RAM Cessna 414 Series VII conversion

CHANCELLOR'S CHOICE

Sitting in the FBO at Phoenix Sky Harbor International Airport, Dan Stuber clutches the arms of his chair and speaks a bit anxiously about his most recent business transaction. Over the course of five months, Stuber's company has cut checks totaling nearly $600,000—all for a tool that Stuber has yet to see, much less put to good use. His patience, he says, has been buoyed by

Just your basic half-million-dollar 414A?

BY MARC E. COOK

PHOTOGRAPHY BY MIKE FIZER

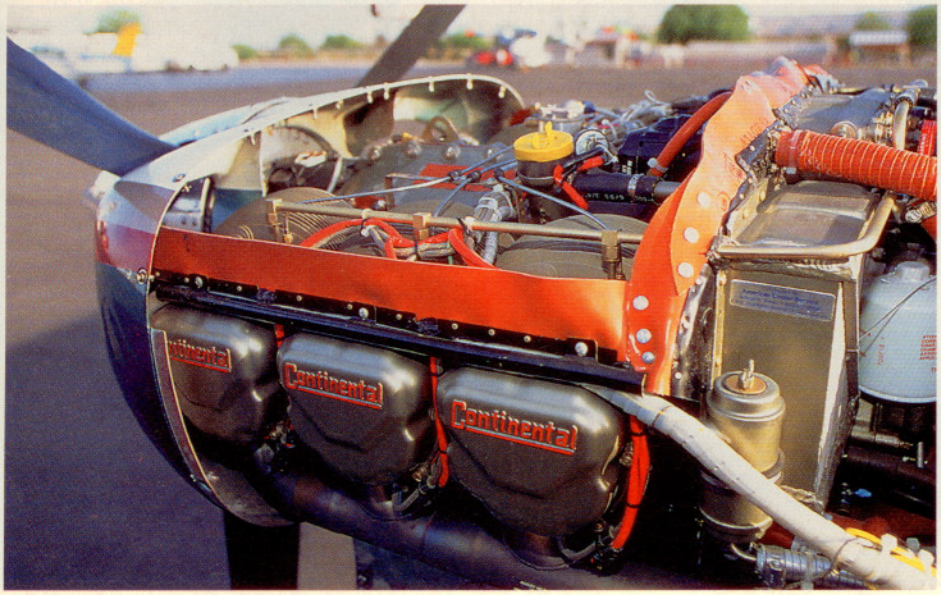
a great expectation that the investment will pay big dividends. We're talking, of course, about an airplane.

Stuber, CEO of AETEC, a subcontracting electronics manufacturer, didn't intend to follow a somewhat nontraditional path to airplane ownership. Instead, he planned on buying new. But none of the current-production general aviation models could fill his needs—specifically, to get himself and as many as five employees from their Phoenix base to (among other destinations) Monterey, California, and Salt Lake City, stage lengths of about 500 nm each. Potential suitors from the turbine world failed to make the cut, too, in large part because of the high acquisition cost and the potential for account-dwindling maintenance expenses.

So Stuber followed a road less traveled, albeit one that is seeing a fair increase in traffic these days—he bought a turnkey airplane from the aftermarket. In this case, he chose an airplane put together by RAM Aircraft, the well-known and longstanding firm that knows twin Cessnas about as well as anyone around. The various upgrades this Waco, Texas, company has applied to the double-breasted Cessnas could fill a phone book—in all, RAM has nearly 100 supplemental type certificates (STCs) and more than 300 parts manufacturing authority (PMA) approvals to its name. What started as a modest business with a few STCs in 1976 has turned into a $15-million-a-year aftermarket fixture.

Stuber's panel sports new avionics and a useful rearrangement of engine instruments.

Why not just buy a 414 and have the work done yourself? Stuber wanted an airplane ready to go, without the headaches, without the running around. He was prepared to pay for the privilege. The journey started when Stuber had RAM find and purchase for him a 1979 Cessna 414A Chancellor. (The A models have the much-improved, 206-gallon wet-wing fuel system. All 414s are basically the cabin of the Cessna 421



with engines from the 340.) In addition to all new paint, interior, and avionics—very little was left from the donor, save for the airframe and basic systems—Stuber had RAM apply the latest Series VII modifications.

Among the highlights of this package are engines overhauled to new limits that, with new-design turbochargers and intercoolers, are uprated to 335 horsepower each from the factory-standard 310 hp. RAM also supplies new propellers, vortex generators, and a maximum-gross weight increase of 335 pounds. Basic cost for the RAM Series VII conversion is $109,400, including installation. Winglets, which are said to offer improved high-altitude performance and really turn up the sex appeal, go for $21,750 installed.

Almost every RAM conversion starts at the factory's 70,000-square-foot facility, located on Waco Regional Airport. (RAM ships some of its kits and engines for field installation, but the majority is done at home.) After an extensive test flight to note squawks and measure performance, the airplane is torn into. Both engines come off and the airframe undergoes a thorough inspection. Much of what RAM does for conversions takes place under one roof; very little work is outsourced. Typically, RAM completes about 100 conversions a year.

Take a tour of the Waco facility and it's easy to understand how RAM came to prominence. RAM's overhaul facility impresses immediately. Clean and brightly lighted, the engine build-up stalls could as well hold dentist chairs as engine stands. One man builds each engine, start to finish, and the pace at which he works seems more efficient and relaxed than harried. Photos of pristine street rods or custom motorcycles adorn many of the toolboxes. These are practiced hands.

When your airplane comes in for the RAM treatment, the old engines are torn down and serviceable parts go into a to-be-overhauled bin; you do not get the same engine cores back after the overhaul. While it's usually desirable to keep your old cores—particularly if they have had good service history—there's so much new in a RAM overhaul that the company's bunch-processing methods should not be of concern. You can keep your old cores, but doing so will add a month to the downtime. On the build-up end, RAM starts with new Continental cylinders—the company does not overhaul or reuse any cylinder assemblies, an expensive move intended to cut down on

warranty claims and to assure the customer the greatest possible reliability.

But RAM doesn't exactly unbox the new cylinders and slap them on an engine. First the jugs are sent out to have their bores channel-chromed. While the industry as a whole has been moving away from chrome and various chroming processes in favor of nitrided or plain steel bores, RAM continues to be a believer. Troubles normally associated with chrome—difficulty breaking in, for example—are overshadowed by the corrosion resistance of the treatment, according to RAM.

Then RAM measures each cylinder's combustion-chamber volume and airflow through the ports. Minor grinding of the ports helps to improve airflow, although RAM doesn't take as much material out of the heads as do some blueprint shops. RAM then groups the cylinders by airflow and combustion-chamber volume to form matched engine sets. Internal parts get similar treatment: Connecting rods and pistons assemblies (including rings and pins) are weighed and grouped into narrow weight categories. The crankshaft is balanced (with drive gears in place) to tolerances a fraction of the factory standard. RAM also fits a new camshaft of its own design, developed with gentler ramps—to make life easier on the rest of the valve train—and a profile that results in better efficiency and increased torque at cruise power settings. Gussets are installed between the rocker-arm bosses atop the cylinder to help prevent breakage.

With the RAM overhaul you also get a heavy crankcase with the so-called seventh-stud modification; this provides another cylinder hold-down point and has proven effective in reducing case cracking. (The upgrade from your old light cases costs $2,650 for each engine.)

An all-leather interior—with Stuber's logo on the headrests—makes for no-hardships business travel.

You also get new magnetos and overhauled alternator, starter/adapter, turbocharger and controller, and fuel-injection system. It's worth noting that RAM performs many of the accessory overhauls in-house, and precision balances items like the alternator and turbocharger turbine.

With the Series VII, there's yet more work to be done, since the new 335-hp engines mate with a substantially improved turbo system. At the heart is a new-design turbocharger by Garrett AiResearch, called the TA81. It's larger—17 cubic inches against 10 cubic inches—and more efficient than the stock TH08A fitted to the 414A. Moreover, the turbo works through an intercooler 33 percent larger than the standard Cessna part, breathing through a new undercowling scoop that separates induction and intercooler air—both the stock Cessna setup and another aftermarket scheme use one source for these two needs. In addition, RAM has designed and had approved a machined insert for the mouth of the compressor that smooths airflow and increases efficiency.

If you need any proof that RAM's machinations have paid off, just look at the Series VII performance charts next to previous iterations of the RAM engines, particularly the 335-hp Series VI. The new model makes the same maximum power (with a 5-minute noise-related limit) on 3 fewer inches of boost than the VI, although takeoff fuel flow is slightly higher. At various comparable cruise settings, the VII maintains that improvement; but at high altitude, the new system really shows its stuff. Set to 75-percent power at FL250 (on an ISA plus 30-degree F day), the latest model makes the same power as the VI on an eye-opening 4.5 fewer inches of manifold pressure. This high-altitude, high-temperature performance is the most dramatic demonstration of the new induction system's efficiency; the more efficient the system, the less inlet temperature rise at altitude, and hence the less manifold pressure needed to maintain a given amount of power. Obviously, RAM makes the most of this new-technology turbocharger.

As the 414 finally arrives in Phoenix and taxies jauntily to the ramp, Stuber recounts the decisions leading up to this RAM conversion. "When I looked at all the new-production models, and at the performance and load-carrying of each one, I came to the conclusion that you don't always get a lot for your money. My first inclination was to go new, sparing the maintenance headaches of a used airplane and secure in the knowledge that everything on the airplane should work.

"Now what I have is essentially a new airplane," Stuber continues, "one that's fast and pressurized and tremendously capable." Stuber pauses, looks outside at his new airplane glistening in the morning sun, and says finally, "Oh, man. That's beautiful."

It's a brave and generous man who will hand over the controls of a new toy to a visiting scribe in advance of flying it himself. But that's what Stuber did. In 104-degree F heat, RAM Aircraft sales manager Jim Allmon and I board N174DS with Stuber in tow. After a brief break to diagnose a recalcitrant boost pump, we have the two Continentals running and the freon air conditioner doing its best to beat the Phoenix heat.

One glance around the cockpit tells few tales of the RAM conversion. New or remarked engine gauges come as part of the package, as does a Shadin fuel computer. Stuber has, however, ordered just about every bell and whistle on the market; his 414's equipment list is comprehensive, including a three-axis S-Tec autopilot, HSI, and a raft of Bendix/King radios, including an IFR-approved KLN 90B GPS. I don't taxi far before the realization sinks in that this airplane, despite its 2,800 hours, feels substantially like new. From the sumptuous

leather-lined cabin, Stuber is already grinning like a teenager in love.

By the time we've reached the other end of the runway—the long taxi has allowed the cabin to be cooled to a tolerable degree—the engines are well into their normal operating temperatures, although neither shows signs of overheating, despite a heavy electrical load and downwind taxiing.

On the takeoff, Allmon suggests running the engines to a nominal power setting of about 30 inches, to make sure that the fuel flow has stabilized and that all the other parameters can be cross-checked. Takeoffs are made with the auxiliary fuel pumps in the Low position. Straining at the power, Stuber's 414 lunges as I release the brakes and wind the throttles up, looking for 38 inches of manifold pressure. Fuel flow clocks in at 36 gph per engine, right on the money. (RAM provides well-organized engine-operating tables with every conversion, so it's easy to find the right power setting and to have the appropriate correlating information handy—items like fuel flow and cylinder-head, oil, and exhaust-gas temperatures.)

At 100 knots, I pull the 414 off the runway. Initial climb is not breathtaking; no surprise, given the temperature. But once accelerated to 130 knots—RAM's recommended climb speed—the Series VII posted better than 1,000 fpm. Within the 5-minute time limit, I start the first power reduction—to 33 inches, 2,500 rpm, and 27 gph per engine. RAM has set this airplane up perfectly, so there's little slop in the engine controls and hardly any hunting of the manifold pressure, despite changes in rpm and mixture. Climb through 3,000 feet clocks 800 fpm.

All during the climb to altitude, carried out at 80-percent power or 268 hp a side, engine temperatures are moderate—somewhat amazing, considering the newness of the engines and the back-wetting outside air temperature. Those larger cowling exits and smoothed outlets are really paying off; no cylinder rises above 400 degrees F, and the oil temperature stays around 210 degrees F. While we pay close attention to engine management, the Cessna obliges by asking for no great amount of effort to keep on speed and heading. Stuber's 414 exhibits the kind of solidity that you'd expect from an airplane of this weight and size.

We climb to 17,500 feet for the first cruise-performance check. Allmon suggests that I shoot for 75-percent power, using 30 inches and 2,450 rpm; our density altitude is nearly 20,000 feet. Leaned as per RAM recommendations, each engine chugs down 20.7 gph. All other temps come down nicely—375 degrees F on CHT and 190 degrees F oil temp. All told, these engines show no obvious signs that they're cranking along at about 81 percent of their originally certified maximum of 310 hp. True airspeed settles on 219 knots. Want to save some fuel? Try 65-percent power at this same altitude for 18.5 gph per engine and 209 KTAS; 55 percent yields 189 KTAS on just under 16 gph per side. RAM is pretty conservative with its leaning procedures. For 75 percent, it's 100 degrees F rich of peak exhaust-gas temperature (EGT); for 65 percent, 75 rich of peak; and 55 percent calls for 50 rich of peak. RAM's gauges measure EGT at the collector of three cylinders, not true turbine-inlet temperature.

The RAM-converted 414A turns in excellent performance—how's 235 KTAS at FL250 for you?

With Stuber looking on and Allmon itching to show off the 414's high-altitude prowess, we set out for FL250, reaching it at an average of 800 fpm from 17,500 feet. Maximum cruise at 75 percent works out to 235 KTAS on the same 20.7 gph per side. Pulled back to 65 percent, the Series VII still manages 219 KTAS on 18 gph per engine. Moreover, the airplane feels as stable and solid at FL250—actual density altitude near 29,000 feet—as at lower altitudes. Allmon suggests that the winglets really begin to shine in the flight levels.

Stuber opted for hydraulically actuated spoilers, and they really help with those long descents from altitude. Boards out and 165 knots indicated, the airplane comes down at better than 2,000 fpm at a 65-percent cruise power setting. All engine temperatures fall slightly, then remain stable. The pressurization system is kind to our ears.

By the time we get sequenced to land at Phoenix Sky Harbor, Stuber is alight in anticipation of actually getting to fly his new toy, er, tool. He's been taking notes while listening carefully to Allmon's operational suggestions. Maneuvering for landing behind the usual string of kerosene-burners, it strikes me that, for all the added power—some 50 hp over stock—and layer upon layer of modifications, this 414 is not only docile and predictable, but even more flexible and accommodating than the stock machine. And those engines, despite being asked to produce a tremendous amount of power for the displacement—these are 520s, remember, not 550s—show nothing but polished behavior. Time will tell, of course, if they make their 1,600-hour TBO in Stuber's airplane.

In the time since our flight, Stuber's put on more than 200 hours, completely trouble-free, he says. Finally, then, the hard question for Stuber: Is this airplane worth the money? "Absolutely, no question. This airplane has been an ego trip, a delight to fly, and an unmatched business tool. I couldn't make the schedules I do without it. I'm only sorry that I didn't do this sooner." □

For more information, contact RAM Aircraft Corporation, 7505 Airport Drive, Waco Regional Airport, Waco, Texas 76708; telephone 817/752-8381.

Cessna 414 Used Aircraft Report

BUYING BEFORE EXTINCTION

Still enjoying the high life after 26 years?

BY PETER A. BEDELL

Cessna's 414 is among a large group of aircraft headed for extinction. Even with the company is getting its feet wet in piston products again, there are no immediate plans to make any cabin-class piston twins to replace those being retired. In response, the market for these airplanes is quite active and the prices are high.

In the 1970s, Cessna offered everything from light owner-flown twins to 270-knot kerosene-burning executive transports. The company alone offered nine choices in new cabin-class piston twins. At one time, it seemed that there were so many names (Titan, Businessliner, Golden Eagle) and numbers (404, 402, 421) that people were easily confused unless they regularly kept their noses in the trade magazines.

Although Cessna built nearly every iteration possible between the two models, it was the top-of-the-line 421 Golden Eagle and the comparatively stripped 402 Businessliner that accounted for more than half of all 400-series piston sales. The 402 has become the workhorse of the short-haul airlines and air-tour operators in real life and on the NBC television show *Wings*. The 421, on the other hand, is a higher-powered (375 horsepower a side) and pressurized version of the same airframe preferred by many corporations for its cabin-class comfort and load-hauling capability over longer distances. Between them lies the model 414. It utilizes the 421's pressurized fuselage but is powered by nongeared Continental TSIO-520s similar to those used in the 402 and identical to those that powered the smaller 340.

Earlier 414s are easily recognizable by their tip tanks and stubbier nose. In 1976, Cessna redesigned the 400 series, beginning with its best seller, the 421. A new bonded wet wing replaced the riveted tip-tanked wing. When the changes trickled to the 414 in 1978, it was renamed the 414A Chancellor. The resulting airplane had a wingspan that was 4.5 feet longer and a nose stretched nearly 3 feet. Fuel capacity reached 206 usable gallons, and the operation of the fuel system was made far simpler with an On/Off/Crossfeed valve for each engine. Previous 414s had as many as six tanks and made for hair-pulling fuel management for the newcomer.

Continental's TSIO-520-J powered the original 414s, while the TSIO-520-Ns pulled the 414A. Both models were rated at 310 hp at 2,700 rpm. Since most pressurized/turbocharged airplanes spend their useful life in the less-than-perfect environment of the flight levels, the 414's engines have had their share of problems. These engines can be very temperamental and do not take kindly to abrupt throttle movements or casually monitored engine operations. The engines began life with a TBO of 1,400 hours, which was later extended to 1,600 hours; but, according to many owners, the 1,400-hour figure is a more accurate estimate of the engine's lifespan.

1976 Cessna 414

1978 Cessna 414A

Airworthiness directives are limited mostly to the engines, and those tagged to the airframe should have been complied with by now. Given the airplane's average of logging 200 or more flight hours per year, aircraft owners should have complied with most of the engine ADs or service bulletins, such as those requiring replacement of crankshafts made via the airmelt process. Exhaust manifold clamps and elbows have a 100-hour inspection requirement, but improved parts can be obtained through RAM Aircraft Corporation. Finally, a

recent AD regarding recurrent inspections of McCauley three-blade propellers covers the 414 line.

Although the 414s have a huge cabin-class interior, the stock airplane has never been a tremendous load hauler. A typically equipped 414A has a full-fuel payload of about 500 to 700 pounds, depending on equipment. Although you could fly for about 1,100 miles, you would be able to bring only two friends and a few bags. In a well-equipped airplane weighing in at 5,100 pounds, you could fill the cabin with six people and a little baggage and fly for about 2 hours with IFR reserves. It's because of this rather limited load-carrying ability that many operators opt for some modifications. RAM's winglet or vortex generator kits boost the maximum takeoff weight of a 414A by 300 to 355 pounds. The winglets are also supposed to give you a few knots at altitudes above Flight Level 200; but, in our observation, they exhibited little if any gains besides that of the gross weight increase. Other companies, such as Micro Aerodynamics and Robertson, also offer VG kits with gross weight increases. For the tip-tanked 414s, RAM offers a 415-pound increase through an engine/prop upgrade and the application of VGs.

The 414 won't be considered a spirited handler by any pilot. Control forces are heavy but rock solid—good for an IFR airplane. According to accident reports compiled by the AOPA Air Safety Foundation, there were 46 accidents involving 414s between 1983 and 1993. The pilot was responsible for almost every 414 accident, and weather was a common link in the accident chain. V_{MC} rollovers are conspicuous only by their absence. Despite the fact that the engines appear to be located far outboard on the wings, their relatively low power output—coupled with the airplane's huge rudder—helps to reduce the chance of a V_{MC} rollover. The addition of vortex generators eliminates V_{MC}, say the VG manufacturers. Many accidents that occurred after engine failures involved airplanes loaded far beyond the maximum gross weight and flown improperly with a failed engine (for example, with the gear and/or flaps down). Single-engine rate of climb is listed as 240 feet per minute for the 414 and 290 fpm for the 414A with the gear and flaps up.

Passengers will like the 414's large cabin, which offers far more room than do competitors like the Piper Aerostar and Beech Duke. In fact, it's the same fuselage as that used for the turboprop 425 (Conquest I). The only unfortunate part is that the stock 414s have more room than the useful load allows. The nose baggage and avionics bays of the long-snouted 414A are cavernous and can swallow skis, golf clubs, and lots of other ungainly cargo. The wing lockers are also useful for baggage and/or auxiliary fuel tanks, which are available from Tom's Aircraft in Long Beach, California.

To utilize the 414 to its potential, it needs to be flown high. True airspeeds down low are no better—in some cases worse—than many normally aspirated light twins, while fuel flow is much higher. Once above 12,000 feet, the 414's turbocharging begins to ratchet up the speed, and at FL 250, Cessna claims 224 knots at 75-percent power. Our test aircraft with RAM's winglets and VGs consistently trued at about 205 knots at FL 240 in warmer than standard air at 75-percent power. At 65 percent, TAS averaged about 195 knots. If you're lightly loaded and if ATC allows you to cruise at high altitudes, bladder-busting legs are possible—and they don't have to be

painful if the airplane has the optional potty in the back.

Currently, tip-tanked 1970 to 1977 414s are averaging $150,000 to $220,000, according to the *Aircraft Bluebook–Price Digest*. The 414A starts at an average of $290,000 for a 1978 model and reaches $455,000 for a 1985 airplane. Prices can vary greatly, depending on modifications and equipment. Because so many of the airplanes have been modified, it would be hard to find one that is still completely stock—and that's a good thing, considering the added usefulness of an airplane with a higher gross weight.

The Cessna Pressurized Twins Aircraft Operators Group serves as a source of information to its members through its quarterly magazine, *Charlie Papa Tango*, which contains maintenance and operation tips for owners and operators of 340s, 414s, and 421s. Another great benefit of owning a 414 is the availability of simulator training through FlightSafety International and SimCom Training Centers. Simulator training is extremely valuable in exploring hazardous operations without endangering yourself or your airplane.

Overall, the 414 is flexible. It can fly six people on a 2-hour trip in a comfortable pressurized cabin or it can fly two people some 1,200 miles. On the other hand, the big cabin results in an equally big speed penalty. Aerostars, Dukes, and the 58P Baron will outrun the 414, but the penalties are comfort and noise level. The availability of modifications is another reason buyers may prefer the 414 over some of its competitors. Handling, too, will never let you down, unlike some of the competitors with tainted reputations.

Hourly operating costs will easily reach into the $250 an hour range, so big expenses won't stop after the rather stiff acquisition costs of a late-model Chancellor. Market strength of the 414A was rated A+ by the *Bluebook*'s market analysis newsletter, *Marketline*, this past summer, and it's likely the result of a pent-up demand for piston cabin-class twins since production ceased. The time to buy may be now if the trend continues. □

1979 Cessna 414A Chancellor
Current market value: $315,000

Specifications

Powerplants	Continental TSIO-520-N(B)
Recommended TBO	1,600 hr
Length	36 ft 3 in
Height	11 ft 5 in
Wingspan	44 ft 2 in
Power loading	10.89 lb/hp
Empty weight	4,764 lb
Useful load	2,021 lb
Payload w/full fuel	797 lb
Max takeoff weight	6,750 lb
Max landing weight	6,750 lb
Zero fuel weight	6,515 lb
Fuel capacity, std	213.4 gal (204 gal usable) 1280.4 lb (1224 lb usable)

Performance

Takeoff distance, ground roll	2,185 ft
Takeoff distance over 50-ft obstacle	2,595 ft
Rate of climb, sea level	1,580 fpm
Single-engine ROC, sea level	290 fpm
Max level speed, 20,000 ft	239 kt
Cruise speed/endurance w/45-min rsv, std fuel (fuel consumption, ea engine)	
@ 75% power, best economy 24,500 ft	221 kt/5.37 hr (102 pph/17 gph)
Max operating altitude	30,000 ft
Landing distance over 50-ft obstacle	2,393 ft
Landing distance, ground roll	1,013 ft

Limiting and Recommended Airspeeds

V_{MC} (min control w/critical engine inop)	79 KIAS
V_A (design maneuvering)	145 KIAS
V_{LE} (max gear extended)	177 KIAS
V_{LO} (max gear operating)	177 KIAS
V_{SO} (stall, in landing configuration)	71 KIAS

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, sea level, gross weight conditions unless otherwise noted.