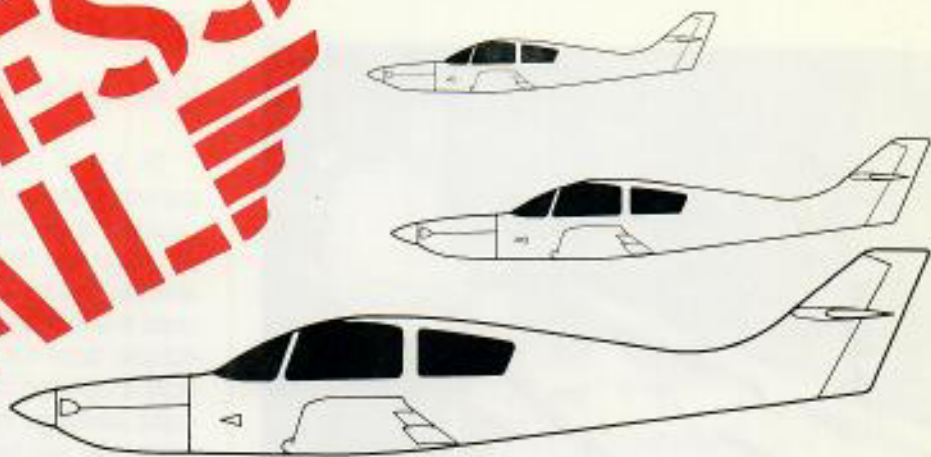


EXPRESS MAIL



Ken tests only briefly on his knuckles.

Don't Take Anyone's Word. Fly Before You Buy.

There's no substitute for flying the planes you're considering. You might narrow your selection to two or three on the basis of your requirements and then test drive those few, just as you would in buying a car. Brochures simply don't tell the whole story.

For example, handling qualities can't be quantified. After a test drive in a Rabbit, someone might convince you it has great handling until you drive a Mercedes. After driving both, no one would choose a Rabbit over a Mercedes if the prices were comparable.

That's the EXPRESS difference. Refined, quiet, and sure; from short, rough fields to 250 miles per hour. The feeling of confidence that this is a plane that will do what you want to do, go where you want to go, effortlessly, and without testing your limits. You don't

have to experience pain to enjoy performance.

In the realm of aircraft performance, the comparison of sports car to sedan is an old flying axiom: "The best two-place airplane is a four-place with two people in it." Because that axiom has a sound basis, we invite comparison with any airplane on the market, two or four-place, kit or factory.

Not only does the EXPRESS offer responsive high and low speed handling, aerobatic capability, and the speed of most of the two-place planes, it offers superior stability coupled with the utility of a true four-place airplane.

If you're looking for the best "all around" airplane, we're confident you'll choose the EXPRESS, as has everyone who has compared it.



Customer Roger Snyder working on his left wing in the factory.

Customer Assembling His Kit In Our Factory

We have been shipping kits since April. Roger Snyder, a PSA/US Air MD-80 Captain, is building his FT kit in our shop and proofing the assembly manual. Roger has many hours in single engine aircraft from T-28's to Glasairs, but this is his first construction project and his first experience with fiberglass. After two hours with the Wheeler Fastforward practice project, however, Roger felt ready to tackle a fiberglass 737. Fortunately, Boeing doesn't offer it as a kit. Anyway, he's got the technique down, he's a meticulous builder and his EXPRESS is going to be a beauty.

We Built One Wing in 2 1/2 Days with Two Guys

As an indication of the ease and speed of construction of the EXPRESS, two of our guys built the wing for the static test in just over two days.

Of course it didn't have the controls, wiring, etc., but it was the complete structure including all the ribs, the shearweb, etc., and they started from the same point a homebuilder would.

While they know how to fiberglass, neither one had built one of our wings before.

Although the EXPRESS is larger than the two place kits, it is much easier to build due to its high degree of prefabrication. The EXPRESS is an assembly project, not a fabrication project.

Estimated Costs for a Completed EXPRESS FT.

To build a flying kitplane, a builder must add a powerplant, propeller and other items. We have listed as examples, two VFR airplanes, one more economical than the other. Due to the fact that the most expensive items like the engine and avionics aren't required until the latter stages of building the kit, the builder has ample time for researching the equipment he wants and shopping carefully for it. The other areas for significant savings are upholstery and paint. In the first example we have shown the approximate costs for materials if the builder were to do the paint and upholstery himself. Builders may purchase any of the following new equipment from Wheeler Aircraft.

Completely Owner-built, the standard FT kit

EXPRESS FT KIT	\$19,750.00
Engine, 200HP, used; mid-time	5,000.00
Engine accessories	500.00
Prop, fixed pitch, wooden with extension	600.00
Avionics and instruments VFR, bargain/used gear	3,500.00
Battery and electrical system	500.00
Interior, by builder (materials only)	300.00
Paint, by builder (materials only)	300.00
TOTAL	\$30,450.00

Owner Built, with low-hour engine, overhauled prop, new instruments, professional paint, and leather trimmed interior

EXPRESS FT KIT	\$19,750.00
Engine, 200HP, used; low to mid-time ...	7,500.00
Engine accessories	500.00
Prop, constant speed, overhauled	2,100.00
Avionics and instruments VFR, new, top quality	6,500.00
Navigation, strobe lights	500.00
Battery and electrical system	500.00
Interior, leather trimmed	3,500.00
Paint, professionally done	1,500.00
TOTAL	\$42,350.00

Glitches Reported in the Press Corrected

We would like to set the record straight on some erroneous and outdated information that has appeared in print about the EXPRESS prototype.

1. Over-rotation on takeoff.

It was slight, and has been corrected by merely changing the ground attitude (adjusting the nose gear) to have a slightly greater angle of attack on the ground roll.

2. Length of runway required.

Somehow, Dave Martin of Kitplanes understood our pilot, Gary Mavrovic to say 3000 feet. Not so. On a standard day the EXPRESS is off in some 700 to 800 feet at gross. Landing roll is about 1200 feet.

A serious effort at short field performance would probably better those numbers, but we'd feel comfortable on an 1800 foot strip without special effort.

3. Rate of climb.

Standard day rate of climb is about 1600 fpm at gross. Some editors are simply heavier than others. We won't mention names but one editor weighed about 325 lbs. At least it demonstrates we've got room for the larger pilots.

4. Lack of a step for entry.

We've installed an optional step.

FT Performance Update

We have made more improvements to the performance the fixed gear EXPRESS. Here are the updated specs on the prototype. It is heavier than the production planes will be, so you can expect better performance overall with the production models.

EXPRESS FT

Maximum level speed at sea level 216 mph*
Maximum cruise speed at 7500 ft. 210 mph true
Stall speeds at gross:

Flaps (V_{so}) 58 mph

No flaps (V_{si}) 63 mph

Maximum rate of climb at sea level 1600 fpm

*timed ground speed, two way average, 2 1/2 mile course

The original estimated data for the RG (retractable gear) model remains the same as previously published except that the rate of climb should be about 1800 fpm instead of 1600 fpm, and the cruise speed should be about 220 mph true instead of 210 mph true at 7500 ft.



EXPRESS wing was loaded to 11 G's without failure.

One Tough Wing!

Demonstrating the conservative nature of the EXPRESS structural design, the wing was loaded to ELEVEN (11) G's without failure. That's 8,400 pounds of fine grey sand. The two outboard AN-7 7/16 inch diameter bolts failed in shear at 11 G's, while the two inboard bolts remained intact. The design ultimate load is 8.8 G's.

The Decision: Fixed vs. Retractable

The EXPRESS FT has dramatically changed this purchase decision. In the past, the best way to make an airplane go faster was to reduce drag by retracting its gear. The cost of doing this though was increased purchase price, weight, complexity, maintenance expense, insurance and the likelihood of a gear up landing some day.

In the EXPRESS, we have reduced drag through state-of-the-art aerodynamics and composite construction. Recognizing the drawbacks of retractable gear, our company goal is to make our FT (fixed tricycle gear) perform within 10 mph of our RG (retractable gear). With careful attention to aerodynamic details, our FT prototype is already faster than any production RG and many kit RG's. Retractable gear is an unfortunate complication to an otherwise simple airframe and we are determined to render it unnecessary.

But, for those who insist on retractable gear, we are making it available. Our design goal is landing gear that performs as well as our fixed gear on rough fields, and is still relatively simple. We've built the trailing arm gear in our brochure, but feel it's still too complex and heavy. We have a fiberglass leg version in process that promises to meet our goals. We are targeting delivery for the end of 1988.

Can The Competition Really Take The Heat?

The homebuilt manufacturers are generally a pretty friendly group of folks, each of whom is deeply involved in something he loves to do and of course trying to earn a living at it. While each manufacturer is to some degree a competitor with the rest, we nevertheless are in an industry where there are many acceptable solutions to the same problem.

Most of us therefore try to promote the virtues of our own products without maligning our competitor's methods or materials, if for no other reason than we might find ourselves doing it their way sometime in the future. (Except in the case where someone has gone to the extreme of using aluminum. There is some historical evidence that it could work, but we'll never try it).

What's the Big Flap?

Friendliness and cooperative spirit aside, one manufacturer has taken a belligerent attitude towards others in the industry. In advertisements and letters to magazines, Neico Aviation (Lancair) has made unsupported claims and used misleading information in maligning his competitors. We would prefer to ignore the situation because we've already explained our selection of composite materials, but Neico's claims have raised doubt and confusion in some of our customers minds, we have been asked to respond, and we feel obligated to do so.

First of all, Neico claims that the Lancair "takes the heat better than the competition" because they use pre-preg fiberglass, oven cured to 250°F.

What Heat?

The highest recorded temperature in the US was 136°F, in Death Valley, California. A white surface (airplane skin) will range from 5°F to 15°F above ambient temperature due to heat absorption, or about 150°F degrees in the worst case. A dark colored surface can easily exceed 200°F.

What Happens If It Gets Hot?

Composites have a critical temperature called the Glass Transition Temperature (Tg), also called the heat distortion temperature (HDT). This is the temperature at which the material begins to significantly lose strength.

One would have cause for concern if a composite part were subjected to stress (flying) at temperatures above its Tg. The material softens and may deform or fail depending on the amount of stress.

In the Lancair, Neibauer claims the parts have been oven cured to 250°F. However, according to composites consultant Andy Marshall, the Tg is still only about 205°F to 215°F. The Tg of Vinyl Ester resin (EXPRESS) is 210°F to 220°F so actually, the resin systems are about equal in heat tolerance.

The weak link in our foam sandwich system is the Clark Foam core, for which the HDT is about 165°F.

The HDT of the core materials of the Lancair (honeycomb and Divinycell foam) is 250°F or greater. Neibauer is right this far; the Express is limited to 165°F by its foam core, and the Lancair is limited to 215°F by its resin system, even if airplanes on this planet don't experience those temperatures, unless their surface is a color other than white.

So, What's The Problem?

The strength of a joint should be greater than the materials joined because the joint is a "seam" in an otherwise homogenous structure, and therefore potentially a weak link.

In the case of the Lancair however, it appears that they have not followed this engineering convention. The high temp pre-preg components of the Lancair are bonded together with two materials having much lower strength than the prepreg at elevated temperatures. When two materials with overlapping weaknesses are used together it's called...

**Catch
Andy Marshall's
forums on
composites
at Oshkosh '88.**

Fractional Redundancy

One of the two materials supplied by Nelco for bonding their pre-pregs together is a wet layup, room temperature cure epoxy resin, called Safe-T-Poxy II. According to Hexcel, the manufacturer of Safe-T-Poxy, the Glass Transition Temperature, (Tg) is 151°F, which may make the *critical bonds throughout the Lancair the weak links in the structure*. Because those joints have a Tg of only 151°F, one might have second thoughts about flying the airplane to Yuma or Death Valley, *even if the airplane were white*. Keep in mind, the EXPRESS is limited to 165°F by its foam core, so now the Lancair is behind by some 15°F. A structure is only as strong as its weakest link, which in the case of the Lancair, are the seams, including the one running the length of the TOP of the fuselage, which of course is subject to the greatest heat problem.

Adding A Weak Link To A Weak Link

Nelco supplies another adhesive for bonding their pre-preg components together in conjunction with the Safe-T-Poxy. This is 3M Scotch-Weld 2216 B/A. This material has an overlap shear strength of 2500 psi at 75°F, but drops dramatically to only 400 psi at 180°F, and 200 psi at 250°F. Which is to say that only 1/12 of the original strength remains at the elevated temperature. Perhaps of greater concern, is the fact that 3M stresses that hot, moist conditions (like Oshkosh?) are a poor environment for 2216. In the Lancair, the 2216 is sandwiched between layers of epoxy which are hydroscopic (that is to say the epoxy absorbs water), and subject to skin heating. *Again this is a material used in the most critical areas, the seams bonding the airframe parts together.*

The data presented above are simply the physical properties of the materials as provided by the materials manufacturers. The designer chooses his materials based on these data. Nelco alone has used this combination of materials (as he points out) which we and others considered and rejected in our early design stages. Perhaps Nelco is simply more adventurous than others in the industry. In any event, Nelco's claim of "taking the heat better than the competition", is not supported by the data, and in fact, it appears that Neibauer has it backwards, *the Lancair won't take the heat as well as the competition.*

So, It Could Get Worse Then?

Burt Rutan, who was mainly responsible for the development of Safe-T-Poxy, published temperature data based on color and warned his builders to paint their airplanes white, because of the potential of exceeding the Tg with the darker colors on a hot,

sunny day. We of course make the same recommendation to our builders. Although composite airplanes are sometimes painted other colors, we feel the practice is reckless, and when recommended by a manufacturer, irresponsible.

Should We Make A Higher Temp Express?

We could in fact use higher temp Vinyl Esters resins and core materials, but to what advantage? You could then paint your airplane dark colors, but the cost of the kit would be thousands of dollars greater. You may notice that *the much smaller Lancair is actually more expensive (apples to apples) than the EXPRESS*, because the materials are much more expensive than ours. We too can use more expensive materials (we wouldn't use the same ones as Nelco) and raise our price, but with little or no benefit to the builder/owner. Which of course, is one of the reasons we chose the materials we use.

What About Resin Safety?

Other misleading information from the Lancair folks concerns the "safety" of Safe-T-Poxy II. Neibauer says that "Toxicity... favors Safe-T-Poxy" (*Kitplanes*, letters to editor, May, 1988). Not only does it have a well known history of allergic reactions, it's hardener contains a suspected carcinogen, MDA (Methylene Dianiline). Because of these problems, *Hexcel is discontinuing Safe-T-Poxy II because it is not safe*. In our early research on resins we were advised by Andy Marshall (aerospace industry composites consultant and author of *Composite Basics*) to use Vinyl Ester resin rather than Safe-T-Poxy because it has the same or greater strength, is easier to work with, and we'd lose 1/2 of our work force from allergic reactions to Safe-T-Poxy. We have heard of kitbuilders who had sell their kits due to reaction to the epoxy. The well known aviation writer, Peter Lert experienced an epoxy reaction and can no longer work with epoxies.

On the other hand, Stoddard Hamilton's (Glasair) experience with Vinyl Ester confirms Marshall's recommendations. *In their eleven years and 1000+ kits, using Vinyl Ester resin, Stoddard Hamilton has not had a single allergic reaction with either their employees or their builders*. Our own experience is more limited, but in several years of daily exposure to Vinyl Ester resin, not one employee has had a problem.

Are There Other Problems with Lancair's Composite System?

As we state in our brochure discussion on composites, there are other drawbacks to the Lancair compos-

Can They Take The Heat?

Continued from Page 5

ites, not the least of which concerns water intrusion, and difficulty of repair.

Representatives of Boeing and McDonnell Douglas spoke at the International Exposition for the Aviation Maintenance and Ground Support Equipment Industry, 1987. At the session on repairability of composites given March 18, they had this to say, as reported by *Aviation International News*, May 1, 1987. "While it may appear that composites (prepreg and honeycomb) are merely a different type of fiberglass they cannot be repaired as easily as fiberglass."

"The preferred repair method involves detailed area preparation, layup of the correct materials in the proper sequence, application of epoxy, heat bonding and vacuum-bagging, and inspecting the completed repair. This procedure is best done in a clean, humidity-controlled environment.

Ralph Myers, a Boeing engineer who spoke at the conference, admitted the process is complicated and said that, "These repairs require clinical precision and control."

"After the presentation, a top maintenance executive from a major North American airline complained that certain composite components on his company's Boeing 767's were wearing out rapidly. He concluded that composites are time-consuming to repair and very costly."

Below, we have excerpted portions of an ad for a company whose equipment detects water intrusion in honeycomb structure. This ad appeared in *Aerospace America*, July 1988.

"Potential delamination and internal cell damage in composite carbon fiber structures, especially in aircraft, are not easy to detect. Faults may be microscopic...but at cruising speed and altitude, moisture can find its way in...and freeze.

"X-Ray inspection of an airliner for fluid ingress ties it up for a full day, at heavy expense.

"Now there's a better way. British Airways is already using it... *with substantial savings in NDT costs.*

"With an Inframetrics' infrared imaging radiometer, a maintenance technician checks for water in control surfaces during turnaround. Thermography clearly identifies suspicious areas on the monitor screen in real time."

Perhaps there's no problem. Maybe Lancair intends to rent the thermography inspection equipment to his builders.

Perhaps Lancair knows something about proper and safe repair of pre-pregs and honeycomb that Boeing and McDonnell Douglas have missed.

Time will tell.

Time has already proven our composite system. It has been used in European airplanes since the early 1960's. Stoddard Hamilton has used it since the late 1970's. There are and have been for many years now, Glasairs and certificated aircraft in service all over the world.

We note that new, well engineered designs like the Cirrus VK 30, have also chosen Vinyl Ester resin and Clark Foam for their materials system, and the FAA Part 23 certificated *Hoffman Dimona* and other sailplanes also use wet layup, room temperature cure systems.

The aerospace manufacturers referenced by Neico do use prepreps and honeycomb core, but primarily for interiors and some exterior parts like flaps and elevators. The exterior parts are manufactured under conditions far superior (they're autoclaved, not merely oven cured) to Neico's, and they still have problems.

With Good Reason

Neico claims to have "the only airframe using all high temp composites". Aside from the fact that they're not using all high temp composites, we suspect that the Lancair will always be the only one to use their combination of composite materials.

Big People Fit Too!

John, shown seated in the cabin of the EXPRESS in the photo, measures 6'8" and weighs 285 pounds. For



John measures 6'8", weighs 285 pounds and fits

him the lower row of instruments would have to be moved, (or his knees) but big folks do fit in the EXPRESS. In order that taller people fit even better, we're moving the firewall and instrument panel forward two inches.

A Customer Expresses His Satisfaction

July 15, 1988

Harry R. Bialock
10711 Countryside Dr.
Grand Ledge, MI 48837

Wheeler Aircraft Company
Tacoma Narrows Airport
Gig Harbor, WA 98335

I just wanted to take a minute of your time to express to you how totally pleased I have been with every aspect of our relationship. From the initial visit at your factory, to the prompt and helpful response of your customer support specialists; I have found Wheeler Aircraft to be one the most helpful and responsive companies that I have ever had the pleasure of dealing with. From your demonstration pilot to your shop foreman, everyone tried to make my visit to the factory as informative and profitable as possible. The information and instruction in the basics of fiberglass layup that they provided on that trip has been invaluable to me.

Even after that great beginning, I still did not expect the extremely high level of support and consideration shown by your customer service employees. When time is at a premium, and working hours are hard to find; it is great to know that a simple phone call brings an instant response and knowledgeable help immediately.

The quality of materials and workmanship has also been a matter of great satisfaction to me. As an automotive engineer, I value high quality components and materials: in no way have you disappointed me!

My one request is: PLEASE KEEP DOING EVERYTHING JUST LIKE YOU ARE NOW UNTIL MY KIT IS FINISHED!

Harry R. Bialock
Harry R. Bialock
One very pleased customer.

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Wheeler

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A Customer Expresses His Satisfaction

Dear Sirs:

I am writing to you to express my sincere appreciation for the excellent service and product that I received from your company. I have been a customer of your company for many years and I have always been satisfied with the quality of your products and the service that you provide.

I recently purchased a new [product] from your company and I am very pleased with the results. The [product] is exactly what I needed and it has been working perfectly ever since I received it. I am very impressed with the quality of the [product] and I am sure that it will last for many years to come.

I would like to thank you for the excellent service that you have provided to me. I am sure that you will continue to provide me with the same level of service in the future. I am a satisfied customer of your company and I am sure that you will continue to provide me with the same level of service in the future.

Sincerely,
[Name]



WHEELER AIRCRAFT COMPANY
Tacoma Narrows Airport
Gig Harbor, WA 98335

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