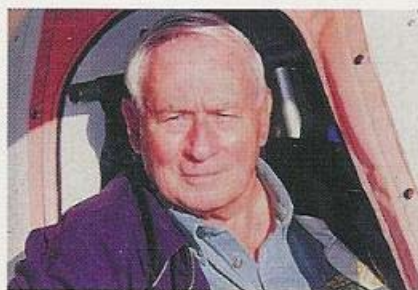


Nat and Shirley Puffer's Cozy Mark IV

*The Only Long-EZ
Clone Licensed by
Burt Rutan*

**TEXT AND PHOTOS
BY NORM GOYER**

*Nat and Shirley Puffer pose
in their Cozy Mark IV.*



NORM GOYER

MET NAT at Sun 'n Fun years ago while covering the event for another aviation magazine, and over the years, I've done many stories about his Cozy. Nat comes by his aircraft design skills via his college training in aeronautical engineering at the University of Minnesota, where he graduated summa cum laude, and his postgraduate work at Johns Hopkins University. For many years afterward, Nat enjoyed a distinguished career with the engineering departments of the Du Pont and 3M companies. Then, in 1973, when family obligations lessened somewhat, Nat turned to building airplanes as a hobby.

Like hundreds of other aviation enthusiasts of that era, Nat opted to purchase a BD-5 kit as his first project. But before all the parts arrived, Jim Bede went out of business, and Nat and the other proposed BD-5 builders were out of luck. At that point, Nat decided that never again would he ever depend on a single aircraft company to provide the design, materials and the engine of a plane he wanted to build. You might say that experience was Nat's Ph.D. in kit building. But Nat's choice of the BD-5 for his first kit showed what his interests truly were. He wanted an airplane

with an unusual design, but one that also offered high performance.

Then Burt Rutan's VariEze caught Nat's attention. The innovative design of this canard was of great interest to him. While helping Rutan at Oshkosh that year, he became one of the first builders to finish a VariEze, and he continuously offered suggestions to the designer about

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what he might do to improve the airplane and the kit. What Nat really wanted was a side-by-side aircraft, either with a third seat in the back or with a larger baggage compartment back there. By that time, Rutan was deep into the development of his next design, the Long-EZ. And Nat continued his work on the plans for a side-by-side aircraft with a third seat in back, but because Rutan had been discouraging builders from making any changes to his designs, he was less than pleased with this situation.

Rutan Approved Cozy Plans

Eventually Rutan reviewed Nat's plans for the Cozy. He liked them and agreed to let Nat sell the plans for a commission on each of them. This effectively makes Nat Puffer's Cozy the only Long-EZ clone (as far as I'm aware) that has the rights signed, sealed and delivered by Burt Rutan himself. Thus was born the Co-Z Development Corporation.

Then the real work began. A large number of builders who'd seen the Cozy at Oshkosh wanted to start building one for themselves. This meant that Nat Puffer had to prepare plans, detailed construction manuals and everything else that goes with the building of a plans-built kit plane. It took Nat and Shirley a year and a half to prepare their design for shipping and, finally, during the winter of 1984, all research and writing was completed and shipped to the printers.

The three-place Cozy was an attractive design, and orders soon began to come in at a satisfying rate. To keep up with volume, Nat took an early retirement from 3M, sold their home in Minnesota and moved, lock, stock and barrel, to Mesa, Arizona, where the year-round climate is much more conducive to building composite aircraft.



Canards, such as the Cozy Mark IV, make ideal cross-country aircraft because of their speed and long range.

Once the sales of the three-place Cozy were off and running, Nat was eager to get back to designing once again. And once again he decided to start cutting pieces to build another aircraft. This time it was the proposed Cozy Mark IV. Work on the new four-place canard began in the fall of 1986 and was completed during the spring of 1988. The plane proved to be an instant success. (The switch from his three-place aircraft to the four-place Cozy Mark IV wasn't actually all that much of a change, but the increase in seating was welcomed by many builders.)

Cozy Mark IV Introduced

The Puffers displayed the Cozy Mark IV at both Sun 'n Fun and at Oshkosh in 1988 and 1989. Although Nat thought they'd retire after that, the Puffers faced a radical change in plans. There was a great deal of pressure from builders to continue the work because there just wasn't any comparable aircraft that could fill the place of the new Cozy Mark IV. So Nat shelved his plans to retire and went back to rewrite the manuals for the new airframe. In

January 1991, plans for the Cozy Mark IV were ready and were then offered to builders. That's how the Cozy Mark IV came into existence.

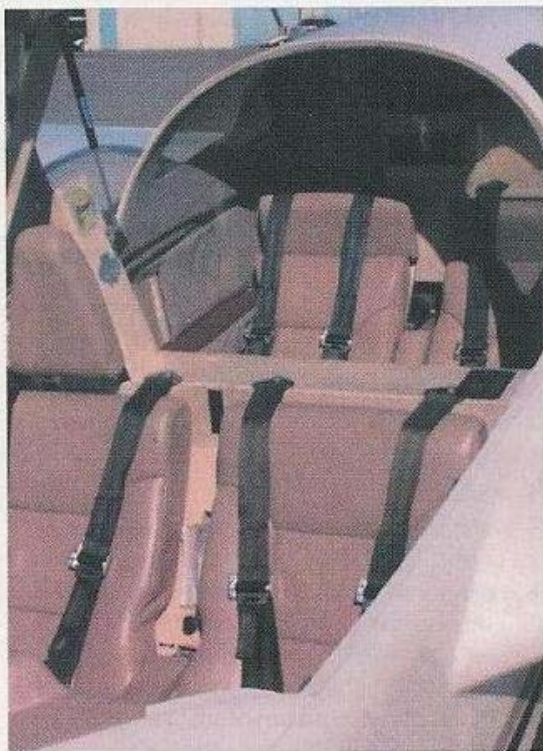
I first flew the Mark IV about five years ago at Apple Valley Airport, and over the years I've flown it several more times. I've always liked the

way it flies. But why has this particular plans-built airplane become so popular with builders?

Why so Popular?

First, the Cozy Mark IV is a compact design with a relatively small engine, capable of hauling four people around with outstanding high performance. Its main selling point for many builders is that it's plans-built, and though this means an increase of work for the builder, it also means a substantial monetary savings. The fact is that a great many builders just love to build, and many of them would rather build than fly. I've heard that almost 50% of homebuilt aircraft are flown by people other than the builder. This fact has to tell you something.

Another reason for the Cozy's popularity is that it's quite easy to build. Once built, the plane has a large cabin, covered with a large side-opening canopy. There are two control sticks on each side of the fuselage and full controls for both pilot and copilot (or passenger). The Cozy Mark IV's large instrument panel allows for the installation of a full comple-



The Mark IV interior was just reupholstered before this year's AirVenture. The four seats are evident.

ment of modern avionics and flight instruments. Its engine controls, trim functions, air brake lever, lights, nose-wheel crank, cabin heat and fuel selector valve are all contained in the center console—all within easy reach of both pilot and copilot.

Because this type of fast and efficient aircraft is conducive to the planning of long cross-country flights, the seats should be (and are) quite comfortable. Those in the Cozy Mark IV include lumbar support, armrests, and thigh and head support for easy-chair-type comfort of the kind not often seen in homebuilt aircraft. Power is supplied by one of the best engines around, the 180-hp Lycoming O-360, which is equipped with a lightweight starter and alternator.

Much of the performance comes from the choice of airfoils for both the wing and canard. For the canard, Nat chose the new 1145 Roncz airfoil, which isn't affected by rain. (In the past, there had reportedly been some problems when flying a canard in a

the aircraft because of its smooth, low-drag surfaces. The airframe is strong because of the high-strength fiberglass that's laid up directly over a core of rigid, closed-cell, shaped foam—which eliminates the need to build complicated (and expensive) molds. This type of construction, first pioneered by Burt

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Rutan, provides more uniform stress, improved fatigue life, better resistance to hostile weather, as well as greater surface durability.

It must be pointed out that there are other factors builders must come to grips with before beginning to build their own composite aircraft. If the builder purchases a kit, he'll

Scratch Building is Easy

Another benefit of building a scratch airframe is the knowledge that you're building your very own airplane, so you know you're doing it right. You get to know every bit and piece that goes into making up the complete aircraft. Another major advantage is that when you build your own airplane, you're listed by the FAA as its manufacturer, so you can do future work on the airplane yourself. It can't be any other airplane—just the Cozy Mark IV you've built, but when you consider the high hourly rates charged by today's qualified mechanics, that's a significant savings. And you're going to save thousands should you decide to scratch-build. Those are the benefits and drawbacks, and for many builders, the benefits outweigh the drawbacks by a long shot.

Another concern that has arisen with some canards was that when entering a deep stall, it was difficult (and sometimes



LEFT TO RIGHT: The recommended engine for the Cozy Mark IV is the reliable Lycoming 180-hp engine with a fixed-pitch prop. Like the Long-EZ, the Cozy retracts the nose gear only. The main gear is highly faired to lower the drag considerably. The original canard was much longer (by 6 inches) than the current version. All negative flying habits have been designed out. Nat Puffer redesigned the vertical fins so they protruded beneath the wing as well and solved many early problems.

downpour.) The high-aspect-ratio wing utilizes the latest in wing research and uses the Eppler airfoils optimized for a fast cruise. In addition, Whitcomb winglets were built into the wingtips of the main wing. This selection of wing sizes contributes to a wetted area much less than conventionally configured aircraft. With the power-off glide angle at only 3.7 degrees, it was necessary to install a landing air brake to steepen the descent for landing.

The type of construction (composite) also contributed to the performance of

receive preformed fiberglass shells that are basically finished. They're assembled in a way similar to that of a plastic model airplane kit. The seams are sealed with epoxy and tape, formers are added and the aircraft goes together quite rapidly. A composite kit is built somewhat from the outside in, while the Cozy is built from the inside out. What's gained in the construction of this kit is the great amount of time that would otherwise have been spent working with epoxies, foam and yards of cloth.

impossible) to recover from it. Much has been written about this situation, and all canard designers have tried to deal with it, each in his own way. With his extensive engineering background, Nat also tackled the situation. There was extensive testing of the Cozy Mark IV with regard to the limits of the aft c.g. position.

A canard isn't supposed to be capable of stalling—when operated within the approved c.g. range. Burt Rutan's designs proved the concept, as did Nat's three-place Cozy. But

another designer's canard suffered four main wing stall accidents, one of them resulting in a pilot fatality. Nat knew that his three-place didn't stall. But he also knew that adding a fourth seat to the design to achieve the new Mark IV might create the possibility that the weight of the extra passenger (or added amount of luggage) might shift the range of the aft c.g. just enough to alter the aircraft's delicate balance.

So Nat sought the services of expert Tom McNeilly, and together they built a mechanism that, when installed in the Mark IV, would allow them to shift the c.g. between 8 inches during flight. The device was actually a 135-pound hunk of lead in a 4-inch PVC pipe that could be moved back and forth by an electric motor, chain and pulleys. It was installed on the right side of the cabin and ran almost the entire length of the fuselage. Nat told us it really hurt him to see his beautiful Mark IV cut apart to allow this installation, but he knew it had to be done to make the plane safer. An elevator position indicator, an angle of attack indicator, plus a video camera were installed with voice hooked up to one of the radios. As an additional safety measure, a borrowed parachute was taken aboard the plane for the flight test of the newly "upgraded" Cozy.

Jim Patton, a highly qualified test pilot, had conducted the same kind of test on similar canards for other companies. It had been determined in advance that the c.g. must be forward of the point of neutral stability. Nat and his associates also did some preliminary c.g. tests prior to the test flight to determine the exact position of the tube with its moveable lead weight.

Deep Stall Solved

After several aborted test flights, the mission was completed by Patton, who discovered that at position 101.05 he was able to stall the main wing. After a rather scary flight, wing cuffs with droop leading edges were installed. But when flown under the same c.g. positions, the stall became even worse. They thought the wing was stalling

The side view of the Cozy Mark IV shows the neat, clean lines that contribute to its high performance.



because the air under the wingtip was bleeding off spanwise, so lower winglets were designed and installed. This last modification "did the trick," and the Cozy Mark IV flew the way it should. At full aft stick, it was impossible to stall the wing with the c.g. at 101.05. It would just sit there with full aft stick at about 55 knots—nose high, wings level—and develop a sink rate.

After an exhaustive series of tests, they determined that the lower winglets provided lateral stability at high angles of attack, and they delayed

Another reason for the Cozy's popularity is that it's quite easy to build.

wingtip stall by containing the high pressure under the wingtips. All was well with the aft c.g. set at 101.05, but the plane and its interior were designed for an aft c.g. of 102.05. Another modification was needed to get the plane back within its design c.g. limits. The final solution was simple. The span of the canard was cut down by 6 inches. This allowed a margin of safety so that other builders wouldn't have to worry about flying a Mark IV at the limits of its design aft c.g., 102.1. We wanted to include this section of the testing of the Mark IV to show how a conscientious aircraft designer must address all the problems that can arise before the plans are distributed and the pieces are cut by anxious homebuilders.

While at AirVenture this past summer, I spoke with Nat and Shirley Puffer and asked if it might be possi-

ble for them to stop in at Apple Valley Airport sometime in the near future. I wanted an update on the Cozy Mark IV, because I realized that canards are here to stay. And so they came to visit me. By the way, while writing this article, I happened to be watching the national news on television, and I actually saw Dick Rutan flying his rocket-powered Long-EZ (canard) at the Mojave, California, test facility. These were preliminary tests for another high-tech project involving rocket power. That's quite an advancement for canards.

I've flown almost all of the Long-EZ-type aircraft, and I must admit that I enjoyed flying them. In the air they're fast, comfortable, have great visibility and are easy to fly. All the previous problems have been designed out of them by now, so if you purchase a kit or plans for any of these aircraft, you should end up with a safe plane. (Of course, this "guarantee" doesn't apply to older kits or to partially built aircraft—which may have been sitting around for years—that you think you can buy at a great "bargain." With this type of thing, you're on your own.)

I've flown with quite a number of high-time canard pilots in my day, but none of them possessed anywhere near the great degree of experience and expertise as Nat. Nat's been flying this type of aircraft for years. In fact, he's got more than 600 hours alone in the Mark IV, his third Cozy type.

Nat called to schedule our test flight in the middle of November at Apple Valley Airport, near where Ron Caraway and I live. This is also where Caraway keeps his Cessna 180 camera plane. As we always do, we first got

together and discussed our plans for the air-to-air photo shoot. We'd fly due south to rendezvous over Lake Silverwood, nestled in the San Bernardino Mountains. This long, narrow reservoir, which supplies much of the water to Los Angeles, has been a favorite spot for air-to-air photography for many years. It's like capturing a

The type of construction (composite) also contributed to the performance of the aircraft because of its smooth, low-drag surfaces.

touch of the mountains in the desert. Aware that the Cozy is far faster in cruise than the 180, Caraway and I took off first, then headed due south, planning to meet up with the Cozy over the lake at 5000 feet.

Formation Flying

Nat is a former U.S. Navy fighter pilot, and he's really great at flying formation, so the flight went flawlessly. Around and around we went, in tight formation, while I took countless photographs of the Cozy over the pine trees and lake. Shirley was plainly visible in the right seat, enjoying the view,



Alex and Norma Strong of Yermo, California, built their Cozy three-passenger plane 10 years ago. Their aircraft has a 150-hp Lycoming engine.

while Nat kept his Cozy exactly the right distance from the Cessna.

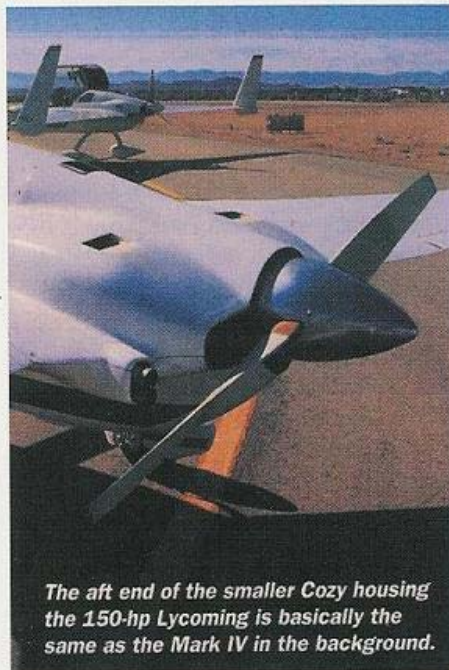
We finished the formation flight, then headed back to the airport for the beauty and detail shots. When we arrived, Nat's friends, Alex and Norma Strong, from Yermo, California, had already flown in, arriving in an example of the earlier three-place Cozy (shown in the photo above). His friends have been flying their Cozy for more than 10 years, and they really love their aircraft.

Whenever I fly in the Cozy Mark IV with Nat, I learn something new. This time we had a bit of a crosswind blowing, but the takeoff was still arrow-straight. In a drag race, canards aren't the first off the ground, but they'll catch up with you in the climb and probably go past you in cruise. Nat had recently redone the cockpit,

and the reclining seats were quite comfortable. The side stick is turning into one of my favorites, and flying from the right seat puts all the controls in my favorite spots: right hand on the stick, left hand for the power controls.

We climbed out at more than 2000 fpm, and once we'd reached our test-flight altitude of 8500 feet over the Lucerne Valley, we trimmed the plane for straight-and-level at cruise power settings that approximated 75% power. The true airspeed was easily over 200 mph, even in the slightly bumpy air. When we throttled back for what I call a long-distance cruise setting, we saw at least 190 mph true. At this setting, you and your passengers can cover about 1000 miles of real estate.

Because most canards aren't really aerobatic aircraft, we flew the



The aft end of the smaller Cozy housing the 150-hp Lycoming is basically the same as the Mark IV in the background.

Cozy Mark IV

SPECIFICATIONS

Engine 180-hp Lycoming O-360
Wingspan 28.1 ft.
Wing area 88.3 sq. ft.
Canard span 12.6 ft.
Canard area 13.4 sq. ft.
Length 16.9 ft.
Height 7 ft. 9 in.
Cabin width 42 in.
Cabin height 39 in.
Max. front seat 400 lb.
Empty weight 1050 lb.
Gross weight 2050 lb.

PERFORMANCE

Takeoff solo/gross . . 1200/1700 ft.
Climb solo/gross . . 2000/1200 fpm
Cruise, 75%, 8500 ft. . . 220 mph
Cruise, 60%, 8500 ft. . . 190 mph
Max. range, 75% power . . 900 s.m.

Max. range, 60% power . . 1000 s.m.
Ceiling 20,000+ ft.
Landing roll,
solo/gross 1000/1300 ft.

For More Information

Co-Z Development Corporation
Dept. CP
2046 N. 63rd Pl.
Mesa, AZ 85215
Phone/fax 480/981-6401
www.cozyaircraft.com
natp@cozyaircraft.com

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|---|---------------|---------------------------|
| | United States | Outside the United States |
| Information kit . . . \$10 | | \$11 |
| Newsletter . . . \$9/yr. | | \$10/yr. |
| Plans and construction manual \$500 | | \$535 |

Cozy Mark IV as any sport pilot might do so on a typical cross-country trip. (I've seen Dick Rutan put his Long-EZ through some pretty decent maneuvers—most of which I thought canards couldn't do, but then few of us are the pilots Dick Rutan is!) I tried to stall the plane, but as Nat had told me, it just didn't stall. Sure it will mush, and the nose will fall slightly, but the canard will bring the nose back up almost immediately, and a gentle oscillation will continue until you correct the attitude. I then made some steep turns, first at cruise speed and then at near stall speed with no surprises at all. The plane simply kept flying.

When it came time to land, I had to readjust my thinking because I realized I wasn't flying Ron Caraway's Cessna 180, nor was I flying my friend Joe

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I learn something new.**

Fitzgerald's Cessna 140 with a 140-hp Lycoming. I was flying a canard, and when I set up for landing, I realized once again that landing a canard is just a tad different. It's not difficult; it's just different. We entered the pattern at 1000 feet agl, and the Cozy is such a slippery airplane that I had to use the air brake to slow it down.

Time to Land

When we reached nosegear-down speed, I was able to slow it down to a comfortable 90 mph indicated on base. When I turned final, I slowed it down to 80 mph, which I held until it was time to gently flare. Then I made a greaser. You really don't want to bounce a canard; the nosegear could collapse, and you'd redesign the nose of your airplane and leave a long line of ground-up fiberglass and resin down the runway.

As I said before, it takes longer for canard-type aircraft to take off than it does aircraft with conventional airframes. Canards must be flown off, rather than hauled off. They also land faster and flatter than other aircraft, and they require longer, hard runways. In an emergency, canards can

be flown from a grass or dirt field, but that's not recommended because of the probability that loose gravel might be drawn up into the pusher prop. Also, the canard's small wheels are prone to "stubbing their toes" on small objects or sinking in small holes or depressions. So if you're flying a canard, it's better to do so from a hard-surfaced runway.

If you're thinking about building a four-place 200-mph aircraft, you should certainly give serious consid-

eration to Nat Puffer's Cozy Mark IV. A plans-built aircraft might take you a little more time, but you'll save money by doing it yourself. Just be sure you have the skills, the patience and the necessary amount of building space to do the job. Those who have built and flown one of these neat composite canard aircraft have only good things to say about them. Dollar for dollar, it's hard to beat the Cozy Mark IV for high performance and ease of handling.



Gary Juergens' Cozy Mark IV

The first flight of my Cozy Mark IV, N2187J, was on my birthday, February 10, 2001. My wife purchased the plans from Co-Z Development six years ago as a birthday present. The building process was enjoyable and straightforward. I built the plane as per plans and I had no major difficulties bringing this project to completion. It is powered by a Lycoming O-360 A4M 180-hp engine with a wood Sensenich propeller. It is configured for VFR only. It weighs 1150 pounds, a little heavy due to using the starter and carburetor that came with the engine.

Performance has been exhilarating. For six years I worked faithfully at least 2 hours a day, five or six days each week. The whole time, completion seemed like it would never come. My thanks to Co-Z Development, St. Louis FSDO, and everyone who helped make parts or just supplied encouragement.



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T/F 480-981-6401 www.cozyaircraft.com