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## Engine & Propeller UPGRADES



### Centurion Celebration

Vitae Aviation's P210 Conversion

### Powerful Caravan

The XP42A from Blackhawk Modifications, Inc.

### Fast-Flying 206

Davis Aviation's IO-550 F Engine Installation

# Blackhawk Modifications' XP42A Caravan with **POWER**

By Bill Cox

The popular Cessna Caravan now has United States and EASA approval for Blackhawk's XP42A conversion.



**L**ike so many other pilots who make a living in the sky, I was introduced to turboprops in a Cessna Caravan. It was a new 1985 model, as I recall, one of the very first of the many, and I was hired to fly it halfway around the world from Florida to South Africa.

At the time, I'd flown a few jet fighters, so turbine engines weren't totally new to

me, but the Caravan proved to be exactly as billed – a Skyhawk on steroids. It was a big workhorse of an airplane with all the visual grace of a container ship, but it was easy to fly, durable, reliable, and willing to haul large loads of whatever you could stuff inside.

Back then, the 208 was the biggest general aviation airplane I'd flown, and I was dutifully impressed. You

boarded via a ladder, the Pratt & Whitney PT6A-114 out front delivered an impressive 600 shp, and there were as many as a dozen seats following behind in the passenger compartment.

Or not. The Caravan is perhaps most famous for its quick-change capability, converted to haul people, things, or a combination of the two with a minimum of reconfiguration.



## Specifications & Performance

### Blackhawk Modifications, Inc. Cessna Grand Caravan XP42A Conversion

All specs and performance numbers are drawn from official sources, often the aircraft flight manual or the manufacturer's web site. Other common sources of information include Jane's *All the World's Aircraft* and RVI Group's *Aircraft Bluebook Price Digest*.

#### SPECIFICATIONS

<b>Engine make/model:</b>	P&W PT6A-42A
<b>Shaft horsepower @ altitude:</b>	850 @ SL
<b>TBO-hours:</b>	3,600
<b>Fuel type:</b>	Jet
<b>Propeller:</b>	Hartzell, 4-blade, CS
<b>Landing gear type:</b>	Fixed/Tri
<b>Gross weight (lbs):</b>	9,062
<b>Standard empty weight (lbs):</b>	4,610 *
<b>Useful load-standard (lbs):</b>	4,452 *
<b>Usable fuel-standard (gal/lbs):</b>	332/2,224
<b>Payload-full fuel (lbs):</b>	2,228 *
<b>Wingspan (ft, in):</b>	52, 1
<b>Overall length (ft, in):</b>	41, 7
<b>Height (ft, in):</b>	15, 6
<b>Wing area (sq ft):</b>	280
<b>Wing loading (lbs/sq ft):</b>	32.4
<b>Power loading (lbs/hp):</b>	10.7
<b>Seating capacity:</b>	14
<b>Cabin width (in):</b>	62

#### PERFORMANCE

<b>Cruise speed (kts-max):</b>	191 *
<b>Fuel burn (gph-max crs):</b>	60 *
<b>Best rate of climb, SL (fpm):</b>	1,500 *
<b>Stall-V<sub>so</sub> (kts):</b>	61

\*=estimated

In my case, all the seats except the front two had been removed and shipped to Africa, and the airplane had been fitted with a quartet of 55-gallon drums for ferry fuel. In total, I had something like 550 gallons aboard, enough for 12 hours endurance, or about 1,800 nm of range.

I spent eight days with the big Caravan, hopping the Atlantic through the

Azores and Canaries, slicing across the Sahara to Ivory Coast, spanning the Gulf of Guinea to Gabon, then tracking straight south to Namibia and South Africa. It wasn't the quickest trip I've made, but I came to respect the Caravan as the ultimate hauler it is.

That particular airplane was scheduled for service as a photo safari transport, hauling tourists from Johannes-

burg and Pretoria to game camps in the Okavango Swamp region of Northern Botswana. The Caravan was/is the next best thing to a flying U-Haul truck, with a 62-inch-wide cabin, capable of enclosing 450 cubic feet of whatever you could imagine, plus loading doors everywhere, forward and aft, left and right cargo doors, one of them large enough to accommodate a fork lift.



As it turned out, I wasn't the only one who appreciated the Caravan's talents. Cessna truly struck gold with the 208. By 1990, the Wichita company upgraded power to an optional 675 shp (on the Grand Caravan), and, in 1998, the big engine became standard. In 2011, Cessna delivered its 2,000th Caravan, marketing the type in more than 100 countries. At an average new price of roughly \$1.2 million per copy over 25 years, that represents \$2.4 billion in sales.

Blackhawk Modifications, Inc. of Waco, Texas, acknowledged the Cessna 208 as one of the most successful utility transports in the world, but the company felt it could improve upon the basic airplane. The company made its name modifying a series of twin turboprops – Piper Cheyenne Is and IIs, Cessna Conquest Is, and Beech King Air 90s and 200s. All of these models used different dash numbers of the Pratt & Whitney of Canada PT6A turboprop engine, and these had proven relatively bullet-proof for nearly 50 years.

Blackhawk's premise was that when these airplanes reached TBO, and their owners were faced with major bills just to return the stock airplanes to service, perhaps they might be willing to spend a little more for a significant performance upgrade. The premise was correct. Blackhawk currently has nearly 250 conversions flying with upgraded P&W engines.

Blackhawk began work on its better-idea Caravan in 2008, replacing the standard Pratt & Whitney PT6A-114A turbine with a PT6A-42A, the latter developing 850 shp. This is essentially the same engine used in pairs on the ubiquitous Beech King Air B200, one of the most popular corporate turboprops above the planet. The -42A boasts a 3,600-hour TBO, and the PT6A engine generically has one of the best safety and reliability records of any turbine mill.

Though the original engine and the upgrade were both Pratt & Whitney turbines of similar design, Blackhawk's development process was anything but

simple. The company invested more than \$3.0 million researching what it called the XP42A package.

The Waco, Texas, company expended some 35,000 man hours in the development process. The R&D effort also included 210 flight test hours that involved 115 spins (which must have been interesting in such a big airplane). Blackhawk flew extensive icing tests with up to 5 inches of ice on the Caravan for a full hour.

As with most other Blackhawk mods, the Caravan engine conversion had several goals. Company president and CEO Jim Allmon explained that chief among them were improved climb, a quicker cruise speed, higher gross weight, and increased useful load.

"This wasn't just a bolt-on conversion," says Allmon. "In addition to replacing the engine, we modified or improved every major system from the firewall forward. The upgrade includes a new Hartzell 100-inch-diameter, four-blade propeller in place of the original 106-inch Hartzell three-blade unit. The



new prop develops lower tip speeds, so it has a slightly reduced noise level and greater ground clearance.

“Behind the prop, we mount a pair of Frakes clean-burning exhaust stacks in place of the original single stack. Under the cowl, there’s a 40-percent-larger oil cooler to help manage high/hot situations.

“Everything is enclosed with a new, lightweight, low-drag, carbon-composite cowling and induction system,” Allmon continues. “We also add a new, four-point, horse-collar, engine mount in place of the old three-point mount and a redesigned inertial separator for maximum protection from ice ingestion and foreign

object damage. New instrumentation and a hose package round out the complete engine upgrade.”

The company was granted its American STC in June of last year, and Blackhawk earned its European Aviation Safety Agency (EASA) approval in October.

Improvements in virtually all performance parameters were impressive. Most unpressurized aircraft do their best work in the 9,000-to-12,000-foot range, unless the crew is willing to breathe oxygen on every flight. Accordingly, Blackhawk performed extensive flight tests in the bottom 2-1/2 miles of sky, comparing the Blackhawk’s performance with that of the standard airplane.

Predictably, one of the primary beneficiaries of additional power was stronger climb. With the Caravan’s huge 280-square-foot wing and the conversion’s 25-percent increase in power, the Cessna 208 scores a climb rate that’s nearly double that of the stock airplane. During flight testing with the XP42A conversion installed, the Blackhawk-modded airplane managed a 12,000-foot climb in 12 minutes, burning 98 pounds of fuel, compared to 25 minutes and 160 pounds in the stock Caravan.

All other factors being equal (which rarely happens in the real world), adding 25 percent horsepower is virtually guaranteed to result in a

# XP42A

# CARAVAN

## Just how good is it?



Takeoff weight?  
*Over 9,000 lbs*

Cruise speed?  
*15% faster*

Rate of climb?  
*Double it*

Takeoff performance?  
*20-40% better*

### THE *XP42A* WILL IMPROVE YOUR OPERATION.

Lift more. Access shorter runways. Takeoff and land in high/hot conditions. Make and save more money. The industry's best Caravan performance solution is FAA-certified and ready to deliver.



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commensurate increase in fuel burn. Unless there's a dramatic reduction in specific fuel consumption, more power will always demand more fuel, and a 25-percent increase in shaft horsepower results in a proportionate increase in fuel burn. On the Blackhawk XP42A, that translates to about 55 gph at max cruise, compared to 45 gph on the stock airplane.

Once again, however, the Blackhawk modification provides some payback for the higher burn with faster cruise speed. Granted the benefit of an extra 175 shaft horsepower, the Blackhawk Cessna scores about 190 knots, compared to 160 knots on the stock Caravan (12,000 feet, ISA +20 degrees C, gross weight, max cruise power). That's 18-percent-better cruise in exchange for 25-percent-higher fuel burn. Pure power has never been the preferred method of increasing cruise, but the Blackhawk Caravan does very well, considering the airframe's sheer size and high drag coefficient.

Typical of turboprop engines, adding horsepower doesn't add substantially to empty weight, in this case, only about 60 pounds. Because the airplane picks up 312 pounds of gross weight in the upgrade, the net change is a 250-pound improvement in useful load.

The good news is that all of the delta translates to payload. Fuel remains the

original 332 gallons, or 2,224 pounds. Economy power (45 gph) allows you 6.0 hours endurance, plus reserve, between fuel stops.

Another obvious benefit of increasing power is improved takeoff performance. With reverse thrust and large brakes, Caravans have long been recognized as excellent short-field airplanes, able to sandwich into fairly small strips. The Blackhawk XP42A allows the 208 to leap back out of virtually any place it can drop into. Takeoff distances with the big engine are reduced by about 40 percent.

Cessna's 208 floatplane should make an especially good candidate for the Blackhawk upgrade, as water takeoffs can be challenging when conditions are hot and the load is heavy. With 850 shp under fist, the Blackhawk Caravan should leap up onto the step and lift off with a considerably shorter water run.

CEO Allmon says target production rate is three airplanes per month, and total down time shouldn't be more than two weeks for the conversion. To date, some 20 Caravan owners have signed up for the upgrade. Price has been set at \$605,000 (with a -114A core exchange), and warranty is 1,000 hours, with no calendar restrictions.

Jim McDonald, president of a major contracting business in Northern

California, recently had his Grand Caravan upgraded to the first of the Blackhawk XP42A engine conversions. McDonald also operates a number of cattle ranches, many with short dirt strips. In addition, the executive flies his Caravan back and forth to his private ranch strip near the San Joaquin Valley.

"I used a 206 for a while on the same trips, but the Caravan is a far superior airplane in all respects. If I drive from the office to my home ranch, it can take as much as two hours during rush hour," McDonald explains. "By flying, I can be at the ranch in about 15 minutes. My strip is fairly short, and the Blackhawk conversion provides the performance I need to get in and back out safely."

The CEO uses his airplane primarily for business, to inspect work sites and provide out-of-town estimates, plus he'll sometimes transport equipment. "I've been impressed with the improvements in performance," says McDonald. "Several years ago, I installed the Oasis interior, and that subtracted substantially from payload. Now, the Blackhawk conversion makes up for that, provides plenty of useful load, and even offers me about 25 knots more cruise, depending on altitude.

"As far as I'm concerned, the Blackhawk XP42A conversion is well worth the investment." <sup>CO</sup>

