the Thatcher CX4

"Looks good; flies well"

Jim Koepnick

PETER BECK, EAA 19566

For three years, Dave Thatcher's CX4 prototype was the only flying example of his first-time design effort, but not anymore. Its performance, economy, and simple construction helped people fall in love with it.

Since the CX4's introduction in 2004, more than 275 builders have purchased plans for the VW-powered, all-metal, single-place amateur-built that meets the definition of a light-sport aircraft (LSA). About 80 builders have begun construction throughout the world, with projects in the United States, Australia, New Zealand, the United Kingdom, Moldavia, Finland, Brazil, and South Africa. In February 2009, the first owner-built CX4s burst from their builders' shops and took to the air—not just one or two, but 14.

Dave brought the flying prototype to EAA AirVenture Oshkosh 2004, after two years of designing and building. Before he even got it there, some people wanted to purchase it on the spot. As AirVenture progressed, the grass around the plane was worn down to the point there was nothing left but dirt. With this kind of reception, Dave began offering plans, added an illustrated construction guide, and then started producing unique components like the cowl and canopy—all because of popular demand.

DESIGN PHILOSOPHY

Dave has had a long career in aviation mechanics and graduated from Embry-Riddle Aeronautical University's aviation maintenance technology program. He put his education and experience to use and set a number of design goals that were not easy to achieve together. The CX4 (he had already chosen its name) had to fly well, have good performance, be straightforward to build, and, above all, look good.


Bonnie Kratz

Dave also wanted his airplane to be low in cost, both to build and to operate. He set a goal of $12,000 to complete the airplane. That meant he would choose the tried and true Volkswagen engine because of its ready-for-installation price at between $4,000 and $6,500. He knew it was reliable when properly modified for aircraft, was widely available from dependable sources, and had been used extensively on a number of aircraft.

By using other off-the-shelf items, such as landing gear from the Sonerai II (available from Great Plains), basic instrumentation, and an all-aluminum 6061-T6 alloy airframe, Dave was able to beat his goal; the prototype came in at just about $10,000, excluding radio and avionics.

UNCOMPLICATED CONSTRUCTION

Dave tried to make everything about the CX4 fast and easy to build, within the requirements of good engineering and aircraft practice. He advertises that the CX4 can be built in 850 hours. That, of course, depends on builder skill, experience, available tools, and other factors. At the time of this writing, Scott Casler holds the record for CX4 building speed; he claims to have completed his in 398 hours, not counting time to paint and assemble the 2400-cc, 85-hp VW engine. But Scott is the same guy who builds the two-cylinder or 1/2 VW for Hummel aircraft, as well as a line of four-cylinder VW engines. It also doesn't hurt that Scott has his own modern shop equipped with a computer numerically controlled (CNC) machine tool!

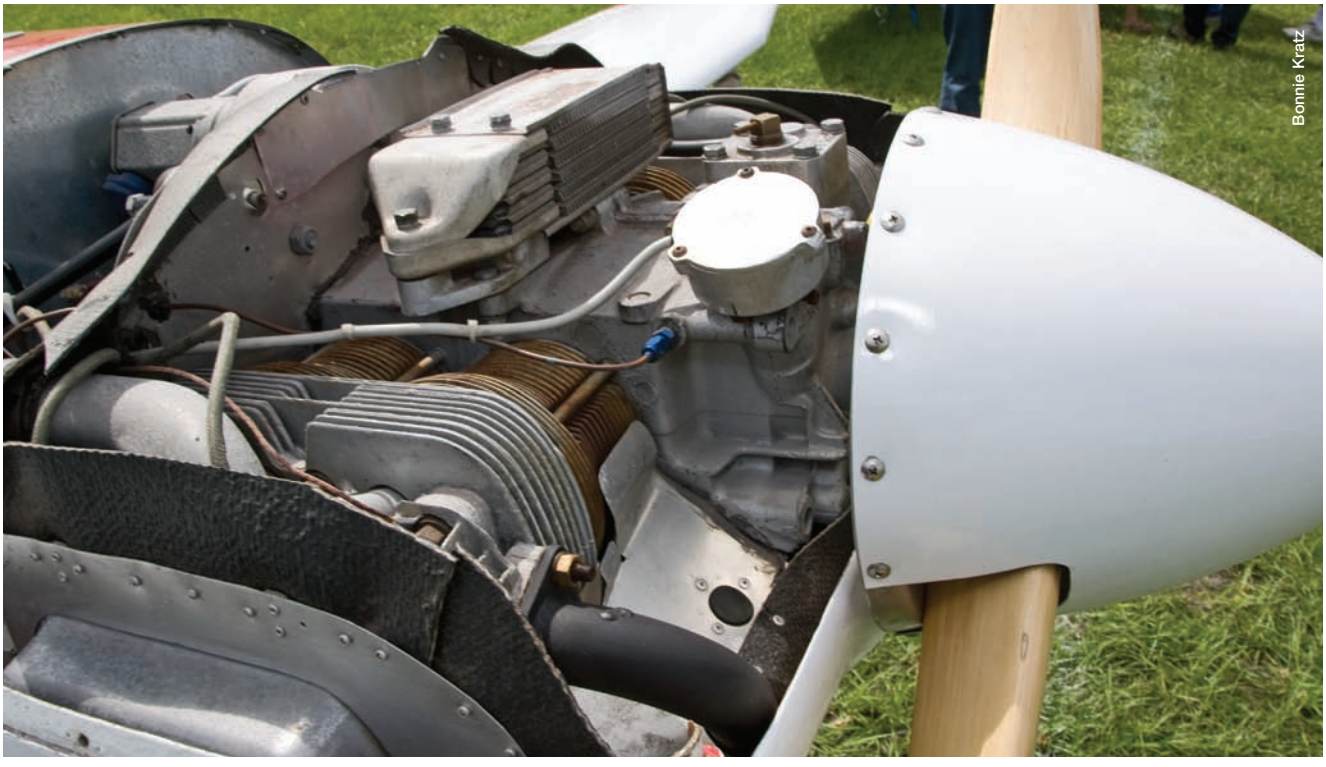
Nevertheless, some experienced, part-time builders are making good progress and have had the full fuselage on the gear and the engine hung within a year. Pending more news of others' experiences, Dave's 850-hour timeline sounds like a sober-minded average.

The availability of major components may eliminate between 150 and 300 hours of construction time. These include a cowl, canopy, and engine mount; a fully assembled, final-riveted spar set; and now a fast-build wing. More major component kits are likely to become available as the CX4 builder group grows.

One of the accomplishments of other designers and builders is general acceptance of pulled rivets. These save countless hours over solid aircraft or AN rivets, and they require only minimal investment in tools—a pneumatic rivet puller and a small compressor. The CX4's main spars, however, use solid AN rivets. The spars, which include a center carry-through, use heavy angle and steel attaching straps. For those who find the spar assembly too challenging or time-consuming, these are now available fully assembled from Dave and his licensees.

The primary structure of the CX4 is a largely aluminum angle from the firewall to the rear of the cockpit. Curved skins are riveted to formers attached to the angle frame. The forward section embeds the wing spar center section on which the entire plane is hung. The tail cone is largely monocoque or sheet with formed bulkheads. This produces a nicely rounded tail cone cross section that contributes dramatically to the plane's good looks.

Without compromising safety or performance, Dave has incorporated a number of simple, readily available, and inexpensive components. The rails for the sliding canopy, for example, are file drawer sliders available at Home Depot for $15 rather than "aircraft standard" rails that cost several hundred dollars more.



The baffling and spinner installation on the 1/2 VW engine.

STRUCTURAL INTEGRITY

One of the builders who began flying his CX4 recently is an engineer recently retired from Boeing after working on the 747. He has run many of the structural numbers on the CX4 to satisfy his own curiosity and conservatism, and he offers the opinion that the plane is more than adequate. Dave has load tested the wing spars and tail surfaces. Tests were successful on the first pass, and the results and pictures are part of the construction manual and are posted on the web.

Construction in the United Kingdom will bring independent engineering confirmation of the CX4's structural and aerodynamic integrity. Under British regulations, the Light Aircraft Association (LAA) carries design liability that our Federal Aviation Administration does not. The LAA, therefore, requires structural and aerodynamic engineering reviews of a homebuilt design before it can be approved for builder construction. This process is ongoing and is supported by several builders in the United Kingdom who expect to complete CX4s in the future.

GOOD LOOKS

Dave had clear aesthetic goals for the CX4. He grew up in an era that produced what he feels are some of the handsomest airplanes ever designed, including the Hughes racer, the Supermarine Spitfire, and Lockheed's P-38 and Constellation, which influenced Dave's ideas. Further, as a young boy he developed an ability to draw and has been drawing airplanes all his life. He has had numerous commissions for his aviation art. So by the time he designed his own plane, Dave had firm ideas about what a good-looking airplane ought to look like and was determined to make his design eye catching.

He seems to have succeeded. A retired airline captain and first-time homebuilder who fell in love with it—never having seen it fly—said that he thinks the CX4 is gorgeous and attracts attention like flies to sticky stuff. Others remark on how it reminds them of a number of golden-era aircraft, such as a Chipmunk or a Spitfire. All finally agree, though, that it has its own unique and attractive look that sets it apart from many light planes on the market.

Finally, inside you'll find a clean, uncluttered cockpit, one in which the control cables and controls are shielded by simple protective panels. The airplane is comfortable and roomy—even for larger-sized pilots.

FLYING and HANDLING

At the time this article was written in mid 2008, Hugh Harrison of Gulf Breeze, Florida, was the only pilot other than Dave Thatcher who had flown both the original and Bill Stinson's first customer-built ship. Hugh is a certificated

Dave Thatcher in his original CX4

flight instructor with flight experiences concentrated in classic Cessnas and the Cherokee Warrior and with limited time in tail draggers. His only experience in a responsive amateur-built aircraft was a few minutes in a friend's Sonex. Hugh was able to step into the CX4 with a minimum of fuss, which suggests that transitioning into it for the rest of us will not be a big event—other than the fun!

Hugh found that Dave's 1700-cc VW-powered ship and Bill's 1900-cc powered ship handled identically, except that Bill's ship with the somewhat more powerful engine climbed and cruised slightly faster.

More important than the specific numbers are the CX4's handling characteristics. With a couple hours of taxiing, Hugh found that the ship is highly controllable on the ground. In high-speed runs, the rudder becomes effective at a low speed, before the tail wheel wants to leave the ground. The CX4's rudder is large, and it and the tail wheel are stuck back at the end of a long tail cone, placing them far enough behind the center of gravity that they are highly effective and need only gentle inputs.

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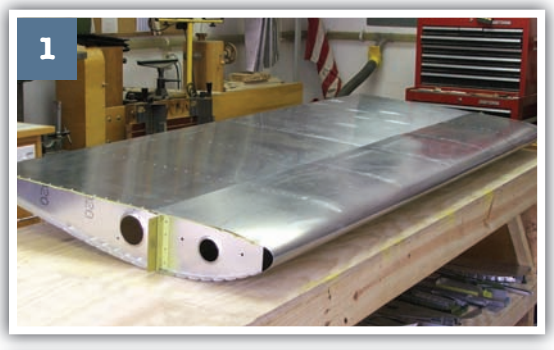
Gentle inputs and finger pressures, rather than control movements, are indeed the key to handling the CX4, according to Hugh. Of all the planes he has flown, he found that the plane responds quickly to control input, most closely resembling the Sonex. Responsive, however, does not mean twitchy or unstable. He said the airplane goes where you make it go and stays there, but never gives any impression that it wants to run away from you and be all over the sky. Hugh quickly found that he was conscious of using finger and toe pressures only and that the plane obeyed quickly but never uncontrollably.

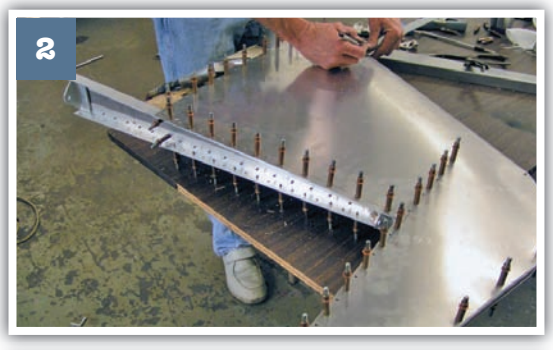
At the same time, the climb and cruise performance are thrilling for a plane in the CX4's horsepower class. Those thrills are magnified by all-around visibility, including over the nose. At 3,500 feet and 3100 rpm, or full throttle on Bill's 1900 VW engine, the CX4 was clocking 130 mph! In 45-degree banks, Hugh was able to nail altitude numbers with only a constant, gentle rearward finger pressure. Approach to landing stalls yielded a gentle bob forward at an indicated 50 mph, with immediate recovery with small power input. This results in an approach speed of about 65 mph, which, according to Hugh, resulted in a long float down the runway. The CX4 has a wing loading of 10 pounds per square foot, wing placement is close to the ground, and the plane has no flaps, giving it a decided tendency to float if you let the approach speed build too high.

Hugh's overall assessment is that the CX4 is easier to control than either a Cub or a Citabria, and that taildragger anxiety can be forgotten. Handling in the air is precise as well as responsive, and the performance is great, given the relatively low and very affordable horsepower.

BROAD RANGE of BUILDERS

That Dave achieved his design goals is reflected in the almost immediate and worldwide response from builders. Appearing just as the light-sport aircraft rule was finalized in the United States, the emergence of a number of more expensive ready-to-fly and kit LSA, and the rise in fuel and other flying costs throughout the world, the CX4 triggered a broad response.





Builders include those who have had no previous building experience as well as those who have built multiple and far more sophisticated aircraft, from fliers who have limited light aircraft and no taildragger experience to those who have thousands of hours in a spectrum of aircraft that include military fighters and airliners. They include younger pilots with families who are looking for an affordable means to fly to pilots of remarkable longevity and experience who are looking to make their flying economical.

PERFORMANCE and SUPPORT

If the CX4 has any tendency to be overbuilt, it certainly hasn't affected performance. Even with the 56-hp 1700-cc VW that Dave installed in the prototype, cruise speeds are in the 120 mph range, and rate of climb is about 800 fpm. That's with 12 gallons of fuel. Bill Stinson's was the first customer-built CX4 to fly; it is equipped with a 1900-cc VW and indicates 130 mph at 1,000 feet and 3100 rpm.

As soon as Dave offered plans for the CX4, he also offered unique components, such as the canopy, cowl, tip fairings, engine mount, control system weldments, and more. Dave did not intend to offer a formal kit-built airplane, intending instead to "see where the wind blew." Builder interest began to grow, even though the only exposure the design had was a short series of small ads that pointed to a modest website and a couple of non-flying appearances at Oshkosh and Sun 'n Fun.

What also grew was the interest of others who could offer additional support. Again, the bet was on Dave's "looks good, flies well" theory. In mid 2006, Dave licensed me to produce a formed parts package consisting of ribs and bulkheads, fully assembled main and center-section spars, and ailerons. This has now grown to include a quick-build wing package that reduces wing assembly time to between 20 and 30 hours and introduces a level of precision and quality that can be achieved only through CNC-drilled and -punched components and skins. Development of new components and assemblies continues as builder interest in the CX4 accelerates.

COCKPIT CAPACITY and WEIGHT LIMITATIONS

One of the first questions from builders is about cockpit fit and payload limitations. The good news is that even fast-food generation pilots are finding the cockpit quite roomy. The CX4 was designed to accommodate pilots up to 6 feet 6 inches and those weighing well more than 200 pounds. Dave Thatcher began the design process with an actual cockpit mockup. At Air Venture, Sun 'n Fun, and other fly-ins, pilots weighing 250 pounds and more tried on the cockpit and even pronounced it "roomy." Even the tallest pilots can position the rudder pedals. The seat-to-canopy height is 37-3/4 inches; cockpit width is 23 inches.

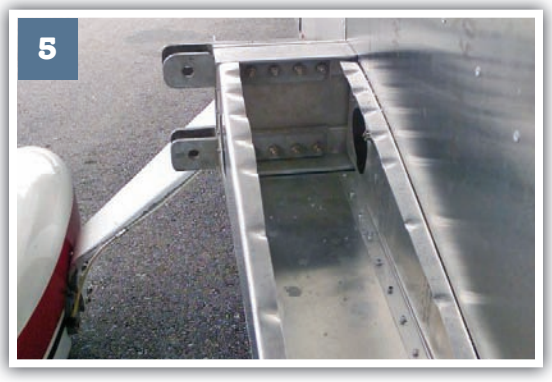
The flying CX4s are demonstrating their ability to carry big pilots and full fuel and still climb at respectable rates, up to 1,000 feet per minute. A general trend to use more powerful engines like 2180-cc and even 2400-cc VWs in preference to Dave's original 1700-cc VW is also assuring that respectable performance can be maintained at high-altitude airfields and in high-density altitude locations like Arizona and New Mexico in summer. Centers of gravity are not changed significantly, although where an auxiliary fuel tank may have been added behind the pilot, a heavy pilot may choose not to fill it.

Detailed numbers still await a full test pilot report.

WHERE From HERE?

As a testament to how easy to build the CX4 is, Anton Tallie's aircraft in South Africa was among the first dozen to fly. Globalization notwithstanding, we in the United States enjoy a well-established parts and materials sales infrastructure, ready availability of experience and expertise, and an encouraging regulatory environment, and we should tip our hats to those in the world who are willing to go it largely on their own.

At 77, Dave has every reason to be proud of his CX4 and the large and growing group of builders and fliers it is generating. The CX4 looks like the plane he envisioned for many years. Its performance and economy seem perfectly attuned to our times. Some would think that the CX4's success as a first-time design effort is a lucky shot. In reality, it integrates a lifetime of experience and many disciplines.



DETAILS: 1. Right wing with formed aluminum skins. 2. In process of skinning vertical fin and fin post. 3. Forward-fuselage with riveted-in instrument panel, instrument, and removable fuel tank coaming. 4. Inside the monococue tail cone, showing elevator push-pull tube and rudder cable installation. 5. Final spar mod applied to W & T fuselage spar carry through, looking forward.

Peter Beck is a CX4 builder and supplier of pre-fabricated parts and assemblies under license to Dave Thatcher. He can be reached via e-mail at ptrbec@aol,com, *or call 502-599-4885.*

PERFORMANCE

With a 1700-cc engine at 750 pounds

Cruise Speed	125 mph (3000 rpm)
Stall (VSO)	40 mph
Max Ceiling	10,000 feet
Best Climb Rate (VY)	825 feet per minute @ 75 mph
Best Climb Angle (VX)	63 mph
Never Exceed Speed	155 mph
Takeoff Roll	700 feet
Best Glide Angle	63 mph

GET A HAT

You know when a homebuilt design is succeeding when the builders are wearing its logo baseball hats. Dave has a CX4 hat for the first reader to guess the origin of the CX4 name correctly. You can reach Dave through the contact information at his website, **http://ThatcherCX4.com.**

Bonnie Kratz

SPECIFICATIONS

Wingspan	24 feet
Length	18 feet 3 inches
Height	4 feet 8 inches
Width at Shoulders	23 inches
Wing Area	84.4 square feet
Fuel	9 gallons, 92 octane auto
Gross Weight	850 pounds
Useful Load	330 pounds
Empty Weight	520 pounds
Design Load	3.8G, 5.7G ultimate

Heater and vent: all season flying
Engines: 1700-cc to 2180-cc VW
Construction: 6061-T6 aluminum, all metal
Brakes: Hydraulic disc, toe brakes
May be flown with canopy off, but not open
Wing disassembly in 20 minutes for transport

watch the video

Thatcher CX-4
www.EAA.org/video