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The Aviation Consumer

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CAN AUTOPILOTS RIDE THE WAVE OF FAA LENIENCY?

Andrew Barker, the CEO of autopilot manufacturer TruTrak Flight Systems, sure hopes so, and so do I. More on TruTrak in a minute. I started thinking about aging autopilot technology while getting beat up in IMC halfway across Lake Michigan on the way to this year's AirVenture at Oshkosh.

Much like low-cost EFIS and other gee-whiz technology that's been available in the non-certified aircraft market, pilots of experimentals have long enjoyed autopilot systems chockfull of advanced features. But with few exceptions, the retrofit autopilot market—and I'm talking about systems for modest entry-level Part 23 airplanes—has been stuck with systems carrying technology left over from the early 1990s, but with 2016 price tags. I'll be direct: While the S-Tec autopilot line (now offered by Genesis Aerosystems) has proven reliable, I think buyers expect more modern features than the venerable System 30 and System 55X (to name two popular systems) offer. Dropping five grand on old autopilot technology is one thing, but dropping 20 grand-plus is another. That's what even an entry-level S-Tec retrofit might cost and it makes little sense for much of the Skyhawk and Cherokee crowd. Enter TruTrak, a veteran in the experimental flight control market. It's working on an STC for its non-certified Vizion autopilot. Make no mistake, the Vizion isn't a bold clean-sheet system and it lives smack in the middle of TruTrak's product line. But it has several key safety features (in addition to the expected pitch, roll and nav tracking modes) that popular analog systems for the market's lower end don't have, including minimum and maximum airspeed mode, plus a "level" emergency mode for unusual attitude recovery.

Having been involved in TruTrak installations, I can vouch for the simplicity of the autopilot's servos, which were actually designed for the Virgin Atlantic Global Flyer project. Equipped with a disengage and slip clutch, plus a high-torque stepper motor, TruTrak servos don't rely on fancy digital software logic—a simplistic approach that TruTrak believes will contribute to safety in lower-end applications—but are tweaked to work in airplanes with heavier control loads than you might find in the experimental and LSA market. And safety and simplicity is the primary pitch when it comes to convincing the FAA that an experimental-category autopilot deserves an STC. Working with the EAA (Experimental Aircraft Association) on the certification effort, TruTrak's Andrew Barker hopes the recent success of experimental electronic attitude instrument STCs (achieved by both Dynon and Garmin) will trickle down to the autopilot world. I suspect it won't be as easy and neither does Barker.

"We're looking at that exact same pathway to certification because we have an FAA today that is interested in improving the safety record of the existing fleet of Part 23 aircraft," Barker told me as we sat behind the Vizion installed in a Cessna Skyhawk. Barker admits that earning an STC for his autopilot system will be far more challenging than it was for Dynon's EFIS D-10A STC, partly because of the installation specifics that tag along with an autopilot interface. That means AML (approved model list) certification likely won't be an option, which tacks on serious cost to the certification process. I suspect the company isn't swimming in excess certification money.

Barker hinted that integrated autopilots by both Dynon and Garmin had a sizable and detrimental impact on the sales of standalone systems like the Vizion. For that reason, breaking into the certificated market—even with minimal STC approvals—could be critical for TruTrak. With planned pricing of around $5000 (TruTrak is targeting a two-day installation effort) for an STC'd Vizion autopilot, time will tell if TruTrak can ride the wave of a more reasonable and logical FAA certification process without stumbling along the way. —*Larry Anglisano*

IN-EAR HEADSETS

I read with interest the Faro Air in-ear headset review in the August 2016 issue of *Aviation Consumer.* I thought I would share an experience with your readers.

I invested in a Clarity Aloft in-ear model a few years ago, but I returned the set after using it for 10 hours of flight time. My issue was ear discomfort, plus it offered fair noise reduction in the cabin of my Cirrus. I went back to my LightSpeed Zulu.

This year at AirVenture, Quiet Technologies caught my attention, so I got a demo of its $359 Halo in-ear model and bought one. Initially, the headset offered a good fit and promised to be quiet. When I started the engine, I immediately noticed low-frequency noise that isn't present in my Lightspeed. I reserved judgement until two hours in cruise flight at 11,000 feet.

The low-frequency noise reduction seemed fair, at best, the set has an excellent microphone and the entertainment audio quality from my onboard satellite system was just mediocre. Even after repositioning the buds, my ears hurt.

My conclusion is they offer good comfort in hot cabins, are lightweight and stylish, have a good price point, but just aren't up to ANR-like performance or comfort.

Ken Newman
via email

Your personal experience with the Halo and Clarity is solid proof that you just have to try them before buying them. This is true with any headset. Worth mentioning is that Quiet Technologies honors a 45-day return policy.

As for our Faro Air review, we need to disclose that the sample headset the company provided us was equipped with demonstration earbuds, which are slightly different than the ones it ships with regular orders. Faro shipped us replacement earbuds, we tried them and noted only marginally better noise reduction than we reported in the review.

BENDIXKING KX155 SUPPORT

I have owned a BendixKing KX165 navcomm radio for 16 years and replaced the display several times (at a cost of $250 to $400 per event). According to BendixKing, it has depleted the inventory of gas discharge displays and replacements aren't available.

The so-called fix is to modify the radio to accept a new LCD display, but at an astronomical price tag of over $2000.

There are 13 used KX165 radios on eBay and the average selling price is $1710, while the median is $1700. It seems this makes the repair exceed the value of the radio. These aren't orphaned units like the Narco MK12D in my panel. You can buy a brand new KX165 for $5500 today.

In my view, this is lousy support for a great product. Not all of us in aviation are made of money.

Bob Reed
via email

We chased this issue and learned that the vendor that supplies the KX155/165 display is gone. A fix won't be cheap, but you have the pricing wrong.

There are two options. The first is a field modification and replacement of the old gas discharge display with an LCD, or with an LED for the KX155A. The cost of the kit, which includes the display, a PC board and other small components is $1333. BendixKing told us the modification can be accomplished by a competent bench tech in a couple of hours. The new displays should last a long time.

This situation prompted BendixKing to create a KX155/165 factory refurbishment program. For $1750, you get a new display, a new bezel, knobs, display lenses and a one-year warranty.

MORE THOUGHTS ON ICON

I've been reading your recent Icon A5 coverage and think the aircraft is very appealing. There are some potential issues that might be important to anyone with the resources to afford a $300,000 recreational aircraft.

Can you give some examples of circumstances under which the owner might be obligated to indemnify Icon should it lose a lawsuit following an accident? Without liability insurance to protect the owner or operator, only exceptionally motivated individuals might be willing to accept unlimited financial responsibility for potential actions against the company.

Additionally, a common accident for amphibious aircraft is landing with the gear down while on water, with sometimes fatal consequences. Has Icon tested or simulated a gear-down water landing? It's going to happen in the real world.

Charles Curtis
via email

In its current revision, the Icon A5 purchase agreement sets out circumstances under which the owner may be required to indemnify Icon in the event of a lawsuit. Buyers should read it carefully.

As for water-landing mishaps, Icon didn't say whether gear-down landings on water were part of the test program for the A5. Moreover, we are not aware of any aircraft manufacturer that does gear-down water landing tests.

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Piper M600: More of Everything

Piper upgrades the Meridian with a new wing, more power and new avionics that delivers more speed, higher useful load and increased capability.

by Rick Durden and Larry Anglisano

In April of this year, Piper announced that its PA46 line of cabin-class singles would henceforth be referred to as the M-Class. While the Matrix would retain its name, the Mirage was becoming the M350 (for its 350-HP engine) and the Meridian was now the M500. Shortly afterward, it announced that its new, top-of-the-line M-Class machine, the M600 had completed FAA certification. It did so in almost unprecedented time—44 days—a tribute to engineering and flight test groups that did developmental testing with amazing thoroughness and FAA inspectors who went through the certification flight testing in a no-nonsense fashion.

The M600 uses the fuselage—with beef ups—and a higher-power version of the engine from the M500. The M600 also has a new wing—marketing claims it's a clean-sheet design—that carries 90 gallons more fuel than the Meridian, allowing the M600 50 percent more range, a 958-pound higher gross weight and 100 more pounds in the cabin with full fuel. The M600 is also Piper's first airplane to use the sophisticated Garmin G3000 avionics suite.

The single-engine turboprop market has long been broken into two halves: an extensive group of haulers such as the Cessna Caravan line, Pilatus PC-6 Turbo Porter and

AIRCRAFT FLIGHT TRIAL

PC-12, PAC P-750 and the Quest Kodiak; and a small selection of personal transport machines targeted at the owner-flown market, the Piper Meridian and Socata TBM line.

A NICHE TO BE FILLED

Until now, there was a sharp dichotomy in performance and load-carrying ability between the offerings in the single-engine turboprop personal transport world. The TBM line offers a 1700-NM range and speeds over 300 knots. With full fuel, the TBM 930 can carry 1300 pounds in the cabin. At the other end of the spectrum, the M500, as an outgrowth of the Malibu, suffers from the cruel physics of putting a turboprop on an airframe sized for piston power—by the time you stuff enough heavy jet fuel in it to satisfy the thirst of the turbine and go any distance, cabin payload is down to 500 pounds. Filling the seats means carrying just slightly more than an hour's worth of fuel.

That's not a criticism of the Meridian—the turboprop conversions of the Cessna 206, 207 and 210, Beech Bonanza and Piper Malibu/Mirage wrestle with the same problem. While not in the TBM's speed class, at max cruise the M500 whistles along at 260 knots. Pulling the power back and flying high can bump the range up to 1000 NM. Speed costs money: A new M500 is priced at $1.9 million while a TBM 930 starts at $4.1 million.

At $2.85 million, we think the new M600 fits nicely into the niche

CHECKLIST

- New wing carries enough fuel to bump range to more than 1400 NM.
- Higher gross weight allows filling the seats and flying 1000 NM.
- Garmin G3000 avionics suite includes upset protection features.

Garmin G3000 avionics suite, top, is more advanced than the G1000 used in other Piper models, including the M500. Cabin furnishings are of a quality to be expected in an aircraft of this sophistication, bottom.

between the Meridian and the TBM series. Max cruise is 274 knots. The new wing carries 260 gallons of jet fuel—bumping the NBAA range to 1484 NM. The cabin and pressure vessel is still that of the Malibu/Mirage/Meridian, however, the empennage has been beefed up to handle a Vmo of 250 KIAS, a speed that we think will allow the airplane to mix easily into the demands of crowded airspace.

Despite rumors, the new M600 wing is not recycled from the jet Piper was developing some years ago; it was designed specifically for the M600. It carries a radar pod incorporated into the leading edge, a lower drag configuration than slinging it under the wing. We were told that there was initial concern with adverse stall effects with a leading-edge mounted pod, but there proved to be none. We noted that the stall strips on the leading edge were symmetrical on each wing and when we did stalls, there was no sign of roll off at the break. The main gear is further aft than on the M500 and has a six-inch wider track.

There are easily removable fairings around the wing roots for fast maintenance access, a design we applaud.

We noted that the new wing maintained one of the smart features of the Meridian—the leading edge attaches to the fuselage forward of the pressure vessel, so the fuel lines remain outside of the pressure vessel on their way to the engine. That's an important crashworthiness consideration.

POWERPLANT

Power is provided by the same PT6A-42A engine used in the M500, although its output has been bumped from 500 to 600 SHP. Thermodynamically, it's rated to 1029 SHP, so it's loafing at 600 SHP—a good thing, we think, for longevity. TBO is 3600 hours.

For single-pilot operation, we like simple engine and fuel system operation—the M600 delivers both. Due to derating the engine, it doesn't need the ram effect of a big scoop. Instead, air arrives via two non-icing NACA ducts under the nose. That means no need for ice vanes, inertial separator or inlet de-icing.

The fuel system is either on or off—and automation corrects any imbalance that may develop in quantity between the tanks by turning on the appropriate pump. Annunciators keep the pilot in the loop.

The airplane is certified to 30,000 feet, however, in the absence of RVSM, the effective maximum altitude is FL280. Max cabin pressurization differential is 5.6 PSI, allowing for a cabin altitude of under 10,000 feet at FL280.

WEIGHT, PAYLOAD

The basic empty weight of the airplane we flew—one of the very first to be completed—was 3678 pounds. We were told that airplanes are coming off the line below that number, with the most recent weighing 3633 pounds. With a maximum ramp weight of 6050 pounds (takeoff weight is 6000 pounds), our airplane had a useful load of 2,372 pounds. With full fuel—1768 pounds—we could carry 604 pounds in the cabin. We think that's quite satisfactory in return for a range of nearly 1500 NM as airplanes in this class seem to be flown with only one or two people aboard. With the seats full of 170-pounders, the M600 still has a range of nearly 1000 NM, a huge step up from the M500. Maximum landing weight is 5800 pounds. Zero fuel weight is 4750 pounds, limiting cabin load to 1072 pounds, or six 170 pounders and 52 pounds of baggage.

The cabin is 49.5 inches wide and 47 inches tall with an overall length from the aft baggage bulkhead to the instrument panel of 148 inches. Baggage is carried in the pressure vessel; behind the rear seats. The baggage area is limited to 100 pounds. The rear seats fold forward, but stowing and retrieving heavy suitcases is challenging.

Cabin furnishings are what we expect in a cabin-class turboprop—leather seats and an overall excellent level of fit and finish. There were some eyebrow raisers such as pilot arm rests that seemed fragile and the

SELF-PRESERVATION AUTOMATION

A review of the accident reports of high-performance singles shows that ever since Bonanzas, 210s, Malibus and their even more capable turboprop siblings have been flying at speed, at altitude, they have been susceptible to catastrophic loss-of-control crashes and pilot incapacitation due to hypoxia. Getting a wing down due to a pilot's inattention or distraction has led to more than one diving spiral and in flight breakup because the clean airplanes will accelerate so quickly.

In addition, improperly programming the autopilot has brought more than one flight to grief as the airplane stalled or blew through Vmo.

The new M600 avionics suite made up of the Garmin G3000 and GFC 700 autopilot with enhanced Autopilot Flight Control System (AFCS) includes automation designed to break the chain of accidents that have dogged the world of slippery singles. The system includes a number of features that come into play whether the airplane is being hand flown or on autopilot.

Electronic Stability Protection (ESP) is designed to prevent the onset of diving spirals, stalls and loss of control generally when the airplane is being hand flown. Piper describes it as a "soft barrier to keep the Piper M600 inside the performance envelope by automatically engaging servos to slightly correct control surface positions when the aircraft exceeds one or more flight parameters."

During our flight review, any time we exceeded 30 degrees of bank, the system would nudge us back to that as a maximum bank angle. ESP can be disarmed temporarily for maneuvering if desired. It reminded us of a much more sophisticated version of the full-time wing leveler on Mooneys 40 years ago. We found that, as described, the further we took the airplane outside the bank and pitch parameters of the system, the more assertively it nudged, then shoved, the airplane back within them. We like what we saw—we've read far too many accident reports of in-flight breakups after a pilot lost control while hand flying and we think this is an excellent way of reducing that risk.

Prominently visible on the M600's panel is a blue "LVL" button (photo below). Pushing it engages automatic level mode which activates the flight director and autopilot, cancels all armed and active modes and returns the airplane to straight-and-level flight.

The automatic-level capability has been offered on other aircraft—we like it for its ability for a pilot to use automation to fix things when he hasn't been able to—possibly due to spatial disorientation—and for a passenger to get things under control should the pilot become incapacitated. If nothing else, it should provide peace of mind for passengers knowing it's there.

The M600's system will also act to recognize hypoxia and take action if the pilot fails to respond. If the cabin altitude reaches 14,900 feet, the system issues a warning and demands that the pilot take some action in response. If the pilot does not respond, the autopilot flies the airplane to progressively lower altitudes and continues to try to get the pilot to respond.

The autopilot also has automatic overspeed and underspeed protection. If the pilot commands a pitch attitude that will take the airplane through Vmo, the autopilot will hold Vmo and no faster. Should the nose-up pitch attitude be commanded that will stall the airplane, the autopilot will keep the airplane at a speed slightly above stall. The underspeed protection allows the autopilot to remain coupled when flying a go-around.

use of what appeared to be plastic in various areas of the flight deck. We were glad to see a liberal approach to installing USB ports—we counted six, all in locations that are designed to minimize cable run.

Getting to the cockpit and seated takes some doing as the cabin is small and there is a step-over at the entrance. Seating is cramped for anyone over six feet tall.

Evidently because of space considerations, the power lever quadrant is set low, so the controls don't fall as easily to hand as in other aircraft in the class. Making small power adjustments requires initially figuring out a way to brace your hand to do so. We noted that once a hand position is worked out, small power changes are easy to make—there is no twitchiness or non-linear power lever response that we've noted in some other turboprops.

The restraint system is three point; adequate, in our view. However, from a crashworthiness standpoint—especially in a cockpit with so little flail space—we'd prefer to see a four- or five-point system.

While Piper did an excellent job in crashworthy design by keeping fuel out of the pressure vessel, we think it erred when it chose an overhead panel for a number of switches. It blocks the view during a steep descent, the markings are difficult to read for the bifocal set and it's positioned so that its supporting structure and the switches have a potential to cause head injury in a sudden stop. Even with the large screens for the Garmin G3000 system, we think there is room to put the overhead switches on the panel.

FLYING IT

Start up is standard PT6—turn it, wait a moment, introduce fuel and monitor. The Garmin G3000 system boots up rapidly and the pretakeoff checklist can be displayed on one of the screens. Taxiing reveals moderate rudder forces and solid control in turns. Residual thrust at idle is high enough that we taxied in Beta or reverse almost constantly. There is a squat switch on the nose gear that locks out Beta and reverse in flight—an important safety feature, we think, that should be on all turboprops as intentional reversing on approach to landing has caused a

New wing includes a radome on the leading edge, top photo. Non-icing NACA engine air inlets flank the oil cooler inlet, bottom photo.

number of accidents over the years.

There are two flap positions, takeoff and approach—15 degrees—and full—35 degrees. On takeoff, setting power lever movement and engine response was linear and predictable, so setting max torque, 1575 pounds, was not difficult even the first time. Loaded to near gross, acceleration was impressive.

Yaw control authority proved to be so effective that there was an initial tendency to over control, which was magnified on landing rollout when reverse was selected. Eighty five knots is the speed for raising the nose and only minimal pressure was required, although significant forward pressure was needed almost immediately as the gear and flaps came up. We suspect that the takeoff trim position is set to minimize the control force at rotation due to the more aft placement of the gear. The forward pressure required as the airplane is cleaned up adds slightly to the workload for a few moments after liftoff. There is pitch change associated with flap position change and gear retraction or extension.

HANDLING

Vy is 122 knots, which generates a nose attitude that blocks all forward view. In a nose-lower cruise climb to 17,500 feet, the rate stayed nearly constant at between 1700 and 1800 FPM. Handling was moderately heavy in all axes—comparable to other airplanes in its class, with no noticeable breakout force or lag. The controls are well harmonized and responsive enough that you find yourself throwing the airplane around a bit simply because you can.

Slow flight was almost too easy—the airplane holds trim speed well and small power changes are easy to make. The long nose is an excellent reference for setting pitch attitudes and helps make steep turns simple.

Not surprisingly—with 600 HP up front—you need rudder inputs with power changes, although less than we'd expected. The rudder trim is electric and needed after most power changes.

Stalls involved considerable warning, including so much buffet and control yoke pulsing that we asked test pilot Craig Masters if the airplane had a stick shaker (it doesn't). The break is abrupt, with the nose dropping cleanly with no roll off. Reducing back pressure resulted in the airplane returning to controlled flight immediately.

Masters told us that Piper test pilots had performed more than 1000 spins in the M600 during the flight test program—essentially throughout its weight, balance and altitude envelope. To assure it would always recover within one turn after a one-turn spin, a small strake was placed in front of the horizontal stabilizer.

In cruise at 17,500, we saw 256 KTAS with a fuel flow of 330 PPH on an ISA plus 15 degree day. That matched closely with the numbers in the POH. Taking the M600 to its Vmo of 250 KIAS in the descent was a non-event.

In the pattern we found the combination of a long nose for pitch reference, solid handling and smooth power lever response meant that approaches could be flown precisely with little effort. Max gear speed is 168 knots, so some planning is required to slow down after a descent at 250 knots. Approach flaps can come out at 147 knots and full flaps can be dropped at 112 knots.

Coming over the numbers at 85 knots while bringing the power to idle and flaring slightly resulted in smooth, nose-high touchdowns. The nose must be on the ground to go into Beta or reverse on rollout.

CONCLUSION

We like what we see in the M600—it has the additional speed, range and payload needed to fill the hole between the M500 and TBM series; the most sophisticated avionics suite and safety automation available in a single-engine turboprop and it's just plain fun to fly. When it was introduced, we frankly expected the price to be slightly higher due to the capabilities and equipment. We also like the warranties offered: Five years on the airframe and avionics and seven years or 2500 hours on the engine.

GARMIN G3000: FLIGHT LEVELS ABOVE G1000

For those who lost track of the OEM avionics market for turboprops and light jets, Garmin's G3000 may seem like a new system, but it was actually unveiled at the NBAA convention way back in 2009. The system isn't limited to Piper's M600. You'll find the G3000 in Daher's TBM930 turboprop single, in Cessna CJ+ series jets and in the Cirrus Vision Jet, currently undergoing certification. There are more applications coming. Textron announced that the G3000 will be in the front office of the Cessna Denali turboprop single. This raises the question: Is the G3000 the replacement for the aging G1000? Garmin says it is not, but it sure looks to have a sizable presence in the lower end of the Part 23 turbine market, a space that was partially occupied by various versions of the G1000.

The G3000 was designed out of the gate as a three-screen touch suite (two PFDs and one MFD, with full reversionary backup), presumably answering the call for something a bit more modern for aircraft with multi-million dollar price tags. For certain, the G3000 suite has an unmistakable big-airplane feel, even when its big screens are powered down. Each of those three landscape-configured screens measure 14.1 inches diagonally (with a 16:9 width-to-height ratio), which is considerably larger than the screens in a G1000 suite. Screen resolution, at 1280 by 800 pixels, is notably better than the G1000.

But what really sets the G3000 apart from the G1000 is the user interface. Two icon-driven GTC570 touchscreen controllers, which are mounted just forward of the throttle quadrant (designated as GTC 1 and GTC 2), serve as primary flight management systems and handle nearly all major pilot inputs. The touchscreen uses a grid of infrared beams to determine the location of the touch, even when the operator is wearing gloves. There is no pressing a screen button and waiting for a response. This makes entering data and hopping through menus an efficient chore, the way it has to be in an airplane of this category. The downside, though, is that objects or debris on the touchscreen can interfere with the infrared beams and cause unintended activation of buttons. Still, we found that the controllers worked flawlessly during our M600 flight trial. On-screen buttons are activated by lightly touching them with a finger and then releasing. It is not necessary to apply pressure, as the infrared touchscreen surface detects only the presence and movement of the finger, not pressure. When touched, the button background is highlighted in blue until the finger is released.

Better yet, if enabled, an aural "click" sound is also issued to confirm the button has been touched. If a touch input was rejected, you'll hear an aural "doink".

If you are even remotely familiar with Garmin's GTN retrofit navigators, the menu structure of the GTC will be comforting and intuitive. The touchscreen controller's functions are arranged by screen. For example, each page has a title at the top of the screen area, while the contents of each screen change dynamically in response to pilot or system input. Get lost in a menu when the workload gets high, and the Home screen can be used to bail you out. The Home option is always available in the "button bar" in the lower portion of the screen. The button bar also has a Back and Cancel icon, to return to the previous screen. When a window contains more information than it can currently show, a scroll bar and scroll buttons appear so you can easily get to the rest of it.

The touch controllers also have joysticks and knobs, which are context sensitive. The large and small right knobs are used for radio tuning and selection, frequency transfer and data entry. For example, turning the large right knob tunes the selected radio frequency in MHz increments; the small right knob adjusts the frequency in KHz increments, just as you expect it would. Push the small right knob momentarily to change the selected COM radio source (COM 1 or COM 2) for tuning. Push and hold the small right knob for 1.5 seconds to transfer the frequency to the active window. The middle knob is used to increase or decrease the selected audio source volume, as displayed at the top of the screen.

The joystick is turned to increase or decrease map range, or to increase or decrease detail on certain system displays. Pushing the joystick in activates the map pointer for panning across the big screens. Since the M600 is equipped with Garmin's digital weather radar, the joystick calls up the weather radar controls when the radar pane is active.

Speaking of panes, the touch controllers are integral in selecting and controlling display panes on the PFD and MFD screens, among other configuration chores. For example, GTC 1 controls the outboard display pane location on the pilot's PFD and the left display pane location on the MFD (when the MFD is in split screen mode). GTC 2 controls the outboard display pane location of the copilot's PFD and the right display pane area of the MFD. The lower photo to the right shows the pilot's PFD with the outboard pane active, displaying map data. And yes, that's an Aspen Evolution PFD for backing up the primary data. A navigation map isn't the only available pane for split-screen configuration. There is a dedicated pane for charts, datalink weather, traffic and TAWS-B terrain. The system automatically stores various settings and selections within crew profiles. These include a wide range of parameters for both the pilot and copilot including map settings, avionics settings, PFD settings, user waypoints and weight and balance information.

As for data entry (waypoint identifiers and minimum descent altitudes, to name two), you can use the virtual alphanumeric keypad on the touchscreen controller or the knobs. Whether you prefer twisting knobs or fingering the touchscreen, you'll appreciate not having to reach up to a display to enter data. We sure did, especially in turbulence. There are soft keys at the bottom of each display for making adjustments to the map, turning bits of data on and off and for acknowledging messages. But for the most part, most of your time is spent on the touch controllers—which in the M600, seem perfectly placed.

The cabin pressurization system controls and switches are located on the left instrument panel and the pressurization system displays are incorporated into MFD. The only action required by the pilot during normal operation is to input the destination airport elevation by entering a flight plan. You can also access the System page and manually enter the field elevation in the DEST ELV field.

The G3000 has dual Integrated Avionics Units, or IAUs. Each IAU contains a WAAS GPS receiver—GPS 1 and GPS 2. GPS 1 provides information to the pilot's PFD and GPS 2 provides data to the copilot's PFD. Internal system checking is performed to ensure both GPS receivers are providing accurate data to the PFDs. In some circumstances, both GPS receivers may be providing accurate data, but one receiver may be providing a better GPS solution than the other receiver. In this case the GPS receiver producing the better solution will be automatically coupled to both PFDs.

As you would expect, the G3000 has Garmin's SVT synthetic vision, with a 71-degree horizontal view when the PFD is in full-screen mode and 50 degrees when in split mode. The SVT also incorporates TAWS-B terrain data and alerting, shown in red and yellow shading on the PFD. TAWS-B is optional in the M600, since it only has six seats, skating the TAWS mandate.

The G3000 incorporates all engine display data (engine indication system or EIS), plus the CAS (crew alerting system). When a new CAS message is issued, the MSG icon at the top left of the PFD flashes. Press the MSG button on the touchscreen controller to address it. We found the EIS to be intuitive at a glance, with engine data presented using onscreen gauges and digital displays. During normal operating conditions, gauge pointers and display text appear in green. When unsafe operating conditions occur, gauge pointers and the display change color to indicate caution (amber) or warning (red). Perhaps one of the most important, the PT6A's torque gauge, will change to red and the numerical and text displays flash red if the torque setting exceeds the safe operating range. Get too aggressive with the power lever on takeoff and you'll know about it.

Finally, as we covered earlier, the Garmin GFC700 flight control system, pictured above, is an integral part of flying the airplane. As in other GFC-equipped airplanes, the system in the M600 has a dedicated control panel, which is located above the MFD and is easily accessible to both pilots.

Plan on substantial studying before going it alone with the G3000. We read the 600-plus page manual before flying the M600 (and have G1000 factory training), but we were grateful to have Piper's Craig Masters in the right seat to share the workload. As with most airplanes in this category, learning the avionics is a major part of the transition.

Medical Reform: Still Many Questions

While legislation to reform the Third Class medical is detailed and specific, some are worried that the FAA still has wiggle room in issuing final rules.

by Paul Bertorelli

The hackneyed aphorism about what happens between cup and lip aptly describes the state of the recently passed Third Class medical exemption. Signed into law in July amidst much cheering by industry groups, the proposed new medical rule lacks just one thing: Certainty, especially for pilots who currently have special issuances.

While the bill's author, Sen. Jim Inhofe, made the law's language as specific as possible to favor minimal FAA intervention, the agency may still have room to add conditions and requirements in the final rule it's required to publish within 180 days of enactment. "The fact is, we just don't know what the FAA will do," one senior AME told us in late July. Nonetheless, the bill's language and intent are clear and even those worried about FAA fiddling in the margins believe it will still benefit thousands of pilots who otherwise couldn't pass medical certification or who worry that they would be disqualified as they suffer age-related conditions.

HARD FOUGHT

Officially called the Third Class Medical Reform and General Aviation Pilot Protections, the bill finally oozed through Congress as part of a continuing resolution to fund the FAA. That improved its chances of passage, but it also required dropping some provisions that would have essentially all but eliminated any kind of medical certification for pilots who now require a Third Class medical. President Obama signed the measure into law on July 15, which sets the clock ticking on a 10-year look back on medical eligibility. The sidebar on the opposite page details the provisions. Regardless of how the FAA implements this reform, the new rules apply only to pilots who heretofore required a Third Class medical; higher medical requirements remain unaffected.

In an effort to hold the FAA's feet to the fire, the bill requires the agency to issue final rules within 180 days of enactment. If it fails to do that within one year, pilots who have made a good-faith effort to meet the spirit of the legislation can fly operations that would otherwise require a Third Class without fear of enforcement action from the FAA. This was a Congressional attempt to address a chronic pattern with many government agencies, especially the FAA. It often fails to meet Congressionally imposed deadlines yet suffers no consequences.

COMPROMISES

The original goal had been to reform the Third Class to the equivalent of the sport pilot requirement. Specifically, that means any pilot with a driver's license and a self-affirmation of no debilitating medical conditions could fly not just a light

The days of sweating through a Third Class medical just to retain flying privileges may finally be coming to an end. (Photo Nyul/Dreamstime.)

CHECKLIST

- For pilots with routine issuances, Third Class exemption is a win-win.
- Thousands of pilots on the sidelines may be encouraged back into aviation.
- Special issuance details remain cloudy. FAA still may have wiggle room on final rules.

sport airplane, but any certified airplane in non-hire operations. This proved politically unpalatable for now. But will we ever reach driver's-license nirvana?

"Based on how this process went, I do not see that happening. I was just amazed at the opposition to not having some proof that an individual is physically fit," says EAA Chairman Jack Pelton. Despite more than a decade of data showing that light sport pilots, who don't require formal medicals, have no higher incidence of inflight medical incapacitation than pilots who do, Congress wouldn't budge.

"As far as I can remember, the data was never discussed. We ran into some very strong opposition. Sen. Nelson from Florida, for example, was adamant that he would never go along with no professional medical involvement in a pilot's ability to fly," Pelton added. He wasn't alone and the bill had to be watered down to appease such opposition, even though it's based entirely on political optics.

According to AOPA's legislative VP, Jim Coon, this resulted in a last-minute addition that may or may not prove problematical for some pilots. The legislation requires the FAA to provide a checklist to physicians performing periodic examinations of pilots.

Although the FAA has no direct involvement in these nor does it review them, the checklist requires the physician to sign a document certifying that the pilot is fit to operate aircraft and vehicles. The checklist has to be retained with the pilot's logbook.

Aviation liability and medical malpractice being what it is, there's legitimate concern that some doctors won't sign the checklist. "We've spoken to physicians about this and some have told us they wouldn't have any trouble signing it and others have told us they would never sign it. That's something we're going to have to work on, educating pilots and educating doctors," Coon told us. The reality? No one really knows if there are enough doctors to sign off the new forms such that the exemption will be less onerous than just getting a Third Class medical.

When we asked if AMEs currently have similar liability exposure, we were told that they don't. That's because AME's merely do the examinations and submit the documentation; the FAA actually certifies the airman as fit to fly.

THIRD CLASS EXEMPTION AT A GLANCE

As it was signed into law on July 15th, if you had an FAA medical of any class within 10 years of the enactment date, you qualify for the Third Class exemption.

Depending on how the FAA constructs the final rules, you will have to visit a physician once every four years. This can be an AME, but can also be a state-licensed physician of any kind.

You'll bring with you an FAA-generated checklist of medical items that the doctor will be required to check. This will include checks of the eyes, head and neck, vascular system, lungs, ears, blood pressure and pulse, to name a few.

However, unlike in the past, the FAA will *not* necessarily specify values or conditions for the examination, but the doctor will have to sign the checklist attesting to your basic fitness to fly an airplane or operate a vehicle.

The checklist won't be sent to the FAA, nor will the FAA retain records of any kind. You will be required to retain the signed checklist as part of your pilot log, just as you are required to log items proving currency.

Every two years, you will also need to take an as-yet-to-be developed online training session on aeromedical factors related to aircraft operation. When the course is administered, you'll be required to provide the FAA with similar data now collected on the standard medical form, including a waiver for a review of the National Driver Register to check for DUIs and other infractions.

The online course will generate a certificate of completion, which also must be kept with your logbook. You'll also have to electronically sign the form attesting that you have no known conditions that would impair safe operation of an aircraft.

WHAT ABOUT SPECIALS?

The law's impact on pilots with no disqualifying conditions seems straightforward. But what about those who currently have conditions that require special issuance, such as coronary conditions, diabetes or who take disqualifying drugs?

The new law specifically identifies only three medical conditions that will require a one-time, special issuance: Certain cardiac, neurological or mental health conditions. Pilots who have had medicals revoked, suspended or denied can apply for a new certificate to operate under the new rules. If that sounds like a reprieve for pilots who've left aviation for medical reasons, it appears to be just that. But is it really?

"None of us know exactly what the FAA will do," says Dr. Ian Blair Fries, a veteran senior AME who specializes in special issuance medicals. "The law is very specific on how you can use this exemption and how the exemption will be obtained. The issues that have not been resolved are how this will affect pilots who have a potentially disqualifying condition. We don't know how the FAA is going to handle this and that's the part I'm not willing to guess about," Fries added.

He also declines to conjecture whether the FAA will twiddle with the basic rule for pilots who don't have disqualifying conditions. Does the agency have room to massage the language counter to the bill's intent?

"Certainly, they could try. I'm hopeful that's not going to be the tack they'll take on this," says AOPA's Coon. "The assurance that we need to compound upon the FAA is that they follow through on the intent," he adds.

WINNERS AND LOSERS

Third Class medical reform has been touted as a potential savior for GA, but what will the real impact be? No one is certain, but Coon said some 240,000 pilots have ac

EAA's Jack Pelton: "I was just amazed at the opposition to not having some proof that an individual is physically fit."

tive Third Class certificates and all of them will be eligible to benefit from this reform. Does that mean that pilots who would otherwise exit aviation will now hang in for a few more years? That's the hope. "We don't have any data on how many pilots are on the sidelines, but there's every reason to believe there are thousands," says Coon.

"I think it's a big help in the 'stave off' category because they'll see that as some relief," says EAA's Pelton. "It does absolutely nothing for new people coming into aviation because they'll still have to get a one-time Third Class as a student," he adds.

Will the reform decimate the AME network? Everyone we spoke to said there will clearly be fewer Third Class examinations conducted, but a survey we did in our sister publication, avweb.com, revealed that about 25 percent of pilots said they would continue to undergo standard medical certification.

"I don't see [AME ranks] changing. You've still got all the Second Class on up category of people that still need the service and I have a lot of friends who said they were going to do a Third Class every four years," Pelton told us.

When medical reform first emerged as a talking point five years ago, it was almost universally assumed that elimination of the Third Class would decimate the emerging light sport aircraft industry. The theory, supported by sales history of some manufacturers, was that LSA was being sustained by pilots who were aging out of flying certified aircraft because of medical concerns. But that was then, this is now.

"People who were going to buy LSA probably made that decision four or five years ago when this serious discussion started. And these buyers have already taken themselves out of the market," says Dan Johnson, head of the Light Aircraft Manufacturers Association. LSA manufacturers we spoke to confirmed this, saying the real effect of medical reform on sales has long since passed.

AME Ian Fries: "Issues that have not been resolved are how this will affect pilots who have a potentially disqualifying condition. We don't know how the FAA is going to handle this."

"It will keep some people who might otherwise consider going into light sport aircraft from doing so. But I don't think our buyers are looking at a CTLS and, say, a 1983 Cessna, and juggling the two. Generally, we catch people on the way up to a Cirrus or on the way back down from one," says Tom Peghiny, whose Flight Design USA is the leading seller of light sport aircraft in the U.S. Darin Hart of American Legend told us he had observed the same trend. Buyers who once spoke of LSA as a lifeboat to extend an aviation career aren't saying that much anymore.

While medical liability for non-AME docs is a concern, the impact on the insurance markets remains an unknown, but appears unlikely to be a thing. Our insurance expert, Jon Doolittle, checked with nine insurers, five of whom said the new medical rules won't change the way they assess pilots as risks. Two companies weren't sure what they would do, but only one said it would continue to require Third Class medicals. We suspect insurers know what politicians do not: The actuarial data shows that medical incapacitation is a negligible factor in accidents and thus represents little meaningful risk.

RECOMMENDATIONS

We're not sure we can advise pilots on what to do about medical certification before the final rules are released. If you've had a recent special issuance with a one-year limitation, hope that the FAA will have final rules published within a year and you'll never need to see an AME again.

If your Third Class is a routine issuance with a 24- or 36-month period and won't expire before the FAA's July, 2017 deadline, congratulations. You're in the best of all worlds. Just wait patiently to see what transpires. We'll revisit this topic when the FAA issues its medical rules, hopefully next year.

Need An Avionics Loan? Ask Nexa Capital

But don't expect a rock-bottom interest rate. You'll need an exceptional credit rating but you won't have to mortgage the aircraft.

by Larry Anglisano

Some major avionics manufacturers, including Aspen Avionics and L-3, are advertising avionics loan options through an outside lending partner that specializes in funding large avionics improvements. Some have created discounted packages, based on loan products.

Need a cool 25 grand to pull the trigger on a retrofit? The claim: simply fill out an online application, get quick approval and the shop automatically gets paid and started on your dream panel. But is it really that easy? How does an avionics loan differ from traditional aircraft financing? And what ever happened to those government-backed private equity loans that were supposed to help fund a big majority of ADS-B upgrades?

To answer those questions, we did some digging. Here's what we learned.

FED-BACKED LOANS

First, some background. It wasn't long ago that a full-up mandate-compliant ADS-B upgrade might require an investment nearing $6000 or more. This sent owners into a frenzy wondering how the heck they'll pay for the force-fed government mandate. For some, it's time to hang it up.

Fortunately, brisk competition among avionics manufacturers and better technology has kicked that number down as low as $4000, for some basic upgrades. That's a price point that might be easily covered with a credit card—or in a good year of ownership, available in the maintenance budget. But for aircraft that haven't seen an avionics upgrade in this century, even a modest retrofit to include a WAAS GPS navigator and all the trimmings will easily top $12,000—perhaps not including ADS-B or a working transponder. Then there are the owners who struggle with spending any money on an ADS-B upgrade. The Feds saw this coming.

CHECKLIST

- Nexa's third-party lenders understand the economics of avionics upgrades.
- NextGen GA Fund loans don't require a mortgage on the aircraft.
- With higher interest rates, you could shell out $2000-plus per month for large upgrades.

Flash back to 2012 and the FAA's reauthorization bill, which included a provision which authorized (but didn't require) the Department of Transportation to establish a loan guarantee program to presumably advance the equipage of GA airplanes for the FAA's maturing NextGen ADS-B program. Government loan guarantees are typically offered by other agencies (the Small Business Administration comes to mind) to help facilitate credit for businesses.

The NextGen GA Fund, which was initially put together by the private equity firm Nexa Capital Partners (also working with the Aircraft Electronics Association), in cooperation with the DOT, was supposed to be a way for owners to get their hands on private sector money for ADS-B projects (plus any other desired avionics improvements), under very simple terms and at low interest rates. It didn't require a lien or taking out a mortgage on the aircraft, plus it was said that loans could be processed in 24 hours. The avionics shop hands you a loan application and sends off a supporting quote for the work. Easy. So, what happened?

PROGRAM BACKFIRE

While Nexa Capital's lending program is still alive (its current lending product is called Jumpstart GA-IN), the original program didn't exactly turn out the way Nexa Capital and the AEA planned. According to

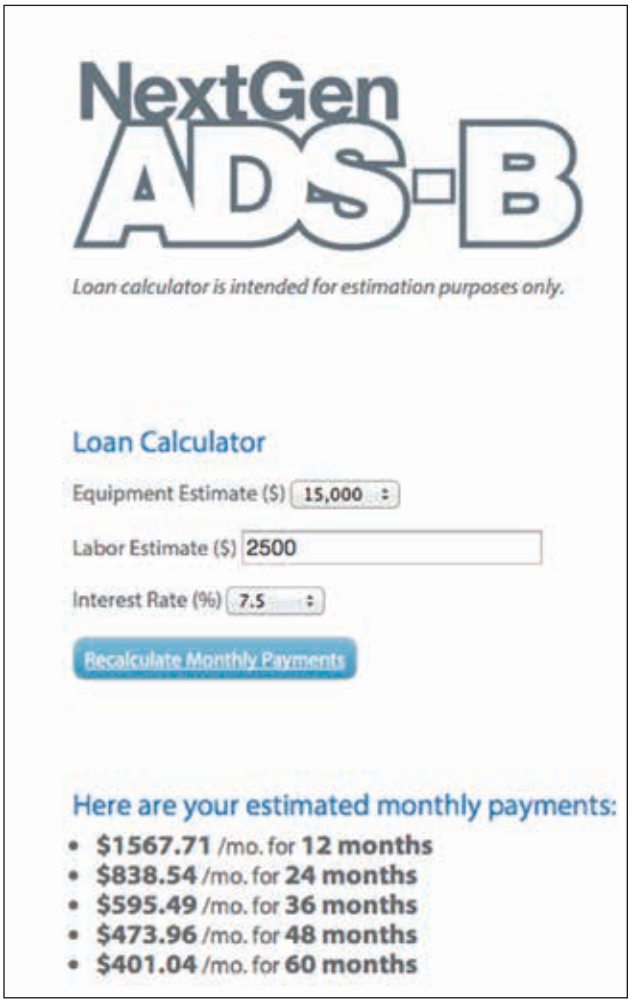
NextGen GA Fund understands why you are investing big in your little Skyhawk. Your local bank might not recognize the cost/value thing.

TYPICAL AVIONICS LOAN MONTHLY PAYMENT EXAMPLES	
Garmin GTN650 GPS, GDL88 ADS-B, Flight Stream wireless system Installed price: $18,800	$615
Avidyne IFD540 GPS, Aspen PFD and MFD, Avidyne SkyTrax200 ADS-B Installed price: $40,000	$1310
Garmin GTX345 ADS-B transponder, GMA350 audio panel Installed price: $9500	$360
Garmin GTN750 GPS, GTN650 GPS, G500 PFD, GTX345 ADS-B transponder Installed price: $58,000	$1900
BendixKing KSN770 GPS, KGX150 ADS-B Installed price: $19,000	$620
Garmin GNS430W (used), Stratus ESG ADS-B transponder Installed price: $10,500	$400
Monthly figures based on a 6-percent interest rate, 36-month terms and includes average installation labor costs of $110 per hour performed on a basic aircraft.	

Nexa's Jim Hughey, it was the DOT that essentially walked away from the idea, which would have created avionics-specific loans (using third-party private capital) with extremely favorable interest rates.

"The way we were going to offer such low interest rates was to work directly with the FAA for a win-win outcome. The aircraft owner gets attractive financing and the FAA gets more equipped aircraft for the NextGen program," Hughey told us.

That interest rate, according to Hughey, would have been better than any rate that's available on the commercial market—home equity and personal loans included. The other side of the program is convenience. Since this is an avionics-specific loan program (it doesn't include lending for maintenance and cosmetic upgrades), you don't have to explain to a loan officer why putting $25,000 worth of avionics in your $30,000 Skyhawk makes sense.



Where does the government come in? Essentially, Nexa—acting as a buffer—asked the DOT to step in and backstop this private sector capital, which could be had nearly interest free.

"We weren't asking the government to make and manage tens of thousands of loans, or even put the money up. We simply wanted them to be there so when we borrowed the money for re-lending, the DOT would guarantee our debt—essentially making us a rock-solid credit to our borrowers," Hughey said. Think of the DOT in the background as a silent partner.

It didn't turn out that way, and at a sizable hit to the interest rates that now tag along with the loan product. Hughey hinted that the DOT simply wasn't comfortable with Nexa lending money to anyone they wished, although he made it clear that the company has confidence in the creditworthiness and financial responsibility of aircraft owners in general. These are folks with high credit scores and perhaps atypical of mainstream borrowers.

Moreover, on its web page Nexa says, in part, that while the U.S. Congress approved the use of federal loan guarantees for NextGen upgrades, the FAA "has signaled that it will not comply with the law, and has ignored all lawful provision," and Nexa urges lawmakers to do more to ensure FAA compliance to free up hundreds of millions of dollars of private sector capital.

JUMPSTART PROGRAMS

With any possibility of a DOT partnership gone with the wind, Nexa Capital has independently moved forward with the Jumpstart loan program, in response to an overwhelming request from buyers looking to borrow money for avionics projects.

Nexa has lined up several established lenders that are making avionics loans at lower commercial rates, with Nexa educating them on the unique and favorable buyer demographic that applies. These commercial lenders can't come close to the interest rates that would have been possible with DOT backing.

Hughey said the NextGen GA Fund has already loaned nearly $2 million, while the average lending amount is roughly $35,000 for packages in typical piston singles. Loan amounts have been as high as $100,000, with terms ranging from three to five years. No limits have been placed on airframe value versus equipment and labor costs. Instead,

Aspen Avionics, a NextGen GA Fund partner, hosts a loan calculator on the Jumpstart-IN section of its web site: www.aspenavionics.com/jumpstartADS-B.

these loans (think unsecured) are being written against the individual's credit worthiness. And you don't have to finance the entire project. Perhaps you want to pay the labor on your own and finance the equipment.

Interest rates, according to Hughey, have been in the 7 percent range. The chart on page 14 shows some common packages and the monthly payment for a 60-month loan term. At these terms, we think the program will have sizable competition from home equity and other available lines of credit, which could yield lower rates. The average credit score for applicants in this program, according to Nexa, has been in the high 700 range or better.

Nexa says the process is seamless. It can source borrower funding in less than one week and handles the payment directly with the installing shop. Simply provide a breakdown of equipment and labor costs and it does the rest. The way we see it, convenience counts for a lot when your aircraft is already at an avionics shop and you are ready to pull the trigger on a project. Still, we think a more attractive interest rate might be in the 4 percent range. For a better rate in the current program, borrowers do have the option of forking over the aircraft as collateral.

The NextGen GA Fund has partnered with a couple of avionics manufacturers, including Aspen Avionics, Avidyne and L3 Avionics, and put together bundled ADS-B upgrade packages. This could yield a small discount, as participating vendors have reduced the equipment pricing of select ADS-B systems and displays in a given package. Additionally, these bundles may include a portion of the installation labor.

As one example, the Jumpstart Bundle 1 product for VFR panels bundles the Aspen Evolution 1000 VFR PFD with the L3 Lynx NGT2500 ADS-B system, both of the required antennas, plus $2000 of installation labor for 60 monthly payment of $243. In our view, prefab packages simplify your trip to the shop (and price haggling) if you don't know what you need. Creating yet more competition among manufacturers, some programs may include one year of interest-free payments to sweeten the deal.

CONTACT...

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The equipment to the right makes up the Next-Gen GA Fund's Jumpstart-IN Bundle 3. It includes Aspen's Evolution Pro PFD, the EFD500 MFD and the L-3 Lynx NGT2500 ADS-B transceiver. A 60-month note at 7.14 percent yields a monthly payment of $430, based on a $21,674 total project.

QUICK—GET YOUR $500

But not quick enough. Little did Nexa know that the FAA was planning its own limited-time program to entice private operators to upgrade now, or at least beginning this Fall. Its $500 ADS-B upgrade rebate—that's estimated to come from nearly $10 million in taxpayer money—has been met with sizable criticism, especially by avionics shops because of logistic snags.

Paula Derks at the Aircraft Electronics Association (the AEA has been contracted to process the rebates) hears the same fits we do as shops struggle with scheduling ADS-B upgrades while waiting for the FAA's program to commence.

"We've heard a lot of disappointment from shops and buyers planning to complete ADS-B upgrades this summer," Derks noted. That's because as with any government program involving money, it must publish a plan in the Federal Register—a 60-day public comment period—followed by a 30-day processing/response period. While the rebate program was announced by FAA administrator Huerta on June 6, 2016, it won't get started until later this September—which is only an estimate, at this point. This means to qualify for the limited-time, first-come $500 rebate (it's available to the first 20,000 applicants), you technically can't have the installation performed until the program starts.

We wouldn't sit on the hands. If you are serious about doing an ADS-B-compliant upgrade, it's worth securing a tentative slot on a shop's schedule for September, given the potential rush among other buyers with the same idea. As AEA's Derks pointed out, use the waiting period to solicit quotes and settle on a package.

Once the program is underway, there are specifics steps you must take to get the $500. Once the installation is scheduled, obtain a rebate

continued on page 32

AirVenture Diary: Competition, Stability

This year's big show at Oshkosh revealed a sharply competitive avionics market, plenty of new aircraft models and had a focus on safety and training.

Staff Report

It's hard not to pass judgment on the health of the industry by what companies unveil at AirVenture. Still, as we've witnessed before, major manufacturers may show up with more new product announcements than we can cover in a week, but that doesn't mean the industry is rolling along fat, dumb and happy. This year, vendors did seem happy, and while many weren't fat with record sales, everyone seemed to agree that the show simply had a positive vibe, perhaps signaling the stability we've been looking for in previous years.

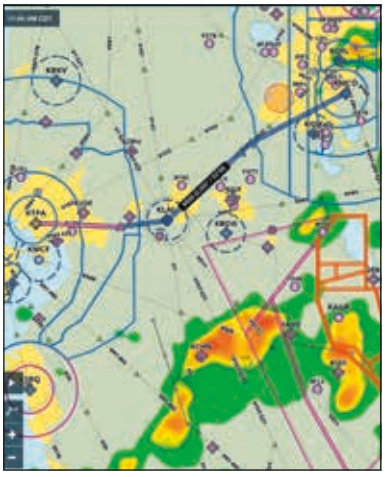
After attending the daily media briefings, walking the show and speaking with manufacturers and showgoers, herewith is our annual AirVenture diary of the standouts.

AVIONICS AND APPS

You don't have to be at the show for long to recognize the superstar product in the avionics market. This year, it was actually a product that was already unveiled at Sun n' Fun this past spring. Garmin's non-certified G5 electronic flight instrument was originally intended for LSAs and experimentals, but when Dynon and the EAA shocked the industry with an AML-STC for the D10A EFIS at Sun n' Fun, we had a serious suspicion that Garmin would bring an STC'd version of its G5 to AirVenture. And we were right. The $2500 G5 now has an AML-STC for over 500 aircraft, where it is fair game for installation as the primary and only attitude source. Unlike the version for experimental aircraft, the STC'd G5 is stripped down of its autopilot capabilities, plus it won't display vertical nav guidance. Look for it at Garmin dealers this Fall.

Audio system manufacturer PS Engineering introduced two more audio panels to its already packed lineup of products. The $2600 PMA450A sports a new OLED display, gets a more powerful bezel-mounted USB-C charging port, plus an internal Bluetooth module called PS Streamer. This wirelessly sends audio to compatible action cams and other devices where you would want to capture the audio you're hearing. The $2300 PMA8000G—with newly designed ergonomics—has a new checklist feature called Flightmate. It allows the pilot to record alert messages that can be triggered by some event or switch in the aircraft, like a stall warning or autopilot disconnect. The four available logic inputs trigger specific messages that are pre-recorded by the pilot. The panel also has two minutes of recording time to store checklists or other information, which can be played back at the push of a button.

On the tablet app front, the big news was the introduction of ForeFlight Mobile 8. The new version uses data-driven map technology, and specifically, a new aeronautical map layer, which dynamically draws map objects and adds and removes data depending on the map zoom level and pilot-settable preferences. It essentially mimics the mapping function found on panel MFDs and even portable GPS systems, but with a more enhanced zoom function. Look for a full report of ForeFlight 8



The Mooney Aircraft exhibit, left, was stocked with two fresh models. Sales reps told us it was the strongest showing they've had in years. ForeFlight 8, top image, was king of the tablet app announcements.

(which ForeFlight expects to release in late August) in the next issue of *Aviation Consumer.*

AIRCRAFT: NEW, REFURBS

No, that's not a Pilatus PC-12 pictured to the right. It's a rendering of the Cessna Denali single-engine turboprop, the name and cabin mock-up revealed by Textron at the show. The Denali just couldn't shake playful chiding—being called the "Cessna Pilatus"—given its close resemblance to the PC-12 turboprop single. Draw your own conclusions.

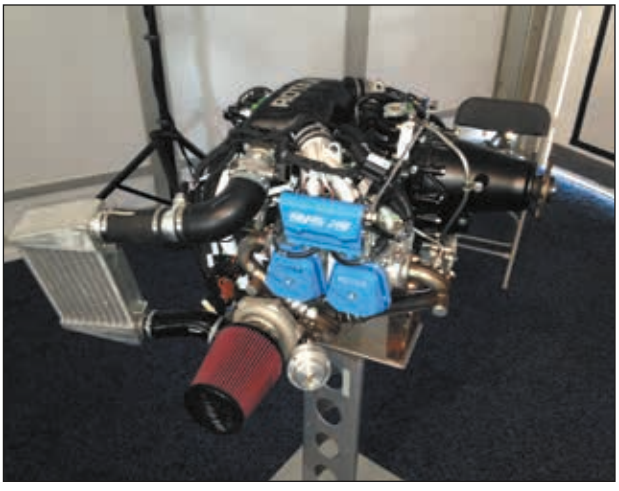
The Denali, with its first flight expected in 2018, will be powered by a new 1240 shaft horsepower-rated GE turboprop engine with a single-lever power and propeller control. Garmin will provide the G3000 touchscreen avionics suite and McCauley will supply a new 105-inch diameter composite 5-blade propeller. The plane can accommodate up to nine seats in the main cabin—which is 63 inches wide and 58 inches tall—the largest in class, according to Textron. Range is being advertised as 1600 NM, with one pilot and four passengers aboard and at a high-speed cruise of 280 knots. Full fuel payload is being pegged at 1100 pounds.

Meanwhile, over at Mooney, two new models were on display: the M20V Acclaim Ultra and the M20U Ovation Ultra. Both models sport two cabin doors, composite cabin structure, plus clean-sheet interior designs. Mooney also said its next-generation M10 is well into the flight test program.

Stemme used AirVenture to finally unveil its Twin Voyager S12 touring motorglider. Previously seen in photos and videos, the S12 has a glide ratio of 53:1, a 140 knot cruise speed and a 950 NM range. Priced at around $370,000, we met a couple of buyers at the show who were anticipating delivery of the niche aircraft.

Yingling Aviation's Ascend refurbished 172 was on display at Garmin's tent and featured a new glass panel, including a G500 EFIS, touchscreen navigator and ADS-B system. But what seemed to attract the most attention was the aircraft's new tricolor paint scheme. The Ascend is AOPA's current sweepstakes airplane.

If there weren't enough King Air refurb programs, Innova Aerospace has two more for the King Air 90.



Textron's Cessna Denali turboprop, top, is expected to have the widest and tallest cabin in its class. Rotax said it's right on schedule with its next-generation 915 iS Sport turbocharged engine, with deliveries slated for early 2017. Murphy's Radical, bottom, was an attention-getter with integrated bicycle racks.

The Innova upgrade ditches the old engines in favor of new GE H80s, which the company said brings a significant reduction in operating costs. Interestingly, one Innova King Air 90 on display at the show was fitted not with a Garmin G1000, but with BendixKing's AeroView integrated glass avionics suite, which is part of the STC process. Worth noting is that BendixKing hasn't yet earned certification for the AeroView, which it is flying in its own King Air 200.

In the "cool airplane" department was Murphy Aircraft's Radical, which has racks for hanging bicycles from each wing. The Radical is the Canadian kitbuilder's first stab at offering a ready-to-fly aircraft, but will also be available as an unassembled kit, a 49-percent quick-build kit or built by Murphy under Canadian builder-assist regulations.

ENGINES, TRAINING

Rotax held a press conference to update the media on its 915iS Sport next-generation engine, which is on track for 2017 deliveries, although the company didn't say which airplanes would carry the engine. The

Expect to see plenty of instrument panels equipped like the one pictured at the top. Garmin showed up with an 500-plus-airplane AML-STC for its G5 EFI, which is priced at $2500. Yingling's Ascend 172 refurb, middle, drew huge crowds. CubCrafters announced it is getting serious about training pilots to fly its line of high-performance utility tailwheel airplanes.

915iS—which is based on the 912iS Sport platform—produces 135 HP at altitudes up to 15,000 feet and has a service ceiling of 23,000 feet. With the turbocharger installed, the engine weighs only 185 pounds and will have a 2000-hour TBO. Rotax says the 915iS has already undergone well over 100 hours of flight testing and over 7000 hours of bench testing.

The first customer delivery of Piper's M600 turboprop wasn't the only big news from Piper. It also announced that the Archer will get a fuel injected engine. With plans to certify the aircraft with Lycoming's IO-360-B4M, Piper said the new model—called the Archer TX—will be an attractive choice for flight schools and operators in severe climates. Fittingly, the first TX will go to the flight department at the University of North Dakota. Piper plans to offer three models, including the plain-vanilla carbureted model, the Continental diesel-equiped DX and the new injected TX.

Airbus brought to the show its hybrid E-Fan Plus twin-engine aircraft. With more endurance than the company's all-electric model, the E-Fan Plus has a thermal engine manufactured by Solo from Germany. What's unique about the E-Fan Plus is its ability to operate in three modes: on electric power (via lithium-ion batteries), with the thermal engine acting as a range-extender by charging the batteries along the way or by electric power alone. Extended-range endurance is said to be just over two hours.

On the training and safety front, the Vision Jet wasn't the only buzz coming from the packed Cirrus tent. The company won AOPA's Air Safety Institute's Joseph T. Nail's annual safety award. "Over the past decade, Cirrus has earned one of the best safety records in the industry. It has doubled down on safety, working with its owners group and making investments in training and transition courses, to lower the accident rate for Cirrus aircraft to less than half the industry average," said ASI's George Perry. Worth mentioning is in 2015, the number of fatal accidents involving Cirrus airplanes fell to the lowest level since 2001, when fewer than 300 Cirrus aircraft had been produced. There were over 6000 flying in 2015.

In addition to showing off its flagship XCub (it sold 20 copies of the new model, which was recently announced early this summer), CubCrafters introduced a new factory training program aimed at easing transitions to all of its models. The transition program will be led by Oregon-based TacAero, which purchased every model in the Cubcrafters lineup. "Many of our customers that come to us are flying Baron and Bonanza models, as an example, and they need to get comfortable flying a tailwheel aircraft. Preferably, our tailwheel airplane," CubCrafters' John Whitish told us.

TacAero's five-day certified transition course was developed with Cubcrafters. The course, which is conducted in Hood River, Oregon, is $6500 and is all-inclusive, including lodging. The robust program includes 20 hours of ground training and 18 hours of flight training. TacAero also offers survival courses.

For more AirVenture news, visit sister publication AVweb.com.

Battery Upkeep: Charge It Right

If you're tired of shotgunning your battery, try a smart charger designed for aircraft batteries. It'll deliver long-term cranking power.

by Jim Cavanagh

As technicians, we know for certain that pilots have problems maintaining the health of aircraft batteries, with expensive consequences. If you're among the crowd that buys a new one every two years—or sooner—you know that a new battery will set you back at least $165 for a Gill flooded model to well over $200 for a Concorde sealed model. These are entry-level prices that don't include labor.

While aircraft batteries endure more abuse than their automotive counterparts, there are some things you can do to ensure the battery will last longer—and won't leave you stranded on a cold, dark ramp. In this article, we'll look at what you can do to keep this critical accessory in top shape.

CHARGING, TESTING 101

The reason folks have problems with batteries—and it is not just aviation batteries—is because they really don't understand them, or even know how to properly test them. Moreover, with so many items using batteries these days, we have been conditioned to think that any battery has a nebulous and mysterious lifespan and that when it gets weak or quits entirely, it's a throwaway item. Not so. First, some essential basics on charging an aircraft battery.

Batteries store electricity in a chemical form and depend on the reaction between lead plates and the electrolytes. The energy is stored in each cell and is discharged when a draw is applied to the battery. A battery will not create electricity, so any energy stored in the battery has to be placed there by a charging device. A battery can be slow-charged or fast-charged and even "kicked" with a high amount of charge to promote starting. A long, slow charge using a charger that is specific to the type of battery is optimal because it can compensate for temperature, the rate of charge and allow for the conditioning of the battery.

Chargers made specifically for aviation batteries allow for the higher concentration of electrolytes used in them, plus they charge at a much lower rate than automotive chargers and with a more regulated voltage.

Most lead-acid batteries take longer to charge than you might think. Usually, a solid eight hours is required for a full charge. How do you know when it's charged? Consider that the traditional way to test a battery's state of charge is with a hydrometer. It's tempting to use, but consider that a VU meter/tester will only reveal the battery voltage.

The proper testing procedure is to fully charge the battery, allow it to sit for 12 hours at room temperature (around 75 to 77 degrees is best) and test it with a hydrometer that has also been at room temperature. Cold balls inside the device can give false readings.

TYPE MATTERS

You should also understand some of the major differences between the two major types of aviation batteries. While many non-specialty batteries are lead acid, in aviation we have both flooded lead-cell batteries and sealed batteries. In general, the Gill aviation battery manufactured by Teledyne Battery Products is a vented, flooded lead-acid battery. You can actually see the cells by removing the caps.

Batteries made by Concorde are called sealed or AGM (absorbed glass mat) and have a maximum number

Since aircraft batteries aren't easy to access, a plug for connecting a battery tender will make your life much easier. The Enhanced Flight connector kit for VDC chargers, right, is approved for permanent installations.

It's often best to leave battery service up to your shop. Ours has the knowledge, plus a well-equipped battery room for servicing a variety of battery types, top photo. In between servicing, use ground power for extended engine-off operation. That's an Enhanced Flight portable GPU in the lower photo.

of lead plates and electrolyte content stored in the same space. Concorde says the cells are sealed with pressure relief valves that keep gasses inside the battery. The plates are sandwiched between layers of fiberglass mat. In general, sealed batteries are more tolerant of periods of inactivity.

In both types, there are cells where the energy is stored, and these are filled to the proper level (which is the split ring on the flooded battery) with electrolyte, a mixture of sulfuric acid and distilled water. While the Concorde sealed battery is considered maintenance-free, don't think that it won't require proper and periodic servicing. It still has to be maintained and most importantly, correctly charged.

A flooded battery will have caps that are vented, allowing gas to escape when the battery becomes too hot from both charging and ambient temperature. If the battery is being overcharged (a common mistake), then distilled water generally needs to be added every three to four months to keep the cells submerged and active. A sealed battery can also overheat, and there are vents built into the case to help counteract. the condition. However, there is no replenishing the water. For that reason, consider that it's only maintenance free if the average ambient temperature is moderate, say, below 77 F. And it's about temperature and controlling the rate of charge. Simply apply a charge at a relatively slow rate until its capacity is reached, and then keep the battery warm, but not hot.

Batteries are sensitive to temperature and perform best when warm. Additionally, a battery will not take a charge when it is too cold. Ever have a dead battery on a cold day, get a power cart start and then go for a quick trip around the pattern or sit idle in the runup area, thinking that it's charging up? In many instances, that just isn't enough.

One trick to warm up a battery in cold temperatures is to first apply a draw to a battery. Turn on the pitot heat, the landing light or even crank the engine. Preheating the battery, of course, is best.

HOW WE KILL 'EM

Just sitting—as our airplanes often do for longer than we would like—a battery will naturally discharge a bit every passing day. Use caution when trying to help it out. Connecting the battery to an automotive battery charger on a hot day could cause it to boil, losing water out of the electrolyte. You can see this with the caps off of a flooded battery. Look closely. If all but one cell is bubbling merrily, the slow one is likely a dead cell.

Worth noting is that Concorde says the popular Deltran Battery Tender product (commonly used on automobile, motorcycle and marine batteries) should not be used with its aircraft batteries because the charging voltage is set too high.

But doing nothing at all is a killer, too. It's when a sitting battery is completely ignored that the real problems begin. Don Grunke, an electrical engineer with Concorde Battery Corp., told us that the simple key to long battery life is keeping it fully charged. Sounds easy, right? Wrong. What he means is it must be cycled, charged and discharged, kept relatively warm and never stored in a discharged state.

That's because a discharged battery will begin to sulfate. While it's

DIY BATTERY MAINTENANCE CHECKLIST

- ✔ Store the battery in a warm place.
- ✔ Keep terminals, anode and cathode posts free of corrosion.
- ✔ Always remove negative terminal lead first, install it last.
- ✔ Allow at least three hours or more to fully charge a battery.
- ✔ Test with a hydrometer, fully charged and rested for 12 hours.
- ✔ Fly infrequently? Keep the battery on an aviation-grade tender.
- ✔ No, dropping an aspirin in the battery won't desulfate it.

BATTERYMINDER: SIMPLE, SMART, SAFE

There are all sorts of battery management devices on the market (generally called battery tenders), but very few are aviation specific. Many owners go the cheaper route and use an automotive battery charger or trickle charger. For a long time this was the main reason aircraft batteries failed at a high rate. Then Bill Woods at VDC Electronics brought the BatteryMinder product to the market. In our estimation, this could be the answer to longevity (perhaps four times the life) and optimal cranking power for any rechargeable lead acid or gel battery.

The latest-generation BatteryMinder—which was announced at this year's AirVenture—is the most advanced model yet, with a feature set that's been simplified for one-touch operation. The device can be used when the battery is out or installed in the aircraft, using a quick-connect harness.

Like previous BatteryMinder models, the CEC1-AA smart charger is calibrated specifically for aircraft use, which is different enough from automobile chargers to be consequential. Using lighted icons on the face of the device, the BatteryMinderer shows the condition of the battery's charge, plus it charges at a rate that compensates for temperature. Also, it automatically cycles into a maintenance mode, which is concurrent with desulfating the battery.

The device is available for use with 12- and 24-volt batteries and there are three specific models appropriate for Concorde, Gill and Hawker-Odyssey batteries. The device can be used to maintain multiple batteries at the same time when connected in parallel with the model BC2AY fuse-protected accessory.

Using the device is simple. Connect it to the battery and then plug it into a wall socket and observe the annunciators on the face. The first battery icon indicates the battery is fully discharged, evident by a steady amber light or flashing red light, which indicates zero volts. The second icon to illuminate indicates that the battery is constant-current charged to 80 percent. When the battery reaches full capacity, the solid green icon illuminates, and the device maintains and desulfates it indefinitely. There is even an annunciator that senses a load/draw on the battery, plus one to indicate that there's a bad cell. The device sells for $240.

not uncommon for crystals to form, these are usually harmless—unless the battery is stored in a discharged state. Lead sulfate will convert to crystalline deposits on the negative cells. Larger crystals will form and eventually short out the plates. If the electrolyte is allowed to evaporate, usually by overcharging, and the plates are dry, they will permanently sulfate. This results in a dead cell, a weak battery that cannot charge to capacity and generally, one that will not crank an engine enough to get it started. Then it is time to replace it, and without the proper maintenance, this vicious cycle starts over.

CHARGING SYSTEMS

As we discuss in the sidebar above, the absolute best way to keep a battery healthy while you aren't using it is to connect it to a smart charger. But in some aircraft, that could mean lengthy disassembly every time you want to connect it.

Lexington, Kentucky-based Advanced Flight has a PMA-approved quick-connect plug that's compatible with the VDC Electronics BatteryMinder line. Have your shop wire the harness to the battery and terminate the connector in a convenient location on the airframe. When installed per the instructions, it's considered a minor alteration and can be signed off with a logbook entry. The BM-ALK2 kit is priced at $69.95.

Finally, don't underestimate the damage a faulty charging system can do to your battery. We've seen many owners insist on changing battery after battery when it was the charging system that needed attention, only because swapping a battery was easier.

If the bus voltage is too low (maybe the voltage regulator is improperly set), the battery will never charge to its full capacity. As a rule of thumb, a 12-volt battery needs a bus voltage of 14 volts to reach and maintain a fully charged condition. A 24-volt battery really needs roughly 28 volts.

Overvoltage can be worse than undervoltage, especially for a sealed battery. We witnessed a Concorde battery self-destruct when the charging system in a Cessna 210 reached nearly 30 volts, and stayed there for a multi-hour trip at cruise power.

How do you know what the bus voltage is? Most modern engine monitors display it, as do some panel avionics systems.

If you don't want to chase fluctuations in charging system output, our advice is to stick with a flooded battery type and deal with associated maintenance that tags along.

Last, how much life can you expect from a properly maintained aircraft battery? As you can tell from reading this article, there are many factors and it's just impossible to say for sure. We've seen airplanes—in cold climates—with batteries that haven't been changed in five-plus years. Those batteries may be on borrowed time, but they've also been cared for. Look for a report on a battery brand satisfaction survey in a future issue of *Aviation Consumer.*

Contributor Jim Cavanagh is a freelance author and aircraft owner who has rebuilt nearly a dozen airplanes. In the process, he's maintained a few batteries, too.

CONTACT...

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859-233-4599
www.audioauthority.com

VDC Electronics
631-683-5850
www.batteryminders.com

Breakdown Assistance: Help Away From Home

Sporty's new Breakdown Assistance Program gets you going again when your airplane breaks and it's a long way home.

by Rick Durden

It's the nightmare that too often becomes reality: You've stopped for inexpensive, self-serve fuel at Resume Speed, Indiana. You strap in for the remaining two-hour leg of the flight to your destination, twist the key to start, there's a strange noise, the prop makes half a turn and everything goes silent. You try again—nothing. You've already noticed that the airport is deserted.

Now what?

If you're a member of Sporty's new Breakdown Assistance Program (BAP), no matter what time of the day or night it is, you pull your membership card out of the glove box, call the phone number on it and provide your membership information. Within 15 minutes—current average wait time is five minutes—you'll get a call from a person who is an A&P and IA, is looking at the file on your airplane and will start the process of troubleshooting the problem and getting you on your way. From our perspective, it's a 24/7 AAA service for general aviation.

BAP (www.sportys.com/pilotshop/bap) is a result of cooperation between Sporty's and Savvy Aircraft Maintenance Management Inc. (SAMM), a company that has been providing professional aircraft maintenance management for owner-flown piston singles, twins and single-engine turboprops for eight years. According to owner Mike Busch, SAMM averages dealing with 350 aircraft-on-ground away from home situations for its customers each year. It has both built up a database of reputable shops around the country and an approach to AOG situations that focuses on troubleshooting the situation carefully before putting a wrench on the airplane.

Because of SAMM's experience in dealing with AOG airplanes, Sporty's and SAMM are now offering the new standalone Breakdown Assistance Program. Full disclosure, Mike Busch has been a contributor to this magazine and I've been a Savvy customer for some years.

TROUBLESHOOT FIRST

Busch emphasizes that troubleshooting is at the heart of BAP because his company's experience is that over 50 percent of the time the problem is something that can be solved without opening up the airplane. He gave us the example of an owner who called when he couldn't start his Cirrus SR22 away from home base.

The owner and Savvy's A&P/IA went through the symptoms and diagnosed a slipping starter drive adapter. The solution proposed was to have the local FBO use its 28-volt APU for an external-power start because often a failing drive adapter will have a few starts left in it if driven with 28 volts instead of the airplane's 24-volt battery. Shortly thereafter Savvy's technician received a call from the owner and could hear the sound of the engine running in the background as the owner reported success.

If the problem requires getting a hands-on mechanic, Savvy will contact a shop—even if there's not one on the field—and get help on the way. It will also brief the mechanic on the results of troubleshooting to date and suggest what part the mechanic bring to the airplane. Savvy stays in touch with the shop/mechanic to manage the needed repairs until they are complete—even if you decide to go on with your trip and come back for the airplane later.

At $149 for piston singles, $199 for piston twins and $249 for turboprop singles, we think Sporty's Breakdown Assistance Program is cheap insurance for any owner who uses a GA airplane for travel.

You're away from home with a broken airplane. Who you gonna call?

Flight Stream 510: Wi-Fi Via Datacard

Garmin cleverly packs Wi-Fi and Bluetooth transceivers into the shell of an MMC card, simplifying database updates and eliminating a teardown installation.

by Larry Anglisano

CHECKLIST

- Flight Stream 510 streamlines the database update process.
- GTN navigator owners can upgrade without tearing the panel open.
- But there's little price break. At $1500, it's close to an installed Flight Stream 210.

We'll be gentle. If you recently brought your aircraft in for a Garmin Flight Stream 110/210 wireless Bluetooth data hub installation, stop reading and close this page. For readers who are still here, rejoice. You won't have to go to an avionics shop for a pricey teardown installation. That's because unlike the older Flight Stream—which required a wired serial connection with one of Garmin's navigators—you can install the new Flight Stream 510 wireless system yourself in just seconds.

The patented next-generation Flight Stream 510 has been brewing in Garmin's engineering think tank for a few years. Part of the Connext cockpit wireless platform, the Flight Stream 510 is a MMC datacard that contains both Wi-Fi and Bluetooth connectivity capability. Worth noting is that the first-gen Flight Stream—a hard-wired remote box—only has Bluetooth. The new Flight Stream works by removing the database card that lives in the slot of a GTN750/650 series navigator (which requires a field software update) and sliding the Flight Stream 510 card in its place. Powered by the navigator, the Flight Stream 510 becomes an integral part of communicating with Garmin's Pilot tablet app for iOS and Android.

TAMING DATABASE UPDATES

Garmin makes use of the Flight Stream's Wi-Fi capability for enabling its database concierge function—something we applaud. Anyone who's felt the pain of keeping the data in panel-mounted navigators fresh will concur. The drill is to download a new database revision, send it to the datacard (hoping there aren't file corruptions in the process), and then bring it to the aircraft for loading in the navigator.

With the new Flight Stream, the process is streamlined—and the data transfer speed is increased substantially. Select and download the appropriate databases directly on Garmin's Pilot app, where the data is stored for use once you get to the aircraft. Once the Flight Stream 510 establishes a Wi-Fi connection with the tablet, the data is automatically transferred to the navigator. You can transfer databases ahead of time (helpful if you are launching on a trip on the heels of a new database cycle), since the data waits in standby mode until the effective data. If you don't want to fetch the data with Garmin Pilot, the Flight Stream MMC card can be inserted into a USB slot (using a provided USB card reader) in a computer for direct download.

At last, Garmin has figured out a way to synchronize the databases among multiple boxes. No more separately loading databases in each unit. Think of a Flight Stream 510-equipped GTN navigator as a server. When its wired to a second

continued on page 32

The MMC-based Flight Stream 510, below, will only work with the current GTN750/650 navigators, right, and with the G500/600 PFD. Legacy GNS530W/430W systems are not compatible.

Cessna 206 Stationair

With impressive useful load, Cessna's utility hauler is at home in the bush or at the busiest airports.

Every pilot who's ever packed an airplane for a trip has experienced the desire for more—more room, more useful load, more seats, more. . . As a family grows, the four-seater isn't enough—the baggage kids seem to need grows exponentially with age. Part 135 operators want a small freighter that is rugged and can get in and out of remote village airstrips with a big payload.

Airplane design is tough—optimizing for speed hurts payload; a large comfortable cabin may mean stodgy performance and no baggage capability. Rumor has it that trying to find an optimum compromise between speed, payload, range and comfort has driven more than one aeronautical engineer around the bend. Many airplanes that have been advertised as "do it all" machines aren't.

Perhaps the poster-child exception is an airplane such as the Cessna 206 Stationair, which carries the SUV/minivan/pickup concept to a capable conclusion.

It's not fast, nor is it that slow, but it is stable, rugged, reliable, has six real seats and is remarkable for being able to carry a half-ton or so after the tanks are filled. You can put it on floats, turbocharge it, dump skydivers from it, and carry small packages or just your family. It has proven tough and reliable enough to be a fixture in the bush throughout the world, holding on even as turbines shoulder out piston power.

So popular has been the 206's combination of simplicity and load-carrying that it's one of three singles Cessna saw fit to bring back to the land of the living when it restarted piston production. As a result and in addition to a wide range of mid-1960s and later airframes on the market, one can also opt for a brand-new one.

You can put it on floats, turbocharge it, dump skydivers from it and carry packages. You call, it hauls.

HISTORY

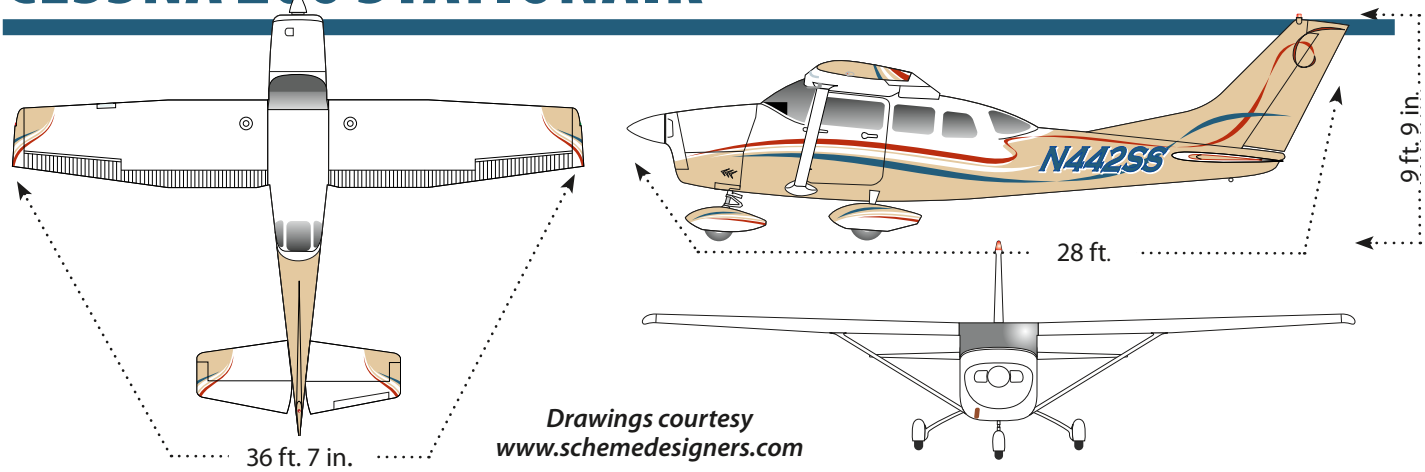
Cessna's biggest fixed-gear piston single is really three models, though all are essentially the same airframe. It was originally introduced in 1963 as the 205, a fixed-gear 210, technically known as the 210-5. It had two doors up front and a relatively small rear door on the left side. The engine was a 260-HP Continental IO-470. This airplane was a fixed-gear version of the recently revamped 210; it was produced for two years, with 577 delivered.

In 1964, Cessna responded to demand for more utility and created the U206 (U for "utility") Super Skywagon, with a 285-HP Continental IO-520A, redesigned wing and bigger flaps. Intended as a flying pickup truck, even the seats were optional. There was one door for the pilot and a big double door aft on the right side.

The next model year saw the 205 become the P206 Super Skylane, with "P" representing "personal" or "passenger," depending on with whom you're speaking. The P206 had the same door arrangement as the 205, but with the bigger engine from the 206. The U206 was by far the more popular of the two.

In 1967, the U model got a take-off-weight boost and a new engine, the 300-HP Continental IO-520-F, while the P model kept the 285-HP O-520-A. Turbocharging became available on both variants in 1966,

CESSNA 206 STATIONAIR

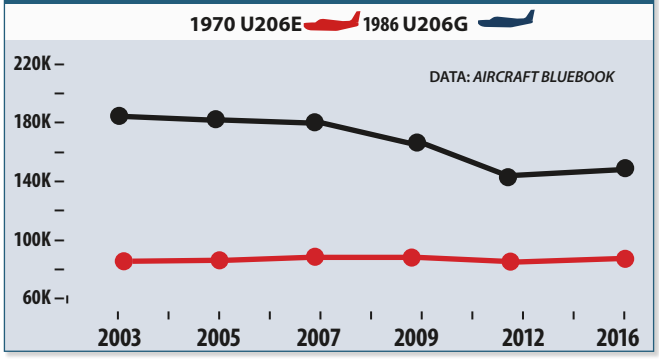


Drawings courtesy www.schemedesigners.com

CESSNA 206 SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1965 U206 SUPER SKYWAGON	CONTINENTAL IO-520-A	1700	$30,000	65	1540 LBS	144 KTS	±$65,000
1965 P206 SUPER SKYLANE	CONTINENTAL IO-520-A	1700	$30,000	65	1510 LBS	143 KTS	±$61,000
1970 P206D SUPER SKYLANE	CONTINENTAL IO-520-A	1700	$30,000	65	1480 LBS	142 KTS	±$68,000
1980 U206G II STATIONAIR	CONTINENTAL IO-520-F	1700	$30,000	92	1598 LBS	147 KTS	±$120,000
1980 TU206G II TURBO STATIONAIR	CONTINENTAL TSIO-520-M	1600	$40,000	92	1534 LBS	152 KTS	±$150,000
1986 U206G II STATIONAIR	CONTINENTAL IO-520-F	1700	$30,000	92	1598 LBS	147 KTS	±$160,000
1986 TU206G II TURBO STATIONAIR	CONTINENTAL TSIO-520-M	1600	$40,000	92	1534 LBS	152 KTS	±$165,000
2004 206H STATIONAIR	LYCOMING IO-540-AC1A	2000	$45,000	92	1249 LBS	142 KTS	±$230,000
2004 T206H TURBO STATIONAIR	LYCOMING TIO-540-AJ1I	2000	$52,000	92	1249 LBS	150 KTS	±$260,000
2009-11 206H STATIONAIR	LYCOMING IO-540-AC1A	2000	$45,000	92	1249 LBS	142 KTS	±$450,000

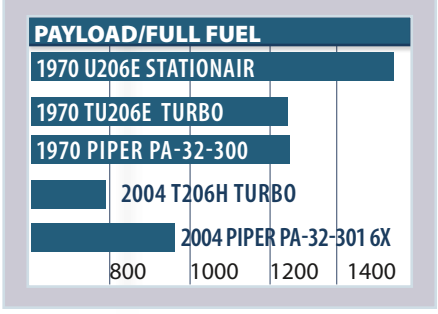
CESSNA 206 RESALE VALUE

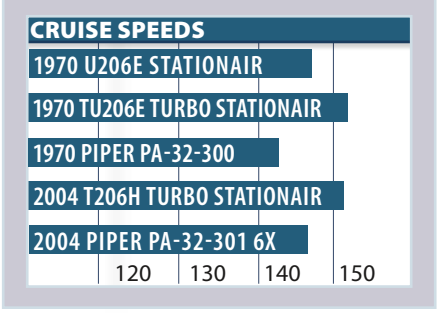


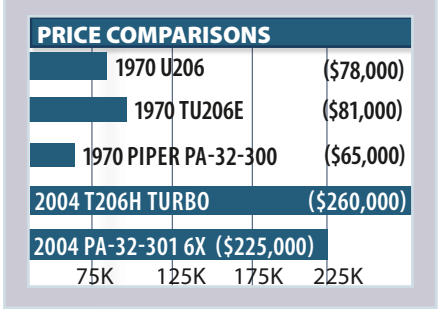
SELECT RECENT ADs

AD 2011-10-09	SEAT RAILS AND ROLLER HOUSING INSPECTION
AD 2008-05-09	ONE-TIME SEAT BASE/BACK ATTACH BRACKETS MODIFICATION (206H)
AD 84-10-01	INSTALL QUICKDRAINS; REPETITIVELY INSPECT FUEL TANK FILLER AREA
AD 79-08-03	DISCONNECT CIGAR LIGHTER OR INSTALL CIRCUIT PROTECTION

SELECT LATE-MODEL COMPARISONS







Acres of panel space provides room for the current Garmin G1000 system, left photo, or just about anything an owner wants to add on to a standard steam gauge arrangement, below.

with a 285-HP Continental TSIO-520C. The P206 was discontinued in 1970, with a total production run of 647. The remaining U206 and TU206 were offered with either a utility or passenger interior, and renamed Stationair.

A stretch of the fuselage brought into being the 207 Skywagon in 1969, powered by the 300-HP IO-520-F. One more seat was added, bringing the number available to seven. Useful load went up by about 30 pounds. An additional bonus was a nose baggage compartment, easing the task of getting the CG in the proper place during loading. The turbo model of the 207 was powered by a TSIO-520-G, also with 300 HP.

Camber-lift wings, which feature a slightly cuffed leading edge, were added in 1972. These improved low-speed handling at almost no cost to cruise speeds. At the same time, the baggage compartment got a 7-inch stretch. An aerodynamic cleanup in 1975 boosted cruise speed by about 6 mph. The cleanup included more-streamlined wheel pants and improved cowl flaps.

In 1977, the horsepower of the turbo engine was upped to 310 (for takeoff only) on both the TU206 and the T207. A wet-wing fuel system was introduced in 1979.

In 1980, another seat was added to the back row of the 207, making it an eight-place airplane. This created the Stationair 8, but the Cessna designator remained model 207. The world would have to wait for the Caravan to see a model 208 and what may be the ultimate evolution of the high-wing, strut-braced single. The 207 was discontinued in 1984, and the 206 two years later.

It was a great run. Along the way, 206s saw several suffixes added, starting with the 206A in 1966 and culminating, temporarily, with the 206G in 1986. More than 7000, by serial number, U206s had entered the market, along with 647 P206s, the 577 aforementioned 205s and another 788 207s.

But then a funny thing happened: In the mid 1990s, Cessna started making piston-powered airplanes again. After starting up assembly lines for the 172 and 182, the model 206 returned in 1998 as the 206H, powered not by a Continental IO-520 but by a 300-HP Lycoming IO-540-AC1A. It was joined by the T206H, powered by a 310-HP Lycoming TIO-540-AJ1A. Cessna recently stopped production of the normally aspirated 206 but has kept going with the T206H and is selling them for well north of $600,000. Unlike the Continental-powered 206s, the H model is available with a five-place, club-seating option.

MARKETPLACE

Enormous fixed-gear singles aren't all that common in the marketplace. In terms of mainstream aircraft, the choices are pretty much limited to the Cessnas and Piper PA-32 Cherokee Six/Saratoga. Prices are comparable, and which makes the better choice depends in part on your needs. The big Pipers have a wing spar running through the cabin right behind the front seats, disrupting the loading area somewhat, and the Cessna is definitely the airplane of choice for floats. Both companies' products have proven reasonably reliable over the years.

The Pipers do have an edge in TBO over the Continental-powered 206s. While the best one can hope for from the Continental-powered Stationairs is a 1700-hour TBO, the Lycoming-engined 206s have TBOs of 2000 hours.

The -540-series Lycomings bolted on the Pipers have a TBO of 1800 hours (for the TIO-540-S1AD), and as much as 2000 hours in the case

Removable cargo doors provide easy access to the rear seats, right, and make loading cargo a snap, bottom photo.

of the IO-540-K1G5 on the Saratoga and the Cherokee Six.

LOADING

This is the name of the game for Stationair pilots. While no airplane can handle anything you can fit in it, the Stationair comes closer than most. Full-fuel payloads of 1000 pounds or better are not at all uncommon.

The big rear cargo doors—creating an opening more than 44 inches wide—make getting bulky cargoes inside less of a chore than in other aircraft. Another nice touch is the lack of a lip at the doors, so cargoes don't have to be maneuvered up and over to get them inside.

The airplane can be flown with the cargo doors off which, combined with solid low-speed handling, makes it popular with aerial photographers and public benefit flying organizations involved in conservation research and monitoring. Public benefit flying organizations LightHawk and CAVU have owned multiple 206s, using them in remote areas.

Specialty kits were made available so the Stationair could take on such jobs as glider towing, parachute jumping and even aerial hearse service. There also is a cargo pod available. When using a cargo pod, make sure you follow any limitations on flap deflection that are on the STC for the installation.

With or without the cargo pod, the Stationairs offer ample loading flexibility. The allowable CG range is unusually long, making cargo/passenger positioning less of a juggling act than with many aircraft. However, despite some pilots' assertions that "If you can get it in, you can take off," weight and balance computations are not optional. Several accidents over the years show it is possible to load a Stationair outside its envelope.

COMFORT

While the Stationairs have large cabins, they're not long on comfort with a full load of passengers. Noise levels, particularly during takeoff and climb, can be fairly high as piston-engined singles go. And the rear-most seats—row three in the 206, rows three and four in the 207—leave little in the way of legroom.

Another comfort consideration is the baggage compartment. In spite of Cessna's best efforts, it doesn't quite match the capabilities of the passenger compartment. As a result, passengers may find themselves sharing space with their bags.

PERFORMANCE

Top cruise speeds will run in the 145-knot area while burning 17 gallons per hour or more. Throttling back to a leisurely 135 knots cuts gas consumption to a more reasonable 13 GPH. Operating LOP can reduce those numbers two to three GPH while keeping CHTs down—a consideration in hot climate operations.

Handling matches the aircraft's size. Pilots who enter the Stationair after climbing the Cessna model ladder may find the aircraft is just more of the same—only heavier, although the ailerons are notably responsive, even at slow speeds. Few owners seem to mind the fairly heavy controls: Snappy handling is not why they bought the airplane.

This is not without its benefits, though. It makes the Stationair an excellent IFR platform—stable and rock-solid. It also makes for a relatively smooth ride in turbulence.

Another benefit is that the Stationair is reluctant to stall. Pitch forces are fairly heavy to begin with. Compounding this is the generally nose-heavy loading of the airplane. Since the CG envelope is so long, and most everyone wants to sit up front, the CG is often at or near its forward limit. Also, with power on, the deck angle required for a wings-level stall is alarming. Put it all together and the Stationair is not generally a willing participant in stalls. If you do stall the airplane,

STATIONAIR WRECKS: OTHER, ENGINE

The results of our survey of the 100 most recent Cessna 206 accidents were a reflection of the sometimes unreasonable demands made on them as utility airplanes. It looked to us as the airplanes didn't let their pilots and passengers down—too often the pilots and mechanics let the airplanes down. Pilots either demanded more performance from them than was ever built in—one loaded his more 700 pounds over gross and stalled it on climbout—or mechanics did something wrong when working on the engine.

Of the 19 engine stoppages not due to fuel issues, over half involved mechanics over-torquing cylinder bolts or engine through bolts. In two cases fuel line attaching hardware was not tightened at all and didn't stay attached for very long.

One owner experienced the separation of the exhaust pipe from the turbocharger. There's a 16-year-old Cessna Service Bulletin that provides a solution to that specific problem. The owner didn't apply the fix. Six months later the same thing happened—this time our hero had to deal with an inflight fire. While Service Bulletin compliance isn't mandatory in Part 91 ops, we think exhaust system issues on turbocharged engines should be taken seriously.

Of the 10 fuel-related accidents, six involved pilots who didn't carry enough fuel for the intended flight; two pilots ran a tank dry while flying low enough they couldn't get a restart in time and two had stoppages due to water contamination.

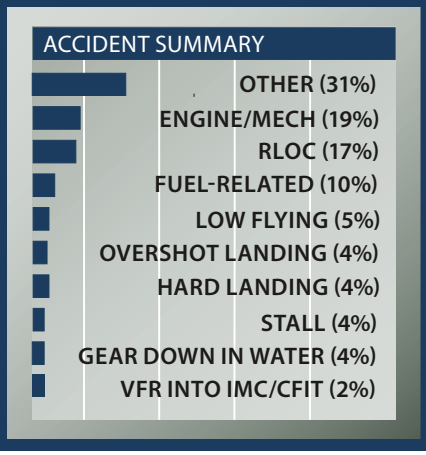
There were 17 runway loss of control (RLOC) events. That's a relatively low number—a good indication that the 206 has affable manners on the ground. We note that some of those were on backcountry airstrips, where 206s are regularly used and sometimes come to grief.

The ability of 206s to "take it" when it comes to a combination of load carrying and backcountry operations was reflected in many of the accident reports we reviewed. They are commonly used for Part 135 operations where there is significant pressure on pilots to fly over gross and to go no matter what, especially in Alaska. We noted one Alaska accident where a 135 pilot made a takeoff on a runway covered with three to six inches of slush. He got into the air but stalled trying to turn away from rising terrain. The high percentage of accidents in 206s that occurred in Alaska was due at least partially, in our opinion, to the "gotta go" factor.

Two pilots came to grief departing from beaches. One hit driftwood with the horizontal stabilizer, jamming the elevator. He put it into the water. The other staggered off the sand, then sank and dragged the left gear in the water to a depth that brought the airplane down.

The Stationair makes a great floatplane whether on straight floats or amphibs. It is, however, wise to ensure the gear is retracted on amphibs prior to making a water landing. Four pilots did not, leading to the assemblage flipping over. The penalty for that mistake almost always involved fatalities.

Glassy water is a hazard in all seaplane operations. One 206 pilot hit so hard on a glassy-water landing that he flipped the airplane. Another 206 float pilot was flying low over glassy water—ostensibly to check a landing area—and stuck a wingtip into the water, leading to a cartwheeling stop.



the behavior is pure Cessna: There is a definite break and it will roll off if the ball is not centered. Recovery requires lowering the nose by at least relaxing back pressure. When heavy, especially with full flaps, it may take some altitude before you can establish a positive rate of climb.

A drawback of the forward CG tendency is a proclivity for inexperienced 206 pilots to arrive nose first during landing, especially at light weights. It takes a hefty pull on the yoke to flare properly. Thus, Stationairs are no strangers to hard, nose-first landings that sometimes damage the aircraft. In the 207, the nose baggage compartment can simply add to the nose heaviness. However, using less than full flaps for landing (say only 20 degrees) can ease the control forces required to flare. Also, as one reader aptly put it, "That is what trim was invented for: Use it."

When loaded toward the aft CG limit the equation changes significantly. It doesn't take nearly as much effort to flare to land. A pilot who isn't ready for the lighter control forces can get surprised at how easy it is to get the nose up.

The 206 can feel like two different airplanes when it is light with a forward CG versus at gross weight and a mid- to aft-CG loading. We strongly recommend that any checkout in a 206 include time with the airplane loaded light and forward and heavy and aft. Part of that should be what it takes to get to the runway when heavy, with full flaps and slow. Be prepared to put the throttle to the stop.

Like most Cessna singles, the 206 does pretty well in short/soft/rough field operations, a big factor in the purchase decision for many of our respondents.

Early models had 40 degrees of flap, which helped tremendously for short arrivals. However, the airplane just won't climb with that much aluminum hanging out in the breeze. Cessna later limited flap travel to 30 degrees.

MAINTENANCE

Simplicity is a good thing, and helps keep maintenance costs down...but on the other hand, Stationairs are working airplanes by and large, and wear and tear can easily turn the tide in the other direction.

While the Cessna 206's controls will never be considered light, they are responsive. Practicing botched go-arounds is a must.

We've seen problems with the tail, mostly corrosion caused by the foam-filled elevator and trim tab getting soaked with water and pulling off rivets, screws and nuts. Obviously a concern if the airplane was ever on floats.

Some of the brackets in the tail can crack. There have also been some instances of cracking door posts, though these problems have not proven to be a safety issue.

Given the number of respondents who routinely operate out of short and rough fields, combined with the nose-heavy landing tendency, we recommend paying close attention to the landing gear (particularly the nosegear), brakes and the prop for erosion from the detritus on back-country strips.

There have been a couple of 206/207 specific ADs: 85-2-7 calls for inspection of a roll pin in the fuel selector, and 85-10-2 mandates recurrent inspection or modification of the induction air box.

Other ADs of note are 91-15-4 and 82-27-2, inspection of the prop; 97-26-17, ultrasonic inspection and possible replacement of the crankshaft; 96-12-22, recurrent inspection of the oil filter adapter and 2011-10-09, seat rails and roller housing inspection.

The 206/207 is also subject to the infamous 84-10-1 fuel tank bladder AD.

MODS, CLUBS

There's probably a modification available for the 206/207 to allow it to do most anything someone might want. This includes skis, floats, long-range tanks, STOL kits, vortex generators and various speed mods.

One can even opt for an STC'd 450-SHP Rolls Royce turboprop engine, courtesy of Soloy (www.soloy.com). If that is too much, and the factory IO-520 isn't enough, maybe an IO-550 from Texas Skyways (www.txskyways.com) would be your power solution.

As far as type clubs, the Cessna Pilots Association (www.cessna.org) is your one-stop shop for all things Cessna. The Cessna Flyer Association (www.cessnaflyer.org) also comes highly recommended.

OWNER COMMENTS

I was involved with a skydiving group out of Iowa, and somehow we ended up owning a 206. For a group of jumpers who wanted a fun plane that worked its butt off every weekend it was hard to beat.

The airplane almost always went to the annual with no major maintenance issue. We stripped out the seats, except for the pilot's, and removed the door. And yes it was cold the times we flew in the winter.

For an instrument panel we had a VHF radio and a compass that worked. I think the fuel gauges were mostly working.

Since we just flew over the airport we just measured the gas with a stick. If it was wet, there was enough to get to 7,500 feet. Gravity always seemed to bring it back down pretty

Interior appointments range from spartan to luxurious—there's a lot of room for four, but a bit tight for six.

well. We rarely did cross-country flights (except for those trips to Mardi Gras, whoo), so we weren't that concerned with efficient travel.

We could put in six jumpers and the pilot and get to 7500 feet and back down three times per tach hour. It was almost like the more we abused it, the more it loved us.

We had no mods on this wonderful plane, not counting on removing the seats and doors, but it was a true STOL aircraft. The field we were based at had a 3000-foot main runway, north and south, and a 700-foot diagonal. Because all you did was takeoffs and landings, you could get pretty good at bringing it in and stopping easily on the 700-foot grass strip.

The trick, if you can call it that, was understanding how to trim it when 1200 pounds of people and gear exited. If you trimmed it to fly neutral, you simply ran out of elevator when it came time to flare, and you ate up a lot of runway. If you kept the trim the same as when loaded (the plane, not the pilot) all you had to do was put out full flaps, slow it down till the needle bobbled around 50 knots, and carry a little power. Once on short final, about 200 feet out, start flaring and cut the power as you went over the cornfield fence. You had to really haul back to get a good flare, but if you did, it easily stopped in 300 to 400 feet.

John "Mac" McCarthy
via email

I bought my 1980 U206 in 2006 for $185,000. It had a new interior and upgraded avionics. I bought it for personal use as there is six of us in our family, including my 6-foot-4-inch son. We live in Oklahoma and fly it regularly to Arizona. I've averaged putting about 70 hours a year on the airplane.

Insurance was initially over $7000 a year as I was a 58-hour pilot. Once I got my instrument rating the rates went down to where I now pay $2004 for a $1M smooth policy. Average cost for five annuals has been $1539. I've added some avionics and GAMIjectors. In the time I've owned the airplane I've only had to replace the spinner, EGT probe, battery, a fuse and repair the beacon and the brakes.

I normally cruise between 9000 and 11,000 feet, LOP, burning 12 gph at a true airspeed of 138-140 knots.

I purchased the airplane so the entire family could travel together. I looked at the 206, 210, Cherokee Six and the Lance/Saratoga retractable. I opted for the weight-carrying ability of the 206 and a non-retract because of my limited flying time, plus the high wing matters when dealing with the Arizona sun. I did not look at 206s with fuel bladders as I did not want to deal with their potential problems.

The ability to carry a great deal of weight is important to me because I prefer to fly with full fuel for safety, and can do so in the 206 and still have a big load in the cabin. It is slow, but I do not feel as if it ever gets ahead of me. It is a great instrument platform but it is also a lot of fun to just fly around for sightseeing or in the pattern shooting landings. I think the slow speed, especially at the stall, makes for safe touch and goes.

My best story came out of a sad event—my daughter was badly injured in a skiing accident, suffering numerous fractures. Driving to the airport for the trip home was agonizing for her. The 206 proved to be the best airplane ever. We used the big cargo door opening to easily get her into the fully-reclined rear seat,

strapped her in and stuffed pillows around her. She slept comfortably all the way home.

Richard Greisman
via email

I have flown several 206s on floats, one on PKs, the rest on Edos. The Edos seemed to be a good design for the 206, almost always easy to get out of the water even when loaded; the 206 with PKs was a dog. My flights were in and out of lakes and rivers in Alaska and in salt- and fresh- water operations from Seattle north to the Inside Passage in British Columbia, Canada.

On floats, the 206 with the IO-520 engine required that the cowl flaps be open at all times to get appropriate cooling. The operator I flew for called for takeoffs at 25 inches and 2500 rpm, mostly to keep the noise level down. Unless the airplane was heavily loaded, or the area was tight, the reduced power takeoff was manageable.

Heavy, full power was necessary, sometimes pressing against the five-minute limit, especially on glassy water.

An issue that came up regularly was carrying too much in the back end, either passengers or baggage. Even though the airplane was in CG, it could be a real challenge to get the floats up on the step on takeoff. If you couldn't get on the step the CHTs would redline and the five-minute limit on full power would get hit and you'd have to go back and do something to change the loading.

The rule of thumb most of us used was that if the tails of the floats started to look even with the surface of the water before the pilot climbed on board, you were headed for a challenging takeoff. This is where the 206 on Edo floats mattered to me. If I could get the airplane on the step, it would eventually come off the water, even if you had to lift one float at a time on glassy water. On PKs, getting on the step did not guarantee the airplane would come off the water; I might end up just high-speed taxiing.

The 206 flew well on floats with a good load, handled turbulence well but didn't seem to like flying too slowly on final approach as it would develop a very high sink rate. The pilots I flew with and I found that a power-on approach was the best for managing gusts and sink rate, with a little bit of power carried all the way to touchdown.

Greg Bedinger
via email

I purchased a new turbo 206 in early 2008, base the airplane in Denver and use it for business and personal travel around the western half of the U.S., often crossing the high mountain ranges of the west. When I was evaluating alternatives, I considered a variety of cabin-class twins and six-place singles. Ultimately, I decided to go with a new 206, which provided a platform for gaining experience flying with a glass cockpit and would give me decades of reliable service, hopefully following me into retirement.

Some of the add-ons to the airplane were extended range/tip fuel tanks, gap seals, active traffic (TAS) and XM weather. The extended fuel tanks provide an interesting combination of higher useful load (1420 pounds), increased range with nearly 120 gallons of fuel on board, higher cruise speed and lower stall speeds. I don't usually fly with fuel in the tip tanks, except for very long trips. The full-flap, power-off stall speed has dropped to an unbelievable 35 knots indicated when lightly loaded.

The TIO-540 engine seems to be happy at 18 gallons per hour at maximum cruise at nearly all altitudes giving speeds from 160 knots at 12,000 feet to 170 knots at 18,000 feet.

As an instrument platform, the airplane is exceptionally stable in every weather condition that I've encountered—no sick passengers, yet. It took some effort to become proficient with the G1000, but it was worth every minute. Landings are predictable and smooth, even in the high crosswind conditions that Denver enjoys every once in a while.

So, obviously, I'm pretty high on the 206. It provides a great combination of huge loads, reasonable speeds, crazy endurance and good maintenance costs that are common to Cessna products.

Mike Henderson
Denver, Colorado

The Aviation Consumer

AVIONICS LOANS

(continued from page 15)

reservation code on the FAA website, which first requires owner, aircraft, equipment and installation date information. The installation must be accomplished within 90 days of obtaining the rebate code, followed by a 30-minute validation flight (which must include aggregate maneuvering) in ADS-B airspace within 60 days of completing the installation. Then you obtain an ADS-B compliance report to show that the stuff works per ADS-B mandate specs, followed by obtaining a claim code for the $500 rebate. Once the FAA reviews the claim, it submits the OK to the AEA for check processing. And you thought it was a hassle to get that rebate on that new refrigerator. Yes, you'll work for your 500 ADS-B bucks.

SIGNING ON THE LINE

In our view, nothing Nexa Capital is doing with its NextGen GA Fund avionics loans is a new concept. It's simply a convenient way to get relatively fast cash for the serious money you'll lay out for even a small upgrade.

Nexa is correct in its claim that it's bringing an avionics-specific loan program to an industry that's been asking for one for years. The way we see it, as 2020 quickly approaches, there's never been a better time for it.

FLIGHT STREAM

(continued from page 23)

GTN and/or to Garmin's G500 and G600 PFD/MFD, it automatically transfers the data to the connected systems. You can still use the data when a synchronization is occurring—you won't be locked out of an approach chart, for example, when Garmin's Flite Chart revision is being sent across the server.

STREAMING ADS-B

Garmin makes use of the 510's Wi-Fi only for database transfers. Other wireless streaming chores, including traffic and weather interface, are handled with Bluetooth.

The Flight Stream 510 is compatible with the GTX345 and GTX345R ADS-B transponders, plus the GDL88 ADS-B transceiver. Since ADS-B traffic and weather from these systems are interfaced with a GTN navigator, the data is transmitted via Bluetooth into the Garmin Pilot or ForeFlight Mobile tablet apps. The stream also includes GPS position. Flight Stream also works with the GDL69 and GDL69A SiriusXM datalink weather and entertainment system, allowing entertainment control directly in Garmin Pilot, plus the display of satellite Broadcast weather.

In a G500/G600 interface, the Flight Stream also broadcasts attitude information on Garmin aera 795/796/660 portable GPS navigators.

HOW MUCH?

At first blush, the Flight Stream 510's price—at $1495—seems heavy. But, consider that some legacy Flight Stream 210 installations might approach $2000. We think the gains in convenience when it comes to managing databases—including the ability to synchronize data among multiple boxes—will entice enough buyers to pay the price.

Speaking of price, Garmin also announced reduced pricing for its database packages, plus makes it easier to manage multiple subscriptions. For example, the new OnePak annual database package is streamlined into a single subscription for all of the Garmin avionics in one aircraft, including a qualifying portable GPS. Garmin also throws in a Garmin Pilot IFR Premium subscription for existing subscribers.

For more, visit www.garmin.com.

FEEDBACK WANTED

MOONEY M20J

For the December 2016 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Mooney M20J/201. We want to know what it's like to own these aircraft, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs **(full-size, high-resolution please)** you'd like to share to the email below. We welcome information on mods, operating expenses or any other comments. Send correspondence on the Mooney by October 1, 2016, to:

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Email at:
ConsumerEditor@hotmail.com