

So what are the primary factors that make a homebuilt safe? Good question. We'd all agree that the most important safety element is the pilot, of course, but if it were the same pilot flying, which airplane would be the safest? Would it be the one with the most pronounced stall buffet? The one with the certified engine and prop? Maybe it would be the airplane with a glass cockpit and avionics for weather avoidance, traffic detection and terrain awareness? Perhaps the plane with the ballistic recovery parachute and the rein-

Piloting, Inspecting and Selecting

Ed Downs, president of the SkyStar Aircraft Corp.'s Sport Plane Division, has a background that includes substantial work in the certified aircraft arena as well as NASA research. He also presents safety information at CFI refresher clinics.

Downs' initial response was to gravitate toward FAA and NTSB statistics. Takeoff accidents and maneuvering accidents (traffic pattern, buzzing, low-altitude aerobatics) are more frequent

about pencil-whipped annuals that don't follow a kit manufacturer's checklist or other complete, appropriate checklist. This is even more significant with a non-certified engine, such as an automotive conversion.

Third on Downs' list is that the airplane be properly selected by the owner. He points out that Experimentals are unregulated, and you may have only the manufacturer's claims on safety, handling and stability. You don't necessarily know if the prototype was flight tested in all c.g. ranges. Many buyers will look only at price and speed with-

The Safe Homebuilt

Take these tips into consideration when it comes to safe homebuilding and piloting.

BY ED WISCHMEYER

forced landing gear? How 'bout the one that was most comfortable and least fatiguing? Or the one with the best visibility? Or the one that was easiest for other pilots to see? Or the one that used certified, TSO'd components wherever possible?

To get a handle on homebuilt aircraft safety, we talked with a number of prominent folks in the field, including Dick VanGrunsven of Van's Aircraft, Ed Downs of Skystar, Joe Norris, who was the first person to be designated by the FAA as an amateur-built Designated Airworthiness Representative (DAR), and Jim Lauerman, Avemco's executive vice president and chief underwriting officer. Here's a teaser—of all the factors listed above, *none* were mentioned by the four people interviewed.

in homebuilts than in factory-built aircraft, and departure stalls cause the highest loss of life. Combined, those are 20-30% of homebuilt accidents. But notice that they're pilot-induced phenomena.

Second on Downs' list, after the pilot, is proper inspection of the aircraft. He says that in the Kitfox community, accidents occur because of failure to inspect properly and to install correctly—cotter pins, lock wire, nuts missing, almost tight enough oil filters.

On homebuilt aircraft annual condition inspections, those performed by the owner may sometimes reflect tendencies to be less than professional and to take things for granted, rather than to really inspect. The consequences of this may just be a forced landing, not a wing falling off, but it could be that serious in some situations. Downs is concerned

out thinking about accident statistics or how many of the type are actually flying. Some homebuilts have more low-altitude maneuvering accidents than others, but is that because profoundly dumb pilots are flying them or because of the aircraft's characteristics?

Downs relates that he's overheard many opine the myth that amateur-built means higher performance and higher technology, and therefore better. That's wrong, he says. At airshows, he sometimes finds it frightening to hear what potential buyers are saying. Some homebuilts are *point designs*, highly optimized for just one parameter, such as cruise speed; the consequences of that optimization may mean degraded and un conveyed shortcomings in other areas. But buyers too often don't know, or don't want to know.

The Safe Homebuilt

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Downs also shared some wisdom that stems from 30-year-old NASA research. Have you ever heard a little voice saying, “I wonder if that’s okay?” NASA found out that by the time you have that thought, whatever event you’re thinking about has already occurred and you should be working on recovery now.

So aside from the pilot, what are the top items on Downs’ list for a safe homebuilt? One that is well inspected and properly selected.

A Little Research

Joe Norris has lots of letters after his name including A&P, IA, CFI (for airplanes and helicopters), EAA Tech Counselor and EAA Flight Advisor. As mentioned, Norris also holds the designation as the first amateur-built DAR, meaning that he can license amateur-built aircraft for flight.

So what’s the most important element for homebuilt aircraft safety on Norris’ list? Education—for building, test flying and purchasing an airplane built by someone else. Norris notes that there is a ton of information for builders to find out how to do just about anything properly and safely—everything from standard techniques and practices to building hints and information on how to find a Tech Counselor or Flight Advisor. Norris strongly suggests joining EAA as the first step for any prospective builder or buyer, and he’s quick to point out that this was his opinion long before he starting working for the EAA, where his primary job responsibility is helping members find information they need.

Reducing Unknowns and Non-Conformity

At last year’s Oshkosh AirVenture, there were more Van’s aircraft present than from any other kit vendor. In fact, there were more Van’s aircraft present than second through ninth place combined. Dick VanGrunsven is the founder of the company, and his designs reflect his goals and ideals.

VanGrunsven acknowledges that homebuilt aircraft safety is a complex

topic and that the pilot is clearly the most important safety factor. He sees two answers to the question of how to build a better homebuilt.

“One of the things that really separates homebuilts from other planes is that they’re not standard,” VanGrunsven says. “You may have a well-developed airplane, but the airplanes that appear in the field do not necessarily mimic the factory prototype. Certificated airplanes have to.”

For example, a homebuilt might have changes, deliberate or not, that affect the flying qualities or provide unknown engine operating characteristics. A prime example is the fuel system. VanGrunsven says that some builders use different fuel selector valves or different plumbing.

“Something they [the builder] felt was better didn’t turn out that way,” he says. Fuel gauges on factory-built airplanes aren’t necessarily foolproof, but a homebuilt aircraft’s fuel gauges may be worse. A builder can overlook that and know how to interpret the fuel gauge readings for his/her own aircraft, but if he/she never placards the airplane, that’s a risk to any other pilot who flies it. This may sound like a worst-case scenario, but VanGrunsven says he’s seen homebuilts where the fuel tank sender float has hit the bottom of the tank without the fuel gauge indicating empty.

VanGrunsven used John Denver’s fatal Long-EZ accident as an example. “A lot of times, folks will arrange controls in ways that are not intuitive,” he said. “The flip side is making sure that all the systems are easy to operate, well calibrated and well placarded, so anyone can operate the airplane and will have a better chance of not screwing something up.”

He offers the same caution for engine installations, too. “You can do anything you want—aftermarket carburetor, supercharger, high-compression pistons, any kind of automobile engine—and this is like fuel systems. These could involve a lot of unknowns. These aren’t necessarily hazardous, but you have the opportunity for variables to enter into it. It could have been done by somebody who truly was an amateur, and there is a chance of partial or

complete power loss.”

VanGrunsven points out that some buyers may not be objective in their purchase. “Another area—maybe a little sensitive—it’s entirely wrong to assume that everything is right because the airplane has been inspected. The FAA primarily signs off that the paperwork is in order. The conscientious inspector will make a best effort, but they can’t attest to the correctness of the airplane. A buyer just cannot assume anything in that regard. And if you’re unfamiliar with the building or licensing process, you may assume. You only know that [things are correct] if you go completely through the airplane yourself.”

As an example of a good attitude, VanGrunsven tells of one builder who held a party and invited everybody to try to find something wrong with his finished but not-yet-flown airplane. “A builder has to put his ego on hold and open himself wide open to any sort of scrutiny that may get past himself and the official inspector,” he says.

VanGrunsven’s list for a safer homebuilt? Reducing the unknowns, and reducing non-standardization.

Handling Characteristics and Testing

Although we asked the question of what makes a homebuilt *safe* instead of what makes a homebuilt *insurable*, it’s no surprise that this line was blurred. As the vice president in charge of homebuilt insurance at Avemco, Jim Lauerman cites two primary gauges for homebuilt safety.

The first is wing loading. Wing loading is calculated by taking the maximum gross weight of the airplane and dividing that number by the number of square feet of wing area. For homebuilt airplanes, wing loadings can vary from 10 pounds per square foot for a Kitfox, to 15 pounds per square foot for an RV-7, to 33 pounds per square foot for a Lancair IV-P. Wing loading is often used in preliminary design calculations to predict landing speeds. In Lauerman’s experience, wing loading is directly proportional

to severity of loss.

The second criterion Lauerman uses is how well tested a design is. For example, the Van's Aircraft RV-6 is a well known and well tested design. If a new design comes from a manufacturer with a good track record, such as Van's new RV-10, that manufacturer's track record counts, too.

Beyond those two primary criteria, there are issues of low-speed handling qualities and longitudinal stability. It also helps if the plane was designed by *real* engineers. Lauerman says that you can look at the distance from the c.g. to the tail and the size of the tail, and just from that you'll be able to tell something about the aircraft's handling.

Also important as a predictor of safety is how well the plane conforms to the manufacturer's original design, especially for critical items like the fuel system.

Drifting more into insurability than safety, Lauerman considers a *three-legged stool* of aircraft, pilot and operating environment, which includes runway length and the availability of crosswind runways. If one is marginal, the other two had better be solid.

Avemco provides discounts to customers who have taken the King Schools video on risk management, but Lauerman observes that external pressures are seldom a factor in homebuilt accidents. Of more significance is whether, when selecting the aircraft, the pilot understands what they have gotten themselves into.

Concluding Thoughts

Although our four experts expressed their thoughts in different ways and emphasized different aspects of safety, they all concluded that the single most important element in homebuilt safety is the human element—pilot, buyer, builder, inspector. The pilot needs to fly the airplane safely, the buyer should choose the airplane wisely, the builder must reduce unknowns, and the inspector needs to put ego aside and aggressively search for mistakes.

For most homebuilders then, what's the single most important element in homebuilt safety? It's you! †



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