

ULTRALIGHT FLYING!

The Magazine of the U.S. Ultralight Association for Enthusiasts of Ultralight and Microlight Aviation

UF! Pilot's Report

Flying the All-New

Cumulus Motorglider



ENGINE

RESOURCE GUIDE



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Across the West
By Ultralight

Get Set to
Get Wet

Race to Cloudbase Flying the All-New Cumulus Motorglider



Competing for attention can be tough at an airshow. There's all that speed and noise that spectators often equate to the ultimate flying experience. Imagine how hard it can be for a flying machine that best shows off its most noteworthy traits flying fluid, smooth maneuvers in near silence, while demonstrating its best-climb characteristics corkscrewing skyward and drifting downwind simultaneously.

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Sailplanes, hang gliders and motorgliders suffer in "demonstration mode." They can't do what rivets the attention of the crowds: roaring takeoff runs that transition into steep best-angle climbs to pattern altitude before crossing the runway's departure end.

What the silent-soaring set excels at isn't easily displayed on demand where the gathered can gaze. That's particularly true at Sun 'n Fun, where every morning and evening the low-and-slow do their best imitation of the sleek-and-fleet.

The Cumulus deserves its share of attention from both sides of the spectrum. Why? The Cumulus qualifies as that rare breed of hybrid bird, a dual-purpose plane with its wings in two diverse aviating arenas: soaring high



The key to the Cumulus' journeyman soaring qualities are in the wings: long and thin, with an effective airfoil profile. Spoilers help counter the qualities desirable for engine-off flight, expanding the variety of fields and approaches usable for landing.

and cruising low. And, atypically, the Cumulus sacrifices nearly nothing to achieve its flexibility.

But then, that's to be expected. Developer Dan Johnson has steadily, steadfastly pursued perfection in a motorglider that shares the speed range of ultralights while delivering soaring performance nearing those of the Spam-can sailplane trainers. A motorglider that combines hang glider/ultralight flying speeds with glide ratios well above the best hang gliders is Johnson's holy grail.

He will concede his Cumulus has yet to hit that goal. But from my perspective, Johnson is being hard on

himself. The only way anyone who has flown the Cumulus would know of Johnson's unrealized expectation is because he'd tell you.

From my time aloft in the motorglider, the Cumulus may have missed its creator's mark by some measurable margin, but it hits so many targets so well it's hard to

"Economy? Sure. When the engine is running hard in max climb or max speed, it's burning no more than 1.5 gallons an hour; the low-and-slow speed range drops consumption to a gallon or less per hour. With a stopped prop, miles per gallon go off the scale."

imagine disappointment for anyone with realistic expectations for any sportplane.

With the Rotax 447 humming, it hits the mark for relaxed, easy-flying, single-seat aircraft with moderate power and small fuel appetites and respectable low- and high-cruise speeds. And it delivers one of flying's least-obstructed views of the world beyond your nose cone.

It hits the mark for short takeoff and landing (STOL) performance, using precious little runway to transition to climb. Give it climb marks, too, for a best-rate at the four-digit wall, and for speed, though it's no 95-mph bullet. The aerodynamics deliver a high-cruise speed of 75 mph on just 40 horsepower. It also gets low-cruise marks for loafing in the low-40s, and stalls in the upper 30s.

Economy? Sure. When the engine is running hard in max climb or max speed, it's burning no more than 1.5 gallons an hour; the low-and-slow speed range drops consumption to a gallon or less per hour. With a stopped prop, miles per gallon go off the scale.

Powered down, the Cumulus is a solid all-around sport aircraft, with good low-and-slow traits. The Cumulus is easy to fly as a sailplane, with under 200-feet-per-minute (fpm) sink rate, a broad speed range and relatively flat 20-to-1 maximum glide ratio, in tune with the demands of staying aloft during thermal-powered aviating. It also has good soaring performance, comparable to older Spam-can sailplanes, for a price in the very low five-figure range.

Simple and Clean

Dan Johnson, and his manufacturer/engineer Jim Collie of AeroDreams, took a winding route to executing the Cumulus that started into production last month. Johnson, a former hang gliding flight school operator, aviation writer (Dan normally writes these monthly pilot reports in *Ultralight Flying!* magazine), photographer and light-aviation businessman, formed U.S. Aviation to acquire, make and sell an early '80s design called the Cloud Dancer.

An underrecognized design, the Cloud Dancer used some proven, though unconventional, ideas

that don't carry the same favor they once did.

U.S. Aviation sold about a dozen Cloud Dancers over the years, but several features didn't fit some stereotypes. Spoil-

ers provided roll control, for example. Many pilots thought ailerons the more modern way to go. The V-tail had its share of critics, too - pilots who thought something more conventional would be better. And they wanted more glide, something better than the mid-teens glide ratio of the Cloud Dancer, and more power for faster climbs.

Johnson first tried to evolve the Cloud Dancer. Later, he decided an all-new design would work better.

What he started designing and Collie managed to execute hits most of the critics' marks. The light and simple cantilevered wings are fabric-and-dope covered, leaving nothing for performance-sapping drag to hang on to. Ditto for the reinforced 4130 chromoly steel cockpit cage, the engine nacelle and the intersection of the fuselage cabin with the seamless aluminum tube that serves as the main fuselage and tail boom. The only exposed airframe with any drag potential are the main gear legs and the twin struts supporting each side of the horizontal stabilizer.

The Cumulus sports aileron aplenty, a cruciform tail, short flaps and big spoilers. Just like the folks wanted. Of course, advances and alterations like these don't come weight-free. While the Cloud Dancer hovered around the FAR Part 103 weight limit of 254 pounds, the Cumulus weighs in at 360 - before adding the optional emergency parachute system. (You'll need an FAA license to fly it.)

But with the clean-sheet approach, Johnson and Collie have managed (after a couple of iterations) to refine the Cumulus into a fine, well-finished motorglider with some real potential.

For example, the main gear strength and stance is designed to support the Cumulus so well you can remove one wing without the other dropping, an asset for a lone pilot in assembling or disassembling the plane. Yet despite its size and light weight, the Cumulus is far from a fragile flyer. The steel cockpit cage is designed to take a 23-G load and hold the occupant in place with a 4-point harness. The airframe itself is rated for G loads of +4.4 and -2.0, with the ultimate structural integrity tested to 1½ times those loads. Even the engine mount was created with safety and crashworthiness in mind. It is designed to break down without coming forward and rabbit punching the pilot.

Keep It Simple

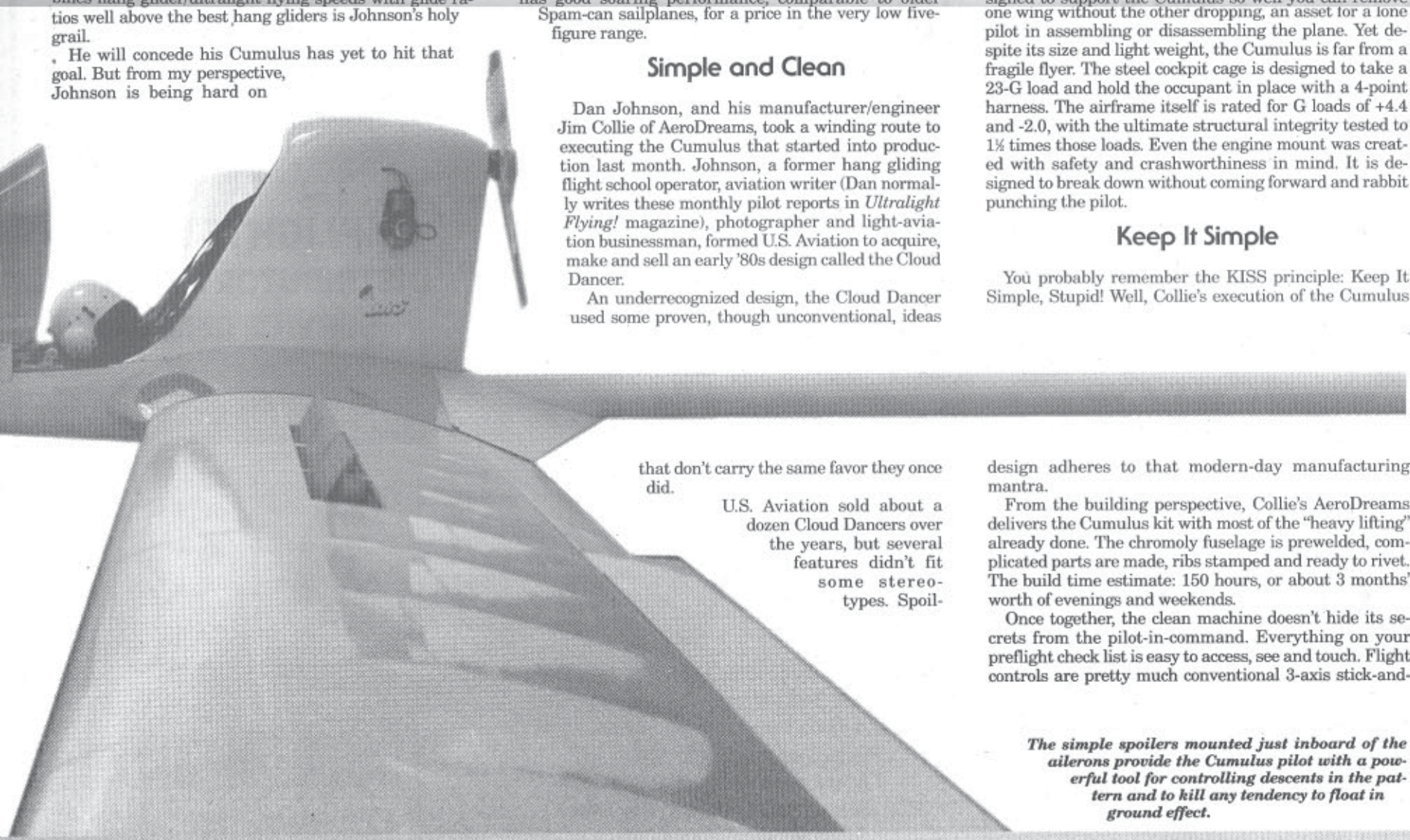
You probably remember the KISS principle: Keep It Simple, Stupid! Well, Collie's execution of the Cumulus

design adheres to that modern-day manufacturing mantra.

From the building perspective, Collie's AeroDreams delivers the Cumulus kit with most of the "heavy lifting" already done. The chromoly fuselage is prewelded, complicated parts are made, ribs stamped and ready to rivet. The build time estimate: 150 hours, or about 3 months' worth of evenings and weekends.

Once together, the clean machine doesn't hide its secrets from the pilot-in-command. Everything on your preflight check list is easy to access, see and touch. Flight controls are pretty much conventional 3-axis stick-and-

The simple spoilers mounted just inboard of the ailerons provide the Cumulus pilot with a powerful tool for controlling descents in the pattern and to kill any tendency to float in ground effect.



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rudder, using cables, pulleys, pushrods, the usual. Ditto for engine throttle and choke, flap and spoiler controls, which are equally simple, straightforward solutions to design goals. And they, too, are easy to check during preflight, even though the actuator cables all run tucked inside the airframe. In fact, except for the rudder pedals, the Cumulus pilot can stand outside the cockpit and move controls and see the surfaces respond.

Finally, checking fuel quantity requires you only to lift the seat forward slightly, still attached to its frame. Need petrol, pull the tank out, disconnect, walk it to the pump, fill and replace. Preflight complete, seated, strapped into the 4-point harness, summer windscreen pinned into place. Ready to go flying? Me, too.

But before I flew anywhere in the Cumulus, I had to get from the tie-downs to the runup area at the departure end of the runway. That took me a little doing. Seems my taildragger driving skills were a bit rusty, and the Cumulus on the ground is a little different breed of bird than most. With so much wingspan and less than half as much tail moment, taxiing the Cumulus in a

strong crosswind challenged the little motorglider's control authority to the max, as well as my ability to adapt.

Ultimately, a little persistence, a little power and all the right rudder pedal the Cumulus could supply won out over the wind and turned the craft in the desired direction. But it wouldn't turn against the wind quickly, which was understandable given the air was blowing in the mid-teens and gusting.

craft to yaw opposite the direction of aileron input. So if you start a right roll with the ailerons, the Cumulus nose first swings left and up before the wings start to take up the roll attitude initiated.

The trait is most common in aircraft with high aspect ratio wings (long wingspan versus short wing chord) and seems to grow more pronounced as span increases. So here we have the Cumulus, 140 square feet of wing

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On the other side of the coin, taxiing for takeoff through soft soil posed little problem in terms of thrust. The chubby tires fairly floated across the sandy surface and wouldn't be bogged down — once we were pointed in the right direction. And like magic, the toughest aspects to master of all the Cumulus' traits disappeared on lift-off.

spread across a wingspan of 43 feet for an aspect ratio of 13-to-1. Throw in the Cumulus' relatively short overall length of 20 feet and you have a pretty good example of a plane with strong adverse yaw traits.

But the solution — or maybe countermeasure is the better word — is rudder. Lead a turn with rudder, follow with aileron as the nose starts to yaw into the turn. After

Nimble Cumulus

The little Rotax twin wasn't even close to red line when the Cumulus lifted itself into the air in a near-level attitude. In fact, it happened so quickly it stymied my intention to mark the liftoff point for measurement later. But this much is for sure: It wasn't quite 100 feet. One hundred feet is only five plane lengths where the Cumulus is concerned.

Once my surprise passed it was easier to note a couple of details. The Cumulus' large ailerons made easy work of countering the crosswind, but the rudder was almost too little to keep the nose straight ahead on the runway centerline. The rudder handled the job, and several subsequent landings, but at full deflection of the pedal each time. More on this later.



Engineer Jim Collie evolved the Cumulus through a combination of design goals and trial-and-error flight tests, an effort that has incrementally improved the little motorglider.

The Cumulus wanted to climb as lazily or aggressively as my heart desired, so I started out with a climb both smooth and flat, the better to feel how the 360-pound plane accelerated with about 200 pounds worth of pilot and petrol aboard. By the departure end of the runway, the Cumulus was cooking along at more than 80 mph — and still climbing slowly. Pulling the nose up progressively brought the speed down to just under 50 mph indicated and brought climb up above 800 fpm.

The match of the Rotax 447 with the laminated wood, 48-inch diameter, 34-inch pitch prop makes for a good working combination. It vaulted the Cumulus down the runway quickly and provided an enthusiastic climb for getting quickly to altitude.

Rolling west away from the field showed up the Cumulus' true sailplane ways — adverse yaw. Remember the earlier comments about running out of rudder? Making coordinated turns is where the rudder shortcoming was most noticeable. Adverse yaw is the tendency for a

little practice, the Cumulus gave me lovely turns with the yaw string centered in the windscreen.

But at higher speeds or when working to reverse a roll, the rudder was almost inadequate at times, or it took longer than expected to make the plane respond. The rudder flying on the Cumulus this past spring was already about 10% larger than the original rudder on the proof-of-concept craft last year. Collie has now crafted a newer, even larger rudder, one with 33% more area and a generous counterbalance horn above the vertical stab, virtually eliminating the shortage of rudder authority. That counterbalance should keep rudder-pedal pressures light and response quick, despite the size change.

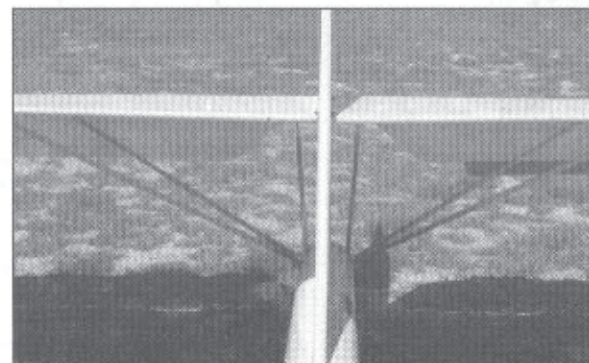
Also helping the maneuverability is a change to the rudder frame from 4130 chromoly steel to aluminum tubing. The swap shaved a little weight off the unit despite the size increase. Given the limits of the second rudder's abilities, this one (which I have seen fly but not flown myself) should more than cover the demands made on it in flight. It probably would even help my clumsy taxiing.

Even with the smaller rudder, the Cumulus flown correctly handled the air with aplomb, the aileron and elevator authority highly effective on roll and pitch, whether at soaring speeds or at maximum-power cruise.

Need to Lead

Roll reversals started with a bit of hesitation, understandably. You've got the inertia of 43 feet of wing to counter. Once it starts to go, though, the roll reverses in a few seconds. But the need to lead remains.

As with virtually all pure sailplanes, rudder use is the



Simple construction techniques like the twin braces on each side of the vertical stabilizer eliminate the need for top braces and reduce drag; twin actuators for the elevators allow individual adjustment when rigging the machine and lend further strength to the control system.

U.S. Aviation
CUMULUS

Specifications

Seating	..... Single-seater
Empty weight	..... 360 pounds
Gross weight	..... 640 pounds
Wingspan	..... 43 feet
Wing area	..... 140 square feet
Wing loading at gross	..... 4.6 pounds/sq ft
Length	..... 20 feet
Height	..... 4 feet 6 inches
Aspect ratio	..... 13.1-to-1
Kit type	..... Assembly
Build time	..... 150 hours
Load limits	..... +4.4 Gs, -2 Gs
Fuel capacity	..... 5 gallons

Performance

Engine	..... Rotax 447
Power	..... 40 horsepower
Power loading at gross	..... 16.0 pounds/hp
Stall speed with flaps	..... 32 mph
Cruise speed	..... 35-75 mph
Economy cruise speed	..... 60 mph
Max speed (V _{max})	..... 90 mph
Never-exceed speed (V _{ne}) —
Rate of climb (powered)	..... 1,000 fpm
Minimum sink rate	..... 190 fpm at 34 mph
Best glide	..... 20-to-1 at 43 mph
Range (powered)	..... 200 miles
Takeoff distance	..... 170 feet
Landing distance —

Standard features: 40-hp fan-cooled Rotax 447 2-cylinder 2-cycle engine with electric start and gearbox reduction drive, 2-blade laminated wood prop, standard 3-axis stick-and-rudder flight controls with steerable tailwheel, flaps and top-mounted spoilers on removable cantilevered wing, padded sling seat and 4-point pilot restraint system, fiberglass pod, streamlined windscreens, engine-driven electrical system, muffler, heavy-duty conventional landing gear, 15 hours of factory telephone support.

Options: bucket seat, BRS ballistic parachute system, muffler fairing kit, wheel fairings kit, full enclosure kit, instruments (altimeter, ASI, CHT, EGT, tach, variometer).

Construction: 6061-T6 aluminum and 4130 chromoly steel airframe, painted dope-and-fabric covered wings and tail.

U.S. Aviation
265 Echo Lane
South St. Paul, MN 55075
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key to effectively exploiting what the Cumulus has to offer. With a little time, most pilots will develop an instinct for how much rudder to lead with, depending on whether it is to reverse a roll, roll back to straight and level flight, initiate a thermaling turn or correct to stay in the core — even with the larger rudder.

And if you lead this plane by rudder, you can make it swing, engine on or engine off.

Now once upon a time the only gas burned to fill my logbook was consumed driving to the mountains or the



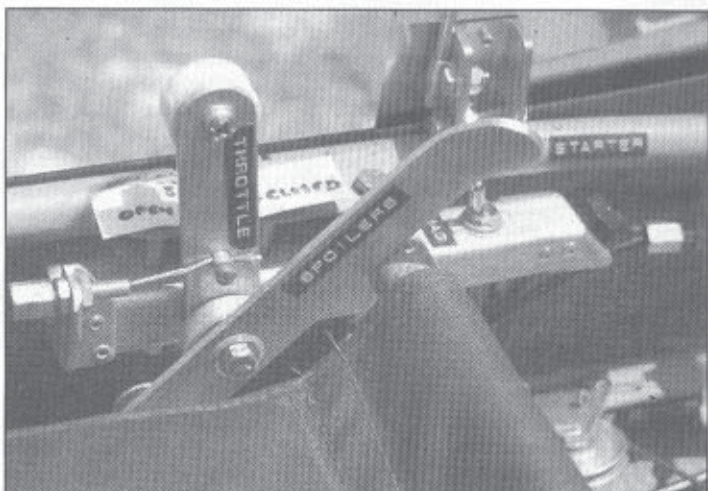
The instrument panel in the Cumulus is necessarily small, but it has enough space for all the required instruments.

seashore or the flatlands where somehow my hang glider would carry me aloft and silently away from any troubles back on the ground. That flying seldom took me anywhere new — or anywhere away from the designated landing field — but it provided the thrill of soaring with the birds.

In recent years, though, my rapture of the heights comes mostly from leaping large chunks of continent in a single bound, enjoying the view of America as I motor overhead less than a mile up at about 2 miles a minute.

But there's that thrill from the purely recreational flight, so low you smell backyard charcoal and see the kids playing in the yard, but just high enough to be safe, cruising lazily to someplace new for the simple thrill of the flight. And to me the true test of piloting skills is in matching wits with the winds, coaxing an engineless aircraft aloft on buoyant bubbles of air for long periods of time, hour after hour after hour.

Flying hang gliders means having a mountain, a



With the palm of your left hand you can control the engine — throttle, starting and stopping — and the wing spoilers that improve the landing qualities of the Cumulus.

winch or a tug to get aloft and challenge the elements. Sailplanes, too, demand a boost if they are to win any lift aloft.

But the Cumulus can take you there any time it can fly. It can make the transition from a lazy weekend cross-country to a coring-lift soaring flight with a simple flick of the ignition switch. And when the silence sets in, it can soar.

It took me some time to talk myself into cutting the engine for this test-flight story. Streams of what-ifs flowed through my thoughts.

One thousand feet up over a brown, plowed field, my left hand flicked off the ignition, and the engine quickly fell silent. My right hand instinctively adjusted the air-speed slower until 45 was indicated.

Time to try some shallow low-bank turns, to carve an S above the field in hopes of bumping into a thermal. A minute later the altimeter slid below 800 feet and my mind raced ahead to pick a field for the upcoming forced landing. At 650 feet agl my left hand flicked the ignition switch back to hot as my right foot and hand started the Cumulus turning back toward the airport almost 2 miles away. As the altimeter needle fell through 600, and my left index finger went for the starter button, the vertical speed indicator (VSI) slowed from 200 fpm down to almost zero.

Could this be salvation? At 575 feet agl the VSI showed 100 fpm up, and gaining altitude and rate of climb. As the altimeter climbed back through 1,000 and kept going, it finally hit me why dizziness was approaching. For a minute or so, my brain had failed to tell my lungs to breathe.

At 1,100 feet agl, the ignition went back to off and a rate of climb peak was reached: 800 fpm, engine off. Throughout the climb, the ailerons provided plenty of authority to fight with the thermal, to counter most attempts to turn the wing out of the lift and end the climb.

The best speed for climbing in the turn seemed to be about 40 mph indicated, a speed that seemed to work well at banks of up to about 30°. Beyond that bank angle, the sink rate wanted to deteriorate quickly.

At 1,600 feet above the ground my flying failed me as the Cumulus was unceremoniously spit out of the thermal and into the sink, all because of my efforts to make a couple of quick notes. The ride back down to 600 feet took more than 5 minutes, despite my now ham-handed attempts to search for more lift with more S-turns upwind.

A second thermal, a little stronger and broader than the first, took me to 2,000 feet in about a minute and 10 seconds, better than 1,200 fpm. This thermal I left voluntarily. With about 3 miles to cover between my position and the landing field, it seemed a good time to try out the glide.

Flying against the wind made calculations difficult.

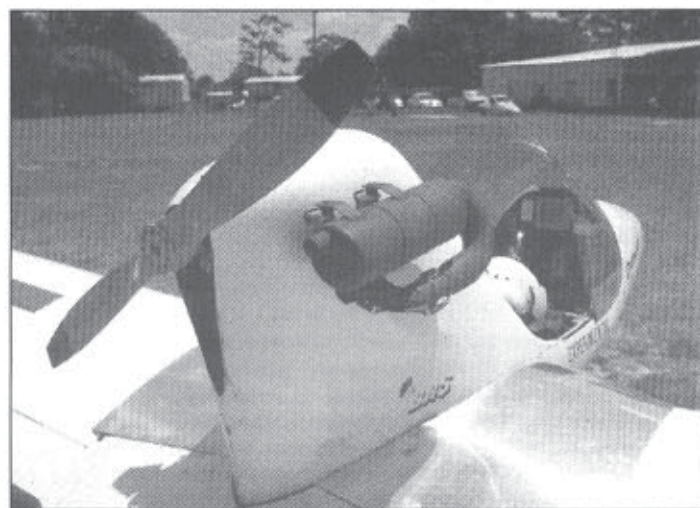
But rough estimates of altitude lost per minute against the true airspeed of about 50 mph yielded a glide near the 20-to-1 ratio U.S. Aviation claims for the Cumulus. To make the final point or two, U.S. Aviation suggests some options it offers, but wasn't yet flying on the production prototype: wheel pants, gear-leg fairings, a muffler fairing and a larger three-quarter windscreen.

My vote goes for Collie's numbers. The Cumulus glides right where it should, lacking the ultimate clean-up work that would put it solidly at 20-to-1.

But we weren't to the point of handing out prizes for accuracy in advertising. The Cumulus still had a couple of miles to fly and too little altitude to keep me comfortable.

Time to try that restart exercise one more time. Switch on, a little choke, a little throttle. Hit the red button and cross your fingers.

The Rotax 447 fired in a couple of seconds and settled to a high idle. The Cumulus continued to descend, albeit at a lower rate, about 100 fpm. Power up, choke off, climbing back to pattern altitude. Time for some pattern work, some touch-and-goes and a stab at handling the flaps and spoilers together.



The 40-hp Rotax 447 powerplant contributes mostly cooling drag to the overall drag profile of the Cumulus, thanks to the tight, smooth cowling that encloses the motor, reduction drive, cooling and induction systems. Only the muffler was exposed, and designer Jim Collie was working on some ideas for fairing even the silencer.

Ground Rush

Little about getting my Cumulus flight had gone easily, what with conflicting schedules and demands. So it stood to reason that winds would make landings as uncomfortable as possible without pushing the limits of safe flying.



Although the roll response of the Cumulus was better than expected for a machine with more than 40 feet of wingspan, that response wasn't without noticeable adverse yaw. Lead with the rudder, though, and the Cumulus rewards you with a well-coordinated turn. The trick is in learning when and how much to lead.

But those same wide-span ailerons that worked so well in maneuvering paid dividends again in the pattern, countering the 70°, 15-mph cross with ease. There was a moment on the first approach when the rudder made me doubt its ability to point the nose straight, but it worked out. The new rudder should give the pilot enough added authority to match the ailerons on a cross.

The flaps work conventionally, with only a slight tendency to change the pitch angle when moved in or out, and the control linkage was firm but light to handle.

But the spoilers were the real star of the steep approach. The single lever on the left side of the cockpit deployed the spoilers without any excess pressure and allowed me to lock them up by pushing the handle past center. Once deployed, the spoilers increased the descent rate and angle and still allowed me full pitch control.

How well does it work? Imagine sitting on the end of a pole descending at a 45° angle, about 1,500 fpm, with an airspeed of about 45 mph. It's not the kind of picture that lends itself to words as well as experience. Let me leave it at this: the experience adds new depth to the phrase *ground rush*.

Once into ground effect, storing the spoilers allowed a somewhat conventional three-point touchdown. Using partial spoilers delivered a solid short arrival at about 38, a couple miles an hour over stall speed.

Given more time experimenting with different spoiler/flap combinations, approach speeds and landing approaches would be a priority for that day when the engine doesn't start on the first try. And with that sort of experimenting behind me my confidence would grow to the conclusion that the Cumulus can return to a field smaller than it can leave.

Cumulus Conclusions

Let's see, to have a solid-flying, comfy, out-in-the-open ultralight you can spend from \$2,500 to \$15,000, depending on your tastes and willingness to use sweat eq-

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uity as part of the investment. Or you can look into the Cumulus, invest about \$16,000 for a kit with all the best options, add about 150 hours of sweat equity and be free to fly however you please.

It breaks down this way: the airframe kit goes for \$7,995; the "firewall aft" kit (this is a pusher, after all) adds another \$3,300; add \$3,300 more for the ballistic chute recommended, basic flight instruments and a Ball 501 variometer for your soaring use; plus another grand for the wheel and muffler fairings and the sleeker three-quarter enclosure; and shipping, of course.

Sounds like a good price for an honest, no surprises, dual-purpose plane with no bad habits and plenty of good ones.

After 3 years of work, testing, experimenting and refining, U.S. Aviation has the machine it set out to create, one that will only get better with time and further refinement. Yes, Dan Johnson still has more plans for his Cumulus. Among possible iterations to come: a Part 103 version, which will likely sport a smaller engine and wing and some materials changes; a "speed wing" using the same planform but a smaller, clipped span, as an available option; and a full-glider variation of the Cumulus. Johnson already advertises the glider-only prospect for the homebuilder, noting, of course, that building a Cumulus without an engine requires calculations to change the weight-and-balance envelope of the machine.

Technical help is a part of every Cumulus kit, with each buyer credited with 15 hours of on-phone assistance from Collie; additional time books out at \$40 an hour if a builder wants to buy, with increments as small as 15 minutes available for \$10. But if you're in a rush, you might not want to dally. Cumulus production has just started in the wake of the final changes mentioned and Johnson declaring the design "frozen" - for a while.



For a pilot-in-command seat sitting nearly in front of the cockpit, the Cumulus does an excellent job of protecting the pilot from windblast, thanks to the wrap-around windscreen that opens for cockpit access.



The simple, streamlined open cockpit gives the Cumulus pilot an unobstructed view of the world beyond his nose, while the sturdy conventional landing gear contributes the least possible drag to the ship's soaring mission while retaining a great deal of stability on the ground.

Already U.S. Aviation has a backlog of orders, a list that could get longer as word circulates about light aviation's latest player. The first deliveries are expected near or shortly after the first of August, early enough in the year for some late-summer soaring and plenty of fun fall fly-ins. And think of those spring thermals, carrying you high into the clear blue and through the summer to come.

If there was space in my hangar... ✈

DAVE HIGDON began flying hang gliders 2 decades ago, and has since earned his private pilot's license and spent more than 2,500 hours soaring, flying ultralight aircraft and a variety of general aviation and military aircraft. A staff reporter for Ultralight Flying! magazine in the early '80s, he is now an aviation magazine and business newspaper writer and freelance photographer in Wichita, Kansas, where he lives with his wife.

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