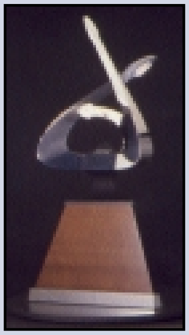

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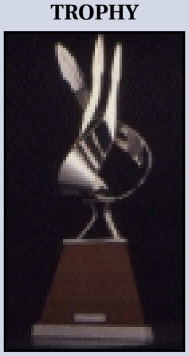

CAFE FOUNDATION
AIRCRAFT PERFORMANCE REPORT

Sponsored and Funded by the Experimental Aircraft Association

Lancair 320

BY BRIEN SEELEY AND THE CAFE BOARD

Larry Ford

The Lancair 320 has proven to be an extremely popular homebuilt aircraft. There are more than 1500 Lancairs sold to people all over the United States and Canada, Europe, Scandinavia, Australia (where the aircraft certification authorities required the tail to be enlarged before allowing them to be licensed), and South Africa.

The company that designs and builds the Lancair, Lancair International, has provided for their customers a network of support which includes extensive free technical support, a Lancair Preflight Inspection Program, the First Flight Test Program, and a Flight Training Program. While all of these programs may not be accessible to a builder in South Africa, the reputation that the Lancair is a reliable, high quality aircraft with a solid, strong airframe, and its sleek eye-catching design, have made it the kit of choice for many EAAers world-wide.

HISTORY

The first model, Lancair 200, designed by Lance A. Neibauer, was developed in 1984. The prototype can be found in the EAA museum in Oshkosh. His company's goal is to be an important part in shaping the future of modern aviation through innovation, technical advances in design, aesthetics and performance.

It is no wonder then to realize that the CAFE Foundation team was delighted when Fred Baron, owner of Lancair 320 N9BF, contacted us about a year ago. Fred had heard about the Aircraft Performance Reports (APRs) that CAFE performs through Steve Barnard, owner of the RV-6A we tested several years ago. Soon after that Fred flew down from his home in Garberville, California to visit the CAFE facilities and made plans for his flight testing weekend.

Fred was looking for more accurate specifications for his plane. He was curious to know if the weight and balance had been correctly determined. He was also piqued by the rest of our program; and not being a test pilot himself, he needed someone else to provide him with the information.

The Lancair was the third airplane that Fred built. He had already built a Q-2 and half of a Skybolt, and had been flying a Cessna 172 for a long time when the need for speed struck him. Fred was looking for an aircraft with good performance and the Lancair was at the top of his list. He and a friend visited several Lancair builders and the Lancair factory in Redmond, Oregon and were very impressed. They decided to build a pair of Lancairs - and had a lot of fun doing it that way. They bought the kits in 1992 and flew them in 1995.

CONSTRUCTION

The kit comes with the left and right fuselage halves, upper and lower wing skins, a complete engine mount, landing gear, a blank panel, and an unfitted Plexiglas canopy. Fred bought the standard kit while his friend built the "fast build" kit. Fred had more options for modifications while his friend was more tied into a fixed design. The wing ribs are of nomex honeycomb-sandwich construction and are built by the owner in the "standard" kit, but are already assembled in the "fast build" kit.

There are a few modifications that Fred employed to the original standard kit. He used a newer engine mount which moves the engine three inches forward of the previous position. This allows for more space, which makes it easier to remove the oil filter, and doesn't require the firewall to be "dished". It also moves the c.g. forward a bit, which may be beneficial. Fred also moved the throttle body from the rear of the engine to the front for more ram air flow. He added landing lights, a GPS and a CD player. His Lancair has the 'small tail'.

N9BF is powered by a Lycoming 0-320 engine which came off of a Twin Comanche. The engine was "ported and flowed" by Lycon before mounting on the Lancair which Fred estimates increased its horsepower to 170. The propeller is a broad-tip Hartzell with seven inches cut off from each blade. The F hub incorporates an integral prop extension and is specifically designed by Hartzell for this engine.

Fred's comments about his experience with Lancair include the following: "Lancair provides good builder support and good manuals. When you call them there is always someone there to answer questions. It was a pretty easy kit to build. The people at Lancair are very business-like, but friendly. They throw a huge party every year for their people." He wishes that they did however have an official network set up to inform owner/builders of potential problems. Information about Lancair on the internet includes: The unofficial "Official Lancair Builders' List", the Lancair Network News at 70263.2174@compuserve.com, and www.lancair.com.

ABOUT THE OWNER

Fred, a pharmacist in Garberville, and his wife Belle have flown over 300 hours in their Lancair; including visits to their four children and six grandchildren. Their trans-continental trips include flying to Sun 'n Fun, Maine, Oshkosh and North Carolina. They like to fly comfortable three hour legs and average 200 mph block to block. Fred, a 2000 hour private pilot, finds the Lancair easy to fly (once he became comfortable with this high performance, sleek design). He says it's fast, comfortable, economical and garners more than its share of comments wherever they go.

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
Chuck Hautamaki--Glasair III
Jeff Ackland--Legend
Jerry Sjostrand--Express
Randy Schlitter--RANS S-7C
Stoddard Hamilton Aircraft, Inc.--GlaStar
Fred Baron--Lancair 320

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IMPORTANT NOTICE

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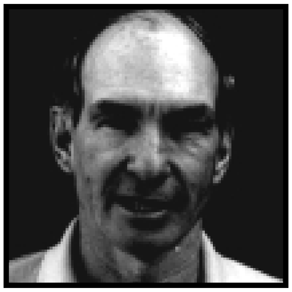


SUBJECTIVE EVALUATION
Lancair 320, N9BF
by
C.J. Stephens and Otis Holt

INTRODUCTION

May 29 was another overcast, showery day in Santa Rosa. The rain in California had been extremely persistent this year as El Niño brought us rain that normally falls along the Oregon coast. With weather like this, I thought there was no way that the Lancair could arrive on time for the APR evaluation planned by the CAFE Foundation.

Otis Holt, the other CAFE test pilot, and I had been trying to contact Lancair owner Fred Baron via telephone to reschedule his arrival. However, just on the off chance that he had actually made it to Sonoma County Airport I drove out and hit the button to open the hangar. The cable strained to raise the huge steel CAFE hangar door as the track wheels squeaked along their guide paths.

As the rising hangar door slowly admitted daylight I was stunned to see the beautiful silver and blue Lancair sitting calmly on the apron in front of the CAFE hangar. No way, was my first thought as I walked over to introduce myself to Fred. I was anxious to hear the story of how he managed to get from Garberville to this airport (about a 45 minute flight) on a day such as this.

Fred's understated character was starting to show through as he described how he had tried to come down a few of the valleys but got turned back due to the downpours along the way. When he made it back to Garberville there was a convenient hole through which to climb on top. By shooting across the tops at 10,500 ft he arrived to find probably the only sucker-hole that passed Santa Rosa that day waiting right over our airport. Some days are just like that - a charmed life.

By reading other articles I had learned of some common opinions about the flying qualities of the Lancair. I wanted to enter this evaluation with an open mind and experience first hand what the plane's flying qualities offered. This was my chance to learn and to share with others what it was really like to fly a beautifully finished and very stock Lancair.

It then occurred to me that I had better notify the rest of the CAFE test team that Fred had actually arrived, since there was a lot of work to do to get test flight ready. As our team began to arrive to prepare the Lancair for installation of all of the data sensors and test equipment, the first order of the day was to remove all of the fuel and anything that was not part of the aircraft's empty weight. The plane was emptied and leveled, and a very accurate weight and balance was established.

Since the weather was not expected to be suitable in the early part of the following day the team quit at midnight to resume preparations at 7 AM. A total of 13 hours, and up to six technicians, were required to complete the process of flight preparation. There was a lot of checking and rechecking of the many wires that were all bundled together and strung through the cockpit and baggage area.

At last, with nearly 50% of the available weekend consumed by equipment installation, it was time to fly the performance tests. I always feel a great personal responsibility placed upon my shoulders as I taxi out in a guest owner's beautifully finished airplane that has never been flown by any other person. What trust has been placed in our team! Admittedly, as a group, we are confident in our abilities, equipment and foresight and are determined to maintain our spotless safety record. Even so, Fred showed the grit of a true EAA member as he permitted our testing and probing and questioning. A person who subjects their plane to this kind of evaluation can learn things about it that they didn't really want to learn. I think it takes a special type of person to step forward and be counted.

FIRST IMPRESSION

As can be seen by the pictures in this article Fred Baron's Lancair has a beautiful finish with many personal touches that represent his own personality. The graphic on the tail, the name, and the color scheme were skillfully executed and reflect much pride and thought on the part of the owner.

OUTWARD APPEARANCE

The Lancair is a sleek design that appears to be sculpted around a well laid out pod large enough to carry two

C.J. and Otis taxi up to the CAFE hangar after a test flight.

individuals. The smooth flowing lines seem to allow the air to flow past the airplane with the least amount of difficulty. The very pleasing appearance is enhanced by a large bubble canopy that hinges well forward causing no interference with cockpit entrance. There are minimal external protuberances to detract from the clean lines and aerodynamic beauty.

Lancair's innovative landing gear design is worth noting here. The nose gear's internal rotary hydraulic mechanism is able to control the shimmy damping and tracking extremely well without any draggy external scissors mechanism. The main gear utilizes a very short swing axle with several rubber discs for shock absorbers. The combination of differential brake steering and main gear/nose gear installation is the best combination that I have tested. It consistently tracks straight, has very positive steering, virtually no shimming and brakes perfectly.

COCKPIT

In spite of the Lancair being a low-wing airplane, entry into the cockpit requires a large step up onto the wing. The step-up height is 22 inches, plus the requirement to step beyond the flaps due to the 'no step' placard on the flaps. (The hinged flap seems

This space reserved for black line graphic of 3 views of Lancair.

quite large for the size of the airplane and employs some up-reflexing which can be observed by sighting the lower camber). There is no step installed to aid in entry; however, it is manageable providing the individual is agile.

Cockpit entrance requires stepping on the seat cushion, partially sitting on the seat back, then sliding into position. The seat back seems very sturdy.

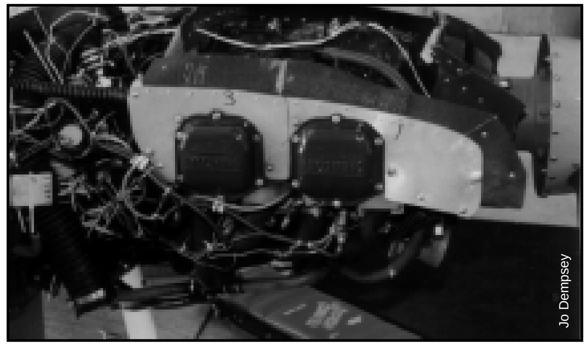
The engine controls are panel mounted in the normal center position for operation by the pilot's right hand. The throttle is the left most of the controls, to the right is the mixture, and just below the throttle is the RPM control. This positioning requires some awareness to keep from inadvertently reaching for the RPM control and actually adjusting the mixture, since the typical arrangement positions the RPM control just to the right of the manifold pressure control.

An alternate air push/pull control is located lower left of the instrument panel and is effective in by-passing the air filter for the induction air. We measure a one inch manifold pressure loss when operating at altitude with the filter involved.

No de-fog capability is installed. The cabin vent system is adequate with a large outlet at knee level for each occupant. During flight plenty of ventilation is available.

GROUND HANDLING

A stainless steel, hand-operated tow bar is provided for maneuvering the plane about on the ground. The tow bar has a nice, positive locking system to attach to the nose gear and ia an excellent piece of auxiliary equipment. The Lancair is very easy to push around on the ramp, due to its light weight.



Refueling is straightforward and is accomplished through a single fuel cap near each wing tip. The aircraft's grounding point for refueling is at the exhaust pipe. The fuel is contained in two tanks, one right and one left, full span, wet wing, and located just aft of the wing spar.

START/TAXI/RUN-UP

The fuel injected engine tends to flood during hot start if normal starting procedures are used. I was briefed to start with full lean mixture and catch it upon start, which works just fine. Field of view during ground operations is excellent in all directions. The landing gear provides excellent ground handling at all times. Run up is straightforward using the laminated checklist provided by the owner.

One magneto has been replaced with a LASAR electronic ignition; consequently the usual keyed magneto/starter switch does not operate the ignition for the electronic ignition side. This requires some special attention to insure the ignitions are in the desired configuration for the phase of flight and off at the required times on the ground. During the pre-takeoff run up it is difficult to tell any difference between operation on either ignition. The RPM drop is virtually the same when running on electronic ignition or magneto.

The flaps are visually set to 10 degrees for takeoff by comparing the position with the aileron. A toggle switch operates the flaps electrically to the desired setting. No cowl flap is installed; however, the temperature seems to stay well within all limits during flight.

The landing gear is electrically controlled and hydraulically operated. An electric motor operates a hydraulic pump to maintain pressure on the system. This motor can be heard operating through the intercom as it intermittently cycles. There are no landing gear uplocks so the pressure is necessary to keep the wheels fully up

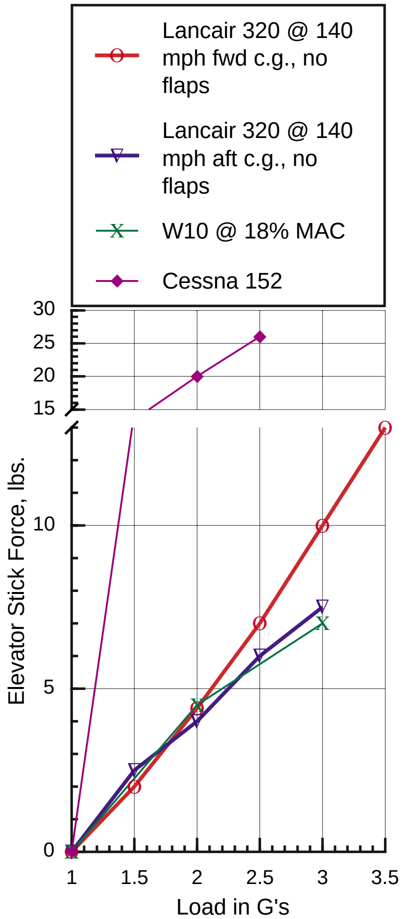
Lancair 320 N9BF Sample c.g.

Sample c.g.	Weight, lb	Arm	Moment
Main gear	773	76.56	59145
Nosewheel	415	32.62	13539
Pilot, front	180	77.5	13950
Co-pilot, front	150	77.5	11625
Fuel, wing tanks full 40 gal.	240	73.8	17701
Oil, included 6 qt.	0	0.0	0
Baggage, none	42.6	80.0	3408
TOTALS	1800		193338
Datum: fwd face of cowl			
c.g. this flight, in.	66.3		
c.g., % MAC	na		
c.g., % aft of fwd limit	0		
Gross weight, lb	1800		
Empty weight, lb	1187.5		
Useful load, lb	613		
Payload, lb, full fuel	373		
Fuel capacity, gallons*	39.98		
Empty weight c.g.	61.21		
c.g. range, inches	64-69.8		
c.g. range, % MAC	na		
*as weighed by CAFE			

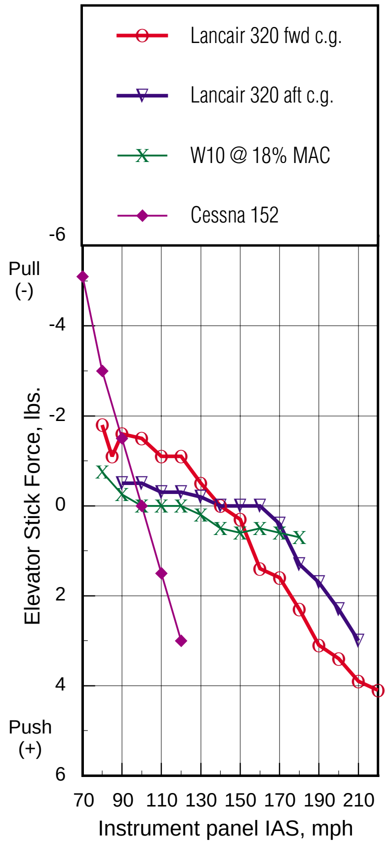
Panel IAS, mph	Cabin Barograph, mph	CAS, mph
**	70.7	71.1
**	75.1	76.5
90.0	82.4	84.5
100.0	91.8	92.8
110.0	103.4	104.1
120.0	113.2	113.8
130.0	123.9	123.9
140.0	133.5	135.3
150.0	146.2	145.2
160.0	156.2	156.3
170.0	165.5	166.1
180	178.0	177.1
190	187.4	186.2
200	195.4	196.5

Lancair N9BF
Airspeed calibration

Cabin Barograph shows the airspeed indicator's instrument error and CAS shows total pitot-static system error.
****Full flaps.**



Maneuvering stability



Static longitudinal stability

Trimmed to zero pounds with stick- free and flaps up at Va.

and to insure positive down.

The forward canopy hinge system requires two positive latches on either side at the aft corner of the canopy before flight. The installed locks are very positive overcenter latches with a release. However, due to the location just behind the occupant's shoulder, it requires some twisting to insure both are locked prior to take off.

The large bubble canopy gives a wonderful, unobstructed view in flight, which I really like. The downside of the large canopy is that the direct mid-day sun makes it hot in the cockpit during ground operations when little cooling air is available. Leaving the canopy open about six inches helps immensely with the ground cooling. It works well if you simply lower the canopy onto your (or your passenger's) arm to help prop the canopy slightly open. Here, I feel a simple brace could be fashioned to positively hold the canopy partially open. This, also, might help prevent inadvertently taking off with the canopy closed but not latched.

TAKEOFF AND CLIMB

The view over the nose during the take off roll is adequate during the rapid acceleration to takeoff speed. At the prescribed takeoff speed the rotation necessary to liftoff seems greater than normal but as soon as the proper pitch attitude is established the airplane quickly lifts off and continues to accelerate. The gear retraction followed by the flap retraction cycle continues to produce greater acceleration and the climb is established.

STATIC LONGITUDINAL STABILITY

The static margin is examined with the Lancair trimmed to 140 mph. Stick force is measured with the CAFE handheld stick force gauge. The graph below shows the stick force measured at each 10 mph increment of airspeed in level flight without trimming. The test is conducted twice at the designer's recommended gross weight (1650lbs), first with the c.g. at .5" aft of the forward limit and a second time with the c.g. 2" forward of the aft limit. (note: Total c.g. envelope is only 5.9")

As shown on the graph, with the forward c.g. configuration, the lower airspeeds have little gradient in stick forces as the airspeed diverges from the trimmed speed. At the higher airspeeds the stick force builds steadily to the maximum airspeed examined. A total of only 5.9 lbs of force is required across the entire (140 mph) airspeed change. In my opinion, this is an acceptable amount and causes a nice, light feel on the control stick. The increasing stick force as the airspeed increases helps control the airspeed in a regime where the pitch sensitivity is the highest. Note the stick force differences on the graph with the aft c.g. configuration. The feel of the stick is noticeably lighter and not as comfortable in that it requires more attention to control the airspeed. Momentary distractions cause the plane to wander more in pitch attitude. Upon concluding the stick force measurements with high indicated airspeed, removing the stick force gauge from between my hand and the stick grip causes a brief but abrupt pitch oscillation.

DYNAMIC STABILITY

The dynamic stability of this plane is examined by introducing mild doublets in pitch and releasing the stick to observe the stick free stability, then repeating the event holding the elevators rigid to observe the stick fixed qualities. The Lancair is deadbeat in the stick fixed trial and resulted in only

Lancair 320 owner Fred Baron shakes hands with C.J., the only other pilot to have ever flown his plane.

one overshoot in the stick free mode.

The stick travels only a small amount fore and aft to control aircraft pitch and has very light stick forces. Though light, they are well harmonized, between the aileron and elevator, and I personally find the airplane to be very pleasant yet responsive when loaded toward the forward c.g. limit.

MANEUVERING STABILITY

The stick force required to increase the g on the airplane are measured with the airplane trimmed to zero stick force, @ 1 g, at 140 mph. The graph shows an incremental increase in stick force required as the g is increased. Note that on the aft configured c.g. there is greatly diminished stick force required. This shows that the airplane will require greater attention and skill from the pilot to correctly operate the airplane as the c.g. location becomes more aft.

One interesting note is that when Fred Baron and his wife Belle returned to the CAFE foundation facility to complete this handling qualities portion of the evaluation, they were on their way to the Merced air show. Just prior to their departure we put the Lancair back on the scales, full loaded, with the usual lawn chairs and thermos jugs aboard to measure their weight and c.g. The c.g. for that flight was exactly 0.1” aft of the most aft configuration that we sampled in our test.

SPIRAL STABILITY

The airplane is trimmed to a level 15 degree bank turn at 140 mph and the controls are released to observe the spiral stability. After thirty seconds of turn in each direction the test is abandoned since the results show absolute spiral neutrality.

ROLL RATE, degrees/second, includes input time	Va	1.3 Vso
Lancair 320	63 Rt/75 Lt	40 Rt/52 Lt
RV-6A	80	36
Cessna 152	47	34
RANS S-7C	61 Rt./63 Lt	50 Rt./53 Lt
GlaStar	52 Rt/50 Lt	47 Rt/43 Lt

ADVERSE YAW

At 100 mph the aileron are fully deflected with no attempt to coordinate rudder input, to observe the airplanes adverse yaw tendencies. The Lancair shows surprisingly little adverse yaw of only a degree or two of hesitation prior to commencing the turn.

ROLL DUE TO YAW

To examine the airplane’s tendency to roll due to yaw or rudder input, the airplane was trimmed to level flight and observations are made of the bank angle required to maintain constant heading while inputting first 1/2, then full rudder deflection in each direction.

Clean configuration at 140 mph:
1/2 left rudder requires 7º right bank
1/2 right rudder requires 7º left bank
Full left rudder requires 10º right bank
Full right rudder requires 10º left bank

Gear down, full flaps and 100 mph:
1/2 left rudder requires 5º bank
1/2 right rudder requires 5º bank
Full left rudder requires 7º bank
Full right rudder requires 7º bank

It is interesting to note that we seldom see an airplane that is so symmetrical in requiring the same bank angles in both directions for similar configurations and inputs.

ROLL RATES

The method of establishing the roll rate is to measure the time it takes from input of aileron to transiting 120 bank change in level unaccelerated flight at two sampling airspeeds. Both 140 mph in the clean configuration and 100 mph in the landing configuration are measured. Since the time to accelerate to the final roll rate is included, the sustained roll rate will be higher than that shown.

The measured roll rate for coordinated flight results in the figures shown in the table.

STALLS--CLEAN

At an altitude of 8,000 ft after several familiarization flights, I

CAFE MEASURED PERFORMANCE

Propeller max. static RPM	2695 RPM
Vmax, TAS, 5975’ dens.alt., 1775 lb, 25.6”, 2701 rpm, 11.8 gph	233.1 mph
Stall speed, 1769 lb, 14” M.P., 1880 RPM, full flaps, CAS	61.7 kt/71.1 mph
T.O. distance, 10 mph headwind, 1808 lb, 72 ° F, 125 ft MSL	895 ft
Liftoff speed, by Barograph, 1808 lb, full flaps, CAS	82.4 mph
Touchdown speed, Barograph, 1753 lb, full flaps, CAS	80.4 mph
Minimum sink rate, 1757 lb, 104 mph CAS, 120 mph TAS	660.4 fpm
Glide ratio, coarse pitch, idle, 125 mph CAS, 150 mph TAS	15.8
Noise levels, ambient/idle/full power climb/75% cruise	62/76/96/99 dBA
Time required to extend landing gear	9.3 seconds

performed a number of stalls. At the forward c.g., the airplane's stall performance is very nice. The only difficulty is getting the Lancair to slow down. It is a very clean airframe and even with little power it holds onto its airspeed. There is no electronic stall warning or angle of attack system installed. However, there is the onset of a mild natural buffet at approximately 5 mph prior to stall. The buffet builds slightly in intensity as the stall airspeed approaches, which is good, since the forces of the stick are light and provide little cue of the approaching stall. Control of bank and heading are simply done with the coordinated use of ailerons and rudder. As the stall occurs the nose drops slightly and stall recovery is immediate with the repositioning of the elevators. Altitude loss is minimal using the conventional recovery methods.

Clean stalls performed at the aft c.g. are a bit more demanding. The first thing that is noticeable is the lighter stick forces required to raise the nose to a stall attitude. The nose also does not drop as noticeably as the stall occurs. However, it does respond very nicely when the stick is repositioned for the recovery. The naturally occurring aerodynamic buffet is present and provides good notice of the aerodynamic condition of the airflow over the lifting surfaces. The clean stall occurs at an indicated airspeed of 85 mph on the panel. This compares with the CAFE-corrected airspeed of 80 mph CAS.

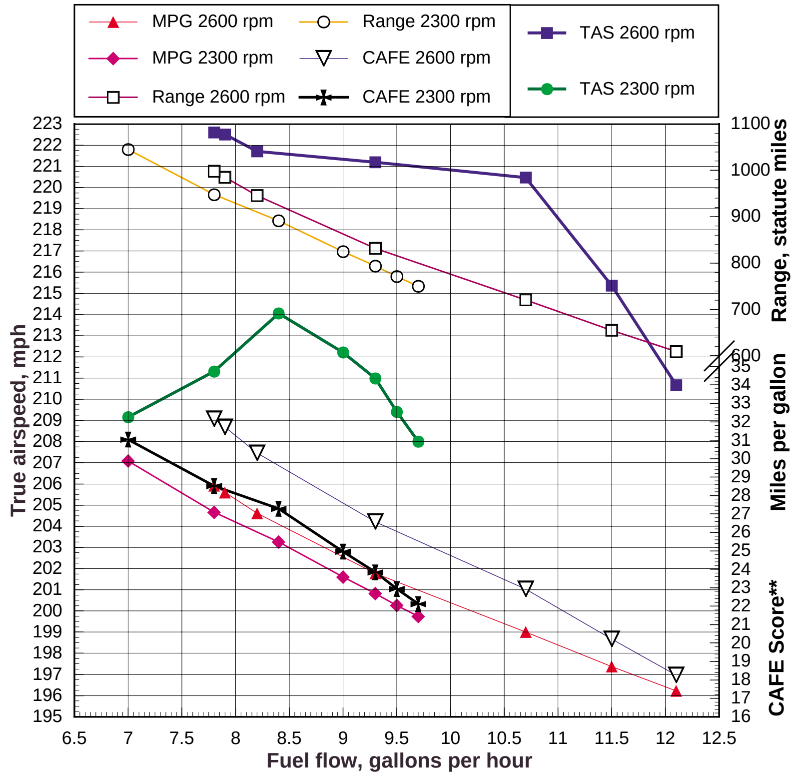
STALLS--DIRTY

The stalling characteristics are also explored with the landing gear down and the flaps fully extended. The deceleration is excellent with the large flap providing sufficient drag to comfortably manage the set up. All of the characteristics that are exhibited during the clean stalls are also present during the dirty stalls, only they are a little more pronounced. The dirty stall occurs at an indicated airspeed of 83 mph on the panel.

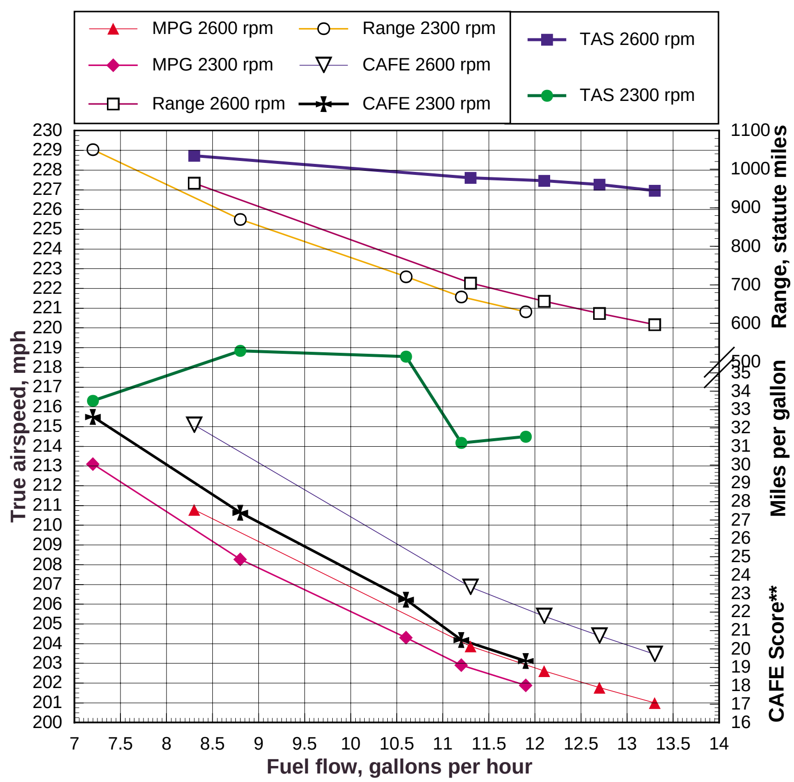
DESCENTS

The Lancair 320's high airspeed envelope makes descents in the Lancair especially exhilarating, with the spa-

The graphs below use a Power-Performance data plotting technique developed by Klaus Savier. The peak CAFE score occurs at the fuel flow and cruise velocity, V, which optimize the trade-off between speed and MPG and is typically lean of peak EGT. The relative CAFE scores shown here, scaled to fit the graph's Y axis, are based on the computation ($V^{1.3}$ x MPG), which is part of the CAFE Challenge formula.



Lancair N9BF: 12000' density altitude, w.o.t..
****Comparative aircraft flight efficiency score**



Lancair N9BF: 8000' density altitude,
****Comparative aircraft flight efficiency score**

Lancair 320 N9BF	Flight/Date	Start time	Pressure altitude, ft.	Density altitude range	Weight, lb	Baro IAS, mph	CAS, mph	TAS, mph	Rate of climb, fpm
	Climbs								
Climbs at various altitudes using	#3--5/31/98	12:23:05	1634	2503.2-3500	1803	134	136	141	1214
wide open throttle (w.o.t.) and	#3--5/31/98	12:42:48	8276	9518.0-10519.1	1787	125	125	145	897
maximum RPM setting at	#3--5/31/98	12:44:28	9668	11009.9-12011.2	1784	124	124	148	791
various weights and airspeeds, flaps up.									
Gross Wt = 1800									
	Descents								Rate of sink
All descents at idle throttle	**#2--5/30/98**	18:11:00	11210	12198.6-11198	**1758**	125	125	150	**834
using coarse pitch and flaps up.	#2--5/30/98	18:13:32	9581	10559.4-9906.9	1758	96	96	112	729
Flight #2 used Baro #3 on wing cuff	#2--5/30/98	18:17:50	8496	9415.8-9034.6	1757	104	104	120	##660.4
Flight #3 used Baro #1 with no wing cuffs	#2--5/30/98	18:18:30	7636	8717.6-7916.5	1756	161	161	183	1283
	#2--5/30/98	18:19:55	4140	5254.6-4287.9	1755	250	250	268	3431
**** 15.8/1 glide ratio**									
## Vx									

Cruise flight data	Flight #/drag/Bar#	Clock	IAS Baro #1, mph	CAS, mph	Dens. alt., ft.	Density ratio	TAS, mph	M.P., in. Hg.	RPM	GPH	MPG	Weight, lb.	Range	Endurance, hrs.	Comment
Lancair 320 N9BF	#2 with cuff, Baro #3	05:50:16	209.4	209.4	5975	0.84	233.1	25.6	2701	11.8	19.4	1775	679	3.0	Vmax 6000'
New TAS computed	#3 no cuff, Baro #1	12:48:57	184.5	183.5	12026	0.69	220.5	20.4	2604	10.7	20.6	1779	721	3.3	rich, w.o.t.
based on CAS and	#3 no cuff, Baro #1	12:50:49	185.0	184.0	12047	0.69	221.2	20.6	2599	9.3	23.8	1777	832	3.8	rich of peak
density altitude and	#3 no cuff, Baro #1	12:52:10	186.2	185.2	12064	0.69	222.6	20.5	2600	7.8	28.5	1776	998	4.5	lean of peak
compensated for	#3 no cuff, Baro #1	12:55:51	174.3	174.3	12024	0.69	209.4	20.5	2307	9.5	22.0	1773	771	3.7	reduced RPM
wing cuff drag	#3 no cuff, Baro #1	12:57:16	176.5	176.5	12066	0.69	212.2	20.5	2303	9.0	23.6	1771	825	3.9	rich of peak
39.975 gallons fuel	#3 no cuff, Baro #1	12:58:18	178.4	178.0	12082	0.69	214.1	20.5	2306	8.4	25.5	1770	891	4.2	sl rich of peak
for computing range	#3 no cuff, Baro #1	01:00:14	176.7	176.0	11980	0.69	211.3	20.5	2305	7.8	27.1	1769	948	4.5	near peak
for VFR reserve.	#4 no cuff, Baro #1	02:25:38	200.2	201.3	7975	0.79	227.0	24.0	2601	13.3	17.1	1734	597	2.6	too rich
	#4 no cuff, Baro #1	02:26:49	200.5	201.6	7966	0.79	227.3	24.0	2605	12.7	17.9	1729	626	2.8	rich of peak
	#4 no cuff, Baro #1	02:27:39	200.6	201.7	7989	0.79	227.5	24.0	2601	12.1	18.8	1728	657	2.9	rich of peak
	#4 no cuff, Baro #1	02:28:50	200.8	201.9	7968	0.79	227.6	24.0	2603	11.3	20.1	1727	704	3.1	rich of peak
	#4 no cuff, Baro #1	02:29:40	201.6	202.7	8030	0.79	228.7	24.0	2601	8.3	27.6	1726	964	4.2	lean of peak
	#4 no cuff, Baro #1	02:34:55	190.4	190.2	7991	0.79	214.5	24.0	2306	11.9	18.0	1721	630	2.9	too rich
	#4 no cuff, Baro #1	02:36:09	191.2	190.0	7965	0.79	214.2	24.1	2310	11.2	19.1	1719	669	3.1	rich of peak
	#4 no cuff, Baro #1	02:37:17	194.0	194.0	7923	0.79	218.5	24.0	2300	10.6	20.6	1718	721	3.3	rich of peak
	#4 no cuff, Baro #1	02:39:27	194.2	194.2	7944	0.79	218.8	24.1	2308	8.8	24.9	1716	870	4.0	near peak
	#4 no cuff, Baro #1	02:40:03	192.8	192.0	7927	0.79	216.3	24.1	2306	7.2	30.0	1716	1051	4.9	lean of peak
	#4 no cuff, Baro #1	02:45:31	129.2	129.2	8238	0.78	146.3	16.8	2002	5.2	28.1	1712	984	6.7	Vmax L/D
	#4 no cuff, Baro #1	02:48:20	101.3	102.3	8283	0.78	115.9	14.5	2024	4.3	27.0	1710	943	8.1	Max endurance
	#4 no cuff, Baro #1	02:55:56	176.1	175.1	12110	0.69	210.7	20.5	2595	12.1	17.4	1702	609	2.9	very rich
	#4 no cuff, Baro #1	02:57:24	180.0	179.0	12114	0.69	215.4	20.5	2594	11.5	18.7	1700	655	3.0	rich of peak
	#4 no cuff, Baro #1	03:01:36	185.3	184.3	12104	0.69	221.7	20.7	2599	8.2	27.0	1696	946	4.3	near peak EGT
	#4 no cuff, Baro #1	03:02:55	186.2	185.1	12057	0.69	222.5	20.5	2595	7.9	28.2	1695	985	4.4	lean of peak
	#4 no cuff, Baro #1	03:04:52	174.0	173.0	12063	0.69	208.0	20.6	2299	9.7	21.4	1693	750	3.6	very rich
	#4 no cuff, Baro #1	03:06:26	176.5	175.5	12062	0.69	211.0	20.6	2303	9.3	22.7	1691	793	3.8	rich of peak
	#4 no cuff, Baro #1	03:08:13	175.0	174.0	12054	0.69	209.2	20.6	2305	7.0	29.9	1690	1045	5.0	lean of peak

Stall speeds--Lancair N9BF	Flight/Clock	Mode	MP/RPM	Weight, lb	CAS, kt/mph
mid c.g. at various	#2--17:54:57	Clean	13.7/1870	1771	73.7
and weights	#2--17:55:46	Clean	11.3/1811	1771	76.6
Wing Baro #3	#2--17:58:54	Dirty	14.0/1880	1769	71.1
gross wt. = 1800	#2--17:59:32	Dirty	9.2/1575	1769	72.7

cious canopy providing a panoramic view. The airplane has no problem doing nearly anything commanded to get to a lower altitude. See the table of descent performance. Maneuvering for the traffic pattern is very easy while searching for other traffic and enjoying the expeditious descent.

TRAFFIC PATTERN/ LANDING

Upon entering the traffic pattern it becomes apparent that the Lancair requires attention to duty beyond a basic trainer. On downwind leg in the pattern the nose position gets fairly high relative to the horizon until 10 degrees of flaps are deployed whereupon the nose attitude very nicely returns to a comfortable, nearly level position. The added drag of the flaps also serves to help slow down. Flying downwind leg at 120 kts with landing gear down and flaps at 10 degrees, the airplane feels very controllable. Maintaining this same configuration and airspeed during the base turn is also easy enough, although there is an awareness that this is a higher performance machine.

Once established on final, the remainder of the flaps are extended and some power is required to continue on the normal flight path to touch down. The flaps provide adequate drag to control the flight path yet not so much as to require a major power application to compensate for the added drag. I compared flaps two-thirds down and full down for landings, and prefer the two- thirds position. Due to the high pitch sensitivity, two-thirds flaps allow more time in the flare to properly position the airplane for the touch down, since the speed bleeds off at a slower rate.

CONCLUSIONS

The Lancair 320 is a fast, fun and beautiful plane to fly. It has a small c.g. envelope, light stick forces, and is quite sensitive to stick inputs. It is very fast for the size of the engine and will quickly accelerate to its maximum allowable airspeeds once the nose is lowered. Therefore, I feel that pilots with less experience should receive proper training to prevent difficult situations. However, in the hands of a more experienced pilot it provides a wonderful flying experience.

LANCAIR 320 N9BF

Privately built and owned by Fred Baron.
Construction: Composite fiberglass and nomex honeycomb core.
Equipment: Vision Micro engine monitor, .

SPECIFICATIONS

Empty weight/gross weight	1187.5 lb/1800 lb
Payload, full fuel	198 lb
Useful load	613 lb
ENGINE:	
Engine make, model	Lycoming O-320 B1A-modified
Engine horsepower	170 BHP
Engine TBO	na
Engine RPM, maximum	2700 RPM
Man. Pressure, maximum	30 in Hg
Turbine inlet, maximum	na
Cyl head temp., maximum	500° F
Oil pressure range	55-95 psi, 115 psi max. on startup
Oil temp., maximum	245° F
Fuel pressure range, pump inlet	19 - 25 psi
Weight of prop/spinner/crank	54 lbs/2.4 lbs/32 lbs
Induction system	Bendix fuel injection, updraft
Induction inlet area	4.9 sq in
Exhaust system	2.4 in O.D. ss, 2 into 1 mufflers
Oil capacity, type, cooler	8 qt., 15W-50, S.Warner 10599R cooler
Ignition system	1 Slick, 1 Lasar magnetos
Cooling system	2 pitot inlets, 3.5" dia. (round)
Cooling inlet area	20.63 sq in (stock cowl)
Cooling outlet area	40 sq in, fixed, no cowl flap
PROPELLER:	constant speed
Make	Hartzell HC-F 2YL-1F, F8468-D 2 blades
Material	aluminum
Diameter	70 in, 2 blades
Prop extension, length	6 in
Prop ground clearance, half fuel	7.875 in
Spinner diameter	11.875 in
Electrical system	12V Electrosystems alternator, B&C regulator
Starter	Bendix
Fuel system	2 wing tanks - injection
Fuel pump	gravity to engine driven pump, no boost pump
Fuel type	100 LL
Fuel capacity, by CAFE scales	39.975 gal
Fuel unusable	0.5 gal. each side
Flight control system	aileron/elevator by rods, rudder by cable,
Governor	na
Tire size, main/tail	11 x 4.0 all three
CABIN DIMENSIONS:	
Seats	2 abreast
Cabin entry	forward hinged canopy
Width at hips	39.5 in
Width at shoulders	41 in
Height, seat to headliner	38 in
Baggage capacity, rear cabin	27 in L x 26 in W x 24 in H
Baggage door size	none
Lift over height to baggage area	39 in
Rear baggage capacity	70 lbs
Step-up height to wing T.E.	22 in

FLIGHT TEST DETAILS

Six flights were made over the course of a week beginning May 30, 1998, all during day VFR conditions. A Flowscan fuel flow transducer was used for the gph determinations and was calibrated by measuring the weight of fuel burned on each flight. A PropTach digital tachometer was also used. Performance data flights were conducted with pilot and flight engineer aboard and flying qualities were assessed with solo flights.

Cruise flight data was obtained with both the wingtip barograph (#3) and the cabin barograph (#1). These were correlated to produce the airspeed correction table shown here. Our data suggest that V_y is 125 mph CAS and V_x is 104 mph CAS. No Triaviaton climbs were performed Total energy monitoring was used in selecting cruise data points.

KIT SUPPLIER

Lancair International
2244 Airport Way
Redmond, OR. 97756.
(541)-923-2244 FAX: 923-2255

OWNER/BUILDER N9BF

Fred Baron
P.O. Box 62
Garberville, CA. 95542.

DESIGNER'S INFORMATION

Cost of fast build kit	$28,900
Kits sold to date	1200
Number completed as of 4/10/98	300
Estimated hours to build, from prefab kits	1200 hr with fastbuild kit
Prototype registration date	July, 1992
Normal empty wt., IO-240 f.p.---O-360 c.s.	1050 lbs
Design gross weight, lb	1685 lbs
Recommended engine(s)	IO-320 Lycoming
Advice to builders:	The sooner you get started, the sooner you're done.

CAFE FOUNDATION DATA, N9BF

Wingspan	23 ft/8.5 in
Wing chord, root/tip	48"/29"
Wing area	76 sq ft
Wing loading	22.17 lb/sq ft , 19 lb/sq ft, ext. wing
Power loading	10.53 lb/hp
Span loading	75.9 lb/ft
Airfoil, main wing	NLF(1)-0215F
Airfoil, design lift coefficient	0.2
Airfoil, thickness to chord ratio	15 %
Aspect ratio, span^2/ sq ft wing area	7.26:1
Wing incidence	1.0 °
Thrust line incidence, crankshaft	na
Wing dihedral	3 °
Wing taper ratio, root/tip,	+.75 °/-.25 °=1 ° Total
Wing twist or washout	1.5°
Wing sweep	0 °
Steering	Differential braking, castoring nosewheel
Landing gear	Tricycle, retractable
Horizontal stabilizer span/area	95 "/952 "
Horizontal stabilizer chord, root/tip	17 in/11 in
Elevator: total span/area	na/612 sq in
Elevator chord: root/tip	10 in/7 in
Vertical stabilizer: span/area incl. rudder	36in/1300 sq in
Vertical stabilizer chord: average	20 in
Rudder: average span/area	12in/576 sq in
Rudder chord: bottom/ top	16 in/9 in
Ailerons: span/average chord, each	34 in/7 in
Flaps: span/chord, each	78 in/9 in
Flap area	702 sq in
Tail incidence/airfoil	0.5 to 1 °
Total length	21 ft .75 in
Height, static with full fuel	5 ft 10.25 in
Minimum turning circle	15.5 ft
Main gear track	94.1 in
Wheelbase, nosewheel to main gear	43.9 in
Acceleration Limits per factory:	+9.5/-4.5 G
AIRSPEEDS PER FACTORY, IAS N9BF	
Never exceed, V_{ne}	235kt/270 mph
Maneuvering, V_a	143kt/165 mph
Best angle of climb, V_x	104 mph
Stall, clean, 1960 lb GW, V_s	70 kt
Stall, dirty, 1960 lb, GW, V_{so}	67 kt
Flap Speed, full 45°, V_f	100 kt/114 mph
Gear operation/extended, V_{ge}	140 mph
Not approved for spins	