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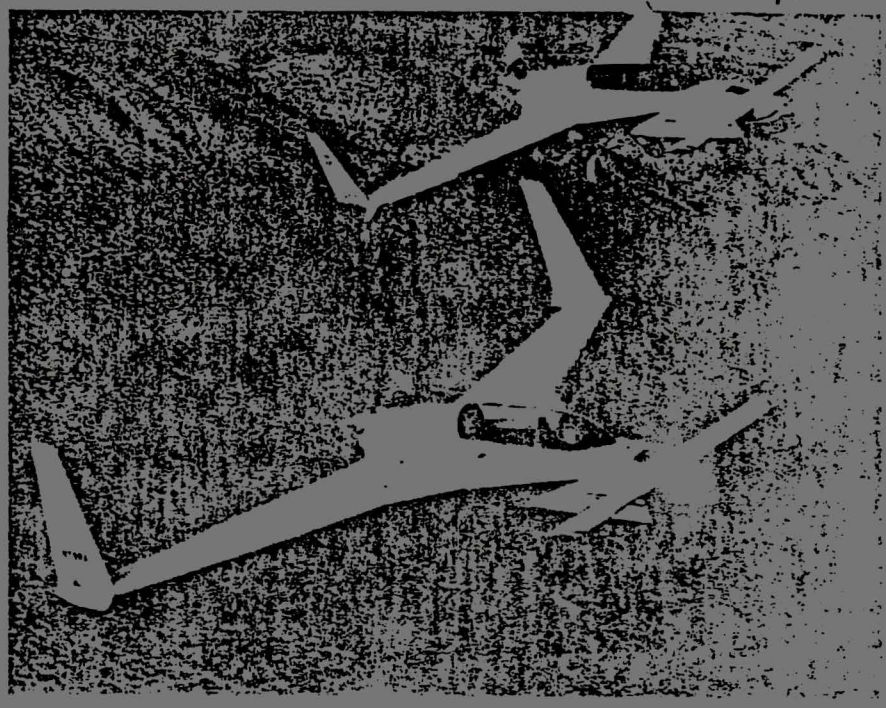
Safety Record of the Rutan Canards



Some surprising findings on the supposedly nearly stall-proof Long EZs and Vari-Ezes.

In last month's used-aircraft report on the Rutan Vari-Eze and Long-EZ, we briefly looked at their safety record. Surprisingly it was rather poor. The fatal accident rate of the futuristic canard kitplanes was much worse than that of comparable two-seat production airplanes like the Cessna 150, and higher even than old WWII-vintage two-place sportsplanes like the Piper Cub, Luscombe 8 and Ercoupe. We were rather taken aback by the Ezes' high accident rate, since designer Burt Rutan seems to be very safety-conscious. Indeed, the prime reason for the Vari-Eze's unusual canard layout is to make it stall- and spin-resistant.

Some Big Questions

Why are the Ezes' accident rates relatively high? Are they stalling and spinning despite Rutan's best intentions? What sort of pilots are crashing Ezes? To answer these questions, we decided to take a close look at the Ezes' accident history. We examined the NTSB briefs of every Eze accident, fatal and non-fatal.

According to NTSB, there have been 23 fatal Vari-Eze accidents and three Long-EZ fatals. For total accidents, the numbers are 57 and seven. Raw numbers of accidents

The fatal accident rate of the Vari-Ezes turns out to be quite a bit higher than that of comparable production aircraft.

are meaningless, of course; a measure of the exposure to accidents, such as hours flown, is necessary to compute an accident *rate* that can be fairly compared to those of other aircraft.

Unfortunately, the FAA doesn't have hours-flown estimates for the Ezes. Nor is it possible to figure precisely the number of Ezes flying, since they are built in garages and basements scattered all over the country. (FAA registration records aren't a reliable measure of active homebuilt airplanes, since many optimistic homebuilders apparently register their aircraft and get N-numbers well before they finish, and many of those registered planes never get completed. For example, a few years ago, FAA files showed 120 registered BD-5s, yet no more than a dozen were actually flying.)

Assumptions

We therefore were forced to guesstimate hours flown, in a very approximate manner. According to Rutan, about 800 Ezes and EZs have flown since the first homemade one took to the air in 1977. If we assume a steady progression of new planes over the eight years, the Eze/EZ population averages out to about 400 for the 1977-1984 period.

We further assumed an average of 100 hours per year for each airplane. This agrees with unofficial EAA estimates of homebuilt aircraft activity. The nine Eze owners who reported annual usage to us averaged about 120 hours a year in their airplanes. We presume that, since they took the time to write us, they are likely to be more enthusiastic about their planes than typical Eze owners, and therefore fly more hours.

Assuming that our hours-flown guesstimate is about right, the Ezes' fatal accident rate works out to about eight fatal and 20 total accidents per 100,000 flight hours.

These numbers are much higher than two-seat production planes of similar power. The Cessna 150, for example, scores a low 1.3 and 4.3 for fatal and total accidents. The Ezes' fatal rate is five times higher than the Cessna trainer's. It's also much higher than the worst of the modern two-seat planes, the Grumman American AA-1 series, which has a fatal rate of 3.5. Even

The Aviation Consumer March 1, 1985

products of half-century old technology like the Piper Cub (4.8) and Luscombe 8 (5.3) have lower fatality rates than the Ezes.

While the Ezes have a high accident rate compared with production two-seaters, there are no figures to show how it compares with other homebuilts. Amateur-built aircraft in general have a higher accident rate than production aircraft, but we have no precise figures for other homebuilt types such as the Q-2, Thorp T-18, KR-2 or Glasair, with which the Ezes should rightfully be compared.

Stall/Spin Crashes

Despite the Ezes' design goal and reputation for being stall-proof, the NTSB mentions stall/spins—or maneuvers that look a lot like them— in at least four of the 18 fatal accidents for which we have full briefs. Stalls are mentioned in four other non-fatal accidents.

However, Rutan Aircraft, which investigates most fatal Eze accidents, believes there has been only one true stall (or "departure," as the engineers like to say) accident in a Vari-Eze or Long-EZ. In 1980, a Vari-Eze crashed at Arlington, Washington, killing the pilot. He had been practicing slips to a landing, and during one particularly strong slip, the plane suddenly snap-rolled inverted at about 1,000 feet above the ground. The plane quickly recovered from the snap roll, but the pilot was not able to pull out from the ensuing dive in time. Unlike many Vari-Eze accident pilots, he was well experienced in the type, with 165 hours in that particular airplane.

According to Rutan's Mike Melville, that particular aircraft had not been updated, as Rutan had strongly urged, with new rudder-travel limits to prevent precisely that problem.

In some other crashes, the NTSB and Rutan disagree about what happened.

A rather cursory NTSB accident brief describes a fatal crash of a Vari-Eze at the 1980 Oshkosh EAA convention as a stall/spin accident, and the probable cause was listed as "pilot failed to obtain/maintain flying speed." In the "remarks" section, the report said, "Steep turn stall."

Difference of Opinion

However, Rutan Aircraft disputes this NTSB verdict, suspecting a pilot heart attack. Says Rutan's Melville, "An aerobatic pilot on the ground saw the whole thing. The plane was coming into the traffic pattern when it just gradually rolled over and dove straight in at full power. But the investigator never interviewed the witness. I'm convinced there was no stall." He also pointed out that the pilot was flying illegally after having failed his medical exam, and had been taking medication for high blood pressure.

Other NTSB briefs describe maneuvers that suggest stalls or "departures." For example, the NTSB has this to say about an accident at Mojave, Calif. in July 1983 involving a Vari-Eze: "As the aircraft approached Runway 22 on final, the nose pitched down, followed by a 180-degree roll to the left in a downward attitude. The aircraft impacted a crossing runway in an inverted position." The crash came during a go-around, the pilot's third unsuccessful attempt to land. He was on his first flight in a Vari-Eze and, according to Melville, had not flown at all in two or three years.

The maneuvers described sound suspiciously like a stall, but Melville doesn't agree. He believes the pilot, who was very short, may have had trouble seeing out of the airplane and became disoriented.

A similar fatal Vari-Eze crash occurred in 1978 at Liberal, Kansas. According to NTSB, the pilot misjudged the landing, started a go-around, then stalled and spun.

Awkward Traits (?)

Two other fatal crashes may have been related to the airplane's flying traits. In Angola, N.Y., a Vari-Eze crashed when the aircraft started "divergent pitching" on its third test flight. (Apparently, the pilot overcontrolled the rather sensitive stick and got into a pilot-induced oscillation.) The aircraft was loaded about 100 pounds heavier than Rutan recommends for initial flight testing, but within the normal gross weight limitation.

In another fatal crash, a Vari-Eze failed to lift off a snow-covered runway in Minnesota and ran off the runway end into trees.

As with most sport aircraft, the Ezes had a number of fatal crashes resulting from reckless flying. One hit trees during a low pass. Another crashed during a low-level barrel roll. Another hit wires while zooming down a scenic river in northern California. Another hit a mountain while sight-seeing in a scenic area of Utah at 7,000 feet.

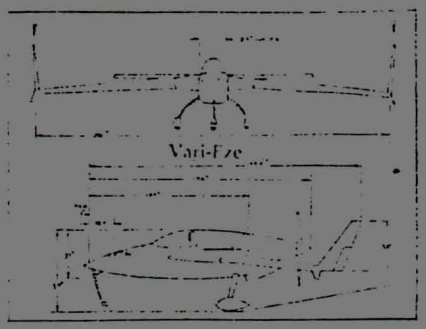
Only two fatal EZ crashes were weather-related. A brave fellow scud-running through the Utah mountains met his maker when cloud turned to granite. And another pilot apparently tried to top some nasty weather but lost it in the clouds, went into a screaming dive and the plane broke apart in the air.

One other in-flight breakup occurred when a winglet failed during a high-speed pass. It was later discovered that the builder/pilot had left out several critical layers of fiberglass in the winglet attach structure.

Two fatal crashes came after engine failures. One was the result of carburetor ice—a common problem with the O-200 engine—and the other was caused by an improperly installed oil line.

Non-Fatal accidents

Of the 38 non-fatal Eze/EZ crashes on the NTSB record, eleven followed engine failures of one sort or the other (the usual stuff: carb ice, fuel exhaustion, water in the fuel, with a broken crankshaft thrown in here and there). Eight were runway accidents—ground loops, overshoots



and the like—and two were triggered by unlatched canopies.

The Eze/EZ has a rather high ratio of fatal accidents. Of the 64 total crashes, 26 were fatal—about 41 percent. Typical commercial lightplane fatality ratios run in the 15-30 percent range.

Pilot Profiles

The 17 Vari-Eze fatal crash pilots for which the NTSB had data averaged only about 50 hours time in type. Seven of them had 10 hours or less in Vari-Ezes, and five were apparently making their first or second flights in Vari-Ezes. These figures suggest that a thorough checkout, some back-seat rides, plenty of high-speed taxi time and recent experience in an aircraft with sensitive controls are necessary for a safe first flight in a Vari-Eze. Calm winds and a long, smooth runway are also a must.

Logbook

The Supersonic Homebuilt

More information has emerged about Jim Bede's BD-10J supersonic homebuilt. Bede refused to release complete information to *The Aviation Consumer*, but a reader sent along a copy of Bede's info packet on the aircraft.

The BD-10J's claimed top speed is Mach 1.6, or about 1,050 mph, at 40,000 feet. Considering that the airplane has a thrust-to-weight ratio better than an F-16, there's little doubt it has the power to hit Mach 1.6. Whether it will be stable and controllable at the speed, however, is another matter.

Bede hedges his bets on this score, and the brochure says, "Flight tests may reveal that operating in the supersonic range may require higher than desired pilot skills, or that the margin of safety standards we have set for ourselves are not as good at supersonic speeds. We, therefore, cannot at the time of the this writing guarantee that the BD-10J will be capable of supersonic flight without certain restrictions. We can guarantee, however, speeds of 550 mph, or Mach 0.87."

Powerplant and Fuel

The keys to any small jet are the engine and the fuel capacity. As we speculated last month, the BD-10J will use the General Electric CJ-610/J85, the engine used in the Lear 20 series and the Air Force T-38 trainer. Thrust is 2,950 pounds. Normal gross weight of the airplane will be 2,750 pounds, but weights up to 3,550 will be allowed for long-range flights with extra fuel. Max landing weight is 2,600 pounds, and empty weight is predicted to be 1,360.

The BD-10J gives new meaning to the phrase "flying fuel tank." Normal fuel capacity is 152 gallons (1,000 pounds), with aux tanks holding an additional 122 gallons (800 pounds). With all tanks full, more than 50 percent of the takeoff weight will be fuel, a ratio exceeded (as far as we know) only by the Voyager round-the-world aircraft and the space shuttle.

It'll be interesting to see how Bede packs these 274 gallons into a fuselage about the size of an AA-1 Yankee's while leaving room for retractable landing gear, two jet intake ducts and the wing carry-through structure. In fact, our measurements of the fuel tanks illustrated in Bede's cross-section drawing suggest their max capacity is about 150 gallons.

Short, Quick Legs

With the standard 152-gallon fuel capacity, endurance is very limited, but the plane is flying so fast that predicted range figures are not bad by general aviation standards. At Mach 1.6 and 40,000 feet, 572 miles is claimed. (That's a half-hour's endurance.) At subsonic speeds, (550 mph at 40,000 feet) range is supposedly 1,364 miles.

The BD-5J is unpressurized, however, so it's hard to imagine flying it at 40,000 feet. And, as with all jets, fuel efficiency and range decline dramatically at lower altitudes. At 18,000 feet, for example, range and endurance are less than half of the above figures. (All numbers include a five-minute taxi, takeoff and climb and descent, plus 20 minutes reserve.)

Claimed climb performance is rather phenomenal. The brochure says, "At a takeoff gross weight of 2,400 pounds, it will be possible to take off, accelerate to 500 mph and hold that speed while climbing at a 45-degree angle through 20,000 feet." Sea level climb rate is listed at 30,000 fpm. Bede says the plane will take off in six seconds and 400 feet.

Stall speed varies from 66 to 94 mph, depending on weight. The wing has leading-edge slats and trailing-edge Fowler flaps. Construction of the BD-10J is mostly traditional aluminum, with some composite sections.

Man-powered Controls

The brochure says that the BD-10J was designed with the principles of supersonic flight in mind, but it remains to be seen if all the exotica necessary for Supermach flight can be translated into an amateur-built airplane. The BD-10J brochure makes no mention of variable inlets, and the control system will be all mechanical, with no power boost—as far as we can tell, the first supersonic plane since the 1947 Bell X-1 to have a non-boosted system. (Unfortunately, the X-1 lost all elevator control as it passed Mach 1 and had to be controlled by