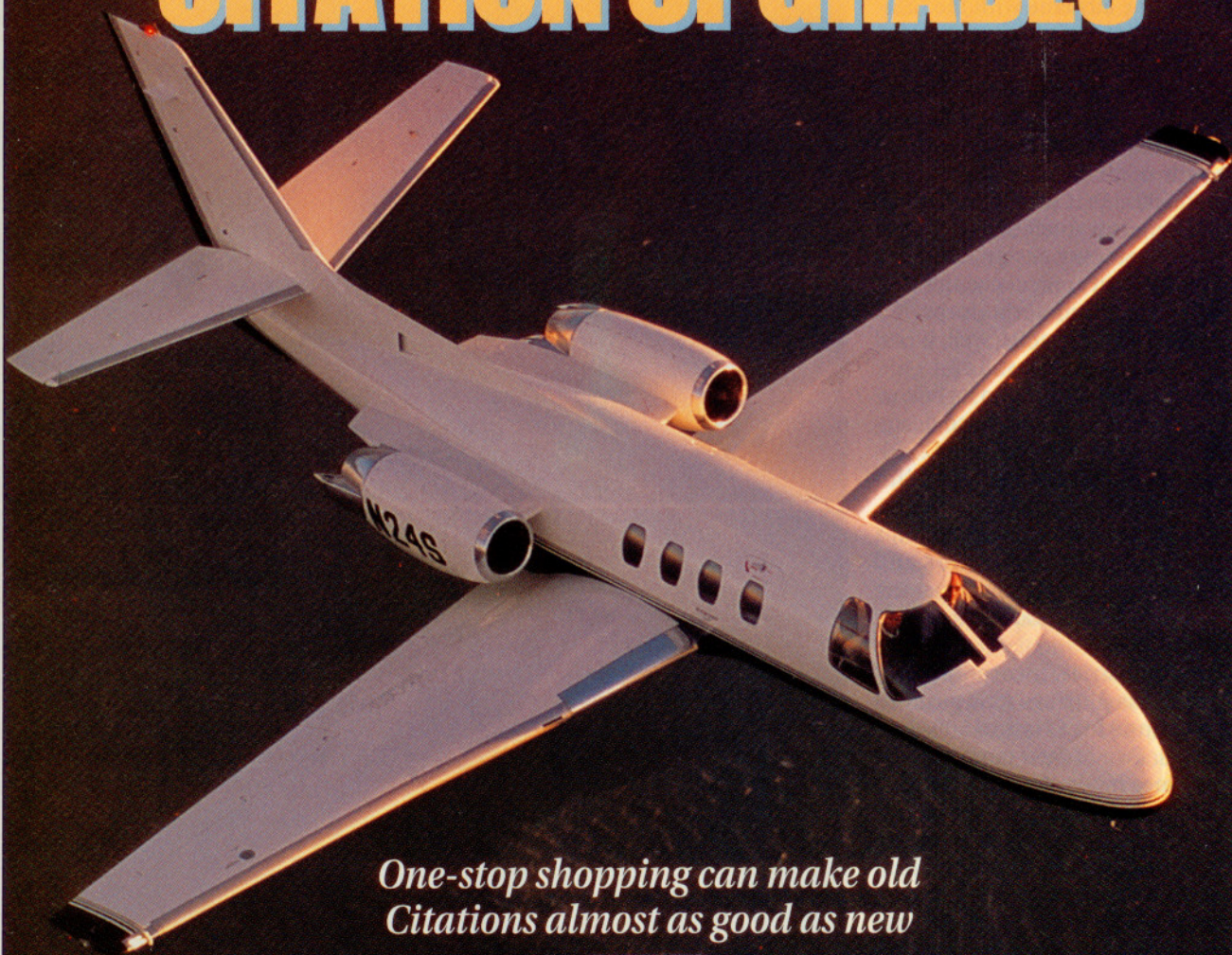


SIERRA'S CITATION UPGRADES



*One-stop shopping can make old
Citations almost as good as new*

BY THOMAS A. HORNE

Twenty-three years ago, Cessna introduced a revolutionary new design, the Citation 500. It captured a great deal of attention because it was the first of a new breed of lower-cost light turboprop aircraft. For about \$695,000, the first Citations offered the kind of comfort, safety, and mission capability that gave turboprop manufacturers of the day some tough competition. At the time, there were plenty of skeptics.

PHOTOGRAPHY BY MICHAEL P. COLLINS



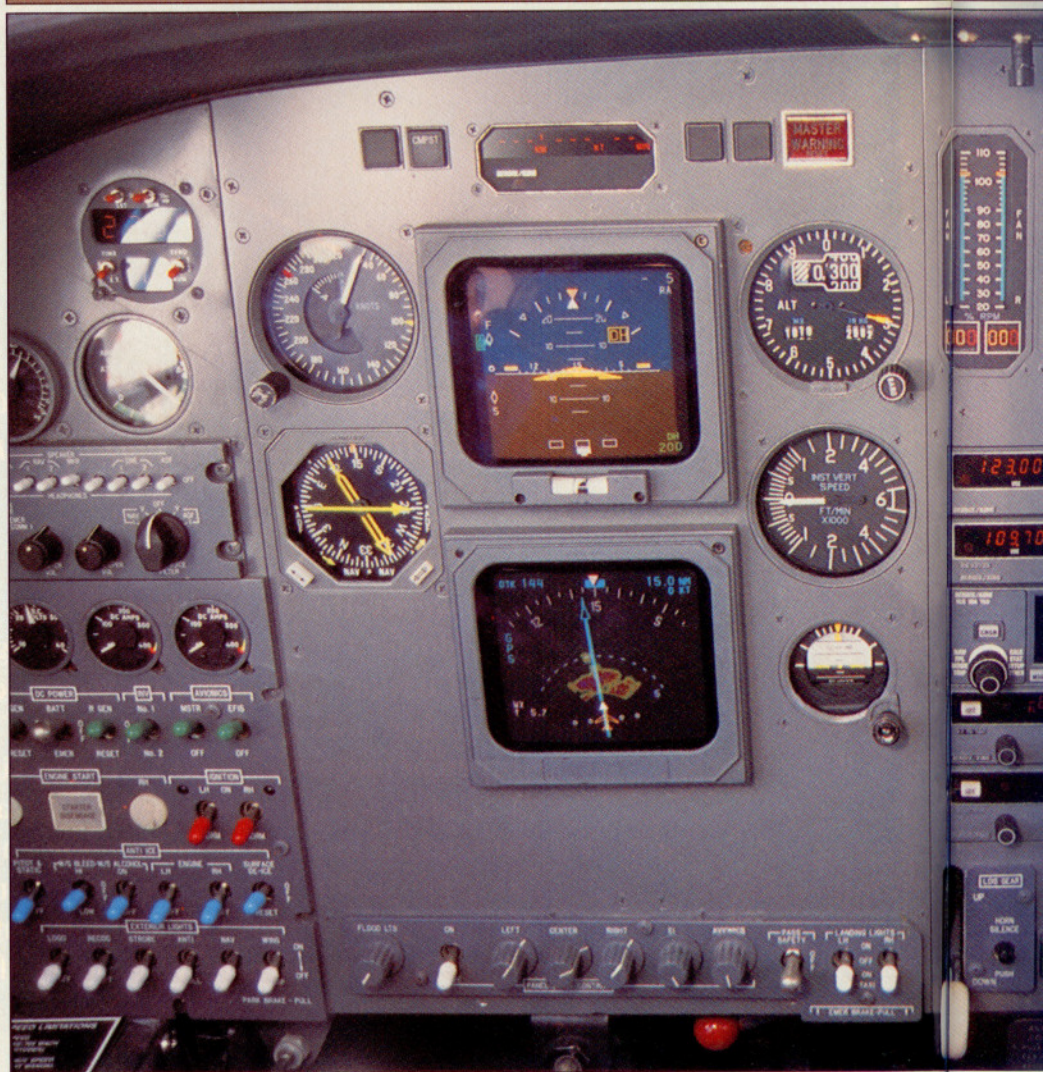
tics. Some felt the Citation's price would be a deterrent. Others pointed out that the Citation's requirement for two pilots (the 500 was certified under FAR Part 25, Transport-category rules) would scare away customers. Still others couldn't resist slamming the airplane with the "Slo-tation" or "Near-Jet" moniker—a reference to the early Citations' 340-KTAS recommended cruise speed, which *was* a full 102 knots slower than that of its contemporary hot rod, the Lear 24D.

In spite of all this, Cessna sold 691 Citation 500s. As it turned out, pilots and customers wanted the safety of a Transport-category design, liked the smooth ride, and appreciated the ability to fly higher than turboprops. If it flew slower than a Lear 24, well, it cost \$200,000 less, and it was still a jet.

Now the Citation 500 and its follow-on designs, the Citation I (also designated the C-500) and I/SP (the C-501, a version certified for single-pilot operation) are getting up in years. While these airplanes still command a loyal following, many owners and operators wish they could boost the performance, utility, and value of their aging Citations.

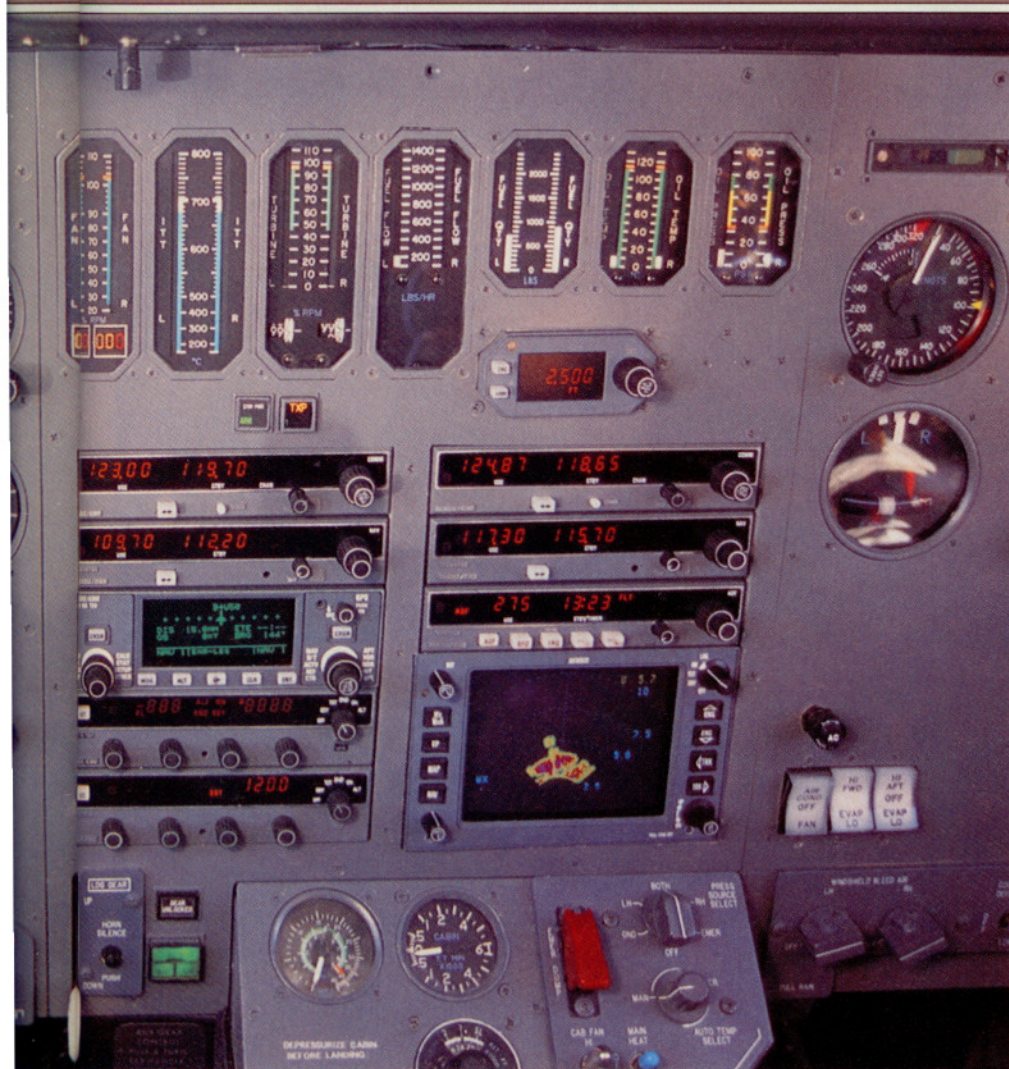
Sierra Industries, Incorporated, of Uvalde, Texas, offers a number of modifications for Citation 500s and Citation Is. Two of their more popular performance mods, the Silver Edition Eagle and Longwing modifications, can boost range, rate of climb, cruise altitude, and fuel economy, while at the same time significantly reducing landing speeds and balanced field requirements. They also provide new wing de-ice boots (BFGoodrich's new Silver Estane boots, if you want them), wing tip recognition lights, compliance with a spar modification service bulletin, flap seals, a new paint job, and the opportunity to go for single-pilot authorization.

The Silver Edition Eagle mod (price, \$235,000; down time, 45 days) involves the installation of wing root cuffs and wing-to-fuselage fairings, as well as an upgrade to the more efficient Pratt and Whitney JT15D-1A engines (for airplanes that haven't already had their original -1 engines improved to -1A status). The airframe changes were originally developed in 1976 by Advanced Systems Technology Incorporated, an Everett, Washington-based consortium of Boeing, Raisbeck,





N24S started out as a 1975 Citation 500, but after Sierra Industries' extensive mods, it looks and performs more like a new model. The AlliedSignal EFIS, in particular, belies the airplane's age.



and Rockwell International engineers.

The idea behind the cuffs and fairings is to reduce the turbulence and drag produced by the interchange of air aft of the stock airplane's leading edges, lessen interference drag, preserve more laminar flow at higher angles of attack, and increase the volume of undisturbed air flowing into the engine air intakes. This, in turn, permits higher fan speeds—and therefore more thrust—than would ordinarily be realized, especially at higher angles of attack and altitudes.

A wingspan stretch is another part of the mod. Extra panels are affixed to the wing tips, giving the airplane a 38-inch increase in wingspan.

At their stoutest points, the cuffs add seven inches to the thickness of the wings, and one foot to the wing chord. The cuffs and tips also provide space for up to 850 extra pounds of fuel, another benefit of the modification. The Eagle also gives the Citation 500 a hike in maximum takeoff weight to help offset the weight of this extra fuel: 12,500 pounds, as opposed to the 10,850 or 11,850 pounds of the standard early airplanes.


More fuel plus less drag and more span equals climbs to higher altitudes and greater range. The Eagle's performance claims include certification to operate at up to Flight Level 410, and a 50-percent increase—or about 600 nautical miles—in the range department. At gross weight, a long-range cruise setting, and a FL410 cruise altitude, the Eagle-equipped Citation can cover 1,550 nm with IFR reserves. Early Citation 500s have maximum IFR ranges in the area of 900 nm, but that's at 35,000 feet—their maximum operating altitude.

Claims for maximum cruise speed are not as highly publicized. At FL350, Sierra says its Eagle will do 365 KTAS. Standard Citations hit top end at 357 KTAS, but at a more fuel-hungry FL230.

Other claimed improvements over the standard Citation include faster times to climb, a 15-percent savings in fuel consumption, and reductions in balanced field lengths. Citation 500s generally require balanced field lengths for takeoff in the neighborhood of 3,600 feet. Sierra says that Eagle/Citations need an average of only 2,900 feet in order for a pilot to accelerate to V_1 (takeoff decision speed), lose an engine, and have enough runway to brake to a stop.

The Eagle mod will also cut stall





speed at maximum landing weight from 88 to 82 KIAS, so reductions in reference landing speed (V_{REF}) of up to 12 KIAS are also realized, according to Sierra. Typical V_{REF} s run from 102 to 115 KIAS, depending on weight; but a good, safe approach speed can be flown using the C-500/-501's angle of attack (AOA) indicator. Sierra modifies the AOA indicator with new software logic as part of the mod. Just keep the pointer aimed at the white mark, or .6 units AOA, and you'll be fine.

A word about the spar modification is in order. Cessna Service Bulletin 56-10 requests that owners inspect their Citation 500s and 501s for cracks in spar caps located in the wing roots. The first inspection comes at 4,300 hours, which makes compliance with this service bulletin a real issue these

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days, given the age of the fleet. If no cracks are found, additional inspections follow at 600-hour intervals. But if a crack is found, those intervals drop to 100 hours. That is, unless you reinforce the spars and do away with the bulletin's requirements altogether. As a stand-alone maintenance item, Sierra charges \$17,000 to fix the spars.

As for the single-pilot authorization, it simply requires that each aircraft be equipped with an autopilot and flight director with approach coupling, a boom microphone, a transponder ident switch on the pilot's control yoke, current inspection and flight manuals, and a certificate of conformity from Sierra. To be eligible, pilots must have at least 500 hours in turbine airplanes, and attend SimuFlite Training International's Citation single-pilot courses at that firm's Dallas-Fort Worth location, or FlightSafety International's Wichita Learning Center. As part of the Eagle or Longwing mod, Sierra will throw in the single-pilot airframe changes. But the training costs must be absorbed by the customer.

Another Sierra modification, the Longwing (price, \$69,500; down time, 20 days) will give you the wingspan

stretch, the deice boots, and the gross weight increase, but only 120 pounds' worth of extra fuel, and new paint on only the affected areas of the wing. The wing root cuffs are not included. Even so, there are substantial increases in fuel economy, and reductions in times to climb, V_{REF} , and balanced field lengths roughly comparable to those achieved with the Silver Edition Eagle mod. In effect, the Longwing turns a Citation 500 with -1A engines into a Citation I, which has a factory wingspan stretch as one of its improvements over its predecessor.

So far, Sierra has given 61 Citation 500s and Citation Is the Silver Edition Eagle treatment. Longwing mods have been installed on another 65 airplanes. This accounts for some 15 percent of the entire remaining 500/501/501SP fleet, according to Sierra. Approximately one-half of their mods have been on airplanes based overseas. Recently, a spate of sales to operators in Eastern Europe, Russia, and Scandinavia has underscored the mods' popularity on the Continent. There, owners want the kind of range that will let them overfly the immigration, landing, and customs fees that used to accompany numerous expensive fuel stops.

Sierra's Citation 500/501 mods certainly don't end with the Eagle and Longwing. For a total of \$2,500, you can update the model 500/501's engines from the standard-issue Pratt and Whitney JT15D-1 or -1A engines to -1A or -1B status, respectively. On early model 500s, -1 engines have their fan speeds limited to 99 percent. Upgrading them to -1As raises maximum fan speeds to 102.1 percent. This results in about eight percent more thrust at all altitudes, higher cruise speeds, and faster climbs. Changing from a -1 to a -1A engine, Eagle mods aside, translates into as much as a 12-knot increase in max cruise speed (365 KTAS), a 100-nm increase in maximum range at the low- to mid-thirties, and the ability to cruise at FL410, where maximum IFR ranges jump by about 200 nm over the stock 500, to 1,150 nm.

Hanging a pair of -1B engines on your 500/501 doesn't boost the range much over -1A performance, but it will give you a 372-KTAS max cruise speed. There's more thrust available at higher altitudes, thanks to this engine's 103.2-percent maximum fan speed.

Yet another mod lets you install JT15D-4 engines, each with 2,500





pounds of thrust, on a 501SP. With the Silver Edition Eagle mods and a trade-in on your old engines, figure on this whole package running you \$650,000 to \$1.3 million. Sierra says this will get you up to 1,700 nm in IFR range, and as much as a 400-KTAS maximum cruise speed.

But let's say your needs, or your wallet, aren't this extravagant. Sierra has 25 other mods for early Citations. A quick-release radome (\$2,190) does away with a bunch of fasteners and chipped paint, replacing them with two levers and a better lock. A four-point restraint system (\$2,730 for both pilot seats) is safer than the stock belts and won't nick the cockpit side windows, as the stock shoulder belts are inclined to do. Avionics master switches are also available for model 500s (Can you believe this wasn't standard?) They're yours for \$1,900. Also available are a gear horn mute switch (\$650), freon air conditioning (\$19,500), a three-place aft divan that gives 20 inches' more leg room (\$11,640), and a set of six vandal-proof, tubular-key exterior locks (\$259).

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The airplane flown and photographed for this article, N24S, shows just how far you can go with Sierra's mods. This is a 1975 model 500, serving as Sierra's demonstrator. It's fitted out with -1A engines and the Silver Edition Eagle modification, plus just about every other modification that Sierra has STC'd for the 500 series. Particularly noteworthy is the latest Sierra STC—a two-tube AlliedSignal Bendix/King electronic flight instrument system (EFIS) and Bendix/King KFC-325 digital flight control system. Filling out the rest of the Bendix/King panel is a complete stack of digital navigation and communication radios, DME, ADF, RDS-82VP vertical profile color weather radar, and KLN-90A IFR GPS with interface to the

autopilot and flight director.

The avionics in this airplane alone represent around \$225,000. Add that to the engine, airframe, and interior mods, and you're looking at approximately \$630,000 worth of upgrades, fixes, and options.

The roster of alterations had no readily apparent effect on N24S's control feel or handling. The airplane behaved in a docile and forgiving manner no matter what the speed or configuration, just like any other Citation.

The *Aircraft Bluebook-Price Digest* says that your average 1975 Citation 500 with mid-time engines will sell for about \$700,000. Add the mod money to the purchase price and you come up with a \$1.3 million airplane, which is what Sierra is asking for N24S. That sounds like a lot, and it is. But you'd wind up with a like-new airplane with zero-time engines, a modern panel, and specs that stand up well to small jets of much more recent vintage.

The performance of a new airplane at a much lower price? Sierra hopes that owners of disco-era Citations will like the sound of that music. □