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LOCKHEED'S UTM: STEPPING UP UAS AWARENESS

A reader flagged me down in the UAS-dominant Innovations building at AirVenture last month and asked when *Aviation Consumer* was going to take the lead in protesting the operation of recreational and commercial drones that were on display. This guy was convinced that a midair with that drone over in the corner with the flashing lights and integrated GoPro (pointing to a DJI Phantom quadcopter on display) was going to take him and his Comanche down in the rural Iowa skies. After offering a polite "deal with it, dude—these things aren't going away," I pointed him to Mike Glasgow, who was manning the Lockheed Martin Flight Services booth strategically colocated in the UAS exhibition area.

Unlike that paranoid Comanche driver, I'm not exactly losing sleep over swapping paint with one of these things, but on the other hand, it would be helpful to know when and where larger commercial drones are lurking. I might sit up a bit straighter in the seat while transitioning the area. That's precisely what Lockheed's emerging Unmanned Aircraft Systems Traffic Management (UTM) service does by utilizing, in part, its web-based Next Generation Briefing product. It's all about increasing situational awareness, Glasgow told me, when it comes to traditional aircraft coexisting with UAS ops. That's a tall order, especially given scalability challenges. Glasgow said there are roughly 100 commercial operations currently participating in UTM, but that number is expected to snowball in short order—something that could hinder Lockheed's ability to better brief pilots on UAS ops, bog down the NOTAM system and increase the workload for telephone briefers. The lack of official policy for smaller amateur-flown UAS vehicles adds to the challenge.

What you might not know is that commercial UAS operators must obtain an air traffic organization (ATO) certificate of authorization (COA) prior to conducting operations in the airspace. Moreover, the COA requires the operator to file a NOTAM not less than 48 hours prior to the operation. That's where Lockheed Martin comes in. It developed a customized flight plan form for UAS operators, allowing them to enter the location, maximum operating altitude and general shape of the operating area directly on Lockheed's web briefing page, www.1800WXBrief.com.

Lockheed has also integrated the UAS information into its Next Generation Briefing capability. For example, in a standard briefing, which graphically shows your route of flight on a map, UAS operating data is overlaid along the route so you'll know if you're flying into a UOA (unmanned operating area) and when it will be active. There is a also a dedicated UAS tab where you can see scheduled operations in the CONUS, Alaska and Hawaii.

Looking to the future, Glasgow rattled off a handful of new alerting features that pertain to UAS operations, including runaway situations where the operator loses control of the vehicle by allowing it to fly out of the range of radio control link. "Imagine an unmanned vehicle that doesn't have internal logic for it to return to its base. Now you've got a drone flying aimlessly on its own. That's a situation we want to warn pilots of," Glasgow reiterated. While that seems easy in theory, it will still be up to the UAS operator to advise Lockheed of the runaway—either by phone or via the website—before the condition is passed along for broadcast through Lockheed's automated ACAS (adverse condition alerting service) uplink. Worth noting is an alert filter that warns only when the UAS is within 4000 feet of your altitude, reducing data flow.

Now that the FAA has awarded contracts to Lockheed Martin for DUATS II, you can expect more UAS briefing and alert capabilities. If you're paranoid about running into one, consider Lockheed's UTM a step in the right direction. UAS ops aren't going away—ever. —*Larry Anglisano*

WHICH AIRCRAFT PAINT?

We are looking at having some military aircraft painted by a company out here in California. They have all the Mil Specs for the color we selected, however, I started receiving phone calls from the various paint manufacturers wanting us to select their brand of paint.

As a military aviator, I never thought about who supplied the paint on the aircraft I fly, as long as it looked good and wasn't peeling and fading. Can *Aviation Consumer* provide me with some counsel on the pros and cons inherent in the different paint manufacturers, including PPG, Sherwin-Williams and Dupont? Do you guys have a preference?

Richard C. Bebb
CW4, U.S. Army

We ran this difficult question by Craig Barnett at Scheme Designers, our go-to for all things having to do with aircraft paint work. Barnett said the answer is easy if you select an experienced shop that specializes in painting aircraft and uses aviation-specific brands of paint (as opposed to vehicle paints or other industrial paints.) Aviation paints are more flexible for sustaining airframe vibration, better designed to cope with large temperature changes without cracking and are designed to be resistant to aviation fluids, including dyes, fuel and hydraulic oil.

As for selecting a paint manufacturer, once you pick the quality shop, stick with its preferred brand of paint. Every brand has different preferred techniques for spraying, as well as desired environmental controls (temperature and humidity, to name a couple) for the best results. Drying times and the look of the finish varies.

Some paints provide an intentional textured finish, which may even appear like subtle orange peel, while others provide deep reflective finishes. Barnett said most of the major paint manufacturers to include Sherwin Williams, PPG, Akzo Nobel and Axalta (Imron) make an excellent product, based on his many years of experience. As was evident from the paint shop survey in our June 2014 issue, the final product, its longevity and finish quality is not only a function of the paint that's used, but is strongly influenced by the quality of the work during the paint job. Bad preparation, incompatible materials—such as cheap primers not designed to work with the paint brand being used—and poor climate control may result in failed paint jobs, no matter what brand of paint is used.

PROPELLER LESSONS

Nice composite propeller article by Rick Durden in the August 2015 issue of *Aviation Consumer.* Where I get puzzled, however, is when the manufacturers and writers don't discuss the reasons why the three-blade props didn't go any faster than their two-blade counterparts.

To those of us who went through aircraft design class in aerospace engineering, it's a no-brainer. The propeller with three blades has more wetted area—hence, more drag—than its two-blade counterpart. More drag means that more energy is wasted pulling that extra blade though the air, thereby reducing blade efficiency (denoted as Greek letter eta). Eta, by the way, is the ratio of power delivered to the airstream divided by the power produced by the engine, typically between 82 to 85 percent. Constant-speed propellers keep eta at this efficiency level at pretty much all cruise speeds.

Going to the scimitar shape did increase eta a bit, however, because the third blade still has more wetted area, which most likely bumped eta back down to where it was before the third blade was added. On the other hand, if the scimitar shape were to find its way into a two-blade design, there would be even more power available. Maybe eta would get as high as 90 percent. Oh, now we're getting somewhere, but that's not going to happen, is it? There is your engineering lesson of the month.

David Rosing
via email

That's good stuff, David. When we looked at the pre-scimitar props, airplanes with engines of less than 230 HP lost some cruise speed going from two- to three-blade props. Above that, the speed was a wash—no gain, no loss.

LOW-COST BACKUP EFIS

I'm planning a glass cockpit retrofit and would like to install an electronic attitude indicator with airspeed and altitude tapes, plus battery backup. The L3 Trilogy, Aspen backup and Mid Continent SAM are out of my price range.

I recall reading in *Aviation Consumer* and AVweb.com there was a company developing an all-in-one EFIS for under $4000. All the unit needed was a electrical connection and a pitot static connections to it. Which unit is that?

Greg Wroclawski
via email

The unit is the $3595 Sandia Aerospace SAI-340, and it's still snagged in the certification process, Greg. We check in with Sandia monthly hoping to get our paws on one for a review, but it's just not ready yet. When it is, we'll publish a full report.

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Data Upkeep For Glass: Some Cost Relief

Database subscriptions are the hidden costs of retrofit avionics upgrades. Consider same-brand pricing discounts when planning your upgrade.

by Larry Anglisano

You aren't finished writing checks for an account-draining avionics upgrade when you fly it home from the shop. Now it's time to buy database subscriptions. If you're fat, dumb and happy updating your $180-per-year tablet app, get ready for sticker shock now that you have to feed electronic data into a Garmin or Avidyne suite. It's a real operating cost that isn't always considered during the buying decision.

While dealers are tasked with maintaining operating software, they generally don't get involved with database subscriptions, but they should deliver a new installation with fresh data. After that, the daunting task of paying for and loading scheduled database updates is on you.

In this article we'll sort through the data costs and update effort that tags along with retrofit avionics. Here's a primer: Sticking to one brand of avionics could make the chore easier and cheaper.

SOURCING AND STORAGE

With some exception—particularly for tablet apps—Colorado-based Jeppesen remains the primary provider of packaged primary navigation data, or NavData (which is airports, runways, frequencies, navaids, controlled airspace and restricted airspace) for nearly all certified avionics. Jeppesen, with its JAD (Jeppesen Aviation Database) has taken a beating over the years for its pricing structure and what some call a monopoly in the navigation data market. That's changing and we're seeing some flexibility on Jepp's part, especially when it comes to bundled pricing. More on that in a minute.

Jeppesen gathers its raw data from a variety of agencies (nearly 220 worldwide), although it says none of the data is sourced from government-compiled databases. Once the data is loaded into Jeppesen's centralized database, it's crosschecked for errors and some data is occasionally sent back to the original provider for clarification and or corrections. Jeppesen NavData is updated on a 28-day cycle and coincides with the International AIRAC calendar. Jeppesen ChartView approach charts are updated every 14 days.

Consider that Jeppesen is the sole provider of base navigation data for nearly every certified retrofit avionics (and experimental brands, too), including Garmin, Avidyne, Aspen and BendixKing. This may also include terrain and obstacle data, plus the familiar Jeppesen approach charting, although Garmin offers its own electronic version of NACO terminal procedures—called FliteCharts—updated every 28 days. Seattle Avionics Software also offers digital charts.

Remember the bad old days of paper charts? From a price standpoint, those were actually the good days. Electronic data has proven to be more expensive than the heaviest briefcase of paper charts. With some

Electronic data for Aspen's Evolution suite is sourced from Jeppesen and Seattle Avionics, left. With syn vis, base mapping, navigation and charts data, a yearly subscription is $744. That doesn't include the data for the GPS navigators that drive it.

CHECKLIST

- Discounted bundle pricing can reduce electronic data costs.
- Data download/upload process is being streamlined, thanks to newer storage technology.
- For even basic IFR avionics, you'll still need to pony up close to $1000 per year for nav and charting data.

Jeppesen has discounted bundled subscription pricing for multiple same-brand avionics like the Garmin G500 and GTN750, top photo, but not for Avidyne's R9 retrofit suite, middle. A subscription for it is $1810 per year. Jeppesen flat-rates all other full-Avidyne cockpits, including those with the new IFD540, bottom, at $994 per year.

exception, the plaguing problem with electronic data is the lack of a one-size-fits all solution. Generally speaking, while an Avidyne and Garmin GPS navigator may use the same underlying Jeppesen navigation database, the data is encoded and sized differently for each system, requiring the buyer to pay for multiple subscriptions.

This means storing and loading the data into the device may differ, too, although there has been progress in standardization by the use of SD datacards and thumb drives. If you own a Garmin GNS430/530, you are familiar with the Skybound Reader hardware that's required to transfer the Jeppesen data to the GNS-specific card. Modern navigators including Garmin's GTN750/650 and Aspen's Evolution use SD storage for transferring the data to internal memory. BendixKing and Avidyne use thumb drives. Retrieving the data from Jeppesen is also getting easier.

While Jeppesen has been dinged for its finicky JSUM (Jeppesen Services Update Manager) data transfer application, it's rolling out the next generation utility—JDM (Jeppesen Database Manager)—already launched for Apple iOS. This new drag-and-drop utility is aimed at reducing and simplifying updates.

GARMIN PILOTPAK BUNDLES

Garmin makes it relatively easy to bundle multiple avionics systems together, although interpreting its PilotPak pricing schedule isn't. But there is a substantial savings when buying data for the whole panel.

For example, one of the more common bundle scenarios includes the Americas Standard with FliteCharts PilotPak for the G500 PFD/MFD and the GTN750/650 touch navigator. This gives you all of the data you need for all three systems, including Jeppesen NavData, Garmin georeferenced FliteCharts, Garmin's SafeTaxi surface charts, airport directory and obstacle/terrain data for $1122 annually. This includes data for North, Central and South America. There are additional options for worldwide coverage.

Garmin told us that PilotPak pricing stands regardless of whether you have a single GTN750/650 or a G600 and dual GTNs in the panel. That's hard to determine when eyeballing Garmin's pricing structure on its subscription web page.

For example, the head-scratcher is the "Americas" versus "U.S. Standard" FliteChart subscription. Turns out the only difference is the Americas version includes FliteCharts for the U.S. and Canada, while the U.S. Standard only includes U.S. FliteCharts and U.S. SafeTaxi diagrams. Further, if you only have one navigator, there isn't a single box update option. You either buy the PilotPak package or purchase an annual subscription of Jeppesen NavData for $300.

While that seems relatively inexpensive, you'll still have to purchase a scattering of single updates throughout the year for SafeTaxi

YEARLY SUBSCRIPTION SAMPLE PRICING

GARMIN	
GTN750 OR GTN650	$1165
G500, GTN750/650 FLITE CHARTS PILOTPAK BUNDLE	$1122
PILOTPAK BUNDLE JEPPESEN CHARTVIEW	$1454

ASPEN AVIONICS	
EVOLUTION PFD/MFD	$445
SEATTLE AVIONICS CHARTDATA	$299

AVIDYNE	
IFD540 OR IFD440	$465
IFD540, IFD440, EX5000 BUNDLE	$994
IFD540, IFD440, CHARTS	$1405

BENDIXKING	
KSN770	$550
SEATTLE AVIONICS CHARTDATA	$299

TABLET APP DATA	
FOREFLIGHT PRO, SV	$179
GARMIN PILOT IFR PREMIUM	$149.99
WINGX PRO7 ADVANCED IFR	$74.99
FLYQ EFB VFR AND IFR	$109.99
JEPPESEN FLITEDECK * FREE WITH A GARMIN, AVIDYNE SUBSCRIPTION	$299

charts, obstacle data or whatever other data you want to update. It's pay now or pay later and PilotPak makes more sense, in our view.

NavData updates for discontinued Garmin products including the GNS530/430 are still supported and handled through Jeppesen. A yearly subscription for the GNS530W or GNS430W is $425.

Garmin offers obstacle and terrain data updates directly on its flyGarmin data services site. Consider that supplemental terrain and obstacle data doesn't change as often as navigation data, so you might update it once a year.

AVIDYNE FULL-COCKPIT

Like Garmin's GTN navigator, Avidyne's new IFD540 and IFD440 hybrid navigators have several internal databases, including NavData, Jeppesen chart data, plus terrain and obstacle data (the smaller IFD440 doesn't have charts).

Data for the IFD navigators is sourced from Jeppesen and stored on a USB thumb drive. Upload is straightforward; when the drive is inserted into the bezel-mounted USB port, the IFD recognizes that a data upload is present and away it goes.

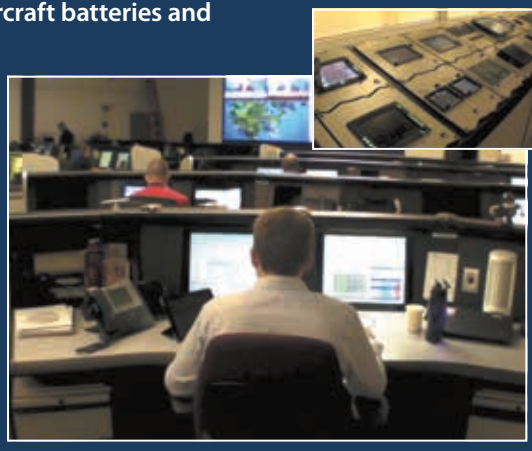
Avidyne worked out bundle pricing through Jeppesen where multi-Avidyne display cockpits—dual IFD540 or IFD440, EX600 MFD, EX5000 Entegra, for example—are eligible for a $994 yearly flat-rate data subscription.

It's important to note that this bundle only includes Avidyne systems. If you have an early-gen Cirrus with EX5000 integrated avionics and Garmin GNS430 navigators, you'll need to buy separate data subscriptions. But swap those Garmin navigators with Avidyne's IFD440 direct-replacement navigators and the $994 pricing will apply across the cockpit. A single IFD540 subscription, without charts, is $465 per year.

We like that data for a suite of Avidyne avionics is accomplished in a single download. Thankfully, gone is the serial number encryption for the avionics being updated, which made it impossible to use the same thumb drive on multiple systems. Now the aircraft tail number is used to identify where the data is going. With this, one drive serves all the boxes. What you can't do is send the data

JEPPESEN'S GLOBAL SUPPORT CENTER

We know firsthand that managing large amounts of navigation data—from downloading it from Jeppesen to uploading it into the avionics—isn't always a seamless process. We've killed enough aircraft batteries and crashed more browsers during data crashes. The stress level escalates when the problem occurs before a long trip, while the family waits in the FBO. But a visit last year to Jeppesen's Global Support and Command center at its Englewood, Colorado, headquarters proved that the company is making a sizable effort to help with the frustration.



The darkened command center is staffed around the clock and 365 days per year and there are no fewer than 60 specialists (some working remotely at sister locations) to handle technical support issues. Many of these support specialists are professional pilots—including experienced flight instructors—and many have backgrounds in avionics support and flight dispatching.

The support center is equipped with a working test bench housing nearly every avionics system that contains Jeppesen data. This means if you're sitting in the aircraft faced with a data upload glitch, a specialist can better talk you through the steps to get the issue resolved. It's also a way for Jeppesen to validate errors in nav data.

Jeppesen also uses the support center and its avionics setup to offer incidental support. This means if you're a new owner struggling to load a chart, as one example, a Jeppesen support specialist can walk you through the button-pushing sequence.

Jeppesen's support language is primarily in English, but some specialists are fluent in six other languages. Jeppesen also has a translation service to support up to 100 different languages.

Jeppesen's business and general aviation technical support division can be reached by telephone at 800-732-2800, or by submitting an email on its website, www.jeppesen.com.

from one system to the other. You'll need to update each box individually.

ASPEN AND BENDIXKING

Both BendixKing and Aspen Avionics devices use electronic data sourced from Jeppesen (NavData) and Seattle Avionics Software (ChartData). A Seattle Avionics subscription for Aspen's Evolution MFD products includes FAA-certified georeferenced IFR and VFR approach plates, airport diagrams, arrival and departure procedures.

Seattle Avionics offers each Aspen customer 90 days of free US ChartData updates (enough for three cycles of 28-day updates.) After that, annual U.S. subscriptions are available for $299. Jeppesen data is also free for 90 days, and then $445 annually. Like other brands, NavData, obstacle and cultural data are combined into a single update, which is delivered via the Jeppesen data update manager every 28 days. Jeppesen also provides mapping and terrain data for Aspen's ESV synthetic vision function.

The data is loaded to a MicroSD card, which we think is way too small to handle in the cockpit. If you don't drop and lose it, it's loaded into the slot at the bottom of the Evolution bezel. The BendixKing WingMan data services division handles the Jeppesen data for the company's new KSN770 retrofit navigator.

We were quoted $550 for a yearly America's subscription, while a single terrain data update is $287. Seattle's ChartData is an additional $299.

PAY TO PLAY DATA

While we're seeing at least some relief in data costs from previous years, a panel full of retrofitted avionics still means spending serious money on electronic databases. That's surely the case for reader Jonathan Baldwin. His Piper Seneca is equipped with a three-screen Aspen Evolution suite, Garmin GTN750, Garmin GNS430W, plus an iPad loaded with ForeFlight's Pro with a synthetic vision subscription. He tallied up a yearly cost that approached $2500—not including the SiriusXM subscription. Upgrading one of his GNS530W navigators to the GTN750 while retaining a GNS430W for backup added to the download process.

"The PilotPak update speeds for the Garmin GTN750 are faster individually, but since the various data packages with PilotPak come in separate downloads, it takes longer to download all of them versus the single download for the older GNS430W," Baldwin told us.

The GTN750s single SD card is a huge improvement over the storage process for the older GNS products. The only data the GTN750 actively uses from the SD card is the Jeppesen charts. The other data is uploaded into the device upon power up.

Baldwin's Seneca has far more avionics than the airliner he captains during his day job. For these bragging rights he takes the high cost of navigation data in stride.

"Electronic data subscriptions for all that stuff is expensive, but so is flying and anything that adds to the safety of my flying is money well spent."

Speaking of safety, if you're tempted to operate with expired data, consult the aircraft flight manual first. In it, the system's flight manual supplement offers specific operational guidance on the legalities of maintaining the database. The Garmin GTN750 supplement prohibits GPS-based IFR, enroute, oceanic and terminal navigation "unless the flight crew uses a valid, compatible and current database"—for which you'll pay.

AirVenture Diary: Engines, Refurbs, EFIS

There were positive vibes at this year's AirVenture at Oshkosh. New engines, refurbished aircraft and a new EFIS from BendixKing were standouts.

Staff Report

We generally don't know what to expect going into AirVenture at Oshkosh, and with several ho-hum years of late, we don't expect a lot. But with near-perfect weather, 550,000 attendees, 10,000-plus local-area arrivals, over 800 vendors (up 140 from last year) and only one major non-fatal wreck, this year's AirVenture impressed. Plus, there was no shortage of new product announcements.

Herewith is a summary of a few major ones that stuck to our show clipboard, to include new engine technology, avionics development (including a more cooperative Garmin) and a nicely refurbished Skyhawk that's priced just right.

ROTAX SURPRISES, DIESELS ADVANCE

Powerplant development in general aviation, while not entirely moribund, crawls along at a glacial pace with mostly small-ball innovations. But perhaps not at Rotax, the Austrian powertrain company that's been on somewhat of roll lately. At AirVenture 2015, the company surprised again with the third engine introduction since 2012. The new motor unveiled is the 915 iS, a turbocharged, intercooled variant of the 912 iS Rotax rolled out in 2012.

Interestingly, with roots in the motorsports world, Rotax is not one for announcing products that then overhang the market as development for the final product continues. Motorcycle products appear when they're ready to ship.

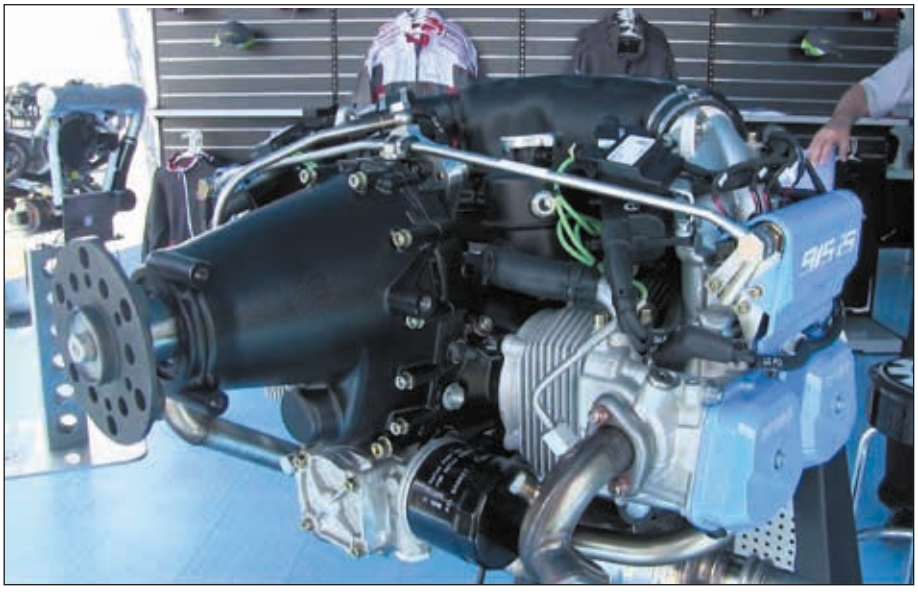
But overhanging is exactly what Rotax did at AirVenture, showing off an engineering concept article, but conceding that the engine won't be ready for market for at least two years. As it usually does, Rotax will offer the 915 iS in an uncertified version for the light sport segment and in a FAR Part 33 variant for certified aircraft.

We're not sure what's going on here, but a source in the European autogyro market told us at AirVenture that one thing that might be driving Rotax's decision to overhang is the Icon A5 light sport amphibian, which promises large production volume and, given its relatively high weight, may need more power.

And the 915 iS certainly has that. At 135 HP, it's the most powerful aircraft engine Rotax has attempted. In addition to offering more power to light sport manufacturers who may wish to offer hot rod versions like the Carbon Cub reviewed on page 8, the engine could very well find applications in a new range of small, certified aircraft.

The 915 iS is loosely based on the 912 iS as far as the basic case and cylinders go, but it has a new, reinforced multi-piece crankshaft, new forged pistons and a notably larger gearbox to handle the additional torque. It will use the same cylinders as the 912 iS.

Rotax's Marc Becker told us the engine will have a similar electronic fuel injection system and dual-channel ignition as the 912 iS, with a turbo controller integrated into the



The Rotax 915iS, left photo, is a 135-HP turbocharged engine for the LSA and certified market expected to be available in 2017. BendixKing's KI-300 retrofit electronic attitude gyro, top photo, should be available by the end of 2015.

ECU. The engine has a single turbocharger with a 1-3.5 compression ratio. Total displacement is 1352cc or 82 cubic inches. Rotax didn't provide cylinder compression ratio, but the minimum fuel requirement is 91 AKI or what popularly passes as premium auto fuel in some markets, including up to 10 percent ethanol content. It can also burn 100LL, according to the spec sheet. These are the same fuel requirements published for the 912 iS.

Performance is predicted to be full power—135 HP—to 15,000 feet, with a service ceiling of 23,000 feet, according to Becker. While the engine is certainly heavier than the 912 iS at 84 kg or 185 pounds, including all the plumbing, it's light for its power output. The 912 iS generally installs at around 165 pounds for a power-to-weight ratio of 0.6 HP/lb compared to 0.73 HP/lb for the 915 iS, if the predicted weights pan out. Compare that to the ECI Titan engine used in the Carbon Cub, which, at 180 HP, also has a power-to-weight ratio of 0.73 HP/lb, but at an installed weight of 245 pounds.

While Rotax hasn't flown the 915 iS yet, it does have some 2000 hours of test cell time on the engine and is moving rapidly toward a formal certification program. TBO is expected to 2000 hours. (See a video on the 915 iS at www.snipurl.com/2a48vze.)

While prompting from Icon may have pushed Rotax to overhang more than it has in the past, one other project may also have popped up in Rotax's rearview mirror: Superior Air Parts' unique three-cylinder diesel, the Gemini. At AirVenture, American Legend announced it has installed one in one of its Cubs and will proceed with testing toward a possible diesel light sport.

Heretofore, small diesels haven't been attractive to LSA airframers because of cost and weight, not to mention not being that much more economical than Rotax's efficient gasoline engines. Superior says the Gemini will run at about 0.37 BSFC on Jet A while the new 915 iS has claimed fuel specific of 0.45 lb/HP/hour. Whether that Delta is enough to make a difference to buyers in an engine that burns 6 GPH may be debatable. For more on the Legend installation, see www.snipurl.com/2a48w4w.

One other diesel development of note at AirVenture: Continental CEO Rhett Ross said the company now has an OEM for its CD-200 235-HP diesel engine, but he declined to identify the aircraft. Recall that the CD-200 has been somewhat of a hard luck engine. Continental acquired the technology from SMA in 2010 to certify its own version, but is only now gaining market traction with it. Cessna is using the SMA version of the engine in its 182 JT-A, but recently announced the project now has no definite timeline. If we were guessing about an OEM for the CD-200, it would be the Cirrus SR20. Cirrus did test the engine some years ago, but declined to move forward with it for technical issues that Continental may have now solved.

American Legend will be testing Superior's 100-HP Gemini three-cylinder, two-stroke diesel in one of its Cub clones, top. Legend says there may be a market for LSA diesels in areas without easy access to gasoline. Yingling Aviation is sticking with a Lycoming O-320-H2AD in its Ascend 172 refurbishment, bottom.

Another diesel project, the high-horsepower EPS line being developed in Wisconsin also surfaced again at AirVenture. With power in the 320- to 420-HP range, EPS is aiming a gap in the market. Years ago, the then Thielert Aircraft Engines developed the Centurion 4.0 from a Mercedes car engine. But that engine proved too heavy to be practical and Continental is now developing the CD-300. EPS's Michael Fuchs told us that the company is moving forward with a certification plan and looking for investor funding. Hear a full podcast at www.snipurl.com/2a48vwm.

AVIONICS

There were a couple of unexpected announcements from the avionics sector, including a new product that BendixKing can call its own: the KI-300. This is a solid-state retrofit replacement attitude gyro for the company's venerable King KI-256/KI-258 air-driven model. While the KI-300 can bolt into the same location as the old iron gyros it replaces, it doesn't require vacuum input.

Instead, the LCD display-equipped KI-300 uses solid-state attitude sensors, plus it outputs digital roll, pitch and yaw signals for driving a wide variety of BendixKing and Honeywell autopilots—including the KAP100, KFC200, KFC/KAP150, KFC225 and KFC250/275 systems.

The KI-300 is equipped with an electronic flight director command bar presentation and outputs roll and pitch stabilization for inputting to select ships' weather radar

Garmin opening its GDL-88 ADS-B architecture answers demand for more cross-brand compatibility, including ADS-B data overlay on Aspen panel displays and third-party tablet apps, including the dominant ForeFlight Mobile, top.

systems, including the BendixKing RDR2000/2100 system.

The KI-300 will be approved for use as the primary attitude indicator, has a standby backup battery for powering the unit for over one hour and can be used in aerobatic environments, BendixKing said at its packed media briefing at the show. When it's available in December 2015, the company said it can be installed under AML-STC and will have a five-year warranty, but noted that the nature of the MEMS technology means it has a lifespan that should outlive the old KI-256 several times over.

The KI-300 will be available in three configurations: The KI-256/KG-258 replacement for $5995, a $7995 version with outputs for replacing the King KRG-330 yaw gyro (for older KFC autopilots with yaw damper) and a standalone model (no autopilot interface) for $4995.

The other head-turning announcement comes from Garmin, who opened the interface of its ADS-B products. By using, in part, its Connext wireless cockpit interface, the GDL88 and GDL84 mandate-compliant ADS-B systems will work with other panel avionics and tablet apps.

Got ForeFlight Mobile on your iPad? With Garmin's Flight Stream 210/110 wireless Bluetooth hub, you can now overlay traffic and weather data from GDL-series ADS-B transceivers (an interface that was previously closed to non-Garmin applications and required Garmin's own Pilot tablet app.) The GPS in the GDL series can also drive ForeFlight's synthetic vision function, eliminating an external GPS or Stratus receiver.

The GDL88 and GDL84 ADS-B products can also interface with Aspen's Evolution displays. What made Garmin decide to start playing with others? Some hinted that the company is feeling pressure from buyers.

"Open systems offers the customer more choices, and choices creates competition and lower prices. Garmin opening its architecture is a remarkable change in the industry and is the result of the pressure from the media and the customers to offer more options," said Aspen's John Uczekaj during a media address.

Speaking of pressure, the FAA could be feeling the pressure to ease the certification complexity of angle-of-attack systems. Both Aspen Avionics (with its integrated AoA) and Safe Flight Instrument Corporation (with its leading edge SCc AoA) announced FAA certification. We flew with Safe Flight's SCc before the show and will have a full report in our October 2015 issue.

ASCEND LIKE-NEW 172

On display at AOPA's AirVenture tent was another remanufactured Cessna aimed at improving the dwindling pilot population. Similar to what Aviat Aircraft is doing with the Reimagined 152 refurbishment, Wichita, Kansas-based Yingling Aircraft introduced the refurbished Ascend 172 Skyhawk.

With a starting price of $159,000, the refurbished Ascend includes extensive disassembly, inspection and replacement of major old components with new ones, plus complete engine, propeller and landing gear overhaul. Don't look for a Jet-A-burning diesel engine conversion in the Ascend. Yingling is sticking with the Lycoming O-320 series.

Yingling says before it refinishes and repaints the Ascend, it strips the aircraft to bare metal to help spot and eliminate future corrosion. Like the Reimagined 152, the Ascend that was on display was finished in an eye-catching bright yellow paint job, but Yingling said two other modern paint schemes are available.

To help keep the price in check, the Ascend doesn't come with an all-glass instrument panel. Instead, the standard avionics package includes new analog flight instruments, a single Garmin GTR225 comm radio, GTX327 digital transponder and Aerospace Logic digital engine gauges. We're surprised that ADS-B isn't standard, but it's available as an option, as is Garmin's GTN650 touch navigator. The interior has new leather seats, a new glareshield and side panels, headliner, carpet and center console. The refurbishment also includes a modern instrument panel, all new circuit breakers, new wiring and new switches.

The 1978 172N Ascend we saw on display had good fit and finish, and Yingling seems a natural fit for refurbishing a Skyhawk. Consider that Yingling—which employs over 100 workers—was approved by Cessna as the first official service and parts facility back in 1946 and has remained a dominant supplier of Cessna replacement parts.

"This program is designed to bring low-cost flying within reach. We think the current market is right for the Ascend when you compare its price to that of factory-new aircraft. Hopefully it will bring lower hourly rental costs for flight training schools and flying clubs," said Yingling's Jerry Pickett.

For complete AirVenture 2015 coverage, including videos and podcasts, visit sister publication AVweb.com.

Carbon Cub Amphib: Quick Off the Water

With 180 HP, the Carbon Cub shrugs off the extra weight of the new glass Aerocet floats over the aluminum Baumanns. Build quality is superb.

by Paul Bertorelli

For people who fish, hunt and camp, and who also fly, float flying is an inevitable career checkpoint. If such pilots don't eventually own floatplanes, they're likely to hire pilots who do. That's why Beavers and 185s keep busy in Alaska and why a portion of light sport sales include floats. Now, one of the most popular float rigs, CubCrafters' hot rod Carbon Cub, is re-entering the market.

After a few years of fitting the Carbon Cub with Baumann floats, CubCrafters has switched over to Aerocet floats, not necessarily electively, either, because Baumann simply stopped making floats around 2011. Until the Aerocets became an option about a year-and-a-half ago, CubCrafters had no float choices for its buyers.

That may have cost some sales; CubCrafters' Randy Lervold told us that as many as one in five buyers order floats at some point in their ownership. And adding floats is not for bottom feeders; the floats themselves are a $50,000 upsell, pushing the total invoice for a well-equipped Carbon Cub to $280,000.

What you get for the money is, according to our recent flight trial of the Carbon Cub, a strong-performing amphibian that gets off the water quickly, is robust enough for operations from unimproved turf and, surprisingly, doesn't give up much cruise speed for hauling around a pair of plastic canoes where the wheels would otherwise be.

CubCrafters, which is based in Yakima, Washington, made its bones picking up where Piper left off with the Super Cub. The Super Cub has always been a favorite among backcountry fliers, glider and banner towers and pilots scratching a living out of flying fisher people on and off sandbars, rivers and frozen lakes for hire. For its size and weight, the Super Cub hauls a good payload, is easy to maintain and does all this at a moderate fuel burn.

Although Piper did well with the Super Cub, eventually selling about 8500 aircraft, it lost interest in the model in the early 1980s. That gave CubCrafters owner Jim Richmond an opening, first to restore and overhaul hundreds still in the field and eventually to design, build and certify his own version, the Top Cub. The Top Cub owes its existence to the Super Cub, using the same basic planform with similar dimensions and the same

The 180-HP Titan engine,right, developed in concert with ECi, gives the Carbon Cub on Aerocet floats plenty of surplus power for water and land ops.

CHECKLIST

- With an O-320 Titan, the Carbon Cub is the highest powered LSA.
- The airplane unsticks from the water quickly and climbs well, even at gross.
- And it will be at gross for most ops. Useful load is 330 pounds.

The Aerocets have manually operated hydraulic gear, above, with an electronic nanny to remind of gear position prior to touchdown.

airfoil section. However, CubCrafters re-engineered the Top Cub, improving its structural efficiency to the point that it carries more than the Super Cub ever did. The Top Cub is a steady but not huge seller for CubCrafters; most of the sales go to government agencies for patrol and survey work.

When the light sport aircraft rule was adopted in 2004, CubCrafters offered another take on the Super Cub, the Sport Cub and followed that model with a new design that both raised the bar on LSA performance and ruffled some feathers in LSA-dom. It was the Super SportCub, which eventually gained the nameplate Carbon Cub. Although it too follows the Super Cub idea—same basic size, planform and wing—the Carbon Cub comes at performance from both ends of the spectrum; lighter weight at the bottom and more horsepower at the top. Stripped to its underwear, a Carbon Cub has a less complex, lighter structure than the Top Cub did and is an astonishing 300 pounds lighter.

It has a 180-HP four-cylinder engine that CubCrafters developed in conjunction with ECi making it by far the most power-loaded airplane in the LSA segment, with performance to match the expectations raised by the numbers. Although it funded much of the development work and design, CubCrafters now has ECi supply the Titan engine which, at 245 pounds, is both the heaviest and most powerful LSA powerplant.

With both cruise and climb performance to spare, that makes the Carbon Cub a natural for floats. So does the fact that most of the pilots who buy floats are experienced seaplane pilots who know their way around lakes and rivers and want to get in and out of them to fish or hunt in peace.

BAUMANN OUT, AEROCET IN

When Baumann exited the float business, CubCrafters didn't have many options. Wipaire tilts toward larger aircraft floats that are both pricier and heavier. Lervold told us that only Aerocet seemed capable of designing and producing what CubCrafters had in mind. And what they had in mind was the lightest possible float with a little more buoyancy and length than the Baumanns offered.

"The airplane was a little under floated with the Baumanns," says CubCrafters' Lervold. "So if you were taxiing downwind and you wanted to turn crosswind and back into the wind, it could tend to bury that outside float and kind of scare you. The Aerocet has just a little more float and it's a little longer," he adds.

But there's always compromise and that's the case with the Aerocets. Made of fiberglass, they're heavier than the all-aluminum Baumanns by about 40 pounds.

Also, in glassy water, the Baumann float rivets break loose the suction that keeps the airplane stuck to the water. To do the same with the glass-smooth Aerocets, just raise one float just a bit when the airplane announces its ready to stop boating and start flying. Back in the Aerocets' favor, says Lervold, is that their chine hulls take chop better than the metal Baumanns do. Anyone worried about open water ops might find that a reasonable tradeoff against the higher weight of the Aerocets.

In exchange for the higher weight, the Aerocet floats also have more robust wheeled landing gear, with five-inch wheels rather than the four-inch rollers on the Baumann floats.

The larger wheels also have oleos rather than spring bumpers, so the floats can handle the bumps and jars of stuffing the airplane into unimproved strips that, besides lakes, is where many back-country pilots like to go. Like some of its larger brethren, the Aerocet floats have a hand-operated hydraulic gear system consisting of a stout Johnson bar attached to a double-acting pump on the floor at the foot of the pilot's seat on the left side. Select down and give the handle a half dozen pumps and the wheels extend; reverse it to suck them back into the floats for a water landing.

And the airplane will do its damnedest to keep you from getting confused about what you're fixing to land on. Standard equipment with the float set is an electronic minder that, when the airspeed gets below a certain value, nannies you to acknowledge the gear is up for a water landing or down for a runway landing. Forgetting one of these is worse that forgetting the other. A wheels-up landing on a runway will require an embarrassing visit to the paint shop; a wheels down landing on the water will involve recovery boats and a tense call to your insurance agent, if you survive the experience, which many pilots have not.

Lervold took us to

Rimrock Lake, west of Yakima, to try the Carbon Cub on both turf and water. We didn't compare the float-equipped airplane with a wheel airplane, but we would say you feel the weight of the floats during a runway takeoff. The wheeled Carbon Cub levitates off the runway almost before you're ready for it, but the float version seems more leisurely. A light Carbon Cub is capable of 1800 to 2000 FPM initial climb and with the addition of the floats, you'll lose about 200 FPM of that, mainly due to weight.

ON THE WATER

On the water, the Carbon Cub gets quickly on the step and with the throttle firewalled, it doesn't stay there long. In the video accompanying this article, you can see how quickly the airplane gets off the water, suggesting that Lervold was only half kidding when he said the Carbon Cub will get into mud puddles. This performance is due to favorable power-to-weight ratio. Other aircraft on floats—the Cessna 185 or 206—have tons more power, but also more weight.

In the LSA version, the Carbon Cub's maximum gross is the standard amphib 1430 pounds and we wouldn't be surprised if it's flown at a higher weight than that. Not to be a scofflaw, but the Carbon Cub's 1100-pound empty weight on floats, leaves but 330 pounds of useful load. Two people will use most of that up.

As noted above, the experimental version of the Carbon Cub is recommended for a maximum weight of 1850 pounds and that's the version we flew. It's essentially identical to the LSA version, save for minor airframe tweaks. The takeoff video was shot with two people aboard and nearly full fuel, so call the weight about 1700 pounds, nearly 300 pounds above the LSA limit.

The cruise performance hit varies. Lervold says that if the floats replace 26-inch wheels, the most popular option, there's little or no speed penalty. Plan on about 110 MPH true at 8 GPH and better if you're willing climb and/or burn more fuel. Not bad for an LSA on floats, in our view.

Visibility in the cockpit and over the nose is excellent, especially for water landings, where the attitude is a little flatter than it appears to be in a three-point runway landing. From the front seat, the view is commanding on floats and good on land gear because the three-point attitude doesn't block the view over the nose; no S-turns required. Approaches are flown at under 60 MPH indicated, against a stall speed of 34 MPH at gross weight.

For our glassy water landings, Lervold recommended 55 MPH indicated and a taste of power to set up a 100 FPM descent rate to settle onto the smooth surface. For this kind of work, CubCrafters has equipped the airplane with an analog precision VSI occupying the center of the pilot's view over the glareshield.

The Dynon glass in the airplane we flew has too much latency and is too far out of the pilot's view to serve the same purpose. Once on the water, the Aerocet's water rudders are deployed with a spring-loaded cable arrangement on the right side of the cockpit. Step taxis and slow taxi offered no particular difficulty.

NO APOLOGIES

As LSAs go, the CubCrafters airplanes are at the top tier, pricewise. Even the land-gear equipped versions invoice for around $225,000 because the base prices are high and buyers tend to option them up with everything imaginable. Jim Richmond offers no apology, for CubCrafters discovered long ago that it's catering to a premium market and that buyers will write the check if they think the quality is there. We get the impression that the company doesn't see a lot of tire kickers, but rather pilots who want a demo flight just to confirm that the 200 big ones they're about to spend will pay for a quality airplane.

At any level in the LSA price chain, we've seen what we would describe as good construction practices and acceptable fit and finish, although some are a little better than others. We don't see any LSAs with goobered paint or doors that don't fit, which is more than we can say for the 25-year-old used airplanes that pass as, if not new, than not that old. CubCrafters airplanes appear to be consistent with this trend, but distinguish themselves, in our view, for creative engineering. The structural revisions CubCrafters wrought on first the Top Cub, then the Carbon Cub are hardly trivial but represent a major effort that approaches transformation, something that's evident in the performance compared to other LSAs. And that, in our view, is what the high price tags fund. Buyers who want that kind of performance should expect to pay for it and about 50 a year are doing just that.

Contact CubCrafters at 509-248-9491 or www.cubcrafters.com

LOTS OF LSA FLOAT CHOICES

Just as this issue went to press and in time for AirVenture, CubCrafters' arch competitor, American Legend, announced its own new float option. Surprisingly, Legend is building its own.

Legend says the new LF1500A floats for the Legend and Super Legend are made of Kevlar and carbon fiber and have mechanically operated landing gear for land ops. Like the Aerocet floats, they have watertight compartments for storage. For more, see www.legend.aero.

Although hardly an everyday sight, floats are also available for other light sport aircraft, including the Flight Design CTLS. Clamar's 1400 float series, according to Flight Design, still allows for 500 pounds of useful load and a 110-knot cruise, down only 5 knots from the land-gear version of the airplane. Price for a fully float-equipped CTLS is about $162,000. See flightdesignusa.com for more information.

Zenair also makes floats for experimentals and LSAs, ranging from models for ultralights all the way to 1450 and 1700 amphibious and straight floats. Zenair offers these as kits. Find out more at www.zenair-floats.com.

Mead Floats, based in Sebring, Florida, specializes in carbon fiber floats in two sizes, a 1430 and a 2200. (These numbers, by the way, refer to the flotation capacity of the floats and appear consistent from company to company.) See Mead's website at www.meadfloats.com for prices and applications.

Garmin GMA350c: Wireless, Voice Command

If you're looking for a bare bones audio panel, you won't find it in Garmin's next-generation GMA-series panel. Wireless Bluetooth only scratches the surface.

by Larry Anglisano

Garmin's first stab at cabin audio control was the GMA340, an audio panel that wasn't packed with fancy features, yet it did what a modern audio panel was supposed to do: Provide high-quality intercom and radio audio. Moreover, it had a feature set that didn't require a PhD to operate.

But the GMA340 replacement—the $2295 GMA350c—takes the user experience to a much higher level. So high, perhaps, that it might be intimidating for users who can barely operate a smartphone.

On the other hand, Garmin says it designed the all-digital GMA350c-series with features that can reduce workload. This includes voice recognition and command for automatically switching comm transmitters, 3D audio for better differentiating multiple audio sources and a wireless interface with the Garmin Pilot tablet app. We went flying with the system in Garmin's Cirrus for a closer listen. Here's an overview.

DROP-IN, ALMOST

Kudos to Garmin for making the GMA350c compatible with the GMA340 interface wiring and connectors. Audio installs are time-consuming and can result in sizable amounts of teardown. But installers (and owners writing the check) won't be entirely off the hook when transitioning to the new panel. It requires replacement of the mounting rack—an easy task in some stacks—but not so much in others, especially one-piece, riveted Mooney stacks, to name one head-shaker. If you already have a non-Bluetooth GMA350, the new "c" model will use the same wiring and mounting rack

If you use stereo headsets, it will be worthwhile to have your installer finally replace the mono audio jacks with stereo jacks, since the GMA350c provides stereo audio. Now more than ever, overall audio quality depends on the quality of the headset and the condition of the wiring.

The new GMA panel comes in three major configurations: GMA350c stack mount, GMA35c remote mount—for interfacing with the GTN750 touchscreen navigator—and the GMA350Hc for helicopters—supporting three comm radios and night vision goggle readability.

CHECKLIST

- If you want seamless Bluetooth connection for a smartphone, the GMA350c delivers.
- GMA35c remote model saves panel space and is controlled from the GTN750 navigator.
- For some, the GMA350c may be a bit too feature rich. Try a Bluetooth headset for less money.

One trait we liked about the GMA340 was its robust push-button and knob controls, plus decent mode annunciation and the GMA350c maintains the tradition. When a key is selected, a triangular annunciator above the key is illuminated. Annunciator brightness is adjusted automatically by photocell dimming. Key brightness is adjusted by the radio dimming bus control. But that is where the similarities end, although the unit retains a six-place intercom, marker beacons (except on the helicopter version), a cabin speaker function, plus pilot, copilot and passenger intercom isolation. Additionally, the new panel includes a comm clearance recorder and player for 2.5-minute looped audio playback.

BLUETOOTH CONNECTIVITY

Garmin isn't the first to offer integrated Bluetooth. It was PS Engineering that brought the feature to its line of audio panels a couple of years ago. If you listen to music in the cabin, you'll wonder how you dealt with cabled music input. If not, you'll likely wonder what the hype is all about. In the GMA350c, it's more than just streaming tunes.

With connectivity to an iOS or Android tablet or smartphone running Garmin's Pilot navigation app, the GMA350c receives terrain and traffic warnings directly from the tablet. Additionally, three wired aux inputs are available for other device inputs. This could be a landing gear warning system, engine monitor or other attention-getting alerts.

Garmin refers to the panel's Bluetooth telephone and entertainment distribution as Blue-Select

GMA350C CONTROL SET

mode, which is entered by pressing the small rotary volume knob. Once pressed, the annunciator over the telephone/music symbol key flashes blue. Additionally, any combination of the annunciators over the Pilot, Copilot and Pass buttons may be blue, indicating whether the pilot, copilot or passengers are also receiving the Bluetooth audio source. Since the panel can accept dual music inputs (actually, three, if you include the 3.5-mm wired stereo input on the front bezel), you might utilize one input for streaming wireless music from the smartphone and the second input from a remote wired SiriusXM receiver, for example. A dedicated Bluetooth annunciator indicates when the panel is paired with a device and will remember it between power cycles.

To pair with a device, press and hold the inner control knob for two seconds. The Bluetooth status annunciator flashes for two seconds to indicate the panel is discoverable—and remains discoverable for 90 seconds—until a pairing is established.

When paired with a telephone, the panel offers full duplex communications. If the Bluetooth connection is supporting a phone call, all intercom positions listening to that source can also speak on the call through the headset. Using a telephone with the system is seamless. Need to call for your clearance? Establish a Bluetooth connection with the phone and communicate over the headset.

The panel has a configurable muting feature for both telephone and music audio when comm chatter is present by pressing and holding the Music or Blue-Select key. Should the audio panel have a power or hardware failure, a failsafe mode automatically connects it to the primary comm transceiver, but the cabin speaker will be inoperative.

TELLIGENCE, 3D AUDIO

Telligence is Garmin's buzz name for voice recognition, allowing the user to control many of the functions using spoken commands. Voice recognition is activated by pushing and holding the pilot or copilot push-to-talk switch while speaking a command. When the switch is released, the panel responds to the command.

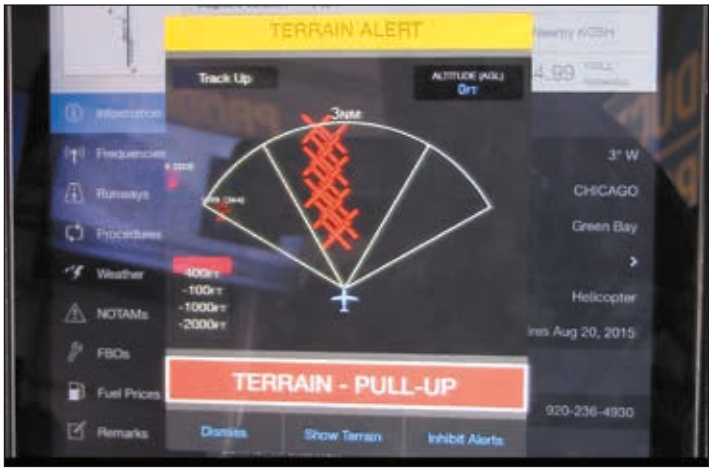
Perhaps the most common use for Telligence is toggling the transmit select mode from one comm radio to another, in the case of a frequency handoff, as an example. Push the switch and say "comm one," and the audio panel automatically toggles comm one as the active transmitter, eliminating the need to reach up and hit the button on the bezel. Other recognized commands include "aux" for enabling auxiliary audio input, "telephone" for activating the telephone audio input and "music," for enabling or disabling music input.

The pilot's guide lists over 100 recognized commands to choose from. Should the panel not recognize a spoken command, a negative acknowledgment tone will be played. When it understands the command, a positive acknowledgment chime is played. Some commands are acknowledged by a voice response from the audio panel.

A function carried over from the non-Bluetooth GMA350 is 3D audio, which uses digital audio processing to locate the inputs to the headset. Think of it as audio spatial dimension, or the processing of the audio more closely to how the human ear naturally responds to directional audio sources. It's an electronic illusion, really, with the panel artificially delivering audio sources as if they were coming from a unique location in the cabin or specific seat position.

Consider monitoring multiple audio sources—perhaps comm one and comm two—while also listening

Wireless Bluetooth connectivity, top, means no more patch cables to pipe the Doobies into the audio system. The GMA350c Bluetooth transceiver also receives audible traffic and terrain alerts from the Garmin Pilot tablet app, bottom.



to passenger intercom chatter. With 3D processing, comm radio one will seem to come from the front left and comm two will come from the right, coinciding the way both comm radios are separated in the radio stack or on the instrument panel, in most configurations. Intercom audio is also separated relative to where each individual sits. By default, the system assumes the pilot is in the left seat and the copilot is in the right. Only have a single comm radio? Its audio will be processed so it's heard in the 12 o'clock position.

To fully benefit from 3D audio, you'll need stereo headsets. If not, you'll still hear all of the audio sources, but without spatial separation.

If 3D audio proves to be too much (we think it takes some getting used to), it can be turned on and off by toggling the Pilot function key.

On a side note, we give PS Engineering's PMA450 a slight edge when it comes to configuring what it calls Dimensional Sound Intelli Audio. That audio panel has a digital display with an onscreen visual setup mode so you can manually configure the position of the comm radios to your liking. It doesn't, however, spatially orient passenger intercom audio. We covered the PMA450 in the September 2014 issue of *Aviation Consumer*.

TV GMA350C VIDEO

AVweb
www.avweb.com

ADVANCED ICS

Of all the fancy features available on the GMA350c, the one we like best is the ability to manually adjust the intercom squelch level. While the system has automatic squelch—which proved to be accurate in the Cirrus we flew—there might be plenty of times when adjustment can come in handy (when mixing different brands of headsets, for soft voices which may not break the squelch and for loud cabins, to name a few situations).

A dedicated manual squelch key takes the unit out of the default autosquelch mode, while the volume/cursor knob controls squelch adjustment. You can also separately adjust the intercom volume for pilot, copilot and passengers by cursoring over the Pilot, Copilot and Passenger function key and then turning the volume knob. There is a even a volume adjustment for the music input, aux input, cabin speaker and marker beacon signal.

In split-comm mode, both the pilot and the copilot can transmit simultaneously over separate radios. When in split-comm mode, the pilot transmits on comm one and the copilot on comm two. As with other systems with this split mode, performance is heavily dependant on the configuration of the comm antennas and the separation of the tuned frequencies.

Our experience has proven that split comm functionality works the best when one antenna is on the top of the aircraft and the other is on the bottom. If not, expect interference or bleed-over from one transmission to the other.

If you have Garmin's latest VIRB X-series action camera, the GMA350c will wirelessly connect to it for piping in intercom and comm audio over the video recording. With this configuration, no more dealing with cables and impedance mismatches with external camera inputs.

Overall, we think Garmin got it right with its next-generation audio panel, although we think it will be over-featured for buyers looking for basic functionality. But isn't that the case with most avionics these days?

Visit www.garmin.com.

FINALLY...BOSE A20 GETS REAL BLUETOOTH

If you're looking for Bluetooth connectivity for entertainment and tablet app interface, you don't have to spend big on a major audio system upgrade. Consider that a full-up GMA350c audio panel interface could easily top $5000 for an average installation. That's a hefty price to pay for Bluetooth connectivity. As an alternative, you might try connecting your devices through a Bluetooth headset, including the updated Bose A20. While the enhanced A20 isn't a new model (it was introduced five years ago), the set now gets the Bluetooth capability the market expects—including wireless music streaming. The only way to listen to music with the previous version was to plug it in via stereo patch cable. Unchanged is the A20's 12-ounce top end, including its fit, finish, ANR audio performance and comfort. New to the A20 is a redesigned control module, which requires swapping the interface cord (also called the downcable.) The downcable also has a new microphone in favor of an improved and more adjustable one, which can be attached to either earcup.

The ANR module on the replacement downcable houses a modernized Bluetooth system, supporting a variety of Bluetooth profiles including A2DP, or advanced audio distribution profile. That means you can finally stream music audio and navigation app data alerts from a tablet or smartphone. Once connected, you can do a lot more with those sources, too. The headset retains the mute and mix prioritization function, which will either mute or mix an auxiliary audio source when there is intercom chatter present, but the updated A20 takes it one step further. It allows you to prioritize and manage multiple secondary audio input sources.

For example, while you might have two Bluetooth devices paired to the headset at one time—plus a wired aux input connected—you can select which of the two Bluetooth devices has priority over the wired input. Perhaps terrain or traffic alerts from a tablet app should have priority over background music, as one example. Essentially, the system has some smart functionality that you would expect from an advanced audio panel.

"If you think of this audio input prioritization as a totem pole, the most important thing is at the top, which is intercom audio. The next device down the pole is a cell phone, which may always be present in the background. Then it's up to you to decide what the next prioritized device is going to be," said Bose's Hratch Astarjian during a demo at AirVenture, where the enhanced A20 was introduced.

Setting the source priority is accomplished with the BT-AUX switch located inside the battery compartment. Simply slide the switch to the correct source to set the prioritized device. When the switch is in the BT position, the Bluetooth audio source will override the auxiliary input source when a Bluetooth signal is detected. Similarly, when the switch is in the AUX position, the auxiliary source overides the Bluetooth source when an auxiliary signal is detected.

The Bluetooth module also has a three-position secondary audio mode selector switch for further configuration. When the switch is in the MUTE mode, all secondary audio sources are temporarily muted if an intercom signal is detected. When set to MIX, all secondary audio sources are mixed with the intercom audio, plus audio from a connected device will keep playing during intercom communications. When set to OFF, only the intercom audio is active and all other inputs are disconnected. Think of it as "pilot isolation" mode for background music. Although the system supports multiple secondary audio sources, you can only hear one input source at a time.

The updated downcable also brings better power management, including automatic power-up when the single panel-power plug is used for ship's power. No more forgetting to turn the ANR circuitry on when you plug in as we've blundered with for years.

While the enhancements will be standard on all new A20s, the upgrade to existing A20 headsets is easily accomplished in the field. Two screws release the old boom microphone and the downcable assembly from the earcup. Simply plug in and secure the new downcable and microphone to whichever earcup you wish and reattach the screws.

The new downcable (available in a coil cord for helicopter ops) with enhanced Bluetooth is $295 and $195 without Bluetooth. Pricing for an entire A20 is unchanged. With Bluetooth, it is $1095 and $995 without Bluetooth capability.

Contact www.bose.com, 800-379-2073.

Personal Flotation Devices: Wide Market Choice

But for short forays over water, an airline-type vest is suitable. For regular overwater flights, pick a vest comfortable enough for constant wear.

by Rick Durden

If you fly one of the vast majority of general aviation aircraft, you can legally operate over any of the waters in and around the U.S. without any sort of flotation device aboard. The requirement to carry survival equipment for operations over water more than 50 miles from land set out in FAR 91.509 only applies to airplanes weighing over 12,500 pounds and turbojets. We bugsmasher operators don't have to carry so much as a set of water wings.

SAFETY GEAR

Given that most pilots can't swim even a mile and despite the fact that aircraft engines can't tell if they're operating over land or water (and have proven very reliable so long as they are getting fuel), having some sort of personal flotation device for each person aboard an airplane that's flying over water is sensible.

We did a survey of what's available for personal flotation gear that we considered suitable for general aviation use and came away impressed with the size of the selection and not shocked by the prices.

When it comes to terminology, we'll use personal floatation devices (PFD), life vests and life preservers interchangeably even though such usage may not be precisely accurate and the FAA uses the term life preserver in the regs.

Because most Part 91 operators do not have to carry life preservers, those who do so are not required to carry ones that are FAA approved. For those who do wish to carry aviation life preservers, they are approved under a version of TSO C13f. At a minimum, we think that a PFD intended to be used by an adult as insurance in case of ditching in a Part 91 general aviation airplane should be Coast Guard approved for watercraft and provide a minimum of 35 pounds of buoyancy.

Based on experience in various general aviation aircraft, we think that trying to put on a PFD while in the cabin on short notice is unrealistic. Accordingly, we strongly recommend that if you are going to be flying over water and have life preservers, that they be put on prior to flight. The need to wear a PFD means that the unit has to be comfortable enough to be worn continually on what may be a long flight and robust enough that it can be removed from its packaging, worn and then stored many times without damage.

Revere Comfort Max, left and Stearns Suspenders, right, got thumbs up for comfort on small shoulders. Pull the tab to activate a CO2 inflator, bottom photo.

STYLES

There are three basic types of PFDs on the market: airline vest, belt pouch and continuous wear. We prefer the continuous wear for comfort, with the airline vest a close second because of its low cost. We've used, but are not crazy about, the belt pouch for general aviation airplanes.

The airline vest-style life preserver is what you've seen demonstrated on airliners forever. One of the reasons is that they work. They provide plenty of buoyancy for an adult and keep a person's head out of the water. Many include a water immersion-activated strobe light for help with search and rescue.

Switlik adult and infant underarm life preservers are specifically designed for GA aircraft.

The downside of the airline vest is that it's not designed for repeated wearings and may not be comfortable when worn throughout a flight. We have used the type for multiple-hour over-water survey flights and found that wearing a shirt with a collar that could be flipped up worked to protect against the real problem—neck chafing. Carefully folding the life preserver after flight and putting it into a dedicated package such as a one-gallon zipper lock bag helped protect it against damage.

In our survey of the market, we found that Switlik, one of the largest aviation life preserver providers offers an airline-style life preserver for $50. We also noted that it offers a dedicated infant, underarm support life preserver for $90.

The belt pouch PFD is a flotation device in a pouch, worn around the waist on the attached belt. Simply open the pouch and don the PFD. We like the idea, we but have a certain level of discomfort with its use unless the user has practiced donning it. We've seen too many examples of people not being able to accomplish a task when doing it for the first time under stress.

To don the belt-pouch PFD, the aircraft shoulder harness(es) have to be released, the PFD slid over the user's head and the harness(es) reattached. If the shoulder harness and seatbelt are a single unit, everything has to come off while the PFD is put on. The risk is obvious. Because the data on the greatly increased risk of injury or death when a shoulder harness is not worn is so compelling, we cannot recommend something that requires disabling a vital piece of safety equipment in an emergency, even temporarily. Our survey of the market found belt pouch PFDs in prices from $80 to $140.

Continuous-wear PFDs have been increasing in popularity for the last 20 years. We like them because they are comfortable, which means it's likely they will be used. A close friend flipped his SeaRey amphib while step taxiing after hitting what was probably a submerged log. His daughter and he each had on a continuous-wear PFD. They swam clear of the inverted, partially submerged cockpit, inflated the PFDs and easily swam to shore. Perhaps that event has colored our perception of continuous-wear PFDs, nevertheless, because they are designed to be comfortable as well as to be used, stored and used again over time, we think they are the best choice for use as life preservers in Part 91 aircraft.

We saw prices for continuous-wear life preservers starting at $105 and climbing to $400 for the best units that were designed for pilots who regularly fly over water and contained pouches and attach points for a PLB, signaling mirror and other survival equipment.

DITCHING

No matter what the landing gear configuration of a general aviation airplane, ditching is a surprisingly low-risk proposition—89 percent of the occupants are able to get out of the airplane following a water landing. In addition, fixed-gear airplanes don't necessarily flip over as is commonly believed—often the gear simply functions as a hydrofoil.

Nevertheless, during egress the cabin may be more or less full of water or upside down. That means that an inflated life jacket—or a flotation device that doesn't require inflation—may hamper or preclude getting out. That's why it's important not to inflate the jacket until clear of the airplane and not to use a marine-type jacket that doesn't require inflation or inflates automatically upon contact with water.

Life preservers are commonly described as "automatic" or "manual." We're concerned that the adjectives are confusing. Automatic means it inflates on contact with water—great for falling out of a boat, but not so hot for ditching. Manual means that the wearer has to take some action to inflate it—either jerking hard on a tab or row of beads, or blowing into an inflator tube. The fact that a CO_2 cylinder does the inflation work doesn't make a life preserver automatic. It's the requirement for action by the wearer that determines the appellation.

Aviation life preservers use a row of red beads for the device that the wearer jerks—and we mean jerk, merely pulling is not enough—to activate the CO_2 inflator. Marine PFDs still have tabs—which can hang up on protrusions or junk in the cabin when you're trying to boogie out in a hurry. That can either stop you from escaping or cause the vest to inflate inside the cabin—either one an unsuitable state of affairs. Make your purchase decision accordingly.

Because the PFDs we surveyed use a CO_2 cylinder to inflate them, and because components and fabrics wear out, every manufacturer recommends regular inspection and maintenance. On top of that, figure on about a 10-year life expectancy.

CONCLUSION

We like the aviation continuous-wear life preservers for anyone who regularly flies in circumstances where there's a healthy risk that a power interruption means going swimming. For the price, and with a little care in storage, airline-style vests are a good deal and provide proven flotation. We're not crazy about belt pouch units where shoulder harnesses are involved. Do not select an automatically inflating unit. No matter what you chose, we consider 35 pounds of buoyancy as the minimum acceptable.

Intercoolers: Turbo Enhancement

Properly designed, intercoolers allow a turbocharged engine to develop more power at higher altitude and improve detonation margins and engine longevity.

by Rick Durden

The idea of stuffing more air into an engine to increase its power output is anything but new. Mechanically driven superchargers have been compressing ambient air and feeding it to engines since at least 1885, with their exhaust gas-driven offspring, turbosuperchargers (often shortened to turbocharger or turbo), since 1905. The first turbos were installed in combat airplanes in World War I to increase their performance at altitude.

While feeding compressed air to an engine means it can burn more fuel and develop more power, there are, of course, limits to this good thing. When a gas is compressed, it gets hotter. Hotter air coming into the engine means the fuel/air mixture is hotter and the heat increase during combustion means that the engine will be running closer to its detonation limits and cylinder head temperatures and pressures will be higher, potentially reducing cylinder life if CHTs cannot be kept in line.

Naturally, someone realized that if the hot air coming out of the compressor could be cooled before going into the engine, there would be a quadruple benefit—the engine would still put out more power than it could breathing ambient air, the detonation margin would increase, engine life would increase and the engine would put out even more power because it was inhaling cooler air (remember what happens when you pull the carb heat knob).

In 1926, 23-year old Indy racer Frank Lockhart developed and patented an intercooler for his supercharged Miller racer. Even though it added some 55 pounds to the weight of the car, the added power allowed him to smoke his competition.

By World War II, intercoolers were found on most supercharged and turbocharged airplanes. After turbocharging came to general aviation in the 1960s, intercoolers, as aftermarket mods and standard equipment soon followed. We like them.

An intercooler was standard on the Cessna P210R, helping to boost its performance.

WHAT IT IS

An intercooler is nothing more than an air-to-air heat exchanger or radiator. The design goal is to keep the weight to a minimum while making it big enough and efficient enough to reduce the temperature of the compressed air coming out of the compressor side of the turbo to something approaching what the engine would be breathing on a standard day at sea level.

As was explained to us by George Braly of Tornado Alley Turbo, a company that makes turbo-normalizing mods that include intercoolers for the Beech Bonanza, Cirrus SR22 and Cessna 177RG and 185, there's no free lunch. When an intercooler is doing its thing, it creates back pressure for the turbo compressor, forcing the turbo to work harder, which means the waste gate has to close a little bit more. That increases exhaust back pressure and that reduces the volumetric efficiency of each engine cylinder. The result is that the improved number of molecules that go into the cylinder with the denser air is offset by the reduced volumetric efficiency.

While that sounds like a zero-sum game, Braly pointed out that there is published research going back decades showing huge improvements in detonation tolerance, and thus more available power at higher altitudes, from the use of even a modestly efficient intercooler.

The detonation margin improvements mean that a pilot is less likely to damage the engine because of momentary inattention to power settings during climb. That's a big deal for turbo systems that require that the pilot keep close track of manifold

pressure and mixture during climb.

Beyond better detonation margins, an intercooler means lower cylinder peak pressure during combustion, reduced exhaust valve temperatures and greater valve and cylinder longevity. Denser air coming into the cylinder means a denser fuel/air charge, more horsepower and a cooler initiation of the combustion event, which means a cooler overall combustion event.

The graph on the next page depicts data obtained by Tornado Alley Turbo and Advanced Pilot Seminars showing the available horsepower, with adequate detonation margins, at different induction air temperatures. For an engine that can develop 330 HP with an induction air temperature of 100 degrees F—a hot day at sea level, its power output drops to 212 HP when the induction air temperature is 250 degrees F. That 250 F temperature is not unusual when flying a turbocharged engine without an intercooler in the high teens on a hot day.

A good intercooler should be able to reduce the induction air temperature significantly. We've seen claims of 160 degrees F across the intercooler, but any such claim has to be taken with caution. The back pressure from the intercooler itself causes the turbo to work harder, which increases the temperature of the air coming out of the compressor into the intercooler, so the real measurement of intercooler efficiency is the amount the intercooler can reduce the temperature of the air coming out of the compressor had there been no intercooler in the first place.

To our knowledge, all of the factory-installed and aftermarket intercoolers give more than they take—they reduce the temperature of the air coming out of the compressor more than they increase it due to the back pressure they generate.

In researching this article, we learned that companies are steadily developing more effective intercoolers. We also learned that bigger is better—more cooling can be obtained with minimal weight gain. A number of aftermarket mod companies have progressively developed more efficient and effective intercoolers over the years, so an owner seeking to replace an existing intercooler may find that the new one is measur-

OPERATIONAL CONSIDERATIONS

The good news about the care and feeding of your intercooler itself is that not much is needed. Pared down to the basics, an intercooler is an air-to-air heat exchanger. According to Wayne Thomas of Pacific Oil Cooler Services, Inc.—one of the biggest repair stations that specializes in repair and overhaul of oil coolers and intercoolers—an intercooler doesn't see the internal pressures oil coolers do and, accordingly, don't usually wear out. He said that ordinarily intercoolers easily last to engine TBO, at which point they should be pulled, inspected and repaired as necessary.

Also, unlike oil coolers, some leakage is acceptable in intercoolers. Where there is zero tolerance for leakage in an oil cooler, finding a small air leak in an intercooler is not a yank-it-and-fix-it-now discovery. There's time to evaluate the extent of the leak and whether it requires further action.

Thomas told us that there are two enemies of intercoolers. The more serious is corrosion—the bane of any aluminum aircraft component. The second concern is cracking due to vibration, although Thomas advised his company sees intercoolers sidelined by cracks far less often than from corrosion.

As with any part, an intercooler will eventually wear out, becoming unrepairable. At that point it's time to either buy a new one or, better still, check to see if the outfit that developed your mod has come up with a more efficient version.

The more serious consideration, particularly on some of the older mods, is missing STC paperwork and POH supplements that establish manifold pressure limitations for climb and cruise that must be followed. If those limits are exceeded, the fact that the engine is getting substantially cooler air than it did during certification—especially on hot days—may result in the engine developing more than its rated horsepower. Doing so for any length of time means a significant risk of damaging the engine through detonation or overheating. On those systems in which the STC mandates reduced manifold pressure, the STC developer wasn't kidding.

Some intercooler mods also include a cockpit gauge that the pilot references in setting manifold pressure. We've received word that it's not unusual for those gauges to be inoperative. If you're buying an airplane with an intercooler mod that includes a gauging system, make sure it's working. If not, be suspicious of the engine condition.

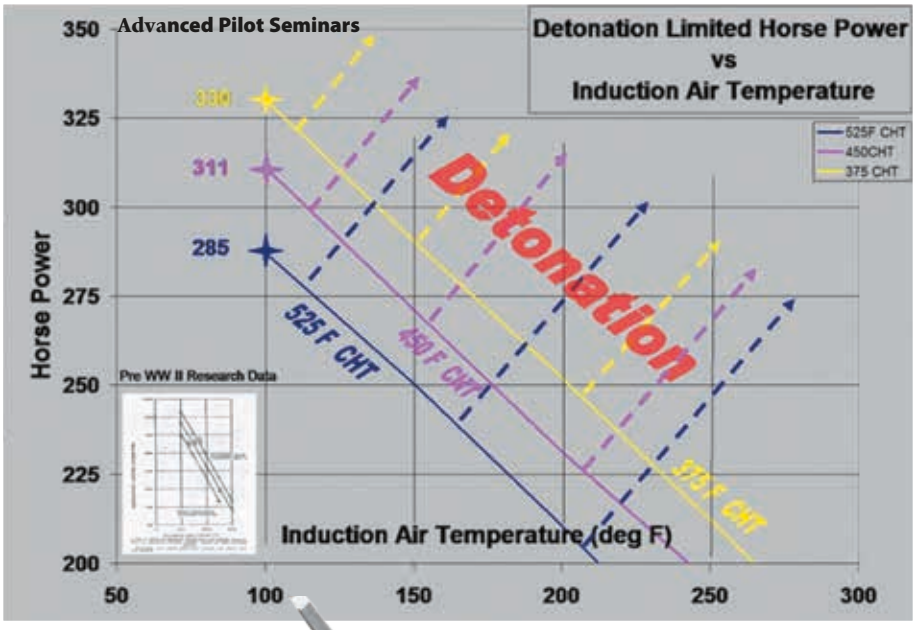
In addition, some intercooler mods also mandate resetting the takeoff fuel flow to a new, higher level. Again, they're not kidding—the engine needs it and failure to set it correctly is asking for problems.

Beyond wondering how the airplane got signed off on its last annual, we strongly recommend that a potential buyer not buy an intercooler-modified airplane that does not have full supporting STC paperwork. Expensive engine damage may already have occurred.

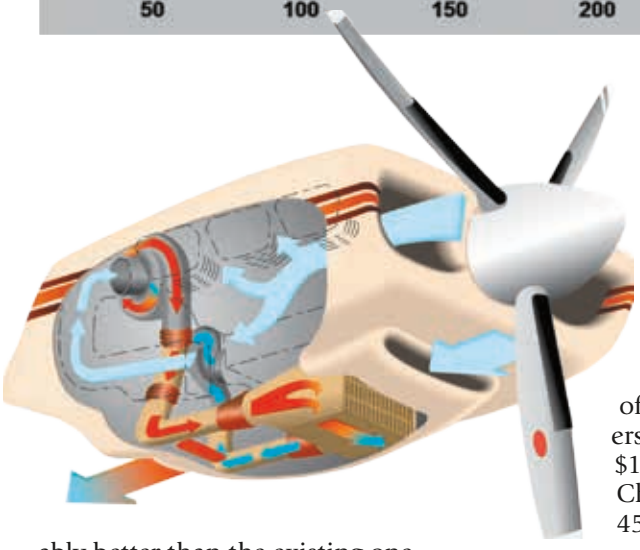
Recreating STC paperwork may range from merely expensive to impossible if the STC holder no longer exists.

Chuck McGill, principal of SafeFlight International, who gives specialized instruction in Cessna and Mooney aircraft, advised us that he regularly sees Cessna P210s with intercooler mods, no operating paperwork and mis-set takeoff fuel flows. That situation is often accompanied by a history of frequent cylinder replacement—something, he said, is not the case when the fuel flow is set right and the pilot knows how to set power correctly.

For airplanes that came out of the factory with intercoolers, such as the Cessna P210R, McGill, and others, told us that their experience is that the systems are well-designed and reliability is very good so long as operating procedures are followed.



Graph showing horsepower available versus induction air temperature—while maintaining a CHT of 375 degrees F (yellow line), reducing induction air temperature from 250 degrees F to 100 degrees F increases available horsepower from 212 to 330 while maintaining a suitable detonation margin, left. Artist's depiction of American Aviation intercooler mod on a Piper Navajo showing airflow through the nacelle and intercooler-equipped induction system, below left.



ably better than the existing one.

We recognize that there is a school of thought that intercooling is not of value for non-pressurized airplanes because it doesn't really make a difference until the airplane is operated at an altitude of 18,000 feet or higher. For older-generation intercoolers, that may be true. With the efficiencies of newer ones, we believe the detonation margin improvement and ability to keep the engine cooler on hot day mean that they are valuable at all altitudes.

WHAT'S AVAILABLE

American Aviation. By the 1980s, many of the manufacturers of turbocharged airplanes were installing intercoolers as standard equipment. Their efficiency was very good for the technology available. Nevertheless, technology marched on and American Aviation (www.americanaviationinc.com) developed more efficient replacement intercooling—which it calls Ultracooling—for the Cessna 340 414 series, placing the intercooler in the nose bowl of the nacelle. Price for the kit is $15,000 and installation requires 45 hours.

American Aviation also offers a kit to add intercoolers to a Piper Navajo. Price is $18,500 and American's Jim Christy said installation is 45 hours.

Merlyn Products. The turbocharging system in the Bonanza A and B36TC has been the subject of some criticism. Merlyn Products (www.merlynproducts.com) offers a bolt-on, intercooler that Merlyn's Hugh Evans described as more efficient. The price is $12,000 and installation takes eight hours, although five hours of that is for required painting.

Evans told us that an even more efficient intercooler should be available from Merlyn by the end of this year.

Turboplus. Offering a wide range of intercooler and induction system ram air NACA ducting kits, Turboplus (www.turboplus.com) says installation ranges from 20-30 hours. For the Piper Turbo Arrow, kit price is $5150; Seneca II and III, it's $11,335.00; Turbo Lance and Saratoga, $11,335; Bonanza A and B36TC, $7211.00; Cessna T206, T207 and T210, $7211 and Mooney M20K, $5150. Turboplus also offers an STC engine power upgrade to 220 HP, with installation of a KB fuel system and its intercooler kit, for the Turbo Arrow and Seneca II and III for $1640 and $2060, respectively.

Tornado Alley Turbo. Going beyond just adding an intercooler, Tornado Alley Turbo (www.taturbo.com) will install a full turbonormalizing system on a line of normally aspirated airplanes.

The systems include the most current version of the line of intercoolers Tornado Alley has developed. Kits are not offered; installation and testing of the full system is carried out at Tornado Alley's facility in Ada, Oklahoma.

Price for the Beechcraft Bonanza S model and later with IO-520 and IO-550 engines—is $46,950, installed; for the Cessna A185E and F models, $44,950; for the Cessna Cardinal RG, $42,950 and for the Cirrus SR22, $44,950.

CONCLUSION

Having flown intercooled and non-intercooled turbocharged airplanes and fought heat issues on the non-intercooled machines, we are bullish on intercoolers, both factory-installed and aftermarket. Nevertheless, use caution when looking at a purchase of an airplane with an aftermarket unit—if any of the STC paperwork is missing, it's probably best to walk away.

Stratus 1S and 2S: More Features, Reliability

Stratus 1S has features and a price to attract the VFR pilot while the 2S unabashedly aims at sophisticated IFR, corporate and airline users.

by Rick Durden

We've reported favorably on the Stratus portable ADS-B receiver series that provides inflight weather, traffic and GPS position to the ForeFlight app on iOS devices. ForeFlight is one of the more popular navigation apps on the market and the Stratus WiFi units drive it well. The only shortcoming has been an issue of hardware reliability, particularly of the power plug. I've dealt with that problem first hand as three Stratus units have failed due to power plug issues in the airplane in which I'm a co-owner.

The Stratus development team—Appareo on the hardware end, ForeFlight handling the software and Sporty's as the exclusive sales and support outlet—released two new models of the Stratus in conjunction with AirVenture this year. The team has not only upped the ante on available features, it sensibly replaced the power plug with a USB Type C power connector that promises to help keep the units from self-destructing.

TARGET MARKETS

The new models are the 1S, targeted at VFR operators, and the 2S, aimed at the IFR pilot crowd and marketed as the "ultimate iPad upgrade." I'm not sure about that claim—ultimate means it can never be improved upon. However, after 10 hours of flying the Stratus 2S over three days and some 1300 NM, my initial impression is positive. The flights included one on which the alternator dropped off line and refused to return. Continuing to a suitable airport meant load shedding that shut down all the panel-mounted navigation, traffic and weather devices. The Status and iPad continued to work happily together without benefit of the aircraft's electrical system.

START UP

The directions for getting started with any Stratus unit are about as simple as humanly possible: charge the battery, put the receiver in the mount in the aircraft, turn it on, connect your iOS device to the Stratus network and open ForeFlight Mobile to confirm the connection.

The new 1S and 2S promise better ADS-B reception, faster GPS lock (I noticed that on my flights) and better thermal protection via an upgraded fan and sealed battery.

The $549 Stratus 1S provides a next-generation lithium battery with a promised eight-hour endurance and the ability to withstand some 300 complete discharge cycles. It has single-band (978 MHz) ADS-B traffic, an internal WAAS GPS and will connect to a remote ADS-B antenna (although our experience has been that the internal antenna is adequate). As with earlier versions, it is a WiFi transmitter and connects with as many as five iOS devices using ForeFlight. There are no cords needed when it's running on its internal battery.

At $899, the Stratus 2S has all the bells and whistles on the 1S and adds an Attitude Heading Reference System (AHRS) giving backup attitude, altitude and groundspeed on the iPad, dual-band ADS-B traffic, an automatic flight data recorder, WiFi security to allow the pilot to hide the network name and/or add a password and a pressure altitude sensor that also powers ForeFlight's cabin altitude advisor. The flight data recorder logs position, altitude, pitch, bank and pressure altitude—the data may be stored as a ForeFlight track log or replayed in Google Earth or CloudAhoy.

Because of the reliability issues we had with previous Stratus models, we'll be doing a long-term review of the Stratus 2S and report on how it holds up in service.

The Stratus 2S, bottom, has noticable gains in ADS-B reception. Its interface with ForeFlight, top, is mostly unchanged.

Cessna Skymaster:

An unconventional twin that's not exceptionally fast, but engine failure can be a non-event, thanks to centerline thrust.

The idea of the push-pull twin makes such fundamental sense that it has been applied to aircraft designs in one form or another for nearly 100 years and in literally dozens of models you've never even heard of. Back in 2005, Adam Aircraft tried the idea again with the A500 push-pull piston twin. Like many before it, it failed more by market reality than by a fundamental flaw in the idea.

Then there's the Cessna 337, arguably the most commercially successful push-pull attempt, at least in terms of numbers built. And although the 337 Skymaster isn't the most popular twin ever marketed, it's done all right for itself and has achieved its primary goal: eliminating asymmetric thrust and simplifying the pilot's workload in the event of an engine out.

If the concept was sound, the execution of it by Cessna was a little less so. The Skymaster acquired a reputation as a bit of maintenance hog and although its performance is respectable, other twins do just as well, if not better, on less fuel and on fewer dollars spent on wrenching. Like most used twins on the market today, Skymasters are a bargain. When fuel prices started their climb eight years ago, market values of twins started downward and today, you can find a reasonably well-equipped Skymaster for under $100,000. Airframe values seem to have stabilized since we first examined them several years ago, which is more than we can say for other piston twins.

A Skymaster will get off the ground in less than 1000 feet at gross weight—a feat very few other twins can manage.

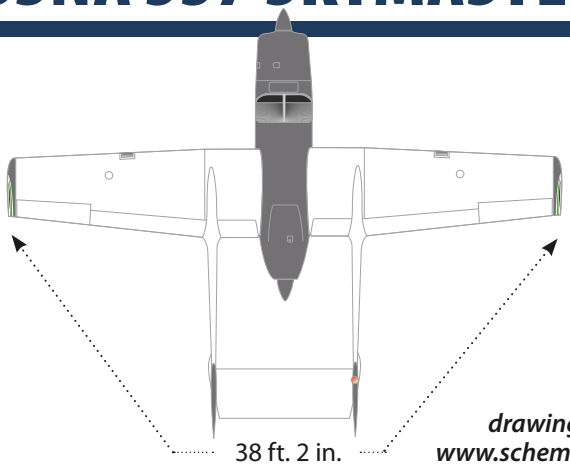
SIMPLER? MAYBE

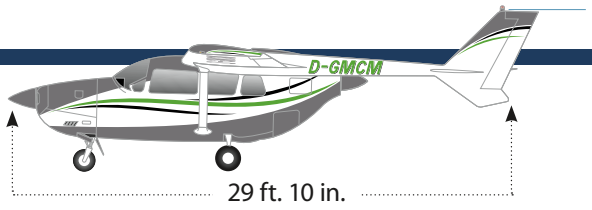
When Cessna began to develop the Skymaster in the mid-1960s, the accident history was horrid for twins. Part of that was due to training. The doctrine in those days was to actually surprise the pilot with a real engine shutdown to simulate losing one. In the hairy-chested thinking of the day, instructors would even do this on takeoff. As a result, loss-of-control accidents due to VMC rollovers were, if not common, more prevalent then they are today.

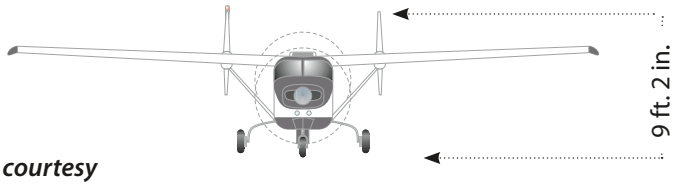
In an engine-out situation, conventional piston twins generally need to be handled with kid gloves lest the airplane get too slow and roll over on its back. So Cessna approached this problem just as other designers had going back to the Caproni Ca.1 of 1914: they aligned

That's a 1965 337 wearing a modern paint scheme. It also has the finicky hydraulic landing gear used on the Cessna 210 Centurion, later upgraded to electro-hydraulic.

CESSNA 337 SKYMASTER





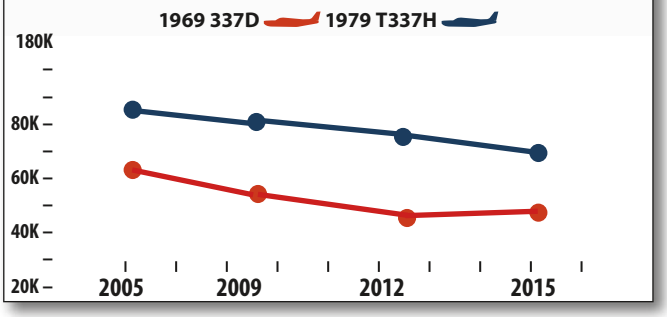


drawings courtesy
www.schemedesigners.com

SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1963-67 337,A,B SKYMASTER	CONTINENTAL IO-360-C/D	1500	$30,000	93	1585 LBS	167 KTS	±$35,000
1968 337C SKYMASTER	CONTINENTAL IO-360-C/D	1500	$30,000	93	1750 LBS	166 KTS	±$40,000
1968 T-337C TURBO SKYMASTER	CONTINENTAL TSIO-360A/B	1400	$30,000	93	1705 LBS	195 KTS	±$45,000
1969-70 337D,E SKYMASTER	CONTINENTAL IO-360-C	1500	$30,000	93	1780 LBS	166 KTS	±$42,000
1970 337E-T TURBO SKYMASTER	CONTINENTAL TSIO-360-A	1400	$30,000	93	1780 LBS	194 KTS	±$49,000
1971-73 337,F, G SKYMASTER II	CONTINENTAL IO-360-G	1500	$30,000	90	1705 LBS	169 KTS	±$51,000
1975 T-337G-P PRESSURIZED SKYMASTER II	CONTINENTAL TSIO-360-C	1400	$30,000	150	1516 LBS	204 KTS	±$68,000
1976-77 337 G II SKYMASTER	CONTINENTAL IO-360-G	1500	$30,000	150	1705 LBS	169 KTS	±$69,000
1978-1979 337 H II SKYMASTER	CONTINENTAL IO-360-GB	1500	$30,000	150	1592 LBS	169 KTS	±$83,000
1978-1979 T-337 H II SKYMASTER	CONTINENTAL TSIO-360-H	1400	$30,000	150	1596 LBS	200 KTS	±$88,000
1980 337H SKYMASTER II	CONTINENTAL IO-360-GB	1500	$30,000	90	1705 LBS	169 KTS	±$78,000
1980 T-337H TURBO SKYMASTER II	CONTINENTAL TSIO-360-HB	1400	$30,000	90	1592 LBS	200 KTS	±$93,000
1980 T-337H-P PRESSURIZED SKYMASTER II	CONTINENTAL TSIO-360-CB	1400	$30,000	150	1516 LBS	204 KTS	±$95,000

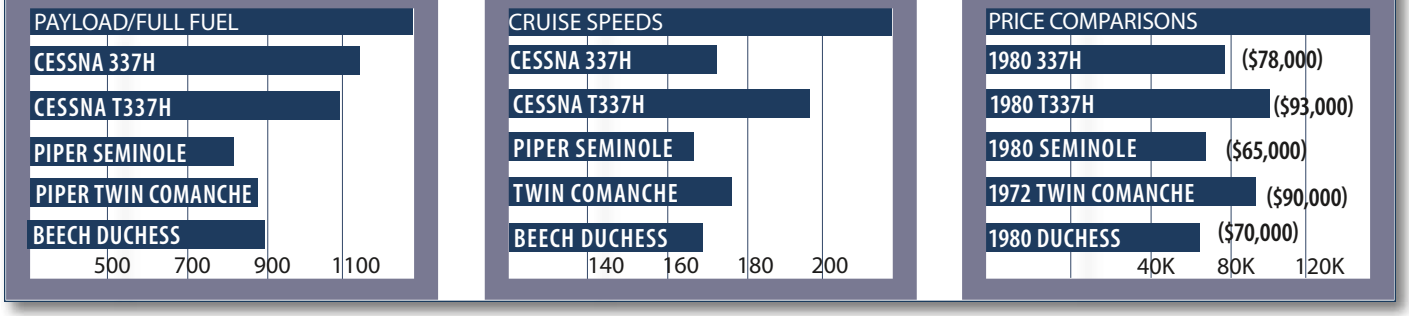
RESALE VALUES



SELECT RECENT ADs

AD 2011-15-11	WING DAMAGE INSPECTION
AD2011-10-09	SEAT RAILS AND ROLLERS
AD 200704-19	SUPERIOR AIR PARTS CYLINDERS
AD 2004-21-05	INSPECT COMBUSTION HEATERS
AD 2004-19-01	SHOULDER HARNESS ADJUSTORS

SELECT MODEL COMPARISONS



The Rocket II Pristine Airplanes refurbishment from Aircraft Sales, Inc., left photos, makes an existing Skymaster as modern as it can be. It includes a custom leather interior, a full panel of Garmin avionics and twin digital engine monitors.

the two engines with the airframe centerline, offering pilots the safety of a second engine without the penalty of adverse handling. If one quits, identify it, feather it and don't worry about the dead-foot, dead-engine drill. The FAA even granted the 337 its own class rating, limiting pilots to centerline-thrust twins only. It was much easier—and probably safer—to earn a multi-engine rating in a Skymaster than in a conventional twin,

Part of Cessna's plan worked, since there's little question the Skymaster is easier to fly on a single engine than a conventional twin. But, since the VMC rollover accident doesn't happen that often in the real world because training doctrine moved to zero thrust instead of an actual engine shutdown, the airplane's overall accident record isn't that much better than conventional twins.

A pilot looking to improve redundancy by stepping up from a single to a twin certainly will achieve it with a Skymaster. But in the bargain of gaining redundancy, pilots can be forced to accept a platform with more cabin noise, a set of operating peculiarities all its own and tightly packaged systems presenting more of a challenge to maintenance personnel than if each engine resided on its own wing.

All of this might argue in favor of a single-engine airplane or even a conventional twin. Then again, if you fly over the Great Lakes at night, maybe not.

MODEL HISTORY

The 337 Skymaster's front/rear engine layout and high wing started out as the fixed-gear Model 336 in 1964, powered by Continental IO-360-A engines of 195 HP apiece. Widely acknowledged as a slug, Cessna sold only 195 336s in one year of production; around 80 remain on the FAA's registry today. In 1965, the company folded the gear and upgraded powerplants to a pair of Continental IO-360-Cs pumping out 210 HP, resulting in the 337 Skymaster. Cessna sold 239 copies that year. (Not really learning from its 336 experience, Cessna flew a cantilever-winged, lower-powered version, the 327, in late 1967, but it proved too slow and the project was dropped the next year.)

To make the original 336 a retractable, Cessna borrowed the complex and occasionally troublesome hydraulic landing gear system from the 210. In 1973, it was upgraded to a simpler and more reliable electro-hydraulic system. While less complex and easier to maintain, the system still isn't as robust as, say, a Baron's or Seneca's.

Early models also came with multiple fuel tanks, another system that proved problematic in the field. It, too, was replaced in 1973 by a superior, less complicated system. A turbocharged version—the T-337B, powered by 210-HP TSIO-360-A or -B engines from Continental—appeared in 1967, but was dropped in 1972 with the addition to the Skymaster line of the almost-revolutionary pressurized 337 version, the T-337 G-P, powered by TSIO-360-C engines up-rated to 225 HP.

The turbo reappeared in 1978, with TSIO-360-H powerplants, but Skymaster sales had begun slipping by then. Cessna pulled the plug following the 1980 model year, after a total production run of 2058, plus 332 pressurized versions. In addition, Cessna built slightly more than 500 Skymasters for the U.S. Air Force. These saw extensive action in Vietnam as the O-2A. This ver-

That's Steve Bowser's 1967 T337B, top. He says it carries anything he can stuff in it. Reader Bill Scherer stuffs U.S Mail sacks in the back of a 336 in the early 1960s, bottom. The aircraft's short-field capability supported Loening Air's U.S. Mail route contract delivering to the Middle Fork of the Salmon River in Idaho's Primitive region.

sion boasts structural beefups, hard points and extra windows. These airplanes frequently appear on the used market and may well be the least expensive warbirds available. Additionally, some civilian models were converted to an O-2B configuration for the military to use in psychological warfare.

Major tweaks in the airplane's history were few, but there were many designation changes. Beginning in 1970, some inspection panels were added—making maintenance easier—and the airframe was lightened a bit, increasing useful load. The interior arrangement also changed through the years, with various combinations of seat mounting.

As is common with any aircraft, the non-pressurized 337's gross weight crept up during its years in production. Early models started at around 4200 pounds; late ones weighed 4630 pounds, with max landing weight limited to 4400 pounds. Meanwhile, the P-337, with its 30 extra horsepower, had a takeoff weight of 4700 pounds and max landing weight of 4465 pounds.

Piston-twin prices are still a bit soft, and the 337 is no exception. On the up side, most of the depreciation has been squeezed out of these airframes. The downside? Cessna 337s can't be counted on to increase much in value. But a Skymaster is a lot of airplane for the money. Besides current fuel prices and future uncertainties, other factors depressing prices are that the 337 has a reputation for being a maintenance hog—one that's not entirely deserved—and they aren't all that fast as like-powered twins go.

Buyers should be aware, however, that buying a cheap twin is not the same as operating a twin cheaply. A hangar queen will eat through a bunch of money if it needs remedial work and, in any case, you'll need to find a shop familiar with the breed to do the pre-buy and maintain the airplane going forward. The Skymaster doesn't perform much better than a Cessna 210, and it has two of everything to maintain and replace, driving up ownership costs.

PERFORMANCE, HANDLING

Skymasters aren't speed-demons, although the turbocharged models do respectably well for pilots willing to take them into the teens. Owners of normally aspirated models can plan on between 155 and 165 knots true, depending on altitude and how much fuel they want to burn. The turbocharged and pressurized models will push 190 to 200 knots at 20,000 feet, their maximum certified altitude. At middle altitudes, 170 to 180 knots is typical for the turbo models, which isn't all that bad.

Since Skymasters have relatively small displacement six-cylinder engines, fuel burn tends to be reasonable, ranging from 15 GPH to 22 GPH total, with 19 to 20 GPH typical for a 150- to 160-knot cruise. For comparison, a Twin Comanche will do about the same speed on 100 fewer horsepower and a lot less gas. Efficiency isn't a Skymaster hallmark, except when compared to larger, faster twins.

All-engine rate of climb ranges from a modest 1300 FPM in the old 336 to a lethargic 940 FPM with the last 337H models. We're unaware of any other twin-engine airplane with a book rate of climb below 1000 FPM; even the old 150-HP Apache had a book climb of 1250 FPM with both engines running. On the other hand, lose an engine in a 210 and there's no rate of climb, only a rate of descent. In a 337, you should at least be able to eke out 200-300 FPM.

Like many Cessnas, runway performance is good. Landing-configuration stall speeds range from 55 to 62 knots, depending on the gross weight of the particular model—about 10 knots below conventional twins like the 310.

As a result, a Skymaster will get off the ground in less than 1000 feet at gross weight—a feat very few other twins can manage. Barrier performance is not quite as good, however; the leisurely climb rate brings the Skymaster's 50-foot takeoff figures down to the middle of the light-twin pack.

The single-engine climb rates of all the light twins tend to be very

The retired O-2A Skymaster, top, worked well as an observation aircraft. It replaced the O-1 Bird Dog in the mid 1960s. Want one? They're out there for resale.

similar—200 to 300 FPM—because engine-out climb rate is a certification point around which the airplane is designed. The FAA requires a certain minimum climb, figured by a formula relating to stall speed, and the manufacturers typically bump up the gross weight to the point at which the airplane just barely meets the FAA minimum. Any excess engine-out climb capability is, in effect, wasted payload. And payload numbers sell airplanes.

What's surprising is the difference between the front and rear engines. Climb on the front engine only is about 50 FPM less than on the rear, but not necessarily for all versions of the Skymaster. Reader Robert Prader told us his research reveals that later models have better front-engine performance. "It is true that front and rear engine single-engine climb rates are significantly different for all pre-1973 Skymaster models; however, the front and rear single-engine climb rates are not significantly different for the pressurized models and the 1978 and later turbo models," he said. "If you consult the POH for any pressurized model, you will find that a single-engine climb rate of 375 FPM is listed for a standard day at sea level at gross weight, with no mention of which engine is out. If you consult the POH for the 1980 non-pressurized turbo model, you will find it specifies a climb rate of 335 FPM for the same conditions, again with no mention of which engine is out."

While leaving the gear down produces a climb penalty of a bit over 100 FPM, raising it carries a temporary 240 FPM hit. (Praeder told us this is about average for most twins and probably for single-engine retracts as well.) This is because Cessna's complicated gear door arrangement adds drag while the gear is in transit. In an after-takeoff engine-out situation, it may be better to leave the gear down, just as it is recommended in some singles to leave it down until obstacles are cleared.

In normal flight, the Skymaster has typical Cessna handling: heavy in pitch, reasonably responsive ailerons. (The P-model has especially light ailerons.) Pilots praise its IFR stability.

The noteworthy aspect of the Skymaster's handling—indeed, the whole reason for the airplane's existence—shows up when an engine fails. Instead of the normal yaw-roll-stall-spin scenario too often following engine failure in "conventional" twins, the Skymaster continues to fly straight ahead. An unprepared or rusty pilot can take his time and concentrate on the task of identifying and feathering the prop on the failed engine, without worrying about losing control.

PAYLOAD, RANGE

A Cessna press release from the 1970s describes the Skymaster as "a full six-place airplane with nearly a ton of useful load."

Good luck with that. At best, the two rear seats can accommodate youngsters. And that press release conveniently forgot when the fifth and sixth seats are installed, there's no baggage space, nor is there a baggage door. Consider the Skymaster a roomy four-placer.

Real-world useful loads run around 1500 pounds—not bad at all, and several hundred pounds more than a Twin Comanche. Standard fuel is 93 gallons, which should leave more than 900 pounds available for payload; plenty for four passengers and their bags. Standard fuel is just adequate, however—unless you throttle back—providing a bit more than three hours with IFR reserves at fast cruise.

Pre-1973 airplanes with long-range tanks had a four-tank fuel system; later ones came with a two-tank system. The long-range tanks—150 gallons in 1975 to 1980 models, 131 gallons in earlier models—solve endurance limitations nicely, at the expense of payload, of course. One owner told us that with long-range tanks full, he has seven-plus hours at 150 knots with 650 pounds of payload (three people and bags). Not a bad compromise.

Oddly, the P-337 is allowed only five people; it was certified under different rules requiring an emergency exit in a six-seat airplane. Rather than put in the exit, Cessna simply limited the seating to five. Early P models had a middle seat hinged up and to the side to get at the back row, but these seats didn't slide fore and aft. Access to the rear seats in other Skymasters requires an awkward scramble over the center row.

The Skymaster's visibility is excellent—about as good as it gets in any light airplane, single or twin. The view down is unlimited, of course, and the wing's leading edge is back far enough that it doesn't block upward vision, either, as with most Cessna singles. Good visibility is not

only a safety feature; it adds to the feeling of roominess in the cockpit.

The Skymaster is also quite noisy, since the passengers are sandwiched between the engines. Also, sympathetic vibration can be a problem, particularly without prop synchronizers. Conventional twins are quieter by far.

MAINTENANCE

The Skymaster was the most complex aircraft ever engineered and manufactured by Cessna's Pawnee Division, which otherwise built only Cessna singles. Evidence suggests the division simply wasn't up to the task, particularly in the 1975-1980 period when production was growing rapidly and Cessna was plagued by an epidemic of design, engineering and production problems.

For example, the pressurized Skymaster was initially such a disaster that the first year's production was recalled to the factory for complete remanufacture and modification. Distinct from other twins, Cessna had to pack everything into the fuselage, not having the luxury of sticking systems out in the wings or into the nose. As a result, access is difficult and it is those systems where most maintenance problems will be found.

The basic airframe is stout, with a rugged strut-braced wing. There are remarkably few ADs on the airplane. And remember that the military version of the Skymaster did plenty of rough duty in Vietnam, often flying home with bullet holes or worse.

Still, a potential Skymaster nightmare is runaway maintenance costs, particularly in the turbo and pressurized models, so the prudent purchaser will closely examine logbooks and service records of any aircraft under consideration.

MODS, GROUPS

The Riley Rocket was a popular Skymaster mod and included upgrades to 310-HP TSIO-520 engines, intercoolers, three-blade props and air conditioning. Rockets come on the market now and again, at a premium price over stock models.

Ohio-based Aircraft Sales' Pristine Airplanes modification (www.pristineairplanes.com) offers the Rocket II full refurb for the Skymaster, while adding intercoolers to P337 models, plus new avionics, paint and interior on all models. Including the aircraft, a fully refurbed Rocket II could top $600,000, but like all of the other refurbished aircraft the company pumps out the end result is a like-new aircraft, following almost six months of intense rework.

Other 337 mods include vortex generators from Micro Aerodynamics (www.microaero.com) and intercoolers from American Aviation (www.americanaviationinc.com). Both Horton (www.hortonstackdoor.com/stolcraft_description.htm) and Sierra Industries (www.sijet.com) apparently still offer STOL kits and other aerodynamic mods. A wing spoiler kit is available from PowerPac Spoilers (www.powerpacspoilers.com).

Aviation Enterprises (www.cessnaskymaster.com) offers a wide range of major modifications for Skymasters, ranging from air conditioning, airstair doors, extended wingtips, IO-550 engine conversions—for one or both engines—long-range fuel and MT propellers. The company also can provide various parts, including cargo pods. Similarly, RT Aerospace (www.rtaerospace.com) offers several items of interest to the Skymaster owner, including a convertible rear seat for the baggage area.

Cessnas seem generally blessed with good owner organizations, perhaps because the company abandoned the piston market in 1986 and stayed out of it until 1997. The clubs and groups have proven to be as good as it gets when it comes to support.

Every Cessna owner should join the Cessna Pilots Association (www.cessna.org). The organization offers the usual benefits, including an insurance program, monthly newsletter and fly-ins, and has a wealth of Skymaster-specific information. Two useful if unofficial Skymaster Web sites are the Cessna Skymaster Web Site (www.skymaster.org.uk) and SOAP, Skymaster Owners And Pilots (www.337skymaster.com).

OWNER FEEDBACK

My 1974 P337 is my first pressurized airplane and as many friends have said, once you own a pressurized airplane, you can never go back. I'm sure they're right. The 20,000-foot ceiling is just fine for my needs as I

THE MISHAPS: FUEL AND FOOLISHNESS

In looking at the most recent 100 accidents of the Cessna 336/337 we formed the opinion that there was little wrong with the airplanes, but had our doubts about some of the pilots who chose to fly them.

There is a school of thought that airplanes that are designed to be extra safe, such as the Ercoupe (cannot be stalled) or the Skymaster series (center-line thrust) attract pilots who rely on the design to overcome subpar skills and judgment. Our accident survey for the Skymaster and Super Skymaster produced results that seemed consistent with that school of thought.

Topping the causal hit parade was fuel-related events—every one pilot caused. In our monthly surveys we expect to see one or two accidents involving something wrong with the fuel system, here there were none. All but one was the result of a pilot running out of fuel or mismanaging a fairly simple system (there's a main and aux for each engine—the aux tank can only be used in level flight), so that he did not get at fuel that was in a tank. The sole exception was water in the fuel the pilot didn't drain.

In a few of the accidents, the pilot managed to run the tanks in one wing out of fuel (left wing tanks feed the front engine) and then did nothing when the associated engine quit—he did not attempt to cross feed to get fuel to the engine from the other wing and did not feather the prop on the dead engine.

Failure to feather was a factor in several accidents. A Skymaster is so air-kindly that it goes straight ahead when one engine stops, but the pilot has to feather the associated propeller, otherwise the airplane probably won't climb and, as the density altitude goes up, may not hold altitude. Among the engine/mechanical-caused accidents, more than half the time the pilot did not feather the dead engine.

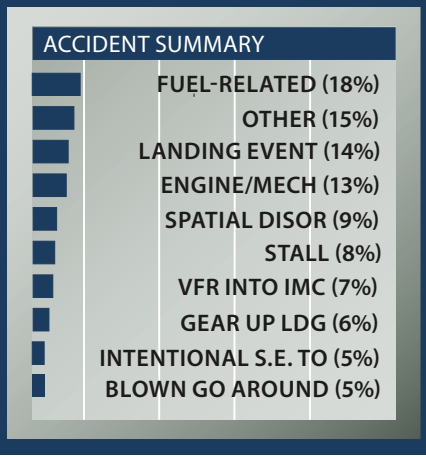
Judgment came into play in a few of the engine/mech accidents as the owner had either failed to perform engine maintenance for some time or it had been carried out, in one case, by mechanics who had had their certificates pulled previously for improper repairs.

One pilot pulled the wings off his Super Skymaster at the end of a high-speed buzz job. Seven, about twice what we usually see, tried unsuccessfully to fly VFR in IMC. Stunningly, five pilots attempted to make single-engine takeoffs and didn't make it—in four of the cases others had tried to convince the pilot not to do it.

We saw no indications that a Skymaster pilot lost an engine on takeoff and didn't realize it—the acceleration is dramatically different when the horsepower is halved.

Ten of the accident reports noted that the pilot attempted "operation with known equipment deficiencies," including trying to fly IFR in IMC without a working attitude indicator. Three of the stall accidents involved flight at very low altitude. A 95-hour student pilot tried to take his family for a night flight in his 336; none of them survived his loss of control in the pattern.

The good news is that the 336/337 handles very well on the ground, only two pilots lost control on the runway. However, nine landed so hard or bounced so badly they damaged their airplanes. There were three landing overshoots—in one case the pilot didn't use the brakes until a passenger said to.



fly between 15,000 to 17,000 feet on a regular basis. At those altitudes, the airplane makes book numbers and for a 40-plus year old airplane, that's pretty impressive.

I see roughly 182 knots true on 10.6 GPH running lean of peak and 11.6 GPH running rich of peak. That's about 65% power either way.

At 7000 feet I still have a sea-level cabin and at 17,000 feet I have a 7500-foot cabin. There is no fatigue after long, high-altitude cross-country flights. Even after using oxygen during similar missions in previous turbocharged airplanes I've owned, I was always a bit fatigued afterwards since I didn't always concentrate on my breathing and I was desaturating more than I would like.

I love the pressurization and I love the air conditioning. Being in Tucson, Arizona, air conditioning is wonderful and the system in my P337 works really well. I had a Piper Seneca with air conditioning that lacked this quality of both air volume and cold air. Of course all pressurized airplanes are turbocharged and mine also has the Riley intercoolers. It also has a Riley STOL kit that makes short takeoff and landing distances and speeds very manageable.

If you manage a TSIO-360 engine properly, they can do very well. On my previous Seneca I had 1600 hours on the engines (they have an 1800-hour TBO) when I sold it and they were running perfectly. On my P337 I have one engine at 1500 hours (1400 TBO) and the other at 100 hours and both are near perfect. Compressions are great, oil analysis is fine and neither engine uses any oil between the 25-hour intervals that I change it.

The 18,700-foot single-engine service ceiling is very comforting. If you lose an engine, there is no adverse yaw and essentially you're now flying a 182RG. The P337 is extremely stable and easy to fly, while the pressurized version has an extremely quiet cabin.

The annual inspection is in a few weeks and my IA said to expect it to be under $4000 (for the inspection only, of course), which for a turbocharged pressurized twin isn't bad at all. Insurance at $2000 per year is also quite reasonable and the insurance-mandated transition

training was only five hours of dual instruction. Other pressurized twins I considered had requirements of up to five days of formal schooling, which would have effectively increased my insurance rates by thousands of dollars.

Ken Reed
via email

In Canada, a multi-engine centerline thrust rating is required to fly the Cessna Skymaster. We recently completed this training at Discovery Aviation in Sudbury, Ontario Canada (jason.fogg@discoveryair-fs.com is a training contact). Discovery Aviation has 18 Skymasters, which are used for fire surveillance. The training was excellent.

The difficult aspect of the Skymaster training was responding to the loss of engine on an overshoot. The single-engine climb rate (285 FPM at sea level, 20 degrees C and at maximum weight) is only achievable once the inoperative engine is feathered and the airplane is in the clean configuration. In practice, we found that any delay to feathering the engine or variation from the single-engine best climb airspeed would result in a slow descent. Lifting the gear during an overshoot adds significant drag, which has to be carefully managed.

Michelle LaPointe, Pat O'Cain
Kincardine Ontario, Canada

I am on my second Skymaster; the first I had about five years and this current one about 10. The present one is a 1967 T337B with about 3660 total hours. The front engine has 825 hours since overhaul and the rear 2450 hours since overhaul. The biggest positive features are, one, that it can carry just about anything I can stuff in it, and two, is that it has two engines. I live on the far north coast of California and there are serious mountains in three directions. I have limited experience in Cessna 182 models, but the flying qualities seem similar.

I normally cruise in the mid teens and see a total fuel flow of 18 GPH there with 160 knots true airspeed. Insurance has cost me an average $2152 per year based on a hull value of $55,000. Parts and labor have averaged $8644 per year, with a high year around $15,000 and a low year just over $2000.

I have been a member of the Cessna Pilots Association since I got the first Skymaster and have benefited greatly from the organization. I also have been lucky to have a local IA who has plenty of experience with Skymasters.

Steve Bowser
via email

The first Skymaster that caught my attention blew over my house at 200 feet one morning spraying for mosquitoes. If you've ever been lucky enough to witness a low pass from a Skymaster you'll never forget it. Because the disturbed air from the front prop washes over the rear prop, they make a unique sound and are easily identified when you hear them coming.

Like the military O-2 version used in Vietnam for recon and forward air controlling, this is a plane you don't have to be gentle with. There was even one used on the airshow circuit for aerobatics a few years back. Other than civilian use, because of their high utility and excellent visibility, many foreign countries still use the Skymaster for military operations. They're also used for many governmental operations such as surveillance, aerial surveying platforms for oceanic and firefighting activities and mosquito control chemical dispersion.

Because they are a love-it-or-hate-it airplane, the market band is narrow so prices are low. Likely due to the aging of the fleet and economic conditions, they are selling for almost 50 percent less than they were 10 years ago. I have personally owned six, and will say I have never met a person that owned a Skymaster that didn't love it. All the criticism I've ever heard came from non-owners simply because they are traditionalists who don't like the look or believed some of the unfounded rumors. Always a head turner and conversation starter, I've had many people visit me on the ramp who just wanted to take a closer look or say how cool they always thought they were.

Neglected 337s can be found from $20,000 to $40,000, but airframes that are well-maintained have decent

The Aviation Consumer

Cessna Skymaster

(continued from page 31)

paint and interior with updated avionics easily push these prices over $100,000. When it comes to maintenance, Skymasters share the same issues as other aging aircraft. They aren't much different than maintaining any other light twin, especially if your mechanic is familiar and you're not paying for the learning curve. The problem with many Skymaster is they're bought by people looking for a cheap twin without the money to maintain or fly them regularly, so the airplane lives on the ramp and wastes away in the weather.

The upside—since they are relatively inexpensive to acquire—it leaves lots of room left over for avionics upgrades or to get a handle on neglected maintenance. They are roomy, solid, capable, stable workhorses with great visibility and plenty of power. I bought my current one, a 1969 turbo model from the original owner who routinely flew at FL290 (its certified ceiling utilizing the onboard oxygen system) to catch the big tailwinds when they were in his favor. The old rumors of not being able to fly on one engine or rear engine overheating are just rumors, which probably started with the first model, the fixed-gear 336 introduced in 1963, but quickly remedied with a redesign into the 337 Super Skymaster in 1965. I live in hot, sunny Florida and have never had an issue with the rear engine overheating as long as the front engine is running and providing airflow to the rear engine. With asymmetrical thrust they fly straight as an arrow, kind of like a single, but with the full redundancy and safety of two engines, dual vacuum pumps and dual hydraulic pumps.

The turbo models can fly close to 18,000 feet on one engine because they don't have the rudder deflection creating drag like you would in a conventional twin. Their safety record is similar to other twins but many Skymaster crashes are attributed to fuel mismanagement—which isn't an issue if you take the time to understand the fuel system. The fuel system was simplified starting with the 1973 models by eliminating the need to manage separate auxiliary tanks. Because of the center alignment of the engines, one should be conscious of picking up debris with the front prop and throwing it into the rear. This isn't the plane to operate off from gravel or unimproved runways. Insurance seems reasonable, but since I've never owned a conventional twin I'm not sure if it's less for the Skymaster due to the asymmetrical thrust and less risk involved when losing an engine.

The airplane is capable of carrying five or six passengers depending on the model, although it might be best to remove a rear seat and use the space for storage or luggage (or get one with the optional cargo pod.) It does make for a very comfortable four-seat aircraft. Performance and fuel consumption is reasonable with the two Continental engines. Typical cruise is 150 knots on 22 GPH. In the case of my nonpressurized 1969 turbo model, you've got an aircraft capable of hauling over 1700 pounds into the flight levels with a true airspeed of nearly 200 knots if you don't mind wearing an oxygen mask.

A fellow named Bill Crews in South Carolina exclusively markets Skymasters, which can be found on his site at www.Skymasters.com. Crews is perhaps one of the most knowledgeable Skymaster people around. There is also a Skymaster Owners and Pilots Association (SOAPA) site, which archives a vast amount of information and has ongoing blogs on the aircraft. If you're in the market for a nice capable twin that won't break the bank and lucky enough to find a 337 that's been well-maintained and with an upgraded autopilot and avionics, take a hard look at it. Make sure you have your prepurchase inspection performed by someone familiar with Skymasters.

Jim Smith
Jacksonsville, Florida

FEEDBACK WANTED

CESSNA 150/152

For the December 2015 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Cessna 150/152 trainers. We want to know what it's like to own these planes, 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) you'd like to share to the email below. We welcome information on mods, support organizations or any other comments. Send correspondence on the 150/152 by October 1, 2015, to:

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e-mail at:
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