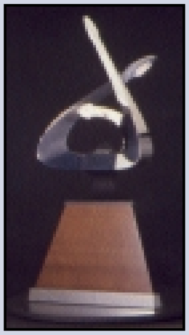
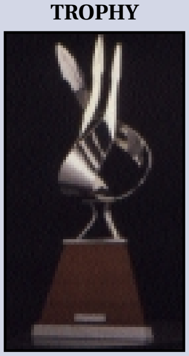


TRIAVIATHON TROPHY

CHALLENGE TROPHY



CAFE FOUNDATION

AIRCRAFT PERFORMANCE REPORT

Sponsored and Funded by the Experimental Aircraft Association and the Federal Aviation Administration

Glasair III

BY BRIEN A. SEELEY, C.J. STEPHENS AND THE CAFE BOARD

The fastest aircraft tested thusfar in the CAFE Foundation and EAA Aircraft Performance Report program, the Glasair III is a high performance design. The prototype first flew in 1986. It was designed in the mid 1980's by Tom Hamilton, Ted Setzer, Bob Gavinsky and others at Stoddard Hamilton Aircraft, Inc., the kit manufacturer. Lyle Powell also offered significant input in the design.

An all-composite, kit-built, low-wing aircraft, the Glasair III uses tri-cycle retractable landing gear and a 300 horsepower Lycoming IO-540-K engine.

Originally flown with a 23.3 foot wingspan, a later factory option offered wingtip extensions giving a 27 foot wingspan. Bill Stamm, an independent supplier, offered alternative wingtip extensions for a 25.8 foot span. These latter were adopted by Bob Herendeen for his airshow aerobatic version of the aircraft in order to enhance its climb and tight turning abilities.

The Glasair III kit includes pre-molded fuselage skins, wing skins, spars, cowling and empennage made of fiberglass and Derakane vinyl ester resin. It also contains complete hardware for the entire aircraft structure including controls, fasteners, weldments, landing gear system, engine mount, windshield, etc.

Stoddard Hamilton Aircraft receives high praise from their builders for their technical support. They provide a well planned, detailed Construction Manual and thorough Pilot's Operating Handbook with the kit for each aircraft.

A PERFECT CANDIDATE

Chuck Hautamaki's Glasair III, N313CH, was selected for flight testing because of its lightweight, stock, plans-built airframe with an unmodified

KIT SUPPLIER	OWNER/BUILDER N313CH
Stoddard Hamilton Aircraft Corportation, Inc.	Chuck Hautamaki, EAA # 154839
18701 58th Ave. Northeast	6425 W 35th St.
Arlington, WA. 98223.	Loveland, CO. 80538
360-435-8533 FAX: 360-435-9525	970-203-0037 FAX: 970-203-0071

DESIGNER'S INFORMATION

Cost of kit, no engine, prop, avionics, paint	$36,980
Plans sold to date	320
Number completed	120
Estimated hours to build, from prefab kits	2000
Prototype first flew, date	1986
Normal empty weight, with IO-540 Lyc.	1625 lb
Design gross weight, with IO-540 Lyc.	2400 lb/2500 lb with long wing
Recommended engine(s)	Lyc. IO-540-K1G5D, 37° left rear induction
Advice to builders:	Keep it light, stick to the plans, join a builder group and read the factory newsletter updates.

CAFE FOUNDATION DATA, N313 CH

Wingspan	23 ft 3.5 in/27 ft
Wing chord, root/tip, short wing	50.5 in/ 33" at tip joint
Wing area, short/long	88 sq ft/97.23 sq ft
Wing loading, 2400 lb/88 sq ft or 2500/97.2	27.27 lb/sq ft /25.7 lb/sq ft
Power loading, 2400 lb/300 hp short wing	8 lb/hp
Span loading, short/long	103 lb/ft /95.6 lb/ft
Airfoil, main wing	LS (1) 0413 root, tip
Airfoil, design lift coefficient	.04
Airfoil, thickness to chord ratio	13%
Aspect ratio, span^2/ sq ft wing area	6.67 short, 7.64 with long tips
Wing incidence	+2.3°
Thrust line incidence, crankshaft	0°
Wing dihedral	6°, (3° per side)
Wing taper ratio, root/tip, short wing	53.84 in/33 in = 0.61
Wing twist or washout	0°
Wing sweep	0°
Steering	differential braking, toe brakes
Landing gear	electro-hydraulic retractable, tricycle
Horizontal stab: span/area	104 in/16.25 sq ft
Horizontal stabilator chord, root/tip	28/17 in
Elevator: total span/area	104 in/ 5.69 sq ft
Elevator chord: root/tip	9.75/6.0 in
Vertical stabilizer: span/area incl. rudder	51.5 in/ 11.4 sq ft
Vertical stabilizer chord: average	31.75 in
Rudder: average span/area	51.5 in 6.1 sq ft
Rudder chord: bottom/ top	23/11.25 in
Ailerons: span/average chord, each	42/6.87 in
Flaps: span/chord, each	69/9 in
Tail incidence	0°
Total length	21 ft 4 in
Height, static with full fuel	7 ft 10.5 in
Minimum turning circle	na
Main gear track	10 ft 2 in
Wheelbase, nosewheel to main gear	see Sample c.g.'s
Acceleration Limits	+3.8/-1.0 at gross weight, +6/-4.0 at 2120 lb
AIRSPEEDS PER OWNER'S P.O.H., IAS	
Never exceed, V_{ne}	291/335 kt/ mph
Maneuvering, V_a	174.5/201 kt/ mph
Best rate of climb, V_y	113/130 kt/ mph
Best angle of climb, V_x	87/100 kt/mph
Stall, clean, 23.3' span, 2120 lb GW, V_s	74
Stall, dirty, 23.3' span, 2400 lb, GW, V_{so}	78
Stalls, 27' span	6 mph less than 23.3' span
Flap Speed, full 45°, V_f	121.5/140 kt/mph
Gear operation/extended, V_{ge}	121.5/140 kt/mph

engine. It also was skillfully built to be straight and very smooth. Its engine had only 130 hours since overhaul and had recently shown 78/80 compression on all cylinders. Ted Setzer and Tim Johnson of Stoddard Hamilton Aircraft, Inc., concurred with the selection of this privately owned aircraft and assisted in this report by providing engineering data about the design.

The equipment list of N313CH included a King Kx-155 navcom, King KT-76 transponder, intercom, Vision Micro engine instruments, and an 18 lb automatic engine fire extinguisher system.

Chuck acquired his Glasair III kit second hand from its original purchaser, Clark Pollard, an American Airlines pilot from San Mateo. He built it in his basement in Minnesota. He received excellent technical support from Stoddard Hamilton Aircraft, after paying a nominal transfer fee. "They treated me very very well." He built the III in his basement, alone, except for some help with the wing closure, engine overhaul and sewing of upholstery.

When Stoddard Hamilton changed to a graphite stabilizer on the Glasair III to achieve more flutter margin, they sent out new stabilizers to their builders at no charge. Chuck said, "SH also lightened up their parts substantially shortly after I got my kit, by improving the bagging process."

This aircraft had only 3 small changes from the plans; a slightly smaller induction air inlet, a slight recontouring of the landing gear doors, and the use of a fixed rather than adjustable cowl exit size.

After making the necessary flight test preparations, Chuck and his son, David, flew his Glasair III to the CAFE Foundation's test facility in Santa Rosa from his home base in Loveland, Colorado.

Chuck's Glasair was built with both the standard 23.3' wingspan. He also built a set of longer wingtips which give a 27' span. Each long wingtip weighed 10.9 lb. Each short wingtip weighed 2.1 lb. The design of the longer wing tip makes it possible to increase the fuel capacity by putting 2.5 gallons of fuel in each tip, but Chuck chose to leave them dry. Not having fuel in the tips makes changing them quite simple, a 20 minute job. The

16% increase in wing span promised to provide some interesting comparisons in the flying qualities and performance. Thus, this report actually covers the flying qualities and performance of two different aircraft with distinct personalities.

All of the tests were performed in a total of 6 flights during 2 days, November 9 and 10, 1996. All flights were made with pilot and 1 crew member/flight engineer, excepting the final flight which was performed solo with reduced fuel and long wingspan.

The data presented here are derived from recordings using CAFE barograph #3 and pitot probe #2. The Lycoming power chart for the IO-540-K engine was used to derive the power settings. The fuel flow readings were made using the Vision Micro gauge on the aircraft's instrument panel, and it was known to be fairly accurate. The intense testing schedule did not allow equipping the aircraft with the CAFE Foundation's fuel flow recording system for these tests and fuel flow readings were not available during the test of the short wingspan.

Jack Norris and Andy Bauer made a computation of the climb rate decrement caused by the barograph's wing drag and showed it to impose a climb rate penalty of less than 1%.

GLASAIR III

SUBJECTIVE REPORT
by

C. J. STEPHENS

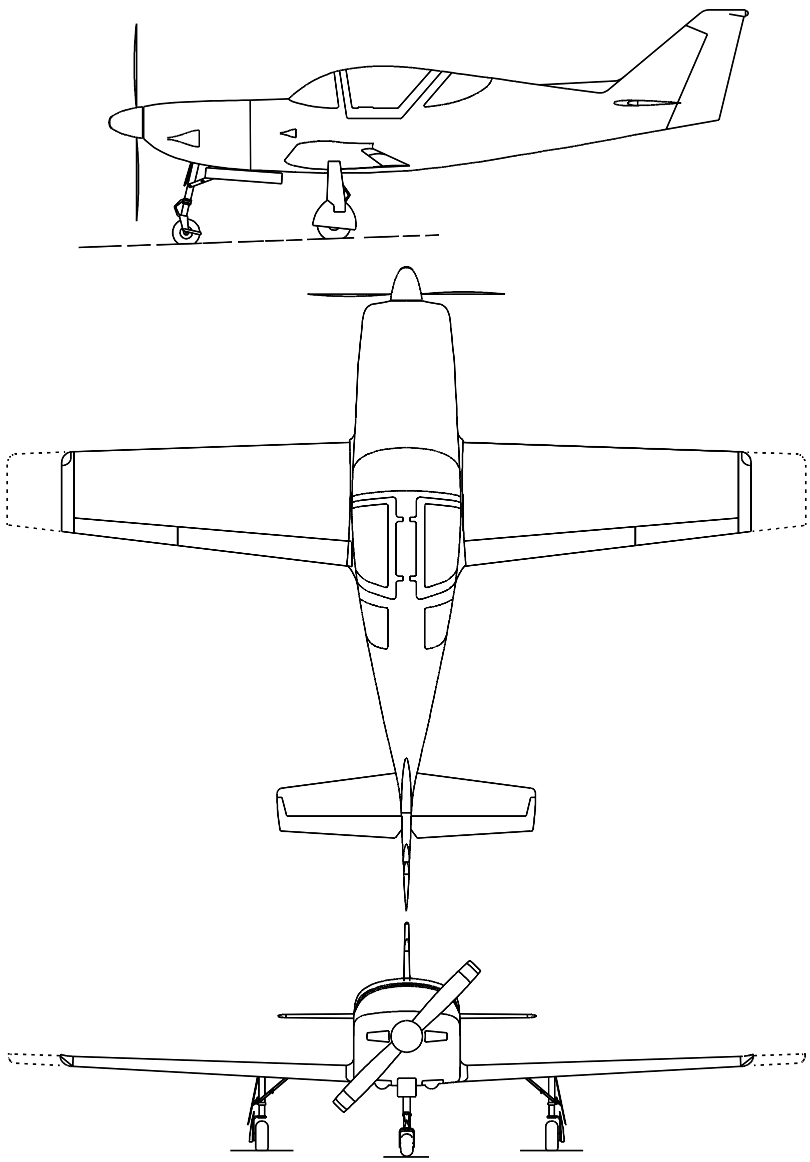
Am I lucky.... Or What?

As test pilot for the CAFE foundation these past five years I have had opportunity to fly many different airplanes. This experience has enabled me to learn what I like and don't like about various features of aircraft designs. A lot of that preference is due to

C.J. Stephens collecting flight data in the short wing version.


The CAFE team: Above, l-r, back row, Otis Holt and C.J. Stephens (in cockpit), David Hautamaki, Chuck Hautamaki, Ed Vetter; front row, Brien Seeley, Cris Hawkins, Larry Ford, Steve Williams.

Below: The last minute confirmation that the flight data collection is recording correctly.



personal taste but over time one learns how his "ideal" airplane would be designed and equipped.

I was ecstatic when I learned that the next airplane to be tested by the CAFE foundation would be a Glasair III. Not only had I heard many good things about the kit manufacturer and the aircraft's performance, but I just happened to start building a GA III on the 4th of July this year. What an opportunity it would be to do a complete handling and performance evaluation while in the early stages of building my own Glasair III. I hoped that the one presented for evaluation would be a good one that was built close to the plans specification.

This next part proves beyond a doubt that I am extremely lucky. Not only was this Glasair III built without any builder design changes but the quality of construction was superb. From the first look at the plane to the last, as Chuck Hautamaki flew it back to its home in Colorado, it was a feast for the eyes; a work of art. On my initial introduction to N313CH words like "perfection", and "masterpiece" kept running through my mind. It was the smoothest, shiniest and best looking aircraft I had seen, inside and out. This one should become the bench mark of quality to which all builders should strive to attain.

THE CHALLENGE

The test plan was to use the first day for preparation and the following two days for actual flying. The plan included evaluating the handling qualities with forward and aft center of gravity in both long and short wing configurations, then installing the CAFE barographs and measuring a variety of performance data on each of the two wingspans. Considering the limited time available and the two wing lengths it was to be a busy and challenging time for our small band of volunteers.

ARRIVAL

The plane landed at the CAFE test facility in the long wing configuration carrying the short wing tips in the baggage compartment.

The first operation after arrival was to completely de-fuel the airplane to obtain an exact empty weight. The main fuel tank is in the wing forward of the spar, with a additional 5 gallon header tank forward of the instrument panel. The exact weight and center of gravity (c.g.) was determined using the in-floor electronic CAFE scales. Normally we would establish a c.g. of 15% aft of the forward limit for the most forward measurements, however, even with Otis Holt (right seat) carrying 20 lbs of lead in his flight suit ankle pocket and all of the baggage compartment ballast in the most forward location, we could only obtain a c.g. 48% aft of the forward limit. During flight the c.g. normally migrates aft due to the entire fuel supply being located forward of the spar.

The main tank is continuous from wingtip to wingtip and connected in the center to act as one fuel tank. There are several baffling ribs throughout the tank with drain/vent holes to allow the fuel to travel to the center pick-up point. Refueling is a slow process requiring filling one side then the other and back again to top off the first side. The fuel fills into the various cavities slowly and care must be used to insure a full fuel load is obtained.

The design could also use a better method of grounding the aircraft during refueling. It has always bothered me a little to connect a static ground wire to the main gear of a fiberglass airplane expecting to get good enough conductivity to prevent a spark at the refueling point.

During my initial conference with the owner, I asked many questions about flying his plane and reviewed some important numbers for use in

GLASAIR III, N313CH

Estimated Cost: $ 57,000 total cost including materials, engine, prop, interior, instruments and radios.
Hours to build: 2300 incl. 1400 airframe, 300 engine, 600 for finish work.
Completion date: June 1993

SPECIFICATIONS

Empty weight, gross wt.,, 27′ span	1646.4 lb/2500 lb with oil
Payload, full fuel	510.5 lb
Useful load	853.6 lb
ENGINE:	
Engine make, model	Lycoming, IO-540-K1G5-D, dual mag
Engine horsepower	300 BHP, +5% and -2%
Engine TBO	2000 hr
Engine RPM, maximum	2700 RPM
Man. Pressure, maximum	29.5 in Hg
Turbine inlet, maximum	NA
Cyl head temp., maximum	500° F
Oil pressure range	55-95 psi, 115 psi on startup
Oil temp., maximum	245° F
Fuel pressure range, pump inlet	18-55 psi, 12 psi for idle
Weight of prop/spinner/crank	na
Induction system	Bendix RSA-10ED1 fuel injection, rear inlet
Induction inlet area	3.25 sq in
Exhaust system	1.75″ O.D. ss, 3 into 1 each side, 3.5″ O.D. outlet
Oil capacity, type	12 qt. 15W-50
Ignition system	Bendix Dual Mag, large coil
Cooling system	2 pitot inlets, downdraft
Cooling inlet area	56 sq in (stock cowl)
Cooling outlet area	30 sq in, fixed, no cowl flap
PROPELLER:	constant speed
Make	Hartzell HCC-2YK-1BF, F8475D4 blades
Material	aluminum
Diameter	84 in, 2 blades
Prop extension, length	integral to hub, standard hub
Prop ground clearance, full fuel	8.25 in
Spinner diameter	13 in
Electrical system	Prestolite: alternator, standard large starter
Fuel system	1 header tank in forward fuselage, 1 tank in wing
Fuel type	100 or 100LL octane
Fuel capacity, by CAFE scales	5.4 + 51.8 = 57.2 gal
Fuel unusable	2 oz
Braking system	Cleveland discs
Flight control system	direct push-pull rods aileron+ elev, rud by cable
Hydraulic system	Electro-hydraulic landing gear actuation
Tire size, main/tail	5.00-5 (10 PR)/ Lamb 11.00x4.00-5 (8 PR)
CABIN DIMENSIONS:	
Seats	2
Cabin entry	gull wing doors each side
Width at hips	41.5 in
Width at shoulders	39.75 in
Height, seat to headliner	34.5 in
Baggage capacity, rear cabin	100 lb
Baggage door size	16x37 in opening above seatback
Lift over height to baggage area	51.5 in
Step-up height to wing T.E.	30.5 in
Approved maneuvers:	aerobatics with 23.3′ span at 2120 lb: (rolls, loops, Immelman's, Cuban eights, but no intentional spins or snap maneuvers).
CENTER OF GRAVITY:	
Range, % MAC	10-28.5 %MAC
Range, in. from datum	79.65-87.88 in
Empty weight c.g., by *CAFE*	79.77 in
From datum location	60 in fwd of cowl to firewall joint
Main landing gear moment arm	95.75 in
Nosewheel moment arm	35.5 in
Fuel moment arms front/rear	65.75/81.35 in
Crew moment arm	108.75 in

flight. The information in the POH provided by Stoddard Hamilton was excellent and provided valuable information for the flight preparation.

PREFLIGHT

Checking the oil and sumping the fuel was easy with the ports provided in the natural places. These small inspection holes, however, allowed little access to other components for detailed preflight inspection of the engine compartment and other areas of interest.

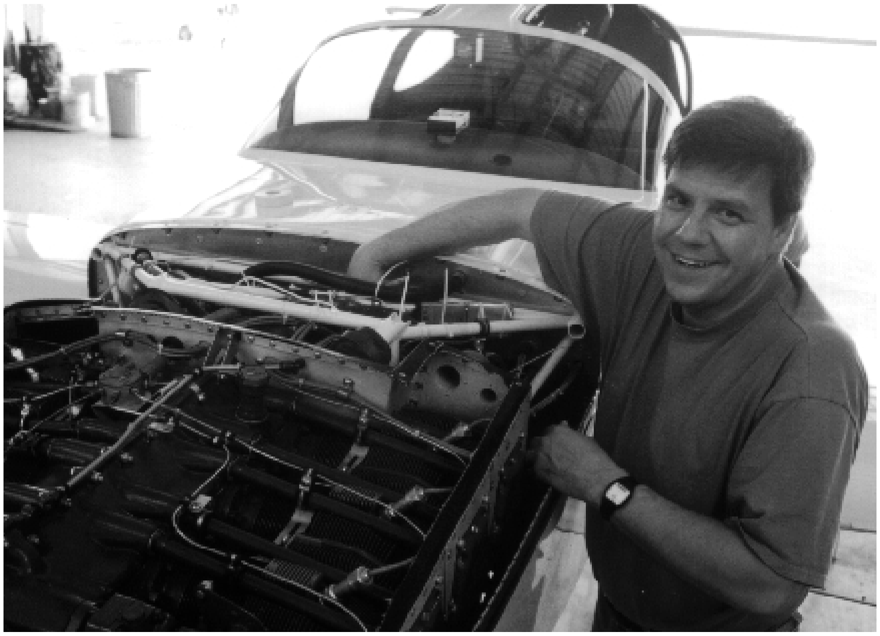
Entry into the cockpit was accomplished by stepping up onto the back of the wing. As can be seen in the photos, the plane stands high on its main gear and requires a large step to get up onto the wing without stepping directly on the flap. This maneuver requires a little more than normal agility and leg strength. Due the high shine and waxed surface, standing on the wing without sliding off was difficult at times.

Note: Another Glasair III, built by Lyle Powell, features a nifty little step on the right side, below the entrance, which retracts by vacuum when the engine is started.

About the only way to enter the cockpit is to step on the seat, sit on the seat back and then slip into the seated position. The seat back is very sturdy and the procedure is easy after you have done it the first time. The cockpit is roomy when compared to many homebuilts. I measured the instrument panel width to be 43" then walked over to a nearby Mooney for comparison and found it to be 41".

I was very pleased with the general philosophy of construction of this test airplane. It was clean, well organized and simple. I think we all can learn a little from that concept. The seats were made of quality leather with fabric inserts and the head liner was Ultrasuede. The interior was finished in soft gray tones which seemed to enhance the spacious, comfortable feeling. The seat cushions were made of a firm foam which proved to be very comfortable. The leg wells were roomy enough to not be constricting and the good leg support made long flights very relaxing.

The instrument panel was beautiful and well laid out for VFR flying. Across the top of the panel was a hori-



Above: Chuck Hautamaki helped the CAFE team ready his aircraft for testing.
Below: Larry Ford, r, serves a hearty breakfast to the dawn flight test crew.

Owner Chuck Hautamaki, l, and CAFE test pilot C.J. Stephens

ABOUT THE OWNER

Chuck Hautamaki was born in Hancock, Michigan and became interested in flying as a child as he observed the adventures of the Apollo Astronauts. He took flying lessons while studying aerospace engineering at University of Minnesota. He later switched to mechanical engineering, in which he is currently working on his doctorate.

His first flight was in a Piper Cherokee 140. He never owned any aircraft except homebuilts. He has only missed Oshkosh once in the last 16 years.

His first homebuilt was a 950 lb, 160 hp, 230 mph Glasair taildragger which he completed in June, 1983. He enjoyed its rough field capability.

He moved to Idaho a few years ago to work with Dan Denny on the Thunder Mustang project in Boise, using his skills in finite element analysis and graphite structural design. Then he returned to Minnesota, where many of his family live, to complete his graduate work. Meanwhile, his wife, Bonnie, who has a Masters of Industrial Engineering, found good position working for Hewlett Packard in Loveland, CO. Chuck moved to Loveland just this year.

He has been married to Bonnie for 17 years and has 2 children, 11 year old Andrea and 9 year old David.

"I flight plan for a 250 mph average. I haven't had a G meter, though I think I've pulled about 3.5 G's on some high speed passes." Chuck explains that Dan Denny's Glasair III, with high compression pistons, porting and electronic ignition is quite a bit faster than his.

Future plans: Chuck plans to keep this aircraft and maintain it in its pristine condition. "I might look at some numerical studies to see if a different airfoil would benefit this airplane. I've done a little bit of engineering work for Stoddard Hamilton in the past. If I designed a homebuilt I'd shoot for about 230 mph cruise with 200 hp and 4 seats."

zontal row of five Vision Micro engine instruments. The second and third instruments from the left were the Manifold pressure and RPM. Since those two instruments are referred to so frequently I feel they should stand out more and not be buried in a row of other similar instruments of lesser importance. It is a matter of balancing function and asthetics. If the panel were to be set up for IFR flying I feel that the flight instruments would need to be moved up more to the line of vision rather than having the engine instruments along the top. The radio stack was kept basic with one nice nav/comm and a transponder using a blind altitude encoder. All of the installed electronic equipment worked flawlessly throughout the flight testing.

A simple tow bar was provided for ground handling and worked very well. The plane was light enough that one person can easily move it about on the concrete ramp.

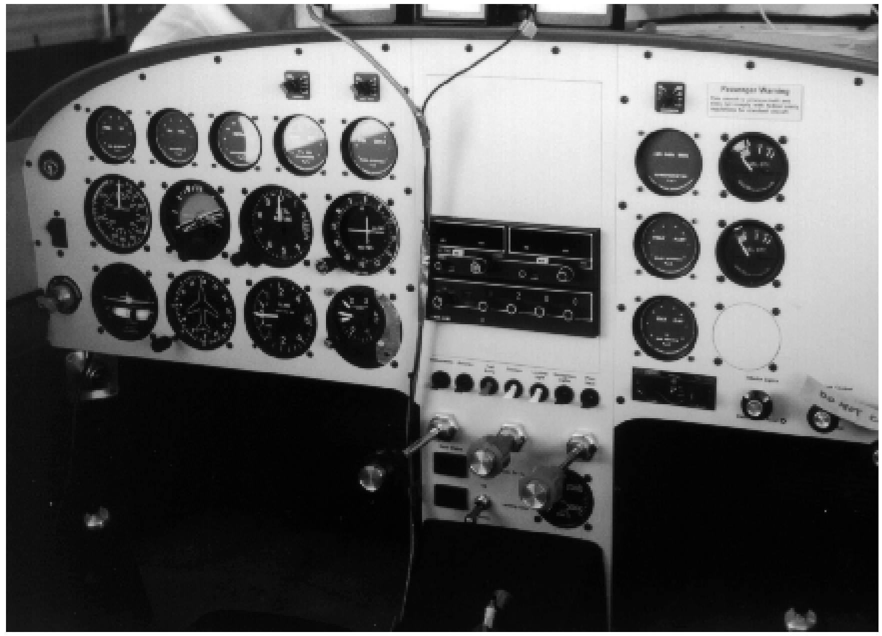
TAXIING

The Lycoming IO-540 sprang to life and idled beautifully after a brief prime using the electric fuel pump. A first impression is that this is a big engine (300 hp) for such a small airplane and it gives off a beefy sound. The stock exhaust system was installed using no muffler. The noise level inside the cockpit however seemed quite normal and comfortable.

Very little power was needed to start the Glasair moving quickly down the taxiway. Directional control is accomplished using light braking with the toe brakes. Brake pedals were only installed on the left side, although the factory makes an optional set available for installation on the right side.

No cowl flaps were installed, however the oil temperature and the CHT remained exactly at the desired readings on all flights even during the sustained high performance climbs. There was no heat cuff installed for cabin heating or defog operation. Even while flying at altitudes of over 10,000' the cabin remained warm enough probably due to engine heat and the oil cooler discharge air being directly in front of the cabin vent (right side) air intake. There was no outlet for any defog system, but a slight fogging problem encountered on the ground was quickly cured by opening an entry door momentarily.

The gull wing cockpit entry doors were large, with a very simple and effective pin locking mechanism and gas struts to hold them open. With the engine running the prop wash seemed to blow the doors around quite a bit. For that reason it seemed best to keep the door closed while taxing. On a~~n~~ windy day it would be even more important to taxi with entry doors closed to prevent damage to the door hinges. The



The Glasair III sits tall and nearly level on its oleo strut landing gear.

fuselage sits level during ground operations which provides an excellent field of view.

The pre-takeoff procedures were well sequenced and logical using the laminated checklist provided by the builder. The flaps stay full up and locked, or full down and locked but the two intermediate positions stay in position only if there is an air load against them. This is due to the way the locking device works on the manual flap handle located on the center console. The normal takeoff procedure is to use the first notch of flaps. Therefore, when awaiting takeoff clearance the flaps will sometimes increase to a higher setting. Prior to taking off it may be necessary to reset the flaps to their proper position. A more secure flap detent would be desirable to preclude possible takeoffs with the flaps in the wrong position.

The only provision for re-trimming the plane from the cockpit was the electric pitch trim switch located on the center console at about the belt loop height. Having it located there made it awkward to operate. There was no pitch trim indicator installed; however by looking back at the elevator counterbalance horn the trim could be easily set prior to takeoff.

TAKEOFF

After a quick mental review of the POH procedures and flight parameters it was time to get airborne for a look at the flying qualities. I had been advised that lift off should occur at about 90 MPH IAS with the long wings. Chuck had also cautioned me about the possibility of trapping the main landing gear out if I delayed the gear retraction too long or climbed too shallowly at first. With the rapid acceleration and the relatively slow gear retraction it is necessary to control the airspeed until all of the landing gear indicators show full retraction.

Liftoff occurred abruptly upon rotation at 90 MPH as expected. Gear retraction was normal and since the speed was building rapidly a slightly steeper climb was used to maintain less than 120 MPH until all three lights were out. Although during the first flight the landing gear retracted normally, on one subsequent flight I did manage to trap the right main in the unlocked position. This situation was further compounded because the three red gear unlock lights are partially hidden behind the throttle knob and not easily seen from the left seat.

During the short-winged flights, takeoff occurred at 96 MPH and the airplane climbed in a more noticeably nose high pitch attitude. As indicated by the tabulated data, the rate of climb suffers during a climb when flying with the short wings.

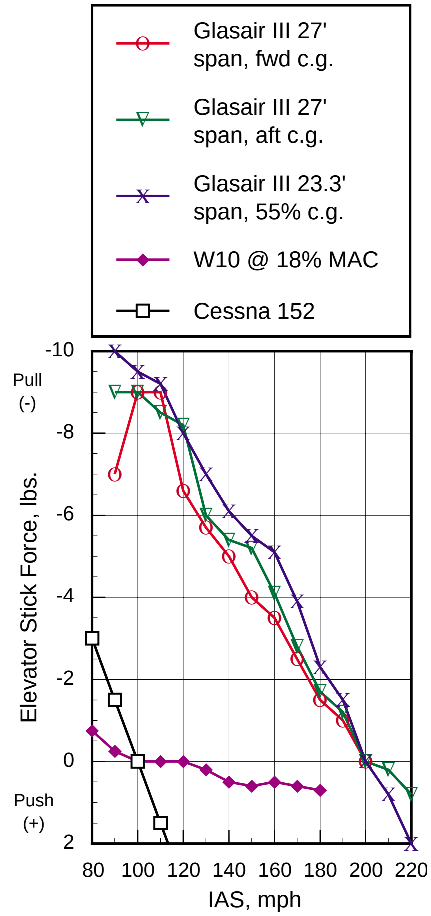
STATIC LONGITUDINAL STABILITY

The airplane was trimmed to level flight at Va (20*1* MPH). Then, using the CAFE hand-held stick force gauge, I measured the pitch stick force at each 10 MPH increment of airspeed change over the entire level flight speed envelope without re-trimming. This stick force gradient gives an indication of the aircraft's tendency to return to the trimmed airspeed. A flat stick force gradient (low stick forces) makes the plane harder for a pilot to fly since there is low control force feedback. This becomes even more important in an airplane such as the Glasair III due to the high airspeeds normally experienced where after even a brief period of distraction the aircraft will quickly end up considerably off airspeed and altitude. The test was repeated at the most forward as well as at the most aft center of gravity locations that could be reasonably obtained. Measurements were made flying with both long and short wings (see graph).

My opinion is that all figures obtained show that the Glasair has an excellent stick force gradient. There is a gradual and steady build up of stick force as the airspeed is changed away from the trimmed speed. Even in the most aft configuration tested, the aircraft showed ample force. ~~The graph shows the full results for comparison.~~

DYNAMIC LONGITUDINAL STABILITY

Short period damping characteristics were evaluated at 6,000' at 140,170, and 200 MPH IAS in the forward and aft c.g. configuration, using first the long and then the short wings. Both stick-fixed and stick-free situations were compared. The stick was held in neutral position during the stick-fixed and released during stick-free. The results were virtually deadbeat during all evaluations. Excellent natural stability certainly adds to the Glasair III's beautiful handling quality.



Static longitudinal stability
trimmed hands-off at Va

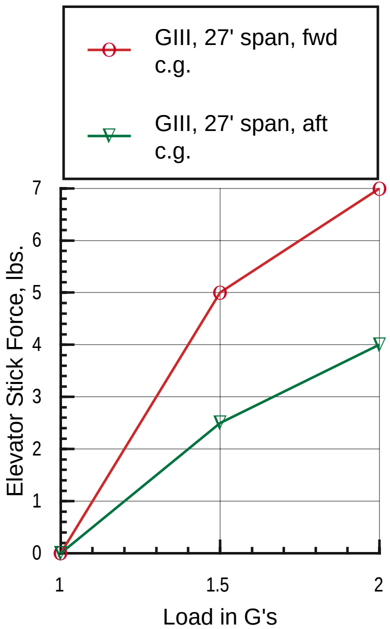
Dutch roll oscillations were excited by synchronizing pitch/roll/yaw inputs together. The damping was immediate with no evidence of Dutch roll tendency when the test was performed using both wing tip configurations. Yaw damping was positive although usually two overshoot cycles occurred after rudder release.

MANEUVERING STABILITY

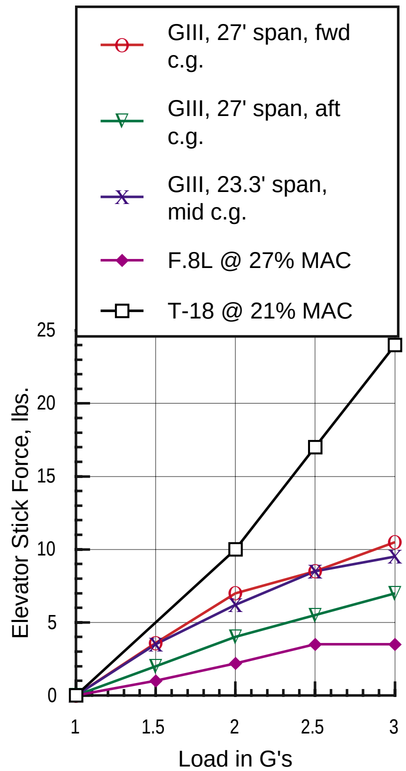
Stick forces were measured vs g forces-with the aircraft trimmed for level flight. The tests were conducted at 6,000' at Va (200 MPH) and in landing configuration at 1.3Vs (117 MPH). Measurements were made at both the forward and aft c.g. positions. As would be expected, the aft c.g. produced lighter stick forces. The rate of stick force increase was linear with ample stick force present at the maxi-

CAFE MEASURED PERFORMANCE

Propeller static RPM, full throttle	2626 RPM
Takeoff distance, 23.3' span, 120' MSL, no wind, 2366 lb., 73.5˚ F.	1500 ft.
Takeoff distance, 27' span, 120' MSL, no wind, 2390 lb., 60˚ F	1400 ft.
Liftoff speed, per barograph data, CAS, 23.3' span, 2366 lb., 73.5˚ F.	104.1mph
Liftoff speed, per barograph data, CAS, 27' span, 2390 lb., 60˚ F	97.5 mph
Touchdown speed, barograph, CAS, 23.3' span, 2270 lb., 68.1˚ F.	95.3 mph
Touchdown speed, barograph, CAS, 27' span, 2268 lb., 57.8˚ F.	88.4 mph
Noise level, full power climb/75% cruise	100.7 dBA
TRIAVIATHON Score	332.4



Maneuvering stability, 117 mph IAS gear and flaps down



Maneuvering stability, Va

SAMPLE C.G. CALCULATIONS, Glasair III N313CH

Aft sample item	Weight	Arm			Forward sample item	Weight	Arm	Moment
Main gear	1209.8	95.8	115833.6		Main gear	1209.8	95.8	115833.6
Nose gear	436.7	35.5	15501.1		Nose gear	436.7	35.5	15501.1
Pilot	170.0	108.8	18487.5		Pilot	170.0	108.8	18487.5
Passenger	170.0	108.8	18487.5		Passenger	0.0	108.8	0.0
Fuel, front tank	2.7	65.8	177.7		Fuel, front tank	32.3	65.8	2120.4
Fuel, wing tank	310.9	81.4	25291.7		Fuel, wing tank	310.9	81.4	25291.7
Oil, included	0.0	36.5	0.0		Oil, included	0.0	36.5	0.0
Baggage	100.0	132.2	13220.0		Baggage	0.0	132.2	0.0
TOTALS	2400.0	86.2	206994.0		TOTALS	2159.6	82.0	177234.2
Long wing					Long Wing			
Gross Weight	2500				Gross Weight	2500		
Empty Weight	1646.4				Empty Weight	1646.4		
Empty Weight c.g.	79.77				Empty Weight c.g.	79.77		
c.g. range, inches	79.65-87.88				c.g. range, in	79.65-87.88		
c.g. range, % MAC	10-28.5				c.g. range, % MAC	10-28.5		
c.g. in inches	86.2				c.g. in inches	82.0		
c.g. in % MAC	24.7%				c.g. in % MAC	15.3%		

mum G evaluated. The control forces felt light enough for good maneuvering yet had high enough feedback to assure accurate pitch control. (See graph).

ROLL RATES

Roll rates were measured by timing the bank change from the video recording made during each flight. The change was measured from a 60 degree banking turn in one direction to a 60 degree bank in the opposite direction in approximately level flight. Full stick throw was used with no compensation made for the time it takes to accelerate to the roll rate; therefore the actual sustained roll rate would be in excess of that reported. Remember the fuel is carried in the wings and we were performing the roll rate evaluations with a nearly full fuel load and with both seats occupied. The comparisons were accomplished with similar fuel loads on each flight.

ROLL RATE, degrees/second, includes input time

Speed, IAS	Va	1.3 Vso
RV-6A	80	36
Tailwind W10	47	45
Cessna 152	47	34
Glasair III, 23' span	92 Rt./ 100 Lt.	na
Glasair III, 27' span	75 Rt./ 67 Lt.	52 Rt./ 60 Lt.

SPIRAL STABILITY

Several tests were performed to explore the natural stability about the roll axis. First the plane was trimmed to level 30 degree bank turns and released. The times required for the plane to either increase, or decrease, the bank by 15 degrees was measured. In all cases the airplane displayed a slight (approximately 1 degree/sec) tendency to roll to the left. This seemed to be caused by an out-of-trim condition. The only cockpit trim available was pitch trim. I believe that, if the out-of-trim condition had been corrected, the plane would have remained in a continuous rate turn, exhibiting neutral spiral stability. The test was performed at both 200 & 117

Flight Data	Mode	A/C Weight	IAS baro	TAS baro	Pres. alt.	OAT °F	Dens. alt.	M.P.	RPM	Gph	BHP	%Power	Speed, mph
Glasair III	23.3' span, 2366.2 lb												
N313CH	Vmax/6000	2328.1	243.9	266.6	3797.9	79.5	5973	25.8	2700		253.0	84.3	281.8
airspeeds	75%/8000	2342.4	223.6	252.4	5894.3	72.3	8086	21.9	2608		211.8	70.6	267.0
corrected	65%/8000	2339.2	213.0	240.3	5896.7	71.6	8041	21.9	2280		184.9	61.6	254.1
for drag	55%/8000	2334.3	196.0	221.0	5948.1	69.9	7999	21.8	1995		153.2	51.0	232.9
due to the	Vmax12000	2301.7	214.0	257.1	10075.0	53.7	12030	20.2	2700		207.2	69.0	273.3
barograph	55%/12000	2296.8	194.2	233.0	10077.0	52.4	11953	18.0	2260		149.6	49.8	248.2
	Vy/12000	2291.4	143.0	171.5	10317.0	47.0	11915	17.7	1870		110.2	36.7	177.4
	27' span, 2389.5 lb	2389.5											
	Vmax/6000	2366.4	243.4	266.0	3864.1	78.1	5971	25.8	2700	23.7	262.7	87.5	280.5
	Vy/6000	2349.6	146.7	161.0	4610.3	67.8	6247	16.1	1900	8.2	102.5	34.1	165.9
	Vx/6000	2345.8	110.8	122.2	4955.5	65.9	6546	13.8	1900	7.0	87.5	29.1	124.1
	Vmax/8000	2303.6	235.6	265.8	5892.2	71.7	8042	23.8	2700	20.0	243.2	81.0	281.5
	55%/8000	2297.5	196.7	221.8	6073.5	67.8	8025	22.3	2000		151.9	50.6	234.0
	65%/8000	2290.2	215.9	244.0	6113.1	69.1	8153	22.3	2280		189.7	63.2	258.3
	75%/8000	2289.0	220.9	249.0	5915.1	70.2	7983	21.5	2600		204.1	68.0	263.4
	Vmax/12000	2329.7	215.2	258.3	9935.7	55.5	11974	20.2	2700	19.0	206.9	68.9	274.8
	55%/12000	2322.3	196.2	235.4	10052.0	53.0	11960	20.6	2070	15.0	159.3	53.0	250.2
	Vy/12000	2313.6	144.5	173.7	10440.0	47.0	12065	14.5	1915	8.3	103.8	34.6	180.3
	SOLO/27' span												
	Vmax/6000	2261.8	246.9	269.6	3885.0	77.2	5936	25.8	2700	21.9	261.9	87.3	285.0

MPH.

ROLL DUE TO YAW

A test was performed maintaining level flight at 130 & 200 MPH IAS with 1/2 rudder displacement, measuring the stick force required to hold the bank constant at a bank required to hold a constant heading. The exhibited dihedral effect should become more pronounced with slower airspeed or increased Angle of Attack. See table below.

130 MPH 2.0 lbs stick force
200 MPH 1.2 lbs stick force

I also checked to see if the wings could be leveled from a 30 degree bank with the use of the rudder alone. In both directions at 160 MPH it was possible to level the wings although during the right turn the recovery occurred more quickly, probably due to the torque of the engine and the slight out-of-rig condition.

STALLS

This Glasair III had small stall strips installed on the leading edge of the wing near the root. During stall exploration I followed the advice contained in the POH by insuring that I had plenty of altitude, (8000'), before attempting stalls. I also mentally reviewed the suggested spin recovery technique should an unintentional spin be encountered. Throughout the six flights I had the opportunity to perform many stalls with both wing lengths and with varying c.g. locations. Every stall and recovery appeared to be exactly the same with the exception of one situation. The exception occurred, on one of the later flights, with the heavy barograph installed directly in front of the air flow of the aileron. In this situation as the airspeed was reduced, the aileron and rudder required to hold level flight increased so much that, just prior to stall, it became necessary to use full rudder and about 1/2 aileron. These abnormal inputs were caused by the installed CAFE test equipment. Even with this

Flight Data	Altitude STD	A/C Weight	IAS baro	TAS baro	Rate of climb, fpm
Glasair III	23.3' span				
N313CH	9500-10,500	2318.0	156.7	179.0	1162.4
rate of climb					
at full power	27' span				
on a	9500-10,500	2338.0	149.0	172.0	1257.5
standard day	2500-3500	2370.0	150.0	159.0	1797.9
at the					
altitudes	SOLO/27' span				
shown	2500-3500	2268.0	150.0	159.0	2078.2

Flight Data	M.P.	RPM	IAS baro	TAS baro	Rate of descent, fpm
Glasair III	23.3' span				
N313CH	15	2400	209	245	1000
rate of descent	8	2500	208	241	1806
at power	8	2500	255	282	2975
shown	27' span				
	4	2400	210	231	2700
	6	2400	283	298	4050
	7	1800	145	163	1197
	7	1800	110	na	1050

Flight Data	Config.	A/C Weight	IAS baro
Glasair III	23.3' span		
N313CH	Clean	2320	87.3
stall speeds	Dirty	2320	80.1
in mph	27' span		
Note span	Clean	2360	82.2
and weight	Dirty	2360	76.9
effects	27' span		
	Clean	2255	79.1
	Dirty	2255	73.8

large amount of control input the stall and recovery characteristics were quite similar to the other stalls.

All of the stalls observed reacted with very little airframe buffet or noticeable sounds until about 1 MPH prior to the stall. Then one very noticeable shudder would take place and the stall would occur. At the stall the left wing would always drop about 20 degrees and the nose would pitch down noticeably but not uncomfortably. I feel the slight out-of-rig condition may have been the cause of the left wing drop. In every case the recovery was instantaneous and positive following the slight forward repositioning of the stick. Altitude loss was minimal and no secondary stalls occurred during any recovery.–It should be noted that all stalls were preceded with a slow deceleration of less that 1 MPH per second.

Accelerated stalls were explored up to an airspeed of 110 MPH with all of the same characteristics being displayed. A pronounced nose high attitude was required to maintain level flight during approaches to the stall in the short wing configuration.

DESCENTS

Various types of descent profiles were explored and reported. (See table). It certainly was impressive to see rates of descent near 4.000 fpm and true airspeeds in excess of 300 MPH.

LANDINGS

I was very interested in evaluating the approach and landings of the Glasair III since this high performance airplane has on occasions given a few pilots some difficulties. Field of view letting down and entering the pattern is good. Any blind spots can be eliminated through mild banking. The plane is noticeably faster than most airplanes in its class and planning the let down is a must or you will arrive at the airport either too high or too fast.

The landing gear speed is 140 MPH which seems adequate for most situations The airplane is clean and does not want to loose speed easily until the gear and flaps are extended. This is another reason to plan the descent carefully. Chuck explained that it was recommended to fully extend the flaps immediately after the gear extension on down wind. However, I felt that created a large drag change and necessitated a major power input to maintain level flight. My preference was to extend only 1/3 flaps right after the gear extension, then extend the remaining flaps just prior to starting the base turn.

A pattern of 115 MPH IAS works well with a target speed across the fence of 100 MPH. Accurate control of the airspeed is necessary. This airplane has high performance and requires good discipline to fly it safely. On final it is extremely easy to hold the airspeed to the exact number that is targeted for approach and touchdown. It has excellent power response when acceleration is needed and ample drag when deceleration is needed. With accurate control of the power and pitch on final the airplane will touch down precisely where desired.

An important item is to not “pull off” the power and expect the airplane to float to a landing. It shows its high spirited, high performance lineage and must be flown completely throughout the landing. It is not a difficult procedure but if you are not used to landing this way it will require some practice.

The cockpit sensation gives the feeling that the airspeed is quite high during landing. Normally during my experience a landing roll of about 3,000’ seemed to be the standard although shorter rolls could be attained with heavier braking. The stiff landing gear leaves no doubt when the landing occurred.

LONG WING/SHORT WING

A burning question that seems to be omnipresent is "How do the different wings lengths compare?" The most noticeable differences are the greater climb rate with the long wings and the more nose high attitude at slow speeds with the short wings. At altitudes above 8000', the long wing seems to win out as far as speed is concerned. As would be expected, the roll rates are faster with the short wings installed. The short wing fits into a smaller hangar space.

The landing speed with the short wing is faster requiring greater runway length. Due to the Glasair III’s high wing loading, the margin for pilot error during an engine-out approach to landing would be extremely small. The longer wing configuration would improve the emergency landing problem by reducing the landing speed slightly.

Is it worth the effort to own both wing lengths? Considering that the interchangeable wing tip construction is actually a minimal amount of effort it is probably something that is worth doing.

CONCLUSIONS

The Glasair III is a fine airplane with excellent flying qualities. It is not an airplane that is meant for the low time or inattentive pilot. The speeds and performance are outstanding The builder who keeps his airplane light and simple is bound to be rewarded with excellent performance.

CAFE HONORARY ALUMNI

Steve Barnard--RV-6A
Jim Clement--Wittman Tailwind
Jim Lewis--Mustang II
Ken Brock--Thorp T-18
Larry Black--Falco F.8L

Panel IAS	Barograph CAS
92	91.00
120	121.00
140	146.00
160	166.50
180	189.00
200	209.00

N313CH
Airspeed Calibration

IMPORTANT NOTICE

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COMPARATIVE AIRCRAFT FLIGHT EFFICIENCY, INC. The CAFE Foundation:

A Non Profit, All Volunteer, Tax-exempt Educational Foundation
4370 Raymonde Way, Santa Rosa, CA. 95404.
FAX 544-2734.
Aircraft Performance Evaluation Center:
707-545-CAFE (hangar, message)
America Online: CAFE400@aol.com
Internet: CAFE400@sonic.net