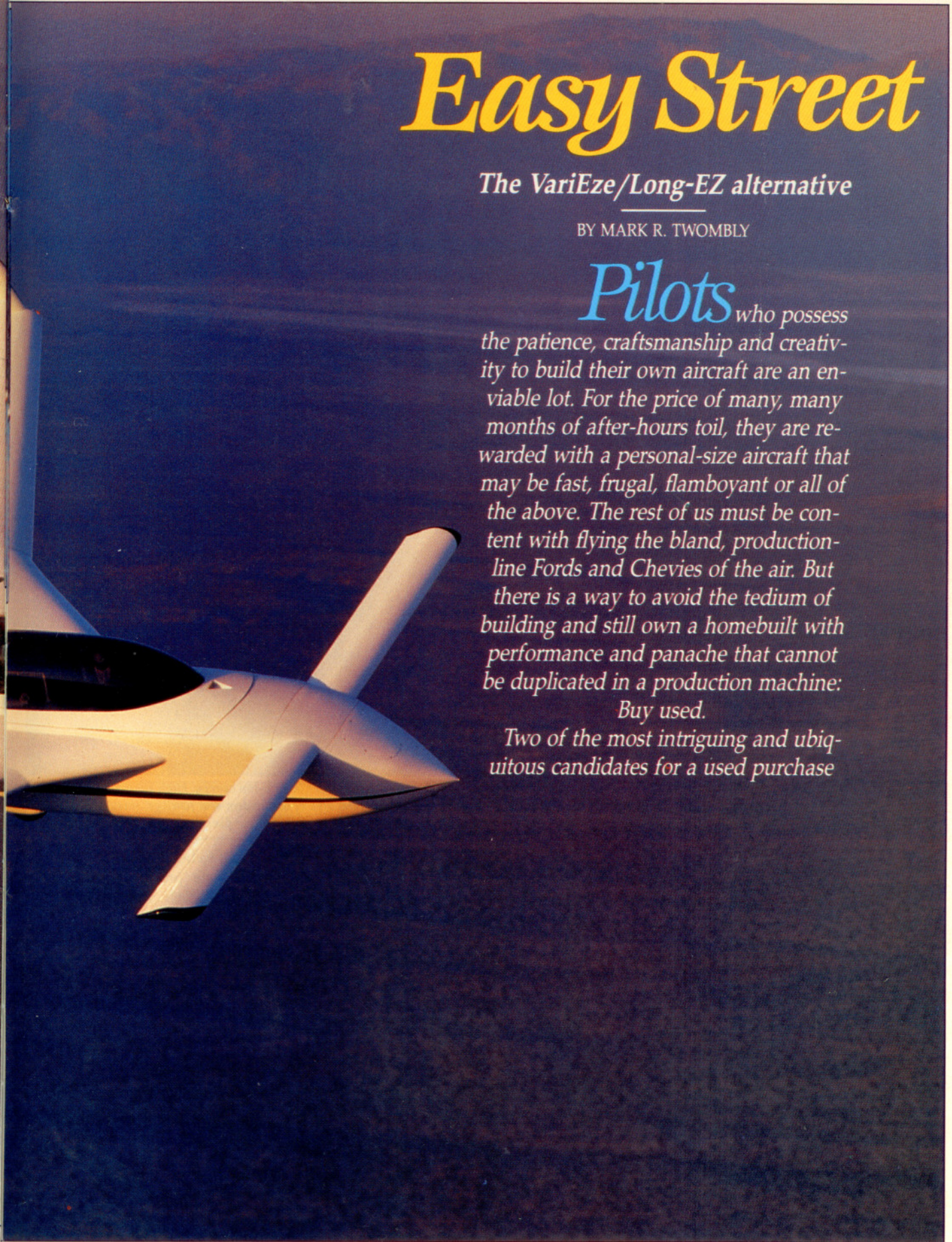
Easy Street

The VariEze/Long-EZ alternative

BY MARK R. TWOMBLY



Pilots who possess the patience, craftsmanship and creativity to build their own aircraft are an enviable lot. For the price of many, many months of after-hours toil, they are rewarded with a personal-size aircraft that may be fast, frugal, flamboyant or all of the above. The rest of us must be content with flying the bland, production-line Fords and Chevies of the air. But there is a way to avoid the tedium of building and still own a homebuilt with performance and panache that cannot be duplicated in a production machine: Buy used.

Two of the most intriguing and ubiquitous candidates for a used purchase

Red Morris dons his Long-EZ and prepares to lower the flip-top canopy. High speed on low power is possible because of the low frontal area of the tandem-seat fuselage, smaller wetted area of the tail-less design and smooth, rivet-free fiberglass surfaces.

are the Rutan Aircraft Factory (RAF) VariEze and Long-EZ. An estimated 400 to 500 VariEzes are flying and an equal number of Long-EZs, according to RAF. More will take to the air, since RAF has sold about 2,000 sets of plans for each design, and most builders take several years to complete their basement or garage projects.

Prices for completed VariEzes begin at about $12,000. A full gyro panel, cross-country avionics, an attractive interior and sharp exterior paint scheme can raise the price considerably. Long-EZs, which have a more powerful engine, greater fuel and baggage capacity, lower takeoff and landing speeds and more benign handling characteristics, can fetch two to four times the price of a VariEze.

The VariEze has been around for more than a decade and the Long-EZ for about seven years, but they still attract gawkers wherever they are flown. From the fiberglass and foam construction and the forward and rear wings to the pusher engine and propeller, tandem-seat cockpit with sidestick controller and nose-to-the-earth resting posture, every aspect of an Eze-EZ oozes radical chic.

VariEzes launched a revolution in homebuilding by popularizing composite materials and relatively quick construction methods compared to most other do-it-yourself aircraft. The VariEze and Long-EZ also won the designer, E. L. (Burt) Rutan, AOPA 795261, national prominence as a creative, maverick engineer who championed the use of canards for drag reduction and stall and spin resistance. Two of his more recent designs, the Beech Starship and *Voyager*, have extended his fame far beyond the homebuilt community.

Buying a used or partially completed project may be the only way to get a VariEze or Long-EZ. In July 1985 Rutan announced that because of sharply decreased sales and the threat of product liability suits, RAF no longer would sell homebuilder plans for any of its designs, including the VariViggen, VariEze, Long-EZ, Solitaire motorglider and Defiant centerline-thrust twin. An additional factor in RAF's withdrawal from homebuilt designs was Scaled Composites, a company Rutan founded in 1982 next to the small RAF hangar at the Mojave, California, airport. Rutan had little time to spend at RAF because of the press of business at Scaled Composites, at which he designs and develops prototype aircraft under contract. One of its first projects was to build and flight-test an 85-percent-scale prototype of the Beech Starship. Beech later bought Scaled Composites and named Rutan to Beech's board of directors.

RAF still provides support to builders. The office is open Tuesdays and Fridays to answer telephone and mail inquiries. RAF also publishes a quarterly newsletter, *The Canard Pusher*, which contains factory and builder news, construction and operational tips and solutions to problems reported by builders. The newsletter is the factory's official method of announcing changes in the design, construction and operation of RAF aircraft. Changes are classified as either optional, desired or mandatory, in some cases requiring immediate

grounding of aircraft. RAF concedes that it cannot enforce compliance with mandatory changes, but the company's stated policy is to "provide information to the homebuilder in the form of recommendations that, in our opinion, are required for him [or her, presumably] to achieve a satisfactory level of flight safety."

A subscription to *The Canard Pusher* is mandatory for builders and should be considered mandatory for anyone who buys a used VariEze or Long-EZ. An annual subscription is $14. Individual copies of back issues can be ordered for $3.50 each. VariEze information is contained in newsletters 10 through 51 (51 being the latest available as this issue of *Pilot* went to press). Long-EZ information is contained in newsletters 24 through 51. (Contact Rutan Aircraft Factory, Incorporated, Building 13, Airport, Mojave, California 93501; telephone 805/824-2645.)

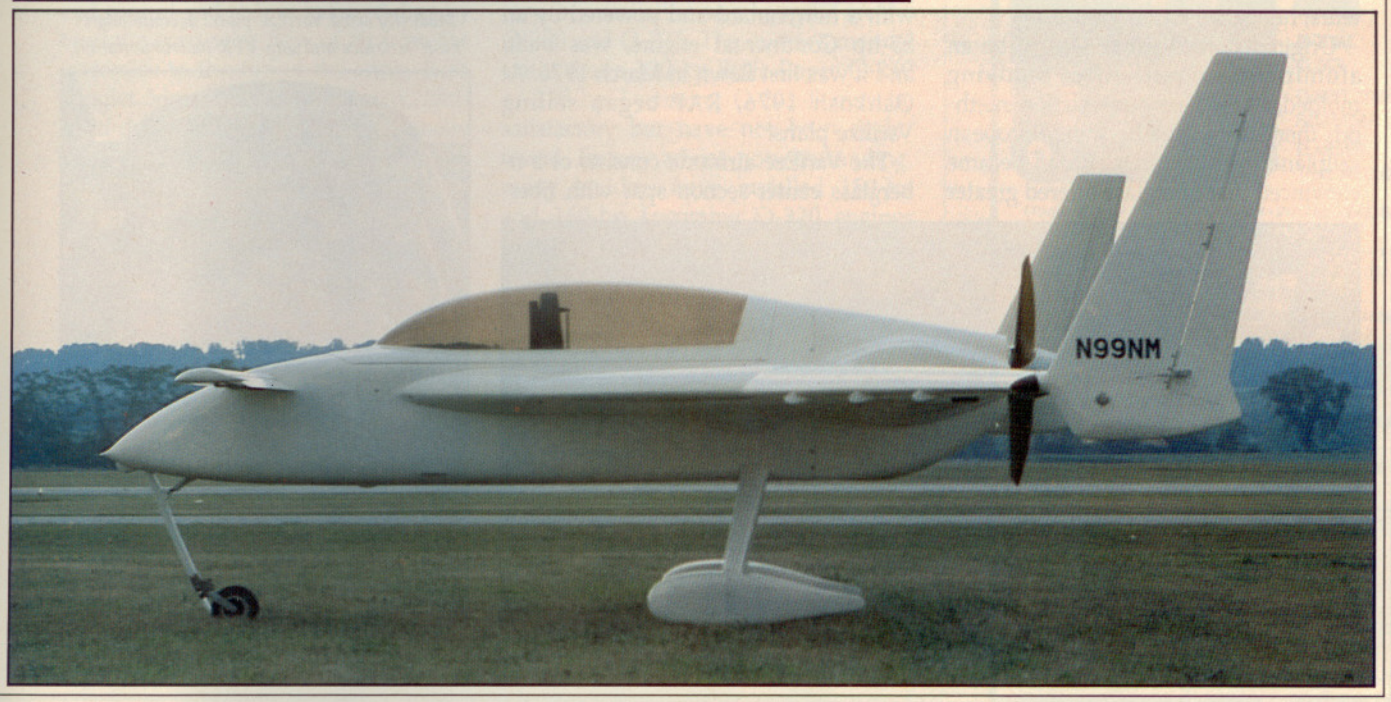
VariEzes and Long-EZs were designed to provide inexpensive, fast, cross-country sport flying. Factory performance figures for a 100-horsepower VariEze at a gross weight of 1,050 pounds promise a 1,500-foot-per-minute sea-level rate of climb and a 148 KTAS cruise at 8,000 feet on 50-percent power. At that altitude and power setting, the VariEze should deliver about 28 nautical miles per gallon for a range of about 700 nm, according to the owner's manual. Maximum level speed at sea level is 178 knots, according to RAF.

A 115-hp Long-EZ at a gross weight of 1,400 pounds will climb at about 1,000 fpm at sea level, says RAF. The book economy cruise speed at 12,000 feet and 50-percent power—four gallons per hour—is 137 KTAS. Maximum level speed is 167 knots at sea level.

No two homebuilt aircraft are identical, and performance hinges on engine power, propeller efficiency, weight and the care the builder has taken in adhering to RAF specifications. The VariEze owners's manual states that cruise performance figures are based on flight tests of RAF's own aircraft and verified by other homebuilders, but actual cruise speeds may be eight to 17 knots slower.

The VariEze was Rutan's first composite aircraft but his second homebuilt project. The first was the homely, mostly wooden, VariViggen, designed when Rutan was an undergraduate aeronautical engineer at California Polytechnic Institute. The design was loosely based on the Saab Viggen, a sleek, Swedish canard-configured military fighter.

The VariViggen embodied Rutan's developing concepts for a cross-country sport aircraft with safe, low-speed handling. Central to all of Rutan's designs is a high-aspect-ratio, cambered, high-lift canard. By obviating the need for a down-loading empennage to balance the up-loading of the main wing, the Rutan canard contributes to lower mass, weight and wetted area. More impor-



Morris wraps an arm around the canard of his Long-EZ to lift the snout and crank the nosewheel down. A small rubber disk protects the nose from scuffing when the EZ is grazing.

tant, it provides stall and spin resistance. The angle of incidence of the canard is set higher than that of the main wing, so the canard will stall before the main wing. At stall, the nose drops until regaining lift. If the control stick is held back, the nose will bob as the canard alternately stalls and regains lift, but the main wing continues to fly with no loss of roll or yaw control.

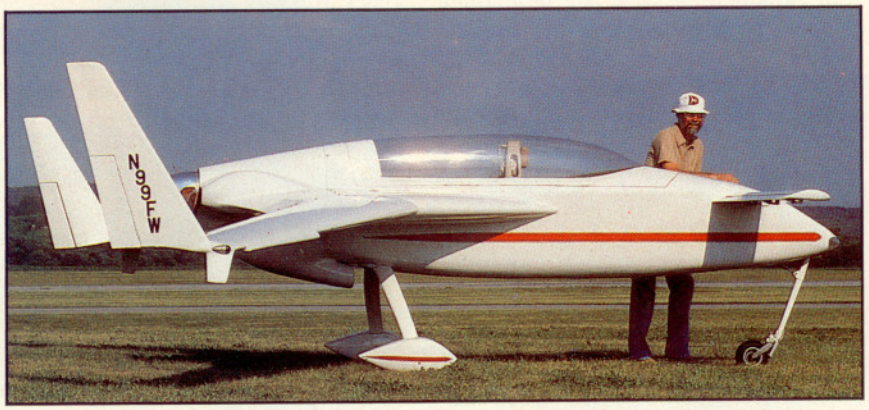
In 1969 Rutan formed Rutan Aircraft Factory as a part-time business to develop homebuilder plans for the VariViggen. RAF moved into rented ex-military barracks at the Mojave airport in July 1974, and two months later Rutan began work on the VariEze. The goal was to achieve better speed and fuel efficiency than the VariViggen could provide without sacrificing safety and handling. Rutan also wanted to offer an inexpensive design that could be fabricated quickly and easily by amateurs; hence the name VariEze.

Originally the VariEze was to be an aluminum aircraft. After studying molded, composite construction methods then being used by some European sailplane manufacturers, Rutan became convinced that fiberglass offered greater flexibility and ease in achieving complex shapes, with no compromise in structural integrity or weight. The prototype VariEze, made of fiberglass and plastic foam and powered by a 62-hp converted Volkswagen engine, first flew in May 1975.

The prototype was flown to the Experimental Aircraft Association's annual fly-in at Oshkosh, Wisconsin, for its public debut. It was a sensation. Homebuilders, numbed by the usual collection of biplanes and designer oddities from backyard aerodynamicists, gravitated to the VariEze with its rakish good looks and performance claims.

Plans for the original VariEze were never sold, however. The Volkswagen engine proved unreliable, and the prototype exhibited undesirable flight characteristics, including poor low-speed roll control and unacceptably high stall and landing speeds. A second prototype with a new canard and powered by an 85-hp Continental engine, was built, and it was first flown in March 1976. At Oshkosh 1976, RAF began selling VariEze plans.

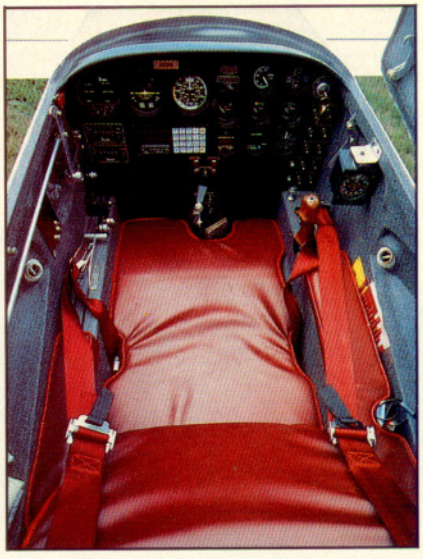
The VariEze airframe consists of a fiberglass center-section spar with fiber-



Fred Wimberly steadies his VariEze. The cockpit compares in size to the Long-EZ's, but VariEze wings have more sweep, less span and smaller fuel tanks and winglets.

Head of Long-EZ backseater is scant inches from engine. Headset cuts noise to a dull roar.

Modestly sized VariEze panel accommodates basic avionics and day-VFR instrumentation.



Short-throw sidestick and narrow, reclining cockpit gives Mach 2 image to Mach .2 EZ.

glass outer wing panel spars buried in foam blocks. There are no stringers, formers or ribs. The skin, the primary structural component of the aircraft, is made from fiberglass plies cured with epoxy. To construct a wing, the builder cuts paper airfoil templates from plans supplied by the factory, tacks the templates to blocks of wood and shapes the wood to the patterns. A wooden template is placed at each end of a length of foam, and a metal wire attached to a small electric transformer is stretched between the blocks. The wire is heated by the resistance of the electric current and is pulled over the wooden templates, cutting through the rigid foam like soft butter. Fiberglass cloth is draped over the foam; epoxy is applied, and the layup is left to cure at room temperature. The fuselage is formed from thin foam panels covered with fiberglass. RAF insists that all of its aircraft be painted with a base coat of white acrylic lacquer to reflect ultraviolet rays, which can deteriorate the epoxied fiberglass.

Fuel is contained in two 12-gallon wing tanks and a two-gallon fuselage tank intended as a 30-minute reserve. Sight gauges serve as fuel quantity indicators. A three-way cockpit selector switch controls the fuel supply to the engine.

The VariEze was the first aircraft to incorporate winglets developed by Dr. Richard Whitcomb of the National Aeronautics and Space Administration. The large winglets provide yaw stability and control and reduce induced drag by blocking span-wise flow of air from the underside to the top of the wing. Each winglet incorporates a one-way, outward-deflecting rudder. An underbelly scoop directs air to the engine for updraft cooling.

The first VariEzes used elevons, a combination of ailerons and elevator, on the canard for pitch and roll control. It soon became apparent that not all the low-speed control problems afflicting the first prototype had been cured. Some builders experienced poor aileron response and even control reversal. RAF mandated changing elevons to a slotted elevator and installing conventional ailerons on the main wings. Main wing leading edge droops were required to correct a wing-rocking tendency at stall. A belly flap was added to increase the descent rate of the aerodynamically slippery VariEze.

RAF has approved a variety of engines for installation on the VariEze, including the Continental A-75, A-80, C-75, C-85, C-90 and O-200 and the Lycoming O-235 minus starter and alternator (to keep the weight at 215 pounds). Two-blade wooden propellers must be used. Maximum allowable weight of the engine, propeller, propeller extension, exhaust system and spinner is 240 pounds, according to the factory.

Not long after the VariEze was introduced, Continental stopped manufacturing new O-200 engines, which most builders favored. Used O-200s became difficult to obtain at prices builders could afford. Rutan decided to increase the size of the VariEze to accommodate larger, heavier engines—specifically the Lycoming O-235 with a complete electrical system. In June 1979 RAF flew the prototype Long-EZ, which featured VariEze outer wing panels attached to a larger center section and a keel-like rudder under the nose.

The design was substantially modified as a result of flight tests throughout the summer. In August the final configuration was approved with a new wing and larger winglets with rudders. Fuel capacity was increased to 52 gallons in two wing-strake tanks. The VariEze's header tank was eliminated. Cockpit dimensions did not change significantly, but baggage space, which is nonexistent in the VariEze, was provided in the wing roots.

The only engines approved by the factory for installation on a Long-EZ are the O-200 and O-235. The owner's manual states that a 130-hp Rolls-Royce O-240 or 125-hp Lycoming O-235-F may be satisfactory but have not been flight-tested. Factory advice notwithstanding, many builders have installed 150-hp and 160-hp Lycoming O-320 engines for better climb and cruise performance.

FAA records contain 104 reports of accidents and incidents involving VariEzes and 36 reports concerning Long-EZs from 1980 through May 1987. About 25 percent of VariEze accidents and incidents occurred during the pilots' first 10 hours in the aircraft, with many first-flight mishaps recorded. There were only two reports of first-flight accidents in the more docile Long-EZ and four involving pilots with fewer than 10 hours in the aircraft.

Nose-gear failures as a result of hard landings or mechanical defects and pi-

lots' neglecting to extend the nose gear for landing accounted for the largest share of VariEze and Long-EZ accidents and incidents. Fuel starvation due to defective tank selectors, nonstandard unvented fuel caps and fuel contamination was cited in several accidents. The only reported in-flight airframe failure involved a VariEze on a high-speed, low-altitude pass over an airport. According to the FAA report, the winglet and wing-tip skin failed due to improper construction.

The uninitiated may have difficulty distinguishing a VariEze from a Long-EZ unless the two are parked side by side. One clue is the Long-EZ's larger, straight winglets. VariEze winglets form an angle at the wingtip juncture. That was one of the few characteristics that distinguished Fred N. Wimberly's six-year-old VariEze from Nolan S. (Red) Morris's two-year-old Long-EZ when both appeared on the AOPA ramp in Frederick, Maryland.

Wimberly, AOPA 395810, a civilian electrical engineer with the U.S. Navy, bought his VariEze plans soon after the aircraft was introduced, in part because he had become disillusioned with a partially completed BD-5 kit purchased from an acquaintance. He spent three years building the VariEze and has flown it 650 hours with no loss of enthusiasm. "It still is the most fun you can have in the air," he said.

Morris, AOPA 806964, who operates his own vending service, has logged 250 hours in his Long-EZ, the first aircraft he has built and owned. Morris earned his pilot's license about 20 years ago but gave up flying until building his Long-EZ. Before flying it, he took instruction in a Cessna 152, then spent several hours with Wimberly, who is an instructor, in the VariEze. (RAF recommends that pilots be current in at least two aircraft types before attempting to fly a VariEze or Long-EZ and that checkouts be performed in calm conditions from a hard-surface runway of at least 3,500 feet. Grumman singles are considered good transition trainers because the differential braking and responsive handling are similar to RAF aircraft.)

VariEze and Long-EZ pilot and passenger sit in semireclining seats. Some builders complain that Rutan designed the cockpit for his own six-foot-plus frame, and unless adjustments to fixed seat positions are made during construction, diminutive pilots must use a number of cushions. When latched shut, the expansive bubble canopy is only inches from one's head. In bright sunlight, the canopy seems more a solar collector than a windscreen. Sunglasses and a floppy chapeau are a must. The backseater is provided with a sidestick controller but no rudder pedals, power controls or instruments. The canard blocks a portion of the pilot's view, and the passenger cannot see past the front seat roll bar, but otherwise visibility is superb.

The price to be paid for high-flying cruise efficiency is to be found in tepid runway performance.

Weight restrictions prevent most builders from equipping their aircraft with electric starters, so proper hand-propping procedures must be observed (see "Pilot Advisory: The dangers and precautions of hand-propping," Sep-

tember 1986 *Pilot*, p. 68). Once the passenger is strapped in and the engine started, the pilot performs a ritual unique to the VariEze and Long-EZ: Grab the canard and lift the nose from its grazing position, then extend the nosewheel with the hand crank so the aircraft can stand on its own three legs. A VariEze or Long-EZ empty of occupants parked with the nosewheel extended would fall on its tail if it had one. Instead, the rear-mounted propeller and engine cowling take the hit.

Takeoff performance is weak. Rutan acknowledges that the tradeoff for cruise efficiency is runway performance. Acceleration is slow, and, with no propeller blast over a horizontal stabilizer, rotation speeds are high. A 100-hp VariEze at gross weight requires about 750 feet of runway at sea level in standard conditions to lift off, according to the owner's manual. A 115-hp Long-EZ requires 1,000 feet. Takeoff distances increase significantly in a crosswind because brakes must be used for directional control. The maximum crosswind component for takeoff is 15 knots; 20 knots for landing. Small tires, a stiff landing gear, steering by braking and high takeoff and landing speeds make the VariEze and Long-EZ poorly suited to turf strips and other soft or rough surfaces.

With two aboard and fuel tanks half-full on a hot June afternoon, Wimberly's VariEze lifted off from Frederick's asphalt runway at 70 KIAS and climbed at 95 KIAS at 900 fpm. Morris's Long-EZ broke ground at about the same speed but gained 1,200 fpm at 120 KIAS. With the engine but a few inches away, the noise level in the rear seat was high in both aircraft.

As twitchy as they appear on the ground, both the VariEze and Long-EZ are docile in the air. There may be an initial tendency to overcontrol because of the small amount of sidestick movement needed to initiate a change in pitch or bank, but control pressures are high enough to discourage gross mishandling. Turns can be made with no rudder input and only a small amount of adverse yaw. Adding rudder increases the turn rate markedly. Both the VariEze and Long-EZ can be trimmed for hands-off level flight, although there is a tendency to porpoise in turbulence, especially in the VariEze. Pulsing the controls causes a momentary pitch change with an immediate return to straight and level flight.

The VariEze stalled at about 52 KIAS at idle power with the stick held back. Except for a mild dutch roll, the aircraft was stable and controllable as it mushed along in a 250- to 500-fpm descent. The Long-EZ stalled at less than 52 KIAS, according to Morris's airspeed callouts. From the rear seat it was difficult to tell that the aircraft was stalled except for an occasional bob of the nose and a 250-fpm descent.

Returning to the airport, the VariEze descended at 1,000 fpm at 156 KIAS with a touch of power. The gear was cranked down at 105 knots, and Wimberly advised a pattern speed of about 78 KIAS. It could be flown 10 knots slower but at the expense of a nose-high attitude and reduced forward visibility. Target speed for short final is 70 KIAS with the belly flap deployed.

Morris prefers slightly higher approach and landing speeds in his Long-Ez for better control response and visibility. Patterns are flown at 90 KIAS, and final approach at 75 KIAS. Both rudders can be deflected, and the belly flap

extended to slow the aircraft on short final.

Proper landing technique in either aircraft calls for flaring to stop the descent, then flying the aircraft to touchdown. A full-stall, nose-high landing attitude will result in prolonged float and possible runway overshoot.

Despite futuristic styling and the personality of a micro-fighter—"I don't know how many Cessna 152s I've shot down," Wimberly grins—VariEzes and Long-EZs are well within the capabilities of proficient pilots. These are not airplanes for everyone, however. The range and endurance of a VariEze and Long-EZ make it dangerously easy for a VFR pilot to fly out of good weather into bad. The tiny instrument panel leaves little room for instruments and gauges considered required equipment on mass-production aircraft. Clever builders have found ways to shoehorn IFR avionics into the cockpit, but the additional weight reduces useful load, which is limited to begin with.

The canard pitches down in precipitation. Plans for a modified canard that does not change trim in rain have been offered by RAF. Other desirable changes specified by the factory, such as larger, more effective Long-EZ rudders and better brakes, may not have been incorporated on an aircraft that is up for sale.

VariEzes and Long-EZs have their foibles but have stood the test of hundreds of amateur airplane manufacturers and recreational pilots. For someone willing to accept the risks, buying one used can be the short cut to easy fun. □

SECOND-HAND DREAMS

can turn into nightmares.

Obvious pitfalls await the second owner of a composite homebuilt. For one, there is no way to conclusively determine how well the aircraft was put together. Homebuilders do not have to meet design and production standards that apply to aircraft certificated under federal aviation regulations. FAA inspectors examine homebuilts during the construction process and approve the final product, but no static or flight tests are required to verify structural integrity and handling characteristics.

The buyer of a used homebuilt must rely on a close inspection of the aircraft, advice from others familiar with the builder and the design, the report of the FAA inspector who approved the construction and, finally, the reputation of the manufacturer who produced the plans or kit.

Most homebuilders receive FAA repairman certification to maintain and inspect their own aircraft. It is one of the important money-saving advantages of homebuilts, but to the used buyer it means there probably has been no periodic evaluation of the aircraft's airworthiness by an objective professional. Repairman certification does not extend to the buyer of a used homebuilt. Unless the original builder agrees to inspect and maintain the aircraft for the new owner, the job will have to be done by an airframe and powerplant mechanic who may be unfamiliar with the design and therefore reluctant to tackle it.

Before agreeing to purchase someone else's homebuilt, arrange to fly it or one like it. Appearance is one thing, performance and handling another. You may be attracted by the former but disappointed by the latter.

Inspect the airframe closely. An internal failure will be evident by cracks in the paint or wrinkles in the skin. Minor tension, compression and delamination failures often can be repaired. Check for debonding of the fiberglass and epoxy by tapping the edge of a quarter on the skin. A sharp knocking sound indicates proper bonding; a dull thud signals debonding. Inspect control surface for freedom of movement and fuel and electrical systems for leaks and access. If possible, obtain the aircraft's owner's manual before inspection. The manual contains a detailed systems checkout procedure that a prospective purchaser could follow.

Have the aircraft weighed. Normal equipped empty weight for an O-200-powered VariEze with day VFR instrumentation is 580 pounds—750 pounds for a Long-EZ—according to RAF. Most builders exceed those figures, but if empty weight exceeds about 650 pounds for a VariEze or 850 pounds for a Long-EZ, it could be an indication that the builder used sloppy construction methods.

Examine the log books. Airframe and engine logs are required, just as with production aircraft. Check for RAF-mandated and recommended modifications, including revised canopy latch system, larger Long-EZ rudders, Long-EZ main gear for a VariEze and improved nose-gear system and new canard to eliminate pitch-down trim in rain.

Keep in mind the certification category of homebuilts: Experimental, Amateur-built. A VariEze or Long-EZ builder is the manufacturer of the aircraft and is free to second-guess RAF by making changes in the design and recommended construction so long as it passes muster with an FAA inspector. Let the buyer of an amateur-built aircraft beware. □