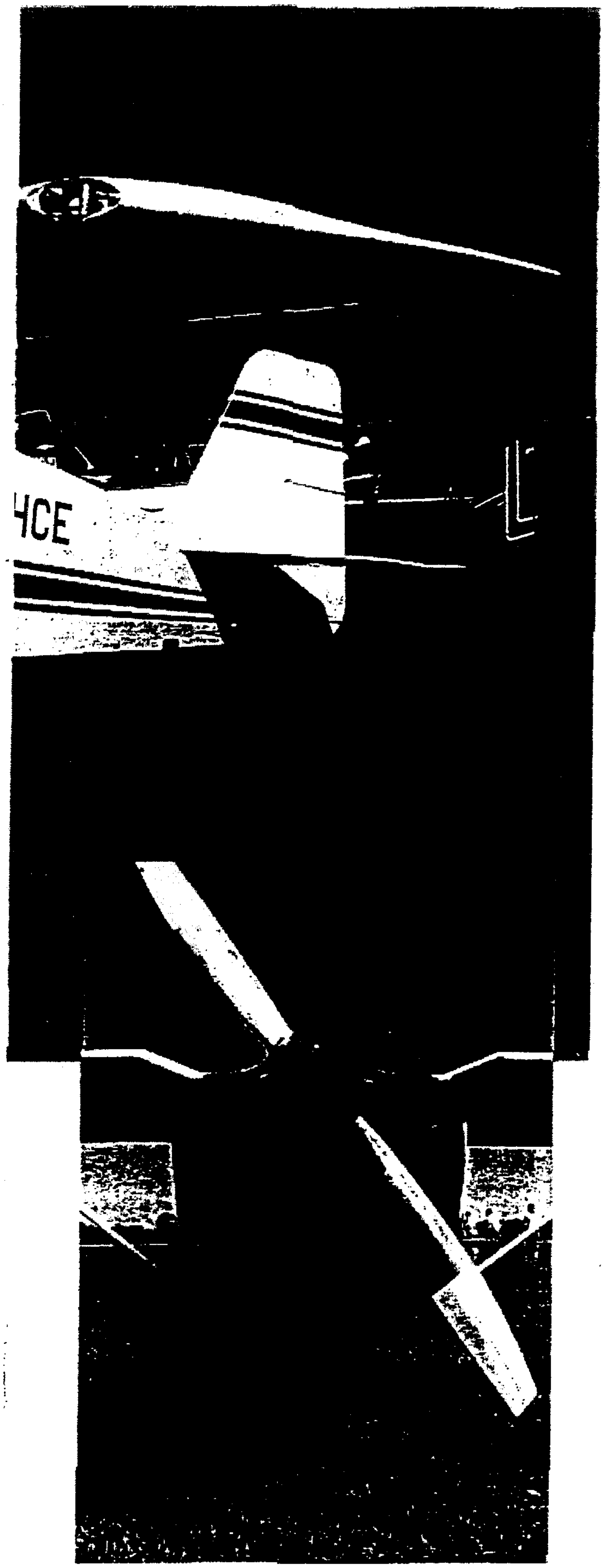
May you always have a Tailwind


George Gregory

Another Look at the Tailwind

Back in the days before quickbuild kits, people made airplanes from plans. Simplicity anc utility were especially important when you had to make everything yourself. There were a few good designs available, and one of the the first real hotrods was a boxy little thing callec a Tailwind, designed by raceplane pilot Steve Wittman.

First, a confession. I've always liked Wittman's design. I first laid eyes on one on the cove: of Homebuilt Airplanes magazine back in 1971 It was a nifty retractable job built by a fellov named Occhipinti; I still have the magazine. Since then the romance has only deepened.



I found out they were quick. After learning to fly and what an expensive pastime it was, I discovered Tailwinds were also easy on the pocketbook. Here was a real blue-collar rocket, a speed demon that didn't cost an arm and a leg to build or to own. I eventually ordered plans and started construction; a leap of faith, considering I had never been up in one.

Fast-forward a few years to Goderich, and the 50th Anniversary of Homebuilding Airplanes in Canada. Prior to coming out, I asked Gary Wolf if he knew if anyone would be bringing a Tailwind to the celebration, and that I'd love to get a ride in one if this was the case. He said he'd investigate.

Upon my arrival he introduced me to Ed Johancsik. In fact, one of the first airplanes I saw there was Ed's Tailwind. It's been around a few years, but I could see it was a well constructed example, well-used but straight and clean as an arrow. I linked up with Ed, peppering him with questions he was glad to answer, and extracting the promise of a flight later that day.

Ed's W-8 is a scratch built in every possible way. Constructed over a period of 7 years, he rebuilt the O-235 that powers it and like many plans-built rides, personal touches and innovations abound. Unlike many of the breed, the fabric on the tail blends smoothly into the vertical stabilizer, and neat metal fairings adorn the top of the wings where they meet the fuselage. The cowling is shapely, segueing evenly into the fuselage and lending some sleekness to its boxy appearance. Its small openings belie the fact that cooling is adequate in all situations.

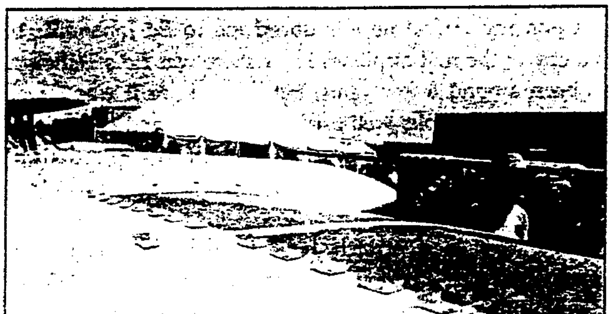
He had some problems with fabric drumming on the top of the fuselage aft of the cabin, but adding vortex generators aft of the windshield solved the problem.

The typical stick controls in a Tailwind are an inverted "J" that actuates between the two seats to facilitate cabin entry. Some people don't like the idea of the stick coming *down* into your hand, however; and Ed's comes up between your legs more like a normal joystick - not the first person to do so. It still pivots from between the two seats and feels a bit strange, but didn't take much getting used to. Small air vents liberated from an imported car are connected to NASA style vents on the side of the fuselage inches away and proved entirely adequate.

Ed also fashioned his own ground-adjustable propeller with shaped tips and small golf-ball like dimples along its span to help the air around it with a little more performance and quietude. The cowling and 6 inch prop extension were also hand built.

The wingtips are built-up fibreglass affairs. The W-8 plans call for a tip fashioned out of tube and fabric covered; many builders have opted for other solutions, and Ed's is no exception. Smooth fibreglass tips swoop back to reduce the drag created by wingtip vortices as well as giving a more finished appearance. Nav lights and strobes are build into the tip.

One of the first things I see when I look at Tailwinds are the lower longerons. The Tailwind fuselage is more or less square in cross-section, giving it an angular appearance. Many builders neglect to bow the longerons out the proscribed 1/2 inch when welding it up, which exacerbates the look: when the fabric goes on they contract inwards between the stations, making them look chunky and decidedly un-aerodynamic. Not with Ed's. A graceful, smooth curve extends the length of the fuselage. In fact, Tailwinds are notoriously sensitive to sloppy building. I have heard of examples not giving the same sort of numbers Ed is getting; every little protuberance will cost miles per hour. Keep it light and clean.



Ed had problems with fabric drumming on the aft fuselage; these vortex generators were the fix.

The aluminum gas tank holds 100 litres (about 26.5 US gallons). This yields about a 5 hour range not counting reserve, at 4.5 gallons per hour; cruising at 150 mph gives a range of 750 statute miles. Not bad! Some builders also add a second tank under the baggage compartment.

The tailwheel is connected directly to the rudder for directional control, but has a small removable pin that enables it to swivel 360 degrees when manhandling it on the ground.

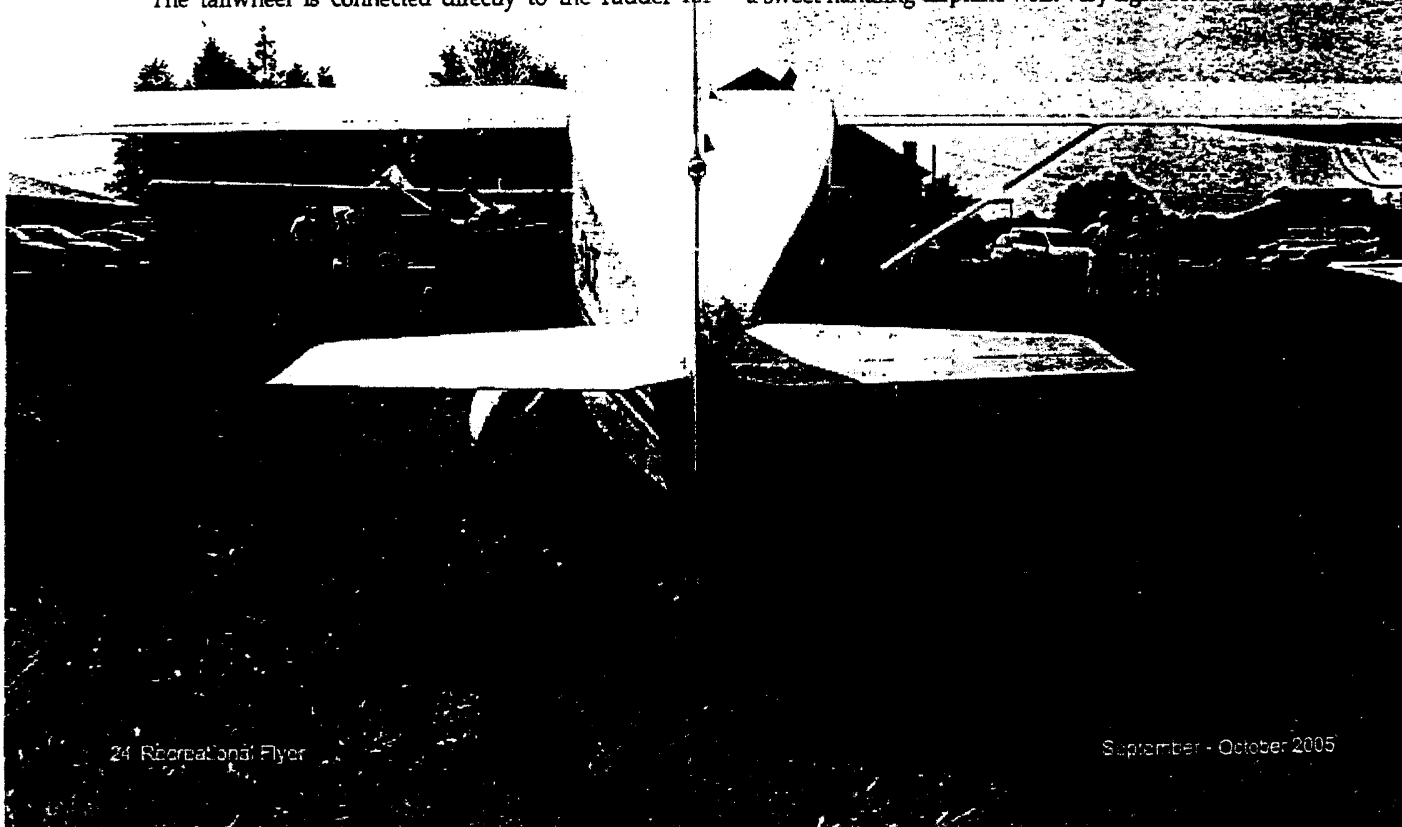
As we climbed into the cockpit, I found it snug, but not cramped; it felt a little wider than a Cessna 152 and featured an ample baggage compartment behind the seats. Visibility was great, with the windshield going back almost as far as our heads and generous side windows. The view sideways is somewhat obscured by the wing, but at all but moderate bank angles the long windshield allows views up to the inside of the turn. Visibiltiy over the nose was fine, even when taxiing.

Flying Qualities

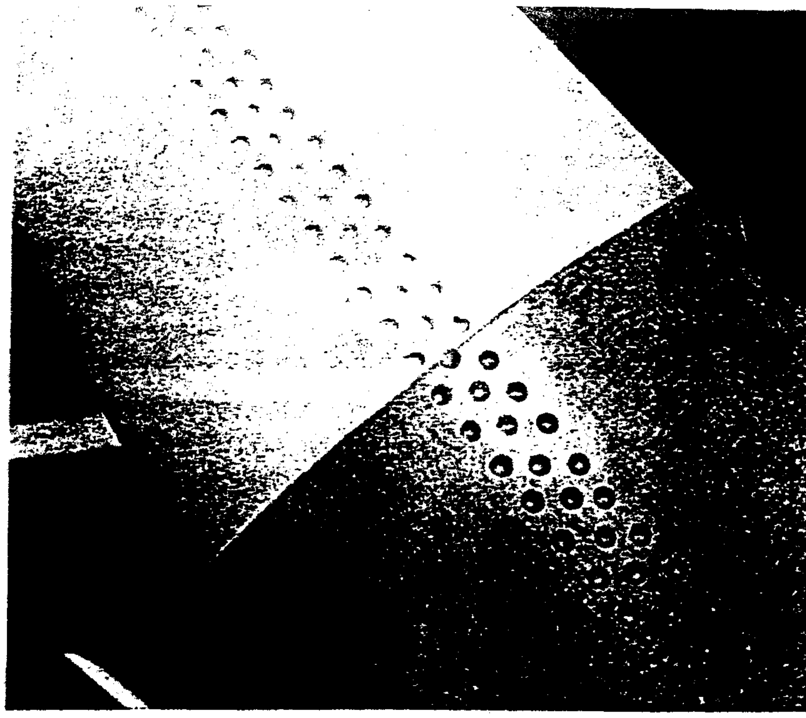
I had heard Tailwinds were pretty noisy, but as Ed fired up the engine I didn't find it objectionable, and even less so as we donned our headsets. We made our way out to Goderich's runway 32 and Ed pushed the throttle in.

Ed's Wittman has only a 0-235 rated at 108 hp; but the acceleration was brisk and the tail came up in a few seconds - I can't imagine what it would be like with an 0-320 up front. We rotated at 60 mph and moments later were over Lake Huron where Ed let me have the controls.

It was quick. It seemed at least as responsive as an RV, but a little more high-strung; I did a few steep turns and was delighted with the light, brisk feel of the controls. Stick forces were well balanced; the sensitivity in pitch was matched by an impressive roll rate, at least by my standards; about 45 degrees per second. Despite the miniscule control surfaces, the controls have plenty of authority. Roll-yaw coupling is good; it's easy to pick up a wing with the rudder. In a word, a sweet handling airplane with very light controls. Wittman



Ed added these dimples to the prop to improve the aerodynamics. Coincidentally, another Tailwind builder by the name of Occhipinti markets a strip with similar indentations for just this purpose.



designed it that way and said that after a few hours most pilots liked them. He even taught his wife to fly in one.

Rate of climb in Ed's 108 hp aircraft is between 800-1000 fpm depending on load and temperature.

Ed mentioned his airspeed indicator was reading on the low side, and that he preferred his GPS for getting a handle on his speed. I noticed about 142 mph at 2300 rpm; he reports a typical cruise of more like 150 at 2400 rpm and about 4.5 gallons per hour. Assuming a groundspeed of 150, that's about 33 miles per US gallon, or 40 miles per Canadian gallon (!) My Honda doesn't do much better, and I have to follow the roads. 'Nuff said.

We didn't have time to try any stalls, but Ed tells me his W-8 stalls at 55 mph; not outrageously fast. He touches down at 60. Jim Clement built a W-10 that stalls about 10mph faster but has reduced wingspan and an 0-320 (during a CAFE test it was still accelerating when it went past Vne in level flight. Top speed was estimated at about 220 mph). Stalls are reported to be gentle with a buffet starting up 4-5 mph before the wing unhooks in a docile and straighforward manner. Nevertheless, it *felt* hot on final, perhaps a result of its diminutive size and general cleanness. In the three-point attitude, the tailwheel usually touches down first; but I wasn't about to ask to do a landing. I am confident I could handle this airplane in all flight regimes but would want a few hours of dual first.

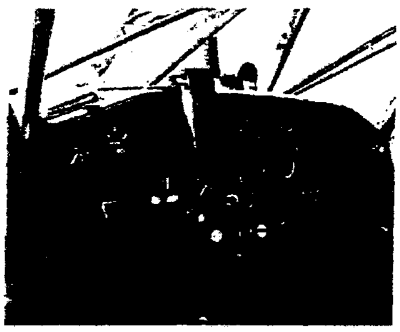
There are several flavours of Tailwind. First came the W-8 with a flat-bottomed wing. Wittman later changed the airfoil, giving it a curve on the bottom and thus making the spar deeper. Last of all is the W-10 with extended, sharply tapered wingtips, a longer fuselage and enlarged tail surfaces so as to accomodate larger engines. Pilots flying behind clean W-10's with 0-320's have been known to outrun Van's aircraft, with top speeds well in excess of 200 mph. I know of a W-10 that is being raced at 215mph. As Ed says, he doesn't know of any airplane that gives you more "bang for the buck"; a simple, elegantly engineered aircraft that delivers a lot more than its plain appearance would indicate. Easy to get in and out of, relatively simple to build, a useful baggage area with the ability to fly out of most strips; fast and cheap to fly. With avgas running nearly $1.30 per litre, a cross country bullet like the Tailwind looks pretty good.

And my W-10? Well, it's waiting

[illegible] Below Left: the cockpit is comfortable [illegible] nicely [illegible]

until the kids are a bit older. But I still have a set of wings hanging in the garage, waiting for me, beckoning. One of these days...

Photos and Story by George Gregory



Tailwind W-10 Specs

Length	19'6"
Wingspan	24'
Empty Wt (C-85, C-90)	700 lb
Gross Wt	1425 lb
Baggage	60 lb
Top Speed	165-200 mph
Cruise	150 mph
Stall (flaps)	50 mph
Stall (no flaps)	57 mph
Vne	195 mph
Range	600 + miles

A TAILWIND PRIMER

STEVE WITTMAN first unveiled the Tailwind in 1953. A race pilot whose career spanned over 5 decades, when he created the Tailwind he threw in many of the ideas he had developed during his years of tweaking raceplanes. He wanted a fast cross-country aircraft with enough room for two adults with decent baggage and range.

The W-8 is the original Tailwind, and accepts engines from 85-125 horsepower. The earliest W-8's have a flat-bottomed wing; but Wittman eventually introduced one with a curved bottom that allowed a deeper spar.

Homebuilders being what they are, larger engines were soon finding their way onto the airframe; eventually Steve accomodated them by producing a version better suited to the larger engines: enter the W-10. The chief difference is the elongated fuselage and larger tail surfaces; but about the same time he came up with a modified wingtip that further improved performance.

There are a lot of neat little tricks built into the diminutive speedster. The boxy fuselage helps with the production of lift, meaning the wings can be smaller. The wings are pinched at the root to reduce interference drag. Wittman invented the simple tapered rod gear featured on the Tailwind: light, low drag, and dirt simple. Many other aircraft use it, including Cessna's singles.

The strut-braced wings feature beefy spars and half-inch wide capstrips. They are plywood and fabric covered from front to back, giving them tremendous torsional rigidity. Controls are all pushrod actuated, giving a precise, light feel, and the leading edges of the flaps and ailerons are simple torque tubes that extend into the cabin for actuation. There are no control wires or bellcranks in the wings.

The airplane is light and easy to build, and can utilize a wide range engines from the C-85 to 0-300 and 0-320.

The Tailwind is one of the most efficient airplanes ever designed and compares favourably to far more expensive kitplanes available today. Many years ago Dr. August Raspet, a professor of aeronautics at Mississippi State University, conducted an elaborate drag polar evaluation of Wittman's design by towing one, sans propeller, to 10,000 feet and releasing it as a glider, measuring its gliding sink rate at previously set weights and varying airspeeds. Published in 1962, Raspet's work confirmed the Tailwind's incredibly low drag coefficient. This is one slick airplane. If compared on the basis of miles per hour per dollar, it is virtually without peer.

Jim Clement is the present day master of Tailwinds. I'm told he's built 9 to date. I had the opportunity to see one in Arlington, WA a year ago, one with a tricycle gear that routinely outruns the RV-6's in the neighbourhood. Jim offers sketches of his mods and a set of construction pictures, including the trigear modifications. Write him at 396 Baraboo St. Merrimack WI 52561 or call at (608) 493-2402.

Tailwind plans, some materials and prefabbed parts are available from Aircraft Spruce, http://www.aircraft-spruce.com/ or phone 1-877-4-SPRUCE.

There are several good places to look on the internet for information on the Tailwind. One of the best is Jerry Hey's website: http://www.jerryhey.com/TailwindSup.html. This is a good source for ads, information, and construction photos and is indispensible for those involved in Tailwind projects.

Yahoo Tailwind forum: http://groups.yahoo.com/group/TailwindForum/

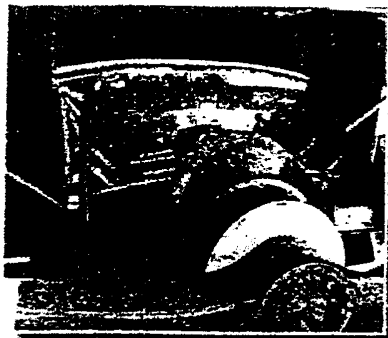
Tailwind List: http://www.matronics.com/tailwind-list/

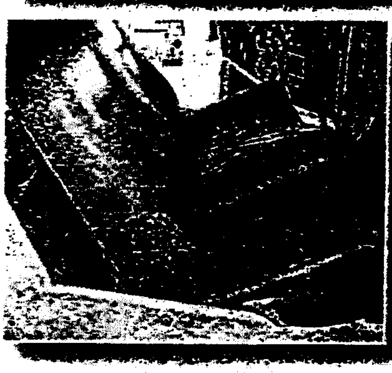
Flight report on the Tailwind: http://members.eaa.org/home/flight-reports/wittman_tailwind.html

The Unofficial Wittman Tailwind Page: http://www.chlassociates.com/Aviation/tailwind.htm

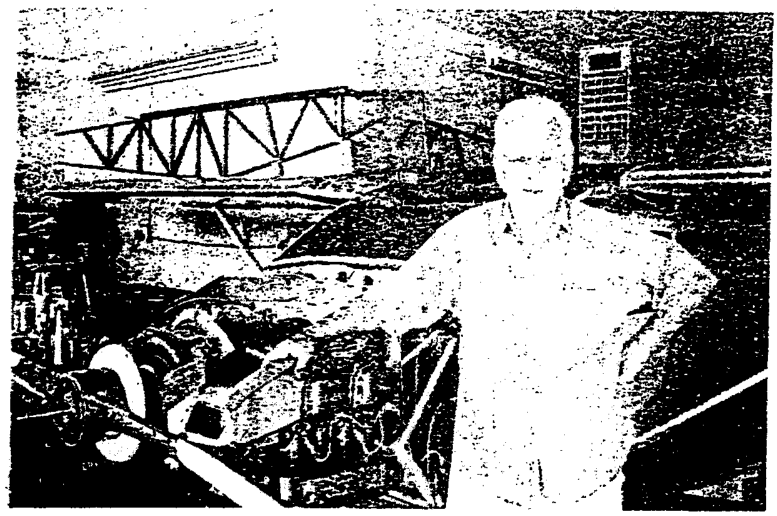
Other Canadian Tailwinds:

Earl Trimble C-GYYT,
Jack Steele C-FSNY,
Mike Zandstra C-FDSO,
Wally Critchlow C-FRDF,
Ted Strange C-FDWW





More **Canadian** Tailwinds



Above: I didn't see Earl Trimble's W-10 at Goderich as it was in the shop getting a paint job (though I did nag him). I am told it is a beaut. Above: Earl Trimble, President of the RAA Brampton Chapter with his W-10. It has Callbie Wood's metal wet wings. From Top down, left: Earl's Lycoming engine installation is very tidy; Wittman landing gear plugs into socket in the engine mount, a feature copied by many designers nowadays; Earl had his seats upholstered in leather to ensure comfort during long flights. Gary Wolf Photos.

Another Canadian Tailwind: Jack Steele's C-FSNY. Bought from builder Dale Lampert in 1982, it cruises 152 mph and maxes out at 165. Not bad for 90 hp (Continental C-90) running mogas!

Above: Mike Zandstra and his historic Tailwind C-FDSD.