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London, ON 5W1

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Back Issues, Used Aircraft Guides

203-857-3100

REPRINTS: *Aviation Consumer* can provide you or your organization with reprints. Minimum order is 1000 copies. Contact Jennifer Jimolka, 203-857-3144

B **AVIATION CONSUMER** (ISSN #0147-9911) is published monthly by Belvoir Aviation Group LLC, an affiliate of Belvoir Media Group, 800 Connecticut Avenue, Norwalk, CT 06854-1631. Robert Englander, Chairman and CEO; Timothy H. Cole, Executive Vice President, Editorial Director; Philip L. Penny, Chief Operating Officer; Greg King, Executive Vice President, Marketing Director; Ron Goldberg, Chief Financial Officer; Tom Canfield, Vice President, Circulation.

Periodicals postage paid at Norwalk, CT, and at additional mailing offices. Revenue Canada GST Account #128044658. Subscriptions: \$84 annually; single copies, \$10.00. Bulk rate subscriptions for organizations are available. Copyright © 2014 Belvoir Aviation Group LLC. All rights reserved. Reproduction in whole or in part is prohibited. Printed in the USA.

Postmaster: Send address corrections to AVIATION CONSUMER, P.O. Box 8535, Big Sandy, TX 75755-8535. In Canada, P.O. Box 39 Norwich, ON N0J1P0, Canada. Publishing Agreement Number #40016479

FIRST WORD

NEED A LOAN TO PAY FOR ADS-B?

As with most things the government requires us to spend money on, many pilots that I talk with aren't thrilled with the idea of force-fed ADS-B upgrades. Buying a non-compliant, \$800 portable ADS-B receiver to get free weather is one thing. Investing thousands on a major installation is another. As we explain in the ADS-B equipment article on page 4, a full-up ADS-B-compliant upgrade, including a WAAS GPS navigator, could easily top 10 grand. If you're lucky, you might get by with a \$2000 investment, give or take, for a basic ADS-B output transponder. That's a best-case scenario.

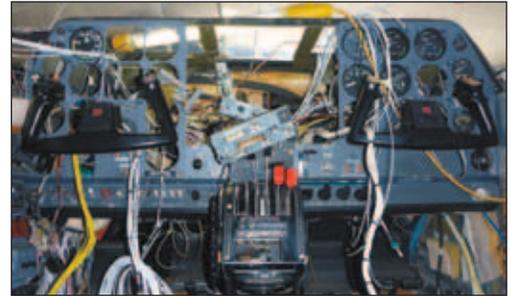
Many owners with lower-end aircraft and tight budgets wonder where they'll come up with ADS-B upgrade money. Some contemplate selling the aircraft before the mandate hits. Can't fault these folks for being realistic. If you can't pay, you can't play, at least in most controlled airspace come January 1, 2020.

But what many owners don't realize is that there's government-backed loans (\$500 million to start) in the works. In 2012, Congress granted financial incentives for GA to begin equipping for ADS-B through the Next-Gen GA Fund. The Treasury is offering loan guarantees to the private sector to allow them to issue commercial paper at lower rates than banks would offer. It's projected that the NexGen GA Fund will ultimately support over \$1.3 billion of NextGen equipment installations for general aviation owners and operators over the next 10 years. But how easy will it be to get your paws on this upgrade money? That's what I asked Michael Dymont with the NEXA General Partnership, the firm that's managing the NextGen GA Fund and the lending process.

Dymont told me the borrowing process couldn't be easier. First, get an installation quote from a qualified shop, which must include a separate breakdown of equipment, labor and certification costs. Then, visit the loan portal on the Aircraft Electronics Association (AEA) web page and fill out the application for funding. Dymont said if the project is under \$30,000, NEXA will initiate a quick credit check to qualify the borrower. Decades of banking data proves that a majority of aircraft owners have excellent credit—the default rate for the GA demographic is less than 1 percent. If you look good, NEXA will approve the loan on the spot and generally pay the shop 50 percent of the project to get started (all borrowed money is paid directly to the shop). Sound too good to be true? It gets better.

Dymont said that financing can cover additional work, including rewiring existing systems and other non-ADS-B upgrades, including autopilots and PFD systems, for example (the project must include a certified ADS-B system.) Want a more modern instrument panel, free of round gauges? Go for it. As long as the installation includes electronics and promotes safety (upholstery and paint doesn't qualify), NEXA said it will finance it. These loans are termed generally from five to six years and are based on current interest rates (between 6 to 9 percent, in general.) Unlike traditional lending, there's no mortgage on the aircraft and qualification isn't based on aircraft value.

Don't think there isn't a government agenda behind this incentive. The GA Fund could protect the FAA's own \$40 billion investment in the NextGen infrastructure. And as with other things involving FAA approval, the capital isn't available yet. Since the FAA has never dealt with a federally guaranteed loan application, the program has been stalled for over a year. NEXA hopes to begin lending money by AirVenture later this summer. Meanwhile, the 2020 ADS-B mandate moves closer by the day, and while \$500 million seems like a lot of dough, Dymont made it clear that it's still not enough to upgrade nearly 160,000 aircraft that need to be equipped with ADS-B. —Larry Anglisano



PAINT SHOP SURVEY

In 2010 we had our Cessna twin painted. I started with the *Aviation Consumer* paint shop survey from November 2006. Then I followed up with other magazine articles and looked at airplanes on airport ramps over several years. I thought that I did everything right.

In spring 2010 we decided to go to Oxford Aviation in Oxford, Maine, to get the airplane repainted. There were some early warning signs about confusion in interoffice communications, but hey, it was spring 2010 and everybody had some problems of some sorts.

The job was done on time, the charge was the amount agreed upon in writing before I left and the airplane looked really well done when we picked it up. The A&P was a bit odd, but everybody else was pleasant to work with. But after a few months paint started to fall off the airplane. We got the areas repaired after one year, no questions asked (and these spots are holding up exceptionally well ever since), however the paint keeps falling off in other areas.

Subsequent attempts to communicate with Oxford (even with return receipt requested) were ignored. In December 2013, Oxford Aviation went bankrupt and more paint is falling off the airplane.

Our experience and the paint shop surveys over the years clearly show that the survey is only a snapshot at the time. There are hardly any shops doing consistently good paint work for over a decade straight. Next time I would wait for the *Aviation Consumer* survey to come out, get the plane painted quickly after that—at a shop as conveniently located as possible. We will get the plane repainted this summer, at a shop minutes away from our maintenance shop. Hopefully I will have done better this time.

G. Pfeifle
via email



Tejas AeroServices, located in San Marcos, Texas, has been performing aircraft refurbishment and restoration of personal and corporate aircraft since 2004, earning a national and international reputation for our quality work. Our customers have won multiple awards at AirVenture and Sun 'n Fun, we provided custom paint work for the Mooney Aircraft Company, and our work has been on many

magazine covers and reported on in many articles. We are very proud of the reputation we have earned over the years (during which we have painted several hundred aircraft).

We were included in the list of top shops in your annual paint and interior shop surveys. We are puzzled by the statement in the latest paint shop survey (June 2014 issue of *Aviation Consumer*) sent to you by a self-described customer of ours. In it he complained that the paint was coming off of his aircraft.

Tejas offers a one-year warranty and we don't want a single customer dissatisfied with the work that we perform and bend over backward to correct even the slightest squawk. However, I have had no customer reports of paint "flying off" any aircraft we painted. In the 10 years that we have been painting aircraft, this has never happened. That is not to say that it can't happen. We simply can't fathom why anyone who has had this type of experience would not report it to us or give us a chance to correct the problem.

Mike Van Sicklen
Tejas AeroServices

This sounds like a serious breakdown of customer/shop communication. Overall, Tejas earned favorable scores in the recent paint shop survey, as it has in previous surveys.

SOUNDPROOFING

The article on soundproofing in your

June 2014 issue gives an understated impression of how much an improvement a 10-decibel reduction in sound is and an overstated impression of the risks associated with exposure to unreduced sound. The article implicitly states that sound doubles every 10 decibels ("80 dBA is twice as loud as 70"), which significantly understates the relative change. Excessive sound is unquestionably damaging to hearing, but perhaps not as much as described in the article. The average of 92 decibels at the pilot's ear which the article mentioned cannot accurately be stated to cause hearing loss, at least not realistically in the context of typical general aviation.

Laurence R. Durio
Baton Rouge, Louisiana

We concur that the decibel scale is logarithmic and a 10-decibel increase is

continued on page 32

CORRECTION

In the Diamond DA40 Star Used Aircraft Guide in our June 2014 issue, we incorrectly stated there isn't an option for air conditioning. There's actually an aftermarket STC for the Cabin Cool™ system, offered by Premier Aircraft Sales.

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ADS-B Update: Stabilizing Prices

But with the FAA's equipage mandate five years away, there's no telling how last-minute demand will affect installation costs. Upgrading early could make sense.

by Larry Anglisano

Judging by the letters and calls we get on a regular basis, ADS-B continues to create head-scratching confusion. While shops report an increased interest in ADS-B retrofits, owners aren't flocking to them in large numbers to have the work done.

While it's easy to advocate a wait-and-watch approach to upgrades, it's also easy to speculate that the January 1, 2020, ADS-B equipage mandate will be extended. There's no evidence this will happen.

We do suspect that if you wait too long, you'll risk paying higher labor costs for installation, as busier shops increase overhead to keep up with increased demand.

In our view, now seems to be a reasonable time to consider upgrad-

ing. There's plenty of competition and options to keep prices stable, and shops aren't flat-out trying to meet the equipage demand.

Here's a current look at the products that are ADS-B compliant and certified, although there are others that could be available by the time you read this. That's how quickly the market is developing.

MODE C MENTALITY

That's what you might use when qualifying your aircraft for an ADS-B upgrade. Chances are you're gonna need to upgrade. Think in terms of installing additional equipment for flying in controlled airspace, while still retaining the existing Mode A and C capability. That's because the

CHECKLIST



We think the FreeFlight RANGR 978 offers the most flexibility.



1090ES transponders are still the easiest path to compliance.



Buy now and you could miss out on other options later. Wait too long and pay a premium.

ADS-B airspace conforms roughly to where Mode C altitude reporting is now required: Class A, B and C airspace or in any airspace above 10,000 feet MSL.

No matter how many times it's explained, ADS-B theory (1090 versus 978, for one) remains confusing. Which equipment you buy will generally depend on how high you fly. Here's another summary.

Due to frequency congestion concerns, the FAA designated two ADS-B frequency bands (dual link network). There's 1090 MHz (the same frequency where transponders operate)

The generic Capstone Interface Protocol-designed FreeFlight RANGR 978 UAT, below, works with a variety of cross-brand interfaces, including Aspen, Avidyne and Garmin displays. That's a plus for future growth.



For many, Garmin's GTX330ES ADS-B transponder, top, is an easy 1090ES solution because existing plain-vanilla GTX330 Mode S units can be upgraded. The dual-linked Garmin GDL88 UAT, middle, provides Target Trend-enhanced traffic symbol-ogy on the GTN-series navigators, bottom.

and 978 MHz, known as UAT, for Universal Access Transceiver.

UAT—with its sizable bandwidth—promises more growth potential because it enables ADS-B reception for free FIS-B weather and TIS-B traffic, while also sending the required position pulse—the reason for satisfying the mandate in the first place. Ultimately, you'll likely make use of both bands, depending on how much ADS-B you need and the services you want. If you own a portable ADS-B receiver, you're already using 978 technology to receive weather and traffic services. This portable technology is a keeper, but does nothing to satisfy the mandate.

Aircraft operating above 18,000 feet will have no choice but to broadcast ADS-B on 1090 MHz, via a 1090ES Mode S transponder. But that won't get you the free weather service and other promised capabilities, including planned text messaging. You'll need the bandwidth of a UAT system for that. Fly below 18,000 feet and you can get by with a one-box UAT solution. That means transmitting and receiving on 978 UAT.

On the other hand, if bare bones compliance is your plan, a 1090ES transponder could be the easiest to retrofit because it can take the place of your existing Mode A and C unit. In many cases it can use the existing L-Band antenna system. The market seems flooded with these transponders, as you can see in the chart on page 6.

The rub, however, is the need for an approved WAAS GPS navigator. Since ADS-B requires a WAAS position source (and not all GPS receivers meet the specifications in the mandate), a sizable portion of the interface is interfacing the GPS



with the 1090ES transponder. That can be a costly proposition for lesser aircraft not equipped with a panel GPS. Classics might not have panel space or substantial electrical systems to support one.

As for cockpit displays, ADS-B output doesn't require one. But to see the FIS-B weather and TIS-B traffic, you'll need one. An easy solution might be a tablet computer connected in a semi-portable wireless installation.

FreeFlight's portable Wi-Fi transmitter connects to the company's RANGR ADS-B receiver and streams weather and traffic data to the iPad. Interfaces like this could solve the panel space challenges in smaller aircraft.

FREEFLIGHT

FreeFlight's RANGR 978 is our top pick UAT uses the Capstone Data Interface protocol. This is a generic interface standard that was developed and proven for over a decade in the Capstone ADS-B program in Alaska.

The FAA published the standard in hopes of promoting interoperability between different types and brands of ADS-B avionics and displays. Smart thinking, no?

In a nutshell, the protocol defines technical requirements for RS-422/RS-232 serial data connections between cockpit displays and ADS-B datalink radios receiving traffic and weather broadcast services. It's also referred to as the GDL 90 interface protocol, since Garmin/UPS-AT developed it and the GDL 90 UAT receiver for Capstone. We should note that Garmin has since chosen not to adhere to the standard, instead adopting a proprietary interface protocol for its newer GDL 88 receiver.



The FreeFlight RANGR, which starts at \$2580, is available in various configurations, including one with built-in WAAS GPS. FreeFlight's Jessica Power made it clear that the company can configure a box virtually any way you need it.

"Unlike some of our competition's boxes that overequip for some missions, the RANGR 978 can be configured for the type of flying you do. For example, if the aircraft flies above 18,000 feet, it needs a 1090ES transmitter. There's no need to equip it with a 978 UAT transmitter as well. What we can do, however, is provide a 1090ES solution for output and a 978 UAT receiver to receive traffic and weather," she told us. That 1090ES solution is the FreeFlight

MANDATE-COMPLIANT, CURRENTLY CERTIFIED ADS-B PRODUCTS

COMPANY/ PRODUCT	ADS-B SPECS	INTERFACES	PRICE	COMMENTS
AVIDYNE AXP-340	MODE-S 1090 TRANSPONDER WITH EXTENDED SQUITTER	N/A	\$3589	Partial plug-and-play with Bendix King KT76A transponder, but requires WAAS GPS input.
BECKER BXP6400-SERIES	MODE-S 1090 TRANSPONDER WITH EXTENDED SQUITTER	N/A	\$3465	Mode S with ADS-B output. Available in two-piece or standard rack-mount configurations.
BENDIX KING KT74	MODE-S 1090 TRANSPONDER WITH EXTENDED SQUITTER	N/A	\$2649	Partial plug-and-play with some existing Bendix King transponders, but requires WAAS GPS input.
FREEFLIGHT SYSTEMS RANGR 978-XVR	SINGLE-BAND ADS-B UAT TRANSCEIVER	ADS-B COMPLIANT MFDS, TABLETS THROUGH WIRELESS	\$3995*	Available in three different configurations: ADS-B output only, output and input, or input only. Also available with or without GPS. * Includes WiFi module for iPad FIS-B display.
FREEFLIGHT SYSTEMS RANGR FDL1090-TX	MODE-S 1090 TRANSPONDER WITH EXTENDED SQUITTER	N/A	\$4995	Can be paired with the RANGR 978 UAT in aircraft that require a 1090ES transmit solution.
GARMIN GDL 88	DUAL-BAND ADS-B UAT TRANSCEIVER	GARMIN ADS-B COMPLIANT PANEL MOUNTS, OTHER DISPLAYS	\$3995	Four versions are available. Price at left is for GDL 88 using external GPS source. Onboard GPS version sells for \$5995. There are also two versions that use dual or diversity antennas.
GARMIN GTX 330ES	MODE-S 1090 TRANSPONDER WITH EXTENDED SQUITTER	N/A	\$4389	Meets ADS-B Out requirement with extended squitter. No ADS-B In. Remote mount version is the GTX 33. Requires WAAS GPS input. Existing GTX330/33 to ES upgrade is \$1200.
NAVWORX ADS-600B	SINGLE-BAND ADS-B UAT TRANSCEIVER	ADS-B COMPLIANT MFDS, TABLETS THROUGH WIRELESS	\$2595	Supports a variety of panel-mounted and portable displays, built-in WAAS GPS.
TRIG TT-SERIES	MODE-S 1090 TRANSPONDER WITH EXTENDED SQUITTER	N/A	\$2889	Similar to Garmin's GTX 330, the TT31 and TT22 starting at \$2595 meet the mandate via extended squitter.

FDL1090—a Trig TT22-series transponder that wears a FreeFlight nameplate.

We suspect the competition Power is referring to is Garmin. Its GDL88 is both a UAT transmitter and receiver and isn't configurable as a receiver only. We're not sure that's considered overequipped, but it can be more equipment than some aircraft need.

GARMIN

The GDL88 isn't Garmin's only solution. There's also a 1090ES option with the GTX330ES transponder. It

can be purchased outright for \$4389 or an existing GTX330 transponder can be upgraded for \$1200. We suspect this unit will be the dominant 1090ES solution, given the large number of GTX330 units in the field. This is the unit that receives TIS traffic data and overlays it on a variety of displays. The GTX330ES works much the same way, except it outputs ADS-B. The GTX33ES is the remote version.

Speaking of dominant, the Garmin GDL88 seems to be the most popular retrofit UAT system, based on our discussions with several avionics shops. One shop told us it

installs a GDL88 along with almost every major Garmin installation, especially with the GTN touch screen navigator.

A one-box 978 UAT solution, the GDL88 is also capable of interfacing with a variety of ADS-B Out compliant transponders and assuring that the same squawk code is being transmitted by the transponder and the UAT equipment without an awkward separate control box.

The dual-linked receiver in the GDL 88 means it receives all traffic data on all ADS-B Out-equipped targets in the area, no matter whether they are transmitting via transponder on 1090 MHz or UAT on 978 MHz. The GDL 88 comes in four versions. For aircraft with a WAAS GPS source and not desiring what's called diversity (that's a system that uses dual L-Band antennas—one on the top and one on the bottom of the airplane for better performance), the basic GDL 88 is \$3995. If the aircraft already has an approved WAAS GPS source, the GDL 88 with diversity is \$4495. A unit with built-in WAAS GPS

NavWorx said its TSO-certified ADS-600B UAT transceiver, left, will be STC-approved by the time you read this. It's newly certified, one-box solutions like this that make us wonder how many others will be available as the mandate gets closer.



and without diversity is \$5143. The GDL 88 with WAAS and diversity is \$5643. These prices do not include L-Band antennas and two are required for diversity models. It does, however, include a WAAS GPS antenna. We should note that the FreeFlight system comes with dual antennas.

As for GPS compatibility, the GDL88 can be connected to Garmin's GNS500/400W-series navigators with software version 5.0 or greater and with the current line of GTN-series navigators. The GNS480/CNX80 isn't approved. Since the GDL88 is a UAT receiver, it can display both ADS-B traffic and FIS-B weather on select Garmin panel displays, including GNS, GTN and MX/GMX-series systems. It won't display on tablets.

TRIG AVIONICS

The TT21 and the TT22 are perhaps the smallest mode S transponders on the market with 1090ES ADS-B output. These models use two pieces: a control head that's installed in the panel and a remote transceiver. An altitude encoder is built in to the controller (a welcome move). The controller uses an LCD screen and squawk code, and Flight ID input duties uses a conventional rotary knob. We've flown with these transponders and found them built to rugged standards. The controllers are even splashproof for water ops and open cockpits. Pricing starts below \$3000.

DEVELOPING PRODUCTS

Our advice is to develop a working relationship with a shop now. It can help spec the best solution for your existing interface. If you need NextGen GA Fund financing, they'll need to provide a detailed quote, as we describe on page 2 of this issue.

While it's encouraging to see new ADS-B products come to market, it also makes the decision to upgrade now more difficult. There's always the fear of something better and cheaper coming along, but that's been the nature of avionics for years.

For example, Aspen Avionics is in the process of bringing a new line of ADS-B solutions to market and is expected to make a sizable announcement at this year's AirVenture later in the summer. While Aspen couldn't give us much details, the products will be the result of a partnership

CAN SHOPS HANDLE ADS-B DEMAND?

It's estimated that nearly 160,000 aircraft will need to be upgraded with ADS-B equipment by January 1, 2020. To put this number into perspective, more than 120 ADS-B installations will need to be performed each working day, or 30,000 annually. As of March 2014, the FAA reported that roughly 1200 ADS-B compliant installations have been performed. According to Michael Dymont from the NextGen GA Fund, this slow start is a NextGen train wreck in the making. Others, including executives at the Aircraft Electronics Association (AEA) and ADS-B manufacturers agree that NextGen equipage is off to a dismal start.

The AEA estimates there are roughly 900 FAA repair stations in the U.S. that are capable of performing ADS-B installs. While that may seem like enough to handle the demand, realize that avionics shops do more than just install avionics. It's unrealistic to assume that 100 percent of a shop's effort can be focused on ADS-B retrofits. The average ADS-B installation might take as little as two days, but as long as a week or more, depending on the interface, the level of teardown and the complexity of the airframe.

According to Ed Rowley, the principal at VIP Avionics in Hartford, Connecticut, his shop has seen an increase in ADS-B interest, but certainly not anywhere near the number of installs that would equip the fleet by 2020. "I estimate that barely 15 percent

of our installs are ADS-B, including 1090ES transponders," noted Rowley. He also noted that Garmin is the most popular, at least at his shop.

One shop, who asked not to be identified, openly admitted that it will consider raising prices as the ADS-B compliance date gets closer. "If I have to take on more hangar space, pay my installers overtime and deal with more FAA paperwork under the stress of pumping installs out the door by a certain date, customers will pay," said the shop manager.

The ADS-B equipage deadline could be similar to the TAWS-B terrain alerting mandate that was implemented in 2001. It required that turbine-powered airplanes with six or more passenger seats be equipped with FAA-approved TAWS. When faced with non-compliance due to logistics, scheduling or cost, some operators removed seats from the cabin in hopes of skirting the requirement. ADS-B upgrades won't be as easy. The way it stands now, if you don't equip for the mandate by January 1, 2020, you'll be skirting lots of airspace.



with FreeFlight Systems. Aspen told us its planned system will work with the company's Evolution line of displays, in addition to other brands.

While Bendix King has a worthy solution with its KT74 1090ES ADS-B transponder (designed as a partial drop-in replacement for the KT76-series transponders), we wouldn't be surprised to see a similar relationship birth a few more products.

For now, our top pick for a 978

UAT solution is the FreeFlight RAN-GR, for its generic interface protocol and flexibility. If enhanced traffic overlay is your need, the dual-band Garmin GDL88 and GTN navigator combo excels with its Target Trend.

For 1090ES, upgrading an existing GTX330 transponder makes sense, especially if it's interfaced with WAAS. If you're starting from scratch and want bare-bones compliance, we favor the Trig/FreeFlight transponders.

FlightPro For Android: Intuitive, Data-Rich

We think the FlightPro for Android is one of the most straightforward and intuitive apps we've used. Don't expect an iOS version any time soon.

by Larry Anglisano

In a flight planning app market that's been dominated by Apple iOS, it's easy to overlook apps designed specifically for the Android platform, but we think that's changing. Tablets from Samsung, Google and others are proving to be just as capable as Apple's offerings for less money.

If you've been away from Android for a while, don't underestimate its processing power and overall ability to support a new breed of highly capable cockpit

apps. An example is FlightPro. Even after using it for a short time, we were impressed with its intuitive feature set, shallow menu structure and speed. We also like that it presents at-a-glance waypoint and weather data, in addition to seamless DUATS flight planning.

SIMPLE MENUS

The FlightPro app is compatible with most every Android device with software version 4.0 or later.

FlightPro says it regularly tests on Nexus 7 and Xyboard 8.2, so these are sure-thing compatible devices. We evaluated the app on a Samsung Galaxy Tab Pro 8.4, which sells for around \$350 and at 5 x 8.62 x 0.28 inches, found it to be nearly the perfect size for the cockpit. We give its screen quality and battery endurance a slight edge over the iPad mini.

FlightPro has minimal menu icons, adding to

FlightPro does well at preflight and inflight planning. That's a high-altitude airway chart with weather overlay, left. The onscreen waypoint window—called the Info Box—provides a detailed summary of a selected airport, with an option to quickly navigate directly to it.



CHECKLIST



A shallow menu structure keeps the app intuitive and easy to navigate.



It excels at delivering detailed airport information in a logical layout.



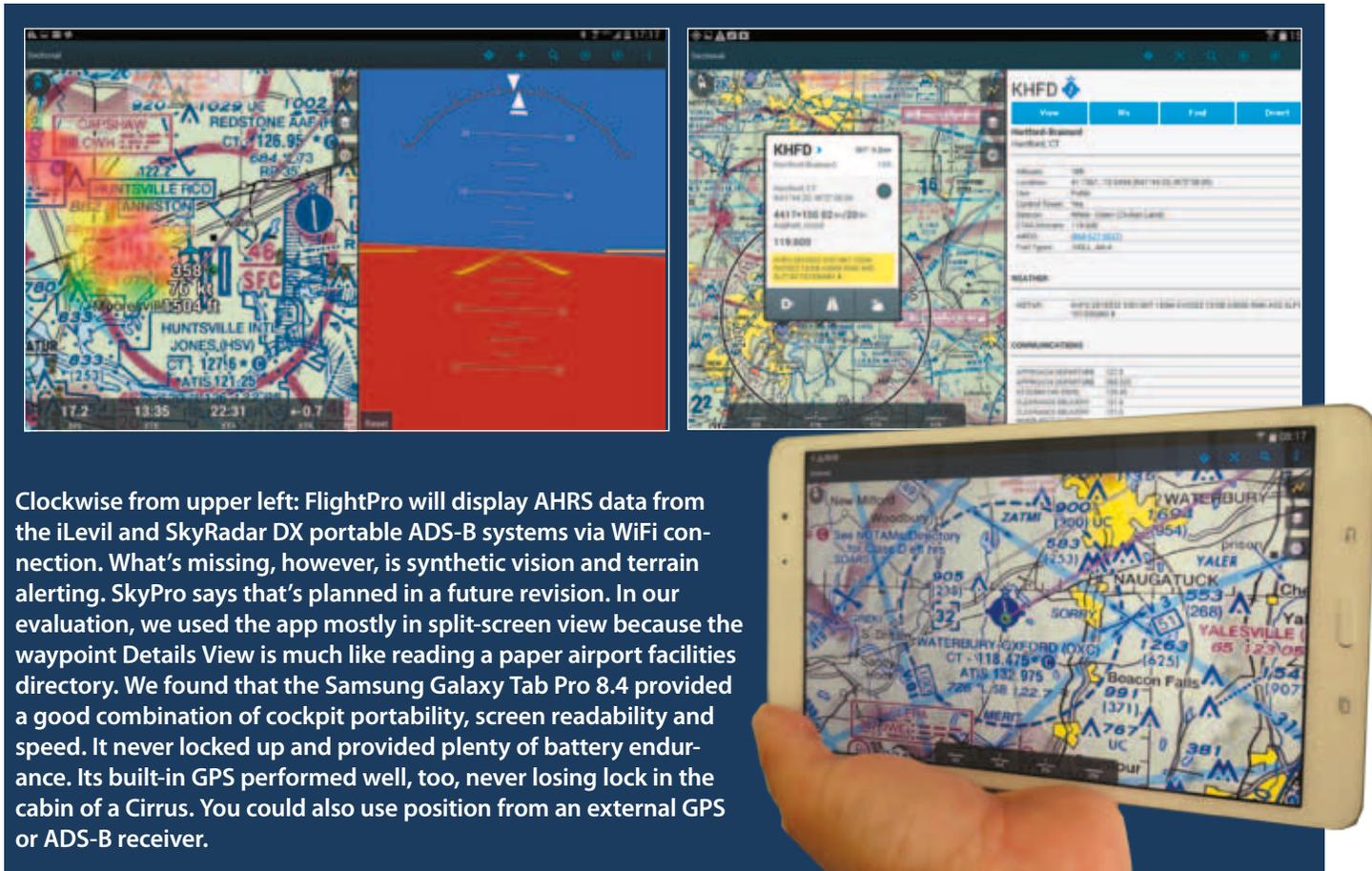
There's no terrain alerting or fuel pricing functionality at this time.

the apps simplicity. There's a basic navigation bar at the bottom of the screen that displays active navigation data fields (distance to waypoint, ETA, ETE) and there's also a selectable onscreen magnetic rose. It can be configured to display a CDI that automatically uses terminal, enroute and approach course-width scaling. As you would expect, a magenta course rhumb line is displayed on the map.

There's an integral, map-overlaid altimeter label that auto-adjusts every 15 seconds when the app is receiving valid weather data. When altimeter data is between 60 and 75 minutes old, the altitude will display in yellow. When the altimeter is more than 75 minutes old, altitude will display in red.

Nearest airports are selected from a dedicated icon from the menu bar at the top of the screen. The upper menu bar also has a POI icon, for point of interest, to manually key in a waypoint name. The app has a full-screen or split-screen mode that's useful for displaying various maps, in addition to side-by-side waypoint and weather data. A major function of the app is the Info Box, which appears after touching an airport on the map. There's also a Details View (a digital version of the airport facilities directory), which tells you everything you could possibly want to know about a waypoint, including frequencies, runway data, available fuel types and also the current weather, including the METAR and TAF.

At the bottom of the waypoint Info Box is an action bar with three icons, including a direct-to command that navigates directly to the associated waypoint.



Clockwise from upper left: FlightPro will display AHRs data from the iLevel and SkyRadar DX portable ADS-B systems via WiFi connection. What's missing, however, is synthetic vision and terrain alerting. SkyPro says that's planned in a future revision. In our evaluation, we used the app mostly in split-screen view because the waypoint Details View is much like reading a paper airport facilities directory. We found that the Samsung Galaxy Tab Pro 8.4 provided a good combination of cockpit portability, screen readability and speed. It never locked up and provided plenty of battery endurance. Its built-in GPS performed well, too, never losing lock in the cabin of a Cirrus. You could also use position from an external GPS or ADS-B receiver.

The Info Box runway highlight icon is for selecting the intended runway for departure or approach. When in the runway highlight mode, the map shows extended runway centerlines with arrows that indicate the direction of the traffic pattern. Nifty and helpful.

There's also a weather icon for displaying textual and weather images, including METAR history, TAF, local radar and radar tops, to name a few products. You'll need an Internet connection or a compatible ADS-B or XM receiver. Currently, FlightPro is compatible with Baron MobileLink XM, SkyRadar and the iLevel ADS-B, plus the Dual XGPS170 ADS-B receiver via Bluetooth connection. Weather is configured with the onscreen Layers Tab. While open, it enables options for displaying or decluttering weather products, based on compatible driving receivers.

If you ever get lost on the onscreen map (after panning a long distance on a busy sectional, for example), there's a dedicated icon that automatically centers the chart on the current position. There's also the option to change the size of the on-chart font

and the ownship icon, accessed in a generous preferences menu.

SUBSCRIPTION, DUATS

The \$149.99 Premium yearly subscription package includes georeferenced charting that's provided by Seattle Avionics. You get airport taxi diagrams, approach plates, sectional charts and high and low airway charts. The Standard subscription tier has the same charting, but no approach plate and taxi chart georeferencing (the aircraft won't appear on the chart). Charts are selected from a drop-down chart menu on the upper left corner of the screen.

There's a dedicated flight plan tab, with drop-down options for clearing, inverting and loading flight plans. Flight plan data is automatically transferred to the Flight Pad Briefing tab, where it can be edited or sent to your DUATS account. A dedicated Request prompt in the Briefing tab requests a weather briefing, with the option to file the flight plan.

The Flight Pad also has a runway-finding feature. It displays a representation of your aircraft in relation to the runway that's in use. The

Scribbles function is a note pad for writing clearances and illustrations.

WHY DROID ONLY?

That's what we asked FlightPro's Paul Coleman, who told us that the Android platform is edging Apple iOS in popularity.

"An announcement was made recently that Android surpassed iOS, making it the most popular mobile platform in the world. The development platform for Android is more common and there are significantly more developers for Android versus iOS," he said.

We're not so sure that's the case with aviation app designers, with top apps including ForeFlight Mobile and Jeppesen only serving Apple iOS. On the other hand, if Android tablets continue to increase in popularity as they seem to be doing, these aviation tablet app developers could have some serious programming to do. Based on our trials, FlightPro would be the one for them to beat once it gains a few lacking features, including terrain and synthetic vision. Contact www.flightpro.com for a trial subscription.



Pipistrel Panthera: A Retractable for the New Age

It hasn't hit its speed marks yet, but the Panthera is docile, comfortable and economical. A new engine will improve its runway performance.

How about this for an overused cliché? "It looks fast standing still." It's been applied to everything from cars, to boats and the occasional airplane, with arguable truth. But when Pipistrel's exotic Panthera appeared as a prototype

BY PAUL BERTORELLI

two years ago, it was mobbed at the Aero Expo in Friedrichshafen and none of the people waiting in line to see it were heard debating its sleek good looks.

Now, the airplane is 100-plus hours into its flight tests and still

some distance from certification. On a recent trip to Europe, we visited the Pipistrel factory in Slovenia and got a close look at the Panthera, along with a flight demo to check out the airplane's flight characteristics. If another cliché is true, airplanes fly like they look, the Panthera confirms that. But it also confirms that not all airplanes are as fast as they look or were predicted to be. More on that later.

The executive summary: The Panthera is a superbly crafted retractable with a comfortable interior, good range and payload and, in our view, the best-looking airplane to emerge

since Cessna clipped the struts off the Cardinal. But it needs better runway performance and another 15 knots of cruise speed, at least, would make it a strong contender, albeit not a cheaper one.

PIPISTREL

Pipistrel is, to a degree, a product of the fall of the Iron Curtain. But it's not a relic of the aviation manufacturing skill base the former Soviet Union established in Eastern Europe during the Cold War. Slovenia is the northernmost segment of the former Yugoslavia and the company's Ajdovscina factory is located just

With everything open, right, the Panthera looks like it's all doors. Ingress and egress are easy, but watch your head. If the airplane has more drag than planned, we doubt if it's cooling drag. Inlets are small and smooth, middle photo. Trailing link gear hides behind fully enclosed doors in flight.

across the Italian border east of Trieste. Company founder Ivo Boscarol fed his lifelong aviation interest by building and flying hang gliders beneath the regulatory and security radar.

Following the dissolution of Yugoslavia and Slovenia's eventual entry into the European Union, he began building powered gliders and now a line of European ultralights that sell as LSAs in the U.S. The Virus and Sinus are Pipistrel products and between those and the gliders, Pipistrel builds about 120 airframes a year.

Boscarol's ethos has been less pure speed than efficiency, a philosophy the company used to win the \$1.35 million NASA Green Flight Challenge in 2011 with the Taurus G4. The challenge required the winning aircraft to fly 200 miles in under two hours on less than one gallon of fuel per occupant, or the equivalent electrical energy. The twin-fuselage G4, an all-electric design, crushed the challenge, using but half of the allowed energy allotment.

The G4 was both faster—by 6 MPH—and more economical than the second place finisher, with the equivalent of 403.5 MPG. The competition had both promotional and practical applications, demonstrating Pipistrel's prowess in low-energy flight and employing the same type of brushless DC motor Pipistrel will use in the electric version of the Panthera.

HIGH AMBITION

You read that right. In addition to the gasoline powerplant, Pipistrel plans a pure electric version and also a hybrid-drive variant. Pipistrel's Tine Tomazic showed us the plans for the latter and although it appears to be quite far along, we can't judge how realistic it is for the short term. For the time being, Pipistrel has its hands full re-engineering the gasoline model.



When it first appeared two years ago, Pipistrel predicted the Panthera would fly at around 200 knots on 10 gallons per hour, burning readily available mogas, at least in Europe.

The planned engine was Lycoming's 210-HP IO-390. However, as the project unfolded, Lycoming revealed that it couldn't make the IO-390 deliver full rated power on mogas with sufficient detonation margin. So in early 2014, Pipistrel announced that it was switching to the 260-HP Lycoming IO-540-V4A5, which is approved for 93 AKI fuel, if not necessarily exactly automotive gasoline.

This appears to be a point of contention because Lycoming's SI 1070 approving 93 AKI fuel for the model of IO-540 Pipistrel plans to use specifies a Reid vapor pressure requirement of 9 PSI or less, which is in the range of avgas. In Europe, fuels with 98 research octane (93 AKI) are available, including at some airports. While these meet the octane requirement, they may or may not meet the vapor pressure requirement, according to Lycoming. Sources in the fuel industry we've spoken with are mixed on this issue. "To us, the important thing is not which fuel or mogas, but that the airplane's future isn't tied to 100LL," Tomazic said.

"The decision on the engine was twofold," says Pipistrel's Tomazic. "Forty percent is that the IO-390 turned out to be not feasible to run on mogas. The 60 percent comes from checking the current backlog and seeing where these airplanes will fly. A big majority of the people who order



the airplanes fly hot and high every day," Tomazic added. That includes South Africa, Argentina, Mexico and Colorado, to name a few locales from which 65 Panthera orders have come. Tomazic said Lycoming made a credible effort at making the IO-390 run on fuels other than avgas, but the physics just didn't work.

With the IO-540, he says, owners will have at least 200 HP available at

HYBRIDS AND ELECTRICS

If nothing else can be said of Pipistrel, this is a company that doesn't lack guts. Or creativity. In its price sheets, it lists both a pure-electric version of the Panthera and an intriguing hybrid-drive variant. The all-electric version is, in our view, difficult to parse. Is there really a market for a \$600,000-plus airplane with the short endurance that electrics are likely to have for the foreseeable future? Call us skeptical.

But smaller trainers, which Pipistrel is also considering as electrics, have more promise for the short term. And so, perhaps, might a hybrid drive. When we visited Pipistrel's factory in Slovenia, they gave us an eyes-only—no cameras—tour of their hybrid-drive project.

Pipistrel is pursuing a serial hybrid design that envisions a 260-HP brushless electric motor driven by both batteries and an engine-driven generator. The batteries are kind of a booster, capable of full power for only six minutes, but at massive horsepower unaffected by density altitude.

In cruise, the airplane's electric motor would be powered by the generator driven by a four-cylinder engine vaguely modeled on the turbocharged Rotax 914. The engine would be capable of 130 HP on about 8 to 9 GPH. At low altitude, the engine/generator/battery combination would be slightly less efficient, but because of the turbocharging, Pipistrel says it will be slightly more

efficient than the straight Lycoming gasoline engine at higher altitudes.

The airplane will likely have a five-blade prop to absorb the electric motor's considerable torque and the entire system—electric motor, gasoline motor and critical components—will be watercooled. The weight penalty for all this is about 150 pounds (70 kg) over the gasoline engine, so the Panthera hybrid will never be a four-place airplane with much practical range.

Advantages? Pipistrel sees five. The engine will burn about any fuel—but not Jet A; it's nonplussed by high density altitude; it's much quieter, especially on takeoff, than the gasoline engine and it offers dual power sourcing, so it's essentially a twin within a single. Last, performance. With a minimum of 260 HP always available when the batteries are charged, the hybrid, at least on paper, should be a heroic climber, reaching 10,000 feet in five minutes or so.

But Pipistrel's Tine Tomazic says the overriding value of the hybrid project to the company is to form a research base for what comes next. It will test battery technology, inverters and distributed computing, all of which may lead to the next generation or two of practical electrical airplanes. Tomazic says the hybrid drive will run in 2015 and fly in 2016. Prices aren't for the fainthearted: You can order an experimental version for delivery in 2017 for \$696,000.

the prop shaft except in extreme conditions, something that can't be said of the IO-390. And what of the weight? Tomazic concedes it'll be a 90-pound hit over the smaller engine.

"Because the low-speed flight side of the envelope turned out so well, we can bump the maximum takeoff weight by 200 pounds. So in the end, we have an airplane that can deliver what we can call the original design horsepower between 190 and 200," Tomazic says. Physically, the larger engine will fit under the same cowling

because Pipistrel had envisioned both the possibility of a larger engine and the planned hybrid drive. (See sidebar above.)

TV PANTHERA VIDEO



AVweb
www.avweb.com

LIGHT, SLICK, STRONG

Viewed from any angle, the Panthera looks like an airplane built by a glider company—light and slick, although given the initial performance shortfall, it's evidently not as slick as it looks. Basic fuselage construction is composite throughout, with two

skins laminated over honeycomb or foam. The material is largely carbon fiber for stiffness, although the cockpit structure incorporates Kevlar plies to reduce sharding in the event of crash impact. The cockpit area is a safety cage consisting of stiff beams connecting the firewall to the cabin ceiling.

The control surfaces are composite layups, with no foam or honeycomb. This was done, Tomazic says, to make them easier to field repair and to mass balance during construction. All of the control circuitry is push-pull tubes, except for the rudder, which is via cables. The landing gear system is Mooney style; all-electric with a motor/transmission raising the gear through rods to each leg. Emergency extension is done via a crank between the front seats. The retracted struts and trailing link gear are fully enclosed behind tightly fitted doors. Flaps are similarly electric with about two-thirds span. Although they're plain flaps, they do produce a slot as they extend, so it's more accurate to call them a hybrid design. But the wing is clean of any rails or guides, for drag reduction.

Anticipating mogas in which vapor pressure might be an issue, the fuel system consists of a pair of wing tanks plumbed through smaller header tanks with return lines and flapper valves for vapor suppression. Capacity is 28 gallons per side (105 liters) for a total of 56 gallons (210 liters). For a four-cylinder engine, that capacity is about right and would give a little over 800 miles of still-air range at 170 knots, but closer to 1000 miles if Pipistrel gets the airframe to 200 knots. But 56 gallons strikes us as stingy for a six-cylinder engine, even if Pipistrel insists the fuel burn won't increase more than about half a gallon an hour. An extended-range option will offer another 16 gallons or 30 liters per side for a typical endurance, with reserve, of about six hours. That's an easy 1000 miles, even at the slower cruise speed.

It's too soon to say where the Panthera will come out on weight, but it could be impressively light. The aircraft we flew weighed 1590 pounds empty (723 kg) and without the gross weight increase Pipistrel envisions, that's a useful load of 1050 pounds (556 kg) on a stated gross weight of 2640 pounds or 1200 kg. Full fuel payload with standard tanks is 714 pounds (324 kg). If those numbers stand, the Panthera is a full-seats, full-



The Panthera's panel, top, is tight, but the cabin is roomy, especially in width. The windshield center post ties the roof to the firewall for crash integrity without tanking the view. Pipistrel has switched to the 260-HP IO-540, right.

tanks airplane. If the gross is bumped up 200 pounds, it will gain enough load capacity for more fuel and baggage. The empty weight includes a ballistic recovery parachute system.

FLIGHT TRIAL

Ingress into the Panthera is through a pair of gullwing-style hatches for the front and a single hatch on the left side of the airplane for the backseats. You'll graze your head on the open hatch the first time, but not the second. The cabin is unexpectedly wide—49 inches (124 cm) at the shoulders—with plenty of headroom above a headset. Despite the raking windshield and a wide center beam that's part of the cabin protective structure, the view forward is good and utterly expansive out the sides.

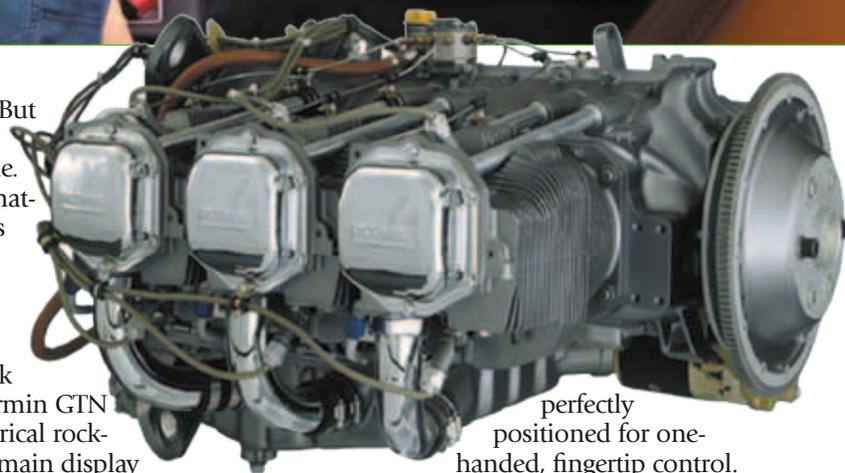
The panel in the airplane we flew had a Dynon Skyview, but Tomazic says Pipistrel isn't sure what production versions will have. It seems likely to be a choice of the Skyview or

Garmin G3X. But it won't be a G1000 airplane. It will carry whatever autopilots support those systems.

Elsewhere on the panel, the center stack contains a Garmin GTN 650/750, electrical rockers below the main display on the pilot's side and backup instruments along the top eyebrow. A nice digital climate control display is on the pedestal under the radios. Less nice, in our view, were switch/annunciators above the displays. It's a minor point, but we thought these looked a little dated and didn't match the exotic good looks of the rest of the airplane. Although they're functional, they would benefit from some spiffing up.

Takeoff in the airplane is not unlike other slick retractors; the Mooney Ovation comes to mind. The Panthera accelerates quite briskly at first, then settles into a slower pace. Rotation comes at about 65 knots and the airplane waddles rather than bolts off the runway. But like the Mooney, once the gear is up, it gathers itself up, speeds up and heads for a climb rate north of 1000 FPM. Way north; at one point, we saw 1600 FPM in relatively smooth air.

The Panthera has center sticks,



perfectly positioned for one-handed, fingertip control.

Control forces are, well, smile inducing. The airplane is a delight in steep turns and once the sight picture is locked in, easy to keep on altitude. Tomazic said the Panthera's slow-speed behavior is good and he's right. But it needs a higher V_{lo} which, at 108 knots, takes some effort to achieve. Pipistrel hasn't taken the envelope in that direction yet and our guess is unless there's something quirky about the gear doors, the cert version may have higher speeds, including V_{fe} , which is also 108 knots.

The airplane looks like it should have the slow-speed habits of something similarly slick, say a Glasair III. Not really. The Panthera happily wallows around in the burble with plenty of warning that the stall is pending. When it comes, the Panthera feels like a more docile airplane, bobbing the nose and almost recovering on

continued on page 32



Gear of the Year: RedHawk 172 Trainer

Redbird, with its Cessna 172 RedHawk refurbishment, wins our Product of the Year award for its forward-thinking contribution to the training market.

Every summer we look back at the editorial year for products and services that stand out for value, innovation and credibility. While this wasn't a bad year, we weren't overwhelmed with products that we consider game changers. Still, there were a select dozen that were worthy of our editors' choice award.

The Aviation Consumer

PRODUCT OF THE YEAR

At AirVenture 2013, Redbird—which invented the inexpensive, motion-based simulator market—unveiled the RedHawk training aircraft. It's a remanufactured Cessna 172 fitted with a Continental Centurion 2.0 FADEC-controlled, turbo diesel engine, modern avionics, fresh interior, a creatively educational paint scheme and a \$249,00 price tag.

We think the timing and price is right. After all, the market isn't exactly oozing with modern and af-

fordable training aircraft. Moreover, Cessna proposed a diesel-powered 172 back in 2007, but bailed out when former engine-maker Thielert ran into trouble.

Each RedHawk is a true airframe-up refurbishment that includes stripping nearly all of the old wiring, inspecting (and replacing, if required) critical parts, corrosion-proofing the airframe and retrofitting off-the-shelf avionics, including a Garmin G500 flight display, GTN650 touch navigator and Garmin's GNC255 radio.

This isn't a personal cruiser, remember. It's intended to provide the training environment with a simple aircraft that's economical to acquire and operate, and has just enough modern gee-whiz appeal to attract a new breed of students. Visit www.redbirdflight-simulations.com.

Recognizing there are still aircraft

BEST BUDGET AUDIO SYSTEM: PS ENGINEERING PAR200

that need affordable yet modern avionics upgrades, PS Engineering developed the PAR200. It's a combination audio control panel and intercom with integrated comm transceiver (the TY90-series radio is provided by Trig Avionics.) While bargain-

priced at \$2995, the PAR200 doesn't shortchange on features and it did well on our test bench. It has Bluetooth, PS Engineering's proven IntelliVox smart intercom with pilot and crew isolation, plenty of unswitched audio inputs for external systems, plus a rugged bezel and decent mode display. See www.ps-engineering.com. If your idea of effective cabin light-

BEST CABIN LIGHTING MOD: AVEO EYEBEAM TOUCH LED

ing consists of a flashlight held in the mouth, it's time for a lighting upgrade. While there are several options, we like the Aveo Engineering EyeBeam Touch overhead lighting the best. The EyeBeam Touch has a swiveling enclosure, LED backlighting and capacitive touch controls.

What we really like is the lack of fragile mechanical controls. Additionally, the vibration-proof



EyeBeam Touch allows for focused cabin lighting, with swiveling LED lamps that have linear dimming. The system is available in a variety of colors (white and red are standard) and sells for around \$200. Visit www.aveoengineering.com. The flush-mount, 3-inch Electronics

BEST ENGINE MONITOR: CGR-30P CLUSTER REPLACEMENT

International CGR-30P eliminates some panel work during primary engine gauge upgrades because it's designed to fit an existing tachometer or manifold pressure gauge cutout. Unlike other monitors, the CGR-30P won't overhang adjacent instruments and doesn't require a lot of depth behind the panel.

The unit replaces up to seven primary engine gauges and up to five secondary non-limited gauges, including EGT and CHT. There's also fuel quantity and fuel flow. We like the simple layout (the main page





displays RPM and manifold pressure side by side) and the easy expansion of other secondary functions that spill over to a secondary screen.

With TSO approval for primary replacement, entry-level packages for four-cylinder engine applications start at under \$4000. Still, don't expect a drop-in installation, but do expect installation costs to vary, based on functions and engine model. Visit www.buy-ei.com. Buying additional training is one

BEST SAFETY MOD: SHOULDER RESTRAINTS

way to reduce the risk of getting hurt in your aircraft, but installing passive shoulder restraints could be the best safety mod you can make.

AmSafe and Hooker Harness offer multi-point harnesses that fit the front seats of most aircraft, in addition to STC-approved restraints for a variety of rare



applications. For rear-seaters, B.A.S. offers a line of inertia reel four-point restraint systems (made by AmSafe) for everything from old Beech Travel Airs to Luscombes. Buckle up that torso for the best safety. Practicing IFR under the hood is a

BEST IFR TRAINING HOOD: ASA JIFFY HOOD

time-honored tradition for all pilots. We went beyond the usual last-minute grab-one and let's-go drill and took a hard look at a variety of models for comfort, the ability to block the view outside (one peek

is worth a thousand scans), ease of scan and ease of removal when it's time to spot the runway and land on it. Prices ranged from \$8.10 to a stunning \$46.74—and weren't an indicator of quality.

The clear winner was the ASA Jiffy Hood, purchased for \$8.10 through Amazon.com. It's a view-limiting device reduced to essentials—an elastic headband snapped to a curved piece of plastic. It was comfortable for long slogs, easy to doff and don, didn't break when dropped and, most importantly for our reviewers, allowed a scan without much head movement and didn't interfere with sunglasses. See www.ASA2fly.com. The \$299 SwitchBox is a convenient

BEST REMOTE HEATER CONTROL SWITCHBOX

way to remotely control a plug-in engine heater or portable cabin heater. The unit independently switches



two 115-volt lines and handles loads up to 15 amps and 1500 watts. It's controlled by texting, calling or with a smartphone app that sends confirmations of commands and answers questions regarding signal strength and how long it's been on. For security, it won't respond to any phone number not on the user-inputted list. See www.switchboxcontrol.com.

BEST NEW LSA: VAN'S AIRCRAFT RV-12

For years, Van's Aircraft has dominated the kit market with the proven and respected RV line. With over 8000 of these aircraft flying, homebuilt RVs are known for their crisp handling, good ergonomics and solid fit. That's why we had



high expectations when we flew the new RV-12 LSA at this year's LSA Expo. Even Van's didn't expect the lightweight flaperon and full stabilator-configured RV-12 to fly like its heavier and faster aircraft. We think the company achieved its goal of building an LSA that offers light and responsive control feel without any bad habits that might get low-time pilots in trouble. Stall speed in the clean configuration and at gross weight is 45 knots (41 knots dirty) and there's plenty of warning before the stall, without much in the way of wing drop. The large bubble canopy provides plenty of visibility and makes the cabin easy to ingress and egress.

The RV-12, with its 740-pound empty weight and LSA-compliant 1320-pound gross weight, is powered by the 100-HP Rotax 912ULS engine and cruises near the top of the LSA category speed limit (135 MPH). The aircraft, which can be delivered from the factory completely built (S-LSA) or in kit form (E-LSA), can be trailered because it's designed with removable wings.

The factory-built RV-12 has a base price of \$115,000 and can flirt with \$125,000 with lots of options. Van's recently announced that it will offer the Garmin G3X Touch glass panel as an advanced avionics option. For more on the RV-12 LSA, visit www.vansaircraft.com.





BEST PORTABLE INTERCOM: HEADSETS INC. DRE205E

Panel-mounted intercoms dominate the market, but there's still a place for battery-operated portable sets—especially in legacy airplanes with no electrical systems. Priced at \$349, we think the Headsets, Inc. DRE-205e is the most advanced and generously featured model we tried. It performed well in our flight trials—nearly as well as a high-end panel-mounted audio system. The DRE-205e excels at music input and accommodates external audio inputs, plus it has a handy stuck microphone indicator and pilot isolation. See www.headsetsinc.com.

BEST AIRCRAFT REFURBISHERS: PRISTINE AIRPLANES

Professionally refurbished aircraft have been the focus of Aircraft Sales, Inc. for over 10 years. Hank and Matt Kozub, the father-and-son team that created the Pristine Airplanes refurbishment process, approach the used aircraft market in two ways: restoring popular models on a spec basis or they'll take on custom remanufacturing projects under a program it calls Plan-a-Plane. This allows customers to specify any level of upgrade or modification, as long as it's FAA approved. In many cases, they'll obtain approval for certain mods, including club seating for Piper Saratoga models.



When we visited Kozub's shop at the Wayne County Airport in Smithville, Ohio, earlier this year, it was bustling with a variety of in-process refurbishments. We saw a completed Cessna 310, several Piper Saratogas, a Beech Bonanza and a variety of other airplanes undergoing the company's through rebuild. The aircraft were torn down farther than any we've ever seen.

The shop turned out over 30 aircraft last year and business is brisk. The process is complex, but the idea is simple: Start with the cleanest used aircraft on the market (the Kozubs are careful about not buying aircraft with damage history, that have lived near the ocean and outside of the United States) and remanufacture it to like-new condition. We think these are the best used aircraft you might find on the market. Visit www.pristineairplanes.com.

BEST AEROBAT: XTREME DECATHLON

The two-place production aerobatic market has long been occupied by airplanes that had significant strong and weak points. The Pitts Special line gives eyeball-snapping performance, but has lousy landing manners—most prangs are RLOC. The Citabria line has good ground handling, but heavy ailerons and modest akro ability. The Decathlon improved on the Citabria's capabilities and kept its pleasant ground behavior, but with 150 HP, had limited vertical ability. The Super Decathlon, at 180 HP, was a step forward and back—better performance, but so heavy it's tough for two people with parachutes to fly it under gross.

In creating the airplane that gets our award for Best Aerobat, the Xtreme Decathlon, American Champion created what we consider a very good, all-around akro machine. It reduced the weight of the Super by 50 pounds, including using new ailerons that were 14 pounds lighter and improved roll rate by 33 percent—then it hung Lycoming's new 210-HP AEIO-390 mill up front. The resulting Xtreme approaches

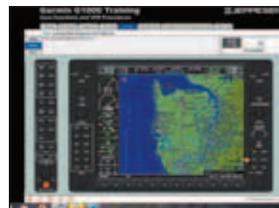


a 200-HP Pitts S-2A in performance, and makes all earlier Decathlons seem positively stodgy.

Rolls are fast, fingertip affairs—gone is the need to muscle the stick to full deflection and wait. An increased useful load turns the airplane into a serious akro trainer and the predictable ground handling means instructors can probably keep Xtremes out of the weeds when students botch landings. See www.americanchampionaircraft.com.

BEST GLASS TRAINING AID: JEPPESEN FOR GARMIN G1000

Airplanes with glass panels are more expensive to rent, plus there's a steep learning curve. Ten-hour checkouts are not unusual for a G1000 Skyhawk, for example, and dual instruction is generally north of \$200 per hour. Several companies offer computer-based video training for a variety of glass cockpit aircraft. We sampled most of them and found that the best



and most complete, in our view, were developed by King Schools and Jeppesen. We gave the nod to Jeppesen's Garmin G1000 training courses, VFR and IFR (\$299.95 for both), not only because the video demo section is first rate, but because it has a two-stage follow-through to make sure the student can apply what was taught. A training section guides the student through buttonology on what amounts to an interactive simulator, followed by a rigorous testing section that requires the student to interact with the simulator without guidance. It's about as real-world as a computer screen can be. Visit www.jeppesen.com.

Turbine Upgrades: Training Required

Low prices for turbine airplanes getting you interested in moving up? Plan on some completing some no-nonsense schooling in order to get insurance.

by Rick Durden

Despite an overall slow market, there is a steady growth in owner-flown turboprops and jets. TBM has no shortage of buyers for its hot new 900, Maibu owners are stepping up into JetProps and Meridians, Baron pilots are buying King Airs, Cirrus owners hold delivery slots for Vision SF50 jets, turbo-prop owners are looking at under \$1 million price tags for nicely equipped Citation IIs and writing checks, and everyone seems to be salivating over Eclipses.

So, what's involved in learning to fly an airplane with engines that go whoosh? How much training is needed and what does it cost?

To find out, we surveyed a spectrum of turbine training providers and an insurance broker—because insurance (see sidebar) effectively drives training requirements.

If you want to insure your new turbine bird, the short answer regarding training is: for a turboprop, figure on three to six days of school and cost of \$3000 to \$9000; for a jet, plan on seven to 14 days of training and a price tag from \$13,000 to \$25,000. That's if you have at least a few hundred hours in a complex piston single (or twin, if you're going into a multi-engine turboprop or jet)—it'll cost you more if you have less experience.

MENTOR

Your training costs won't end when

Turbine upgrade training can be completely carried out in a simulator—Level C or D is required for jet type ratings.

you finish class. Plan on being required by your insurer to fly with a mentor pilot for some period of time; 25-50 hours being the most common numbers. Additionally, if upgrading to a jet, FAR Part 61.64 places a mentor requirement on certain type ratings earned purely in a simulator.

WHAT DO YOU LEARN?

SimCom's training center manager Tom Goonen, explained that many pilots transitioning from piston to turbine aircraft are not expecting the systems complexity. "They've got to learn to manage the electrical system and understand that they've

CHECKLIST



Insurers will cover new turbine owners who get approved training.



There is a good selection of training providers at different price points.



Trying to cut corners on training may make you uninsurable.

gone from an engine where you risk hurting it in flight, not on start and shutdown to one where it's hard to hurt it in flight but you can do great damage on start and shutdown. I've got broken pieces that I show my clients."

A turbine upgrade syllabus is heavy on powerplant and systems management, including systems failure analysis. As would be expected, it also covers avionics, fuel management, loading, normal and emergency procedures, but also spends significant time on flight profiles—getting used to the idea that it's necessary to go high to get range and endurance with a turbine engine—and the specialized hazards of high-altitude flight.



PLAY BY THE INSURERS' RULES

We spoke with Mike Pratt, a broker with Epic Insurance Solutions about placing coverage for clients that were upgrading to turbine equipment. As did the training providers we interviewed, Pratt told us flat out that anyone buying and upgrading into a turbine airplane will have to complete a training program acceptable to the particular insurer who issues the policy. There is no getting around it.

In general, Pratt told said, if a pilot is going to a single-engine turboprop, she or he is probably going to have to have some high-performance retrain time to get coverage. If the pilot wants to make the jump to a twin or a jet, significant multi-engine experience will be required.

Pratt said his company sees a lot of pilots go from a Cirrus to a Meridian/

TBM/Pilatus or from a Bonanza to a Meridian/TBM/Pilatus, so the insurers are used to such a transition. His company also has seen a number of pilots successfully transition from Bonanzas to Barons and then to King Airs and jets.

Also, a majority of the underwriters (the people at the insurance company who make the decision about insuring a pilot) he deals with are pilots, and they know that flying many of the light jets are comparable to or easier than the turboprops.

Often the question of coverage is not so much a matter of the particular type of aircraft as it is the number of seats, the airspace the pilot will be operating in, the airports to be used (either busy and unfamiliar or remote and more difficult) that add to the factors the underwriter looks at in writing the transitional risk.



Pratt said his company was able to place coverage for pilots with 1500 hours total time that were upgrading to Citations because each had a lot of multi-engine time.

If a pilot has some good high-performance time, a well laid-out plan for transition training, is more than willing to do whatever the carrier asks with regard to initial training and mentor time and doesn't try to take shortcuts, Pratt told us that his company has found that it can place coverage for that pilot for a turbine upgrade.

Also, as the pilot gets more flight time in the airplane, there are more markets to shop at renewal other than just the original transition

market. A carrier that may not have written this risk at the transition may write the risk at 500 hours in type.

Finally, Pratt mentioned that

when an insured has a significant claim, premiums are likely to increase, but usually less than 10 percent.

Nevertheless, the increase often generates an angry response from the pilot and a change to another carrier. There are very few things that anger a carrier and/or an underwriter more than when they take a chance on a risk, the risk has a claim, they pay the claim and then the pilot changes carriers. That will be remembered by the carrier and the underwriter.

The low-time pilot in turbine airplanes insurance market is small and the underwriters at the carriers talk with each other—so the pilot can get a reputation for jumping between carriers. That can potentially cause the carriers to decline coverage and force the pilot into an even smaller market, substantially increasing his or her premiums.

TURBOPROP TRAINING

Turboprop training time varies slightly by provider—our survey found that programs ran four to six days, including class, pre-and post simulator/airplane briefings and time in a simulator and/or airplane. Each provider we spoke with told us that advertised times were minimum times—it was not uncommon for a new-to-turbines owner to buy additional simulator or airplane time.

The “big-box” training providers, FlightSafety, SimCom and CAE, do most of their training in Level C or D, full-motion simulators and have prices at the high end of the \$3000 to \$9000 turboprop training range.

Some, such as SimCom, also offer specialized introduction classes for those moving up to turbines—from one to as many as five days. Goonen told us that at SimCom, new turbine owners find spending two days and \$1200 on a class on the operation of the type of turbine engine in their airplane makes the subsequent initial training class go much smoother.

There are a number of centers that specialize in specific types of turboprops. For example, Recurrent Training Center offers a King Air initial training course that lasts four days and costs \$3200. Rocket Engineering, which hangs turboprop engines on Maibus, Bonanzas and Dukes offers initial training for \$2900 plus fuel. Rocket's Doug Smith told us that many of their owners get their recurrent training through the Malibu Mirage Owners and Pilots Association.

JET TRAINING

For type rating training in a jet, the choices are a provider that is FAR Part 142 approved so that all of the training can take place in a Level C or D simulator, and usually means a minimum of 14 days, or a Part 61 school that put a pilot through a type rating in as little as five days for a lower cost. We do not have enough information to express an opinion on which is the better approach. We note that all of the providers we spoke with said that insurers had approved their programs.

Figure on \$14,000 to \$25,000 for the course at a “big box” provider, depending on the type of jet and your level of experience.

At SimCom, adding a single pilot

Some training providers do most or all of the training in the airplane itself.

authorization on a Cessna 500-series type rating means another five days of training.

Noel Yantoas, CEO of Loft in Carlsbad, California, told us that his school provides Cessna 525 (CJ) training in a six-day course that includes 48 hours of ground school, 10 hours in a CJ1 simulator and a two-hour checkride. Cost is \$11,550. Yantoas said that the majority of clients elect to purchase additional simulator time before taking the checkride, pushing the price up to about \$13,000.

Loft also works with clients who wish to take the checkride, or at least the preflight inspection, takeoff, ILS approach, missed approach and landing in the airplane so as to avoid the Part 61.64 "SOE" or mentor limitation on the pilot's type rating.

The SOE limitation requires that the pilot subsequently fly 25 hours as PIC under the direct observation of a type-rated pilot in the airplane. The limitation is then removed from the pilot's certificate, but it requires a trip to the local FSDO to get it done.

Yantoas told us that most of his upgrade clients have insurance coverage that requires they get at least 50 hours of flight with a mentor anyway, so the SOE limitation is not a big deal. Nevertheless, many pilots upgrading don't like to see the writing on their certificate, so they won't do the entire checkride in the simulator.

There are also a number of specialized "in airplane" jet training companies that advertise five to seven days to a type rating. Josh Birmingham, owner of Premier Jet Training in Stuart, Florida, told us that five to seven days is the average time it takes for a pilot coming to them to complete the Cessna Citation type rating courses they offer.

Birmingham said that many of his clients who can afford to buy a jet can't afford to take more than a week off to get trained in it. His company regularly provides mentor pilots for customers who need them for insurance.

Premier Jet Training's program in-



cludes simulator time for procedures so the applicant is ready when he or she steps into the jet. Birmingham said that each customer signs a training contract—the type rating course is \$12,995—so the customer knows what is expected going in. If more airplane time is needed to achieve proficiency, it is available at \$2000 per hour plus \$750 per day for the instructor.

PREPARATION

We were told by every provider that showing up prepared matters. That means absolutely current on instruments, having at least scanned the course materials and having put the rest of your life on hold. Your day is for class; your evening for intensive study. If the training is in Florida, by all means send the family to Disney, but don't plan on going with them or even seeing them for more than a few minutes each day.

CUTTING CORNERS

The training companies are used to a certain percentage of clients doing everything they can to cut corners on training—they've heard all the excuses. They'll work with you as best they can, but they don't dare cut you loose unless you actually take the training and demonstrate your proficiency.

In addition, all of the training organizations we spoke with told us that the aviation insurers have seen their course syllabi and are making the decision to insure a pilot based on the reasonable assumption that the new pilot has actually

been taught in accordance with that course program.

Many years ago, a professional athlete upgraded from flying a King Air to a jet. The training provider agreed to amend its program to train the athlete on the road. That probably didn't have anything to do with the subsequent crash, however, the training provider had to defend its non-standard training in the ensuing lawsuit. The insurance companies took notice—they want training by the published syllabus—so plan on focusing your life on completing the full training program when you go to turbine school.

CONCLUSION

Turbines are generally easier to fly than piston airplanes, however, the combination of more sophisticated systems to manage, higher speed and the realities of operating in the upper atmosphere bring about their own set of risks. Insurers recognized this long ago and now are in the driver's seat when it comes to telling an owner what sort of training he or she is going to have to take. It's also the main reason, in our opinion, that the accident rate for turbine aircraft is lower than for pistons.

That means the cost of admission to turbine operation will include the price and time of an initial and recurrent training program approved by your carrier. Reality, in our opinion, is that initial training in a turbo-prop is going to take five days, in a jet, seven to 14. Show up ready to fly and willing to completely dedicate yourself to the program.



Replacement LED Lights: Long Life, Efficiency

LED landing and taxi lights serve double duty as always-on recognition lights. Whelen wins for economy while Aveo edges for styling, build quality.

by Jim Cavanagh

It takes a while for otherwise common technologies to filter down to aircraft applications. And so it went with LED lighting, with welcomed advantages.

Lighting up the airframe with LEDs allows airplanes to be seen as effectively as in the old days of incandescent lamps (the FAA requirements for visibility, brightness and all that have not changed), but without the draw on the electrical system. They'll also eliminate the over and over again draw on the pocket book that's too familiar with frequent replacement of traditional landing and taxi lights. That's because LEDs are so simple they last for thousands of hours, can endure vibration out the kazoo and reduce the electrical requirements of a system. Many owners keep LED landing and taxi lights on all the time.

While this article discusses LEDs in general, we'll focus on certified products that replace the older incandescent units with minimal rework—so-called drop-in lights. There are too many to cover in this space, so we'll look at the most popular, based on our discussions with high-volume retailers, including Aircraft Spruce—an excellent source for aircraft lighting, in our view.

LED 101

The first LED was discovered back in 1961 by Baird and Pittman who were engineers at Texas Instruments. Their discovery was based on electroluminescents, but since there was no perceived use, it remained a simple known concept for decades. Engineer Nick Holonyak, Jr., is considered the father of LEDs after he developed the first visible spectrum LED. The first

Replacing the industry-standard PAR36 taxi and landing lights with an LED lamp can be accomplished without any wiring changes. It could be the last lamp you'll have to change.

were used in seven-segment clusters and we recognize these as the faces of digital clocks, watches and lab instruments. The display on my first Loran-C receiver had a bunch of LED segments, almost always displaying these words: No Signal.

Green is the hue to which human eyes are most sensitive and can detect at a low candela. Other colors require much more power before being detected. LEDs are rated in millicandella. High-Brightness LEDs can achieve 15,000 MCD, or 15 CD, and optical trickery can create effective candela of over 45,000. The High-Brightness LEDs are used for anti collision lights and landing/taxi lights. Anti-collision lights are usually 20 to 30 times the candela of a standard LED.

There are a number of companies in the aviation LED industry—almost too many to count. For a primer, browse the Aircraft Spruce website (www.aircraftspruce.com). Besides the recognizable Whelen name, you will find AeroLED, Kuntzleman, Aveo, PSA, LED XPAK, Aircraft Sextant, Teledyne's Alphabeam and EPL. Older companies, like Grimes, which was purchased by Honeywell, have forsaken LED Technology, but still support the legacy lights.

The biggest players are Whelen, AeroLED, Teledyne Lighting and

CHECKLIST



Aveo's lifetime warranty and fully encapsulated waterproof design is worth the premium.



Whelen offers a large variety of economical, drop-in replacements.



LED landing and taxi lights are easy replacements, but strobes could require wiring changes.



Display and Aveo Engineering. It's important to note that not all LED lamps are incandescent plug-ins. Some strobe lamps will require the removal of the power supply and rework of the wiring. Do-it-yourselfers might easily tackle a landing or taxi lamp replacement, but installing new LED strobes and position lights might require the help of a shop.

WHELEN ENGINEERING

Whelen was started by George Whelen, who invented the rotating beacon for aircraft in 1952. This company developed lighting products for airplanes and the different configurations that would allow a plane builder to meet the \$1401 requirements. The company went on to develop automotive and railroad lighting systems, which overtook its aviation sales numbers. Even so, Whelen enjoys huge popularity in the aviation market.

Whelen's George Ginnetti told us that the company purchases 60 million individual LEDs each year for its various products. Whelen has an OEM line and an aftermarket/replacement line of lighting products, including the Parmetheus lamp, which drops into a PAR 36/46 landing or taxi light installation.

Like any drop-in LED lamp, aftermarket products have to be designed for the space taken up by the original lighting, often allowing for much less of an area available for heat sink on the lamp's chassis. The trick for landing and taxi lights, for example, is to design the unit so it's no deeper than the incandescent lamp it replaces. Overall, LED technology brings advantages over older lights. In some cases, that means ridding old power supplies and accessories.

Whelen's ORION600-series anti-collision light eliminates the need for external flasher boxes, can be flush-mounted in a variety of applications and is retrofittable to most Whelen legacy strobe products.

The company's 71055 LED anti-collision beacon is designed to directly replace existing Quartz Hal-

Whelen's ORION600 anti-collision LED, upper left, isn't exactly a drop-in, but the payoff is eliminating the existing remote strobe power supply. There are more electronics in an LED light than you might think, upper right. That's the AeroLEDs SunSpot, middle and the Aveo PosiStrobe CP combination strobe/position light, bottom.

ogen beacons installed as original equipment on single-engine Cessna models (some models have an in-line resistor that has to be bypassed, requiring some wiring changes). The LED beacon is also retrofittable with a variety of mounting options.

AVEO ENGINEERING

Aveo is a European company and the president and founder was an early Apple employee. Christian Gather, who runs the Florida office, told us that Aveo will soon be consolidating all manufacturing to Florida.

Aveo products are more expensive than competitors, but they offer a lifetime warranty and, based on our evaluation, a virtually unbreakable product. We think they look good, too.

Aveo brings European styling to general aviation, and its lights are all fully encapsulated, hermetically sealed in a proprietary polycarbonate and then coated with what they call Nano-Cloak, a UV-resistant spray.

The TSO'd AveoMaxx Hercules (with 140,000 candela) is the three-in-one landing, taxi and pulse light that uses what Aveo calls the Rocky-Reflector system. Aveo advertises the Hercules to maintain 70 percent



CONTACTS

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www.teledynelighting.com

Whelen Engineering
860-526-9504
www.whelen.com

Regulatory Counterpoint

THEY LOOK GOOD, BUT...

The owners of experimental, Light Sport and Ultralight aircraft often think that position and anti-collision lighting don't have to be certified. That's not the case. A number of companies have developed position, landing and anti-collision lighting for these aircraft, and while the lighting may be bright enough, the lack of certification could make them off limits for night ops.

The focus of the FAA on lighting is direction and coverage, not necessarily brightness. Aviation lights are judged on their candela (CD), or the energy in a focused direction. Design considerations for LEDs are the focusing of light coming from a source encapsulated in clear epoxy. If you look at an aircraft light closely, you will see a number of individual LEDs mounted to face in different directions. The ultimate direction toward which these are focused is the measured candela as required by the FAA. The degrees of arc necessary to meet the FARs is called the dihedral. Some LEDs can stand on their own, while others need focusing and optics to achieve design goals.

The fact is, if an aircraft is intended to be flown at night, any lighting must meet the FAA's FAR 91.205(C) requirements for night flight. It is not the airplane—it is the environment. Mixing it up at night with other airplanes requires stringent visibility standards.

If the aircraft is flown during nighttime hours, all of the lighting has to meet the above FAR and individually must be certified under Part 23.1385-1401, for intensity, horizontal and latitudinal coverage.

The experimental and LSA markets, with aircraft certified under the ASTM rules, is obviously huge. A number of companies have developed good, economical lighting that likely fulfill all of the FAR requirements, however, have not been submitted for approval. Without this approval, all of this otherwise nice lighting is illegal. To address this rather odd situation, companies have developed LED technology that can be purchased less expensively and provide real visibility. In my view, this can place an owner in jeopardy if used at night.

That a major company like Whelen has developed a non-certified family of lights attests to the size of the non-certified aircraft market. The uncertified lights from Whelen look good and are bright, but do not meet the FARs and have not gone through the certification process. Its lights are aimed at the daytime VFR operations that want or require enhanced visibility in daylight hours at economical prices. The Microburst I, II, and III systems rival the brightness of strobes and are available in different configurations, depending on the aircraft design. They are available in position, anti-collision or combination fixtures. Just like their certified brethren, they are waterproof, pretty much vibration proof and will last for thousands of hours.

AeroLED, Aveo, Kuntzleman and a couple of others have both non-certified and certified lighting in its lines, and most of the time the non-certified parts significantly outnumber the certified parts. Most of the time, the pricing of all of the non-certified lighting is reflected in the lack of paperwork, but not always. The Aveo PowerBurst lights look great and are priced at a premium—considerably higher priced than Whelen's Microburst. Both are about half of what you would expect to pay for certified lights. The LED XPAK and the EPL Wingtip light kit (both sold by Aircraft Spruce) are examples of minimalist lighting that some owners might opt to install.

If you think that experimental lighting is good enough for your certified aircraft, you might be right, but remember that it isn't Bernoulli's Principle that makes airplanes fly, it's paperwork. You gotta fly by the rules.



lumen maintenance after 60,000 hours. The Hercules is available with a bracket or without, for dropping into an existing PAR 36 housing.

The Galactica RedBaron XP anti-collision light contains 36 LEDs and is designed as a replacement for existing anti-collision systems, which will likely require a wiring change. We're impressed with Aveo's newest generation combination strobe and position light, suitable for mounting on top of the tail.

Aveo said the low-drag unit fits almost all standard rudder light mounts, but is also available with an aluminum adapter. It's a good choice for applications requiring a rear coverage light due to wingtip light coverage zone limits. It requires no external power supply and operates from 9-32 volts. We like Aveo's lifetime warranty policy.

AEROLEDs, TELEDYNE

AeroLED is best known for its SunSpot series landing and taxi lights. These lamps are certified replacements for the GE4509 and PAR 36 lamps, while using the existing mounts or mounted with custom mounting rings.

AeroLED says the SunSpot 36LX product has a 50,000-hour guarantee and has over-temp protection, in addition to a low-voltage sensor that shuts down half of the LEDs when it senses low input voltage.

The SunSpot 36HX lights have an integral wig-wag that can be used as standalone or pulse with other SunSpot lights. The 36-series is available with an optional Pro-Tech lens coating, which comes with a lifetime warranty against breakage from rocks and debris. While these lights are pricey as it is, we think the extra \$40 or so premium is worth the coverage.

Of interest is the specifications of the SunSpot—measuring only 1.25 inches deep, making the lamp versatile for tight cowlings.

If you opt for the HX model, with the wig-wag functionality, plan on extra wiring.

AeroLED also offers the certified Pulsar NSP wingtip navigation/posi-

tion/strobe light. At nearly \$1200, it's priced in line with Aveo's Ultra-series certified wingtip strobe and doesn't require a remote power supply. It also mounts into the footprint of many traditional legacy wingtip strobe lights.

Teledyne Lighting and Display Products offers the Alphabeam for replacing GE4509 and PAR 36 lamps, in addition to the Alphabeam II for the larger PAR 46 replacement. It operates on 28 volts and has a calculated 30,000 MTBF (mean time between failure), thermal protection from overheating and has an anti-icing lense.

COMPELLING UPGRADE

We think LED upgrades make sense on several fronts. In a previous *Aviation Consumer* field trial, every replacement LED landing and taxi lamp we tried had a broader beam and did better at illuminating objects than a 4509 lamp did. That means with an LED leading the way, you might have the advantage of spotting wildlife or other stuff on the runway that you wouldn't want to hit.

"The LED landing lights on my Cessna twin are extremely white—probably whiter than even HID lights. While the colors at night seem a bit washed out, the white and yellow pavement lines and reflectors stand out really well," one owner told us. Incidentally, the \$1000 STC'd cowl lighting kit for 300 and 400-series Cessna twins offered by Knots2U can be upgraded with LEDs.

As we reported, some PAR 36 replacements offer the optional see-and-avoid benefit of a wig-wag mode, but with the cost of additional wiring. Speaking of costs, you'll certainly pay more for LED technology. In our view, when considering the long life expectancy of the light, the minimal power draw, the dependability that it will almost never let you down (you know, that gnawing question whenever you reach for the landing light switch), the buy-in price could seem more palatable.

When it comes to anti-collision lights, we really like that LED upgrades can eliminate remote power supplies. These power packs often

SELECT REPLACEMENT LED LIGHTS

BRAND/MODEL	PURPOSE	COMMENTS	TYPICAL STREET PRICE
AEROLEDS			
SUNSPOT 36LX	LANDING/TAXI	Drop-in PAR36 replacement	\$325
SUNSPOT 36HX	LANDING/TAXI	PAR36 with integral wig-wag	\$439
PULSAR NSP	NAV/ANTI-COLLISION/POS	Wingtip light combination	\$1137
AVEO			
RED BARON GALACTICA	ANTI-COLLISION	36-LED light array, lifetime warranty	\$849
AVEOMAXX HERCULES	LANDING/TAXI	Drop-in PAR36 replacement	\$975
ULTRA GALACTICA	WINGTIP STROBE	Both wings, fully encapsulated	\$1195
TELEDYNE			
ALPHABEAM	LANDING/TAXI	Drop-in PAR36 replacement	\$275
WHELEN			
PARMETHEUS	LANDING/TAXI	Drop-in PAR36 replacement	\$229
ORION600	POSITION, ANTI-COLLISION	Eliminates remote power supply	\$474
71055-SERIES	ANTI-COLLISION BEACON	Replaces Cessna flasher beacons	\$498

In this chart, we use the terms drop-in and replacement with caution. While that often defines a light that can use the existing wiring and mounting hardware (all of the holes will line up and the new LED replacement will fit where the original was installed), the reality is there might be some additional work to do. For instance, combination LED navigation/strobe lights will likely have you climbing in the tail section to remove the existing strobe power supply. That could also mean rewiring, an A&P sign-off and revision to the weight and balance report. If you're lucky, you might be able to retain the existing panel control switch with the new LED lights, unless you opt for wig-wags.



induce annoying noise and create imperfections in the audio system, they get in the way when installing remote avionics equipment and add weight to the aircraft. Plus, they fail.

We believe LED technology is here to stay, simply because LED lamps are bright, efficient and reliable. Best of all, we think LED landing lights bring sizable benefits to daytime operations because you can keep them on all the time.

As we reported in our October 2013 issue, a few companies, Aveo in particular, have developed high-tech

LED interior lighting, and who doesn't have an LED flashlight in the flight case?

We think any of the lights covered in this article are worthy investments. If we had to pick a favorite brand, it would be Aveo. We think it edges the competition when it comes to styling, build quality and a lifetime warranty. But you'll pay.

If it came down to economics, Whelen would be our top choice. It has a diverse product line and is seemingly focused on offering LED replacements for its vintage products.

Socata TB-20/-21 Trinidad

A stylish, load-hauling, French import with a surprisingly low accident rate.



It may not be the fastest airplane to sport a big Lycoming, but on pure style points, it has no equal.

When the so-called Caribbean line from Aerospatiale first appeared at the Paris Air Show in 1977, the U.S. general aviation industry was booming, building mainly tried-and-true, if staid, designs like the Cessna 172 and the Piper Cherokee line. Against that backdrop, the new TB-20 was a splash of cold water.

It's not that the airplane was terribly innovative—it wasn't, sporting the same Lycoming engines we had all been flying behind for years. But it had something no Skyhawk ever did: a sleek and stylish European panache. Ultimately, this didn't help much with sales, but the thing sure was—and is—good looking, what one aviation writer famously described as a Cherokee done over by Club Med.

The Trinidad is the top of the line of a small family (five) of single-engine aircraft developed and built by Socata in Tarbes, France, from which the TB derives. Socata is the general aviation division of the government-owned aerospace conglomerate, Aerospatiale. Although the TBs are out of production, Socata is still going great guns with its turboprop TBM line, now up to the 900 model.

The Caribbean line of aircraft includes the TB-9 Tampico and -10 Tobago, fixed-gear singles of 160 and 180 HP and the 250-HP, retractable-gear TB-20 Trinidad and -21-TC turbocharged Trinidad. In this regard, the French have largely duplicated the American marketing strategy of a model for every price and usage strata. No surprise there.

The models share a common fuselage, wing and empennage, which has obvious advantages in

Compared to its staid competition when it was introduced in 1977, the new TB-20 was a splash of cold water.

production economies, something U.S. airframers haven't always done. In practice, this means that a batch of fuselages and flying surfaces can be built and kept on the shelf until orders need to be filled. It also means that for the Caribbean series, no distinction is drawn between the airframes: The two variants co-exist within the same run of serial numbers.

To date, the total worldwide TB-20/21 population tops out at about

830 airframes, with the plurality based in France. There are about 260 on the U.S. registry, according to the TB Users Group.

After its promo appearance at the Paris Air Show in 1977, the TB-20 was awarded French type certification in December 1981. The first Trinidad arrived in the U.S. during the summer of 1983, with FAA approval the following year. The turbo'd TB-21 got FAA certification in March of 1986.

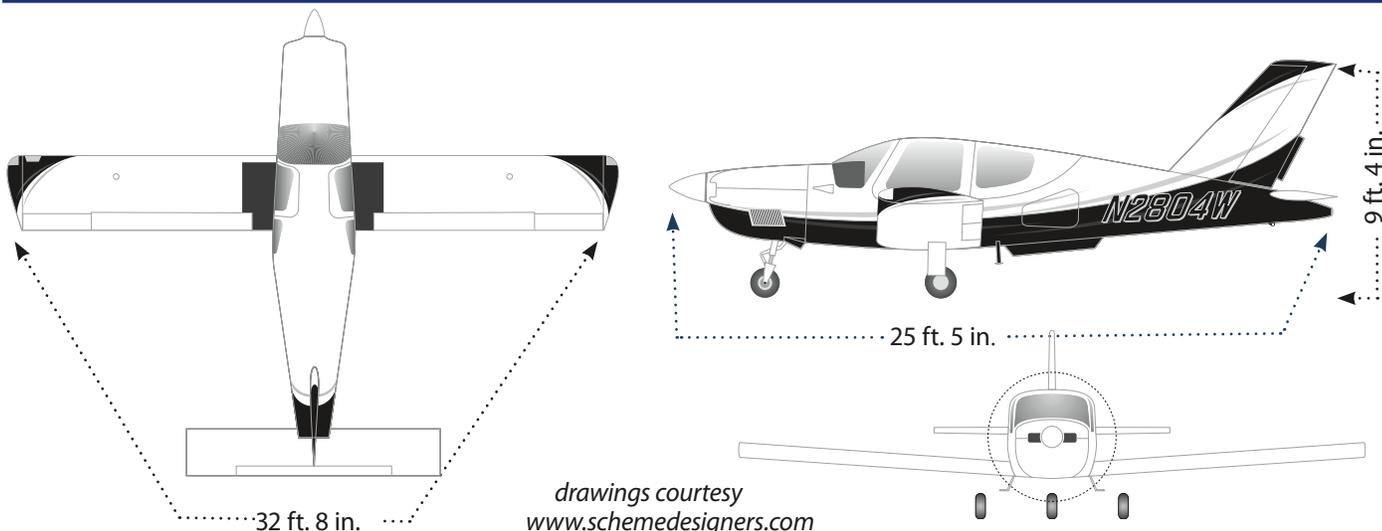
Acceptance of these models can best be described as mixed. The French had been in the U.S. before with the Rallye, of which 3500 were made worldwide, and had not done well with it in a market that still supported volume sales. After a couple of failed efforts to introduce the TB line, Socata established its

own operation just outside of Dallas, Texas. Aerospatiale General Aviation (AGA) shared facilities with Aerospatiale Helicopter Corp. in Grand Prairie.

This facility was phased out in favor of a single distributor in Florida and as of this writing, SOCATA North America, Inc. is headquartered in Pembroke Pines, Florida, as a wholly owned subsidiary of DAHER-SOCATA. It still supports all models.

TB-20 models built between 1977

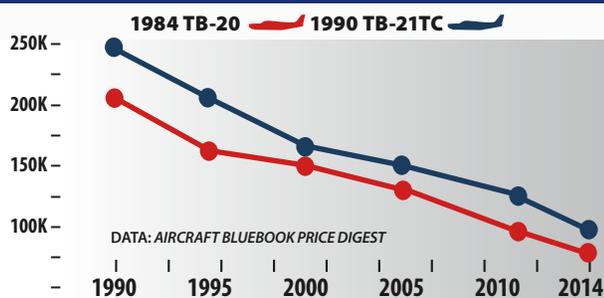
SOCATA TB-20/-21 TRINIDAD



SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1984-1988 TB-20 TRINIDAD	LYC. 250-HP IO-540-C4D5D	2000	\$35,000	86	1280 LBS	160 KTS	±\$85,000
1986-1988 TB-21 TC TRINIDAD	LYC. 250-HP IO-540-AB1AD	2000	\$50,000	86	1230 LBS	180 KTS	±\$105,000
1989-1992 TB-20 TRINIDAD	LYC. 250-HP IO-540-C4D5D	2000	\$35,000	86	1280 LBS	160 KTS	±\$110,000
1989-1992 TB-21 TC TRINIDAD	LYC. 250-HP IO-540-AB1AD	2000	\$50,000	86	1230 LBS	180 KTS	±\$120,000
1993-1997 TB-20 TRINIDAD	LYC. 250-HP IO-540-C4D5D	2000	\$35,000	86	1280 LBS	160 KTS	±\$130,000
1993-1997 TB-21 TC TRINIDAD	LYC. 250-HP IO-540-AB1AD	2000	\$50,000	86	1230 LBS	180 KTS	±\$145,000
1998-2002 TB-20 TRINIDAD	LYC. 250-HP IO-540-C4D5	2000	\$35,000	86	1280 LBS	160 KTS	±\$170,000
1998-2002 TB-21 TC TRINIDAD	LYC. 250-HP IO-540-AB1AD	2000	\$50,000	86	1230 LBS	180 KTS	±\$190,000
2003-2005 TB-20 TRINIDAD	LYC. 250-HP IO-540-C4D5	2000	\$35,000	86	1280 LBS	160 KTS	±\$220,000
2003-2005 TB-21 TC TRINIDAD	LYC. 250-HP IO-540-AB1AD	2000	\$50,000	86	1230 LBS	180 KTS	±\$260,000

RESALE VALUES

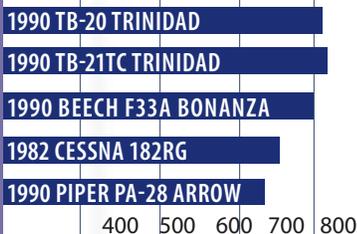


SELECT RECENT ADS

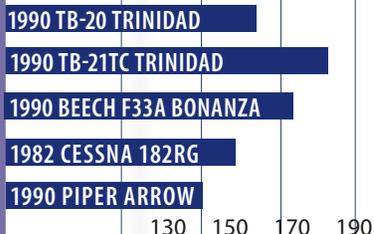
- AD 2007-02-04** WING SPAR LOWER BOOM/FAIRING ATTACH SCREW INSPECTION
- AD 2003-04-03** AILERON CONTROL GIMBAL JOINT INSPECTION
- AD 2002-20-04** EXHAUST SYSTEM MODIFICATION
- AD 2001-23-04** LOWER RUDDER HINGE FITTING INSPECTION
- AD 98-18-13** INSPECTION OF MAIN LANDING GEAR ATTACHMENT BEARING

SELECT MODEL COMPARISONS

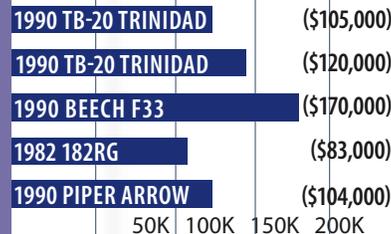
PAYLOAD/FULL FUEL, POUNDS



CRUISE SPEEDS, KNOTS



PRICE COMPARISONS





and 2000 are so-called "Generation One" aircraft and most of those already in the field are of this vintage. In early 2000, Socata introduced the "Generation Two" or GT line, with upgrades to the original aircraft design. The GTs have essentially the same airframe, controls and powerplant as the originals, but they have a modified carbon-fiber-based cockpit roof which increases headroom and cabin volume, thus addressing complaints from taller pilots. Other minor changes have been introduced. In 1990, starting with serial number 950, maximum landing weight was increased to 3086 pounds. Unfortunately, structural modifications were made to the landing gear attachment points and they are not retrofittable to earlier models.

At the same time, the electrical system was changed from 14 to 28 volts. A change to a higher-speed starter motor followed. To its credit, the detail and systems changes Aerospatiale/ Socata has made to the design are almost completely the result of customer experience.

CONSTRUCTION

The relatively simple, monocoque fuselage has a comparatively low parts count compared to like aircraft. According to the company, it took about 600 man hours to construct

a Trinidad, which is excellent in context. This is lower than, for instance, the hours required to build a Mooney or Bonanza airframe. Most of the cabin is fabricated from reinforced glass fiber which sits on top of the load-bearing structure, the fuselage tub.

Flight controls are actuated by push rods rather than the more typical cables, which gives a positive—albeit a bit heavy—control feel similar to Mooney models. Since much of the wing trailing edge is occupied by the flaps, the ailerons are short span. It's a simple, yet sleek design.

A prominent distinction is the vertical stabilizer, which is located forward of the horizontal, all-flying tail or stabilator. Both control surfaces have trim tabs. Pitch trim is via an anti-servo tab.

The rudder trim tab is an additional surface appended to the rudder that looks like an afterthought. The main landing gear is a trailing link design that favors pilots who occasionally botch landings; it soaks up the bumps well.

For power, the TB-20 uses the Lycoming IO-540-C4D5D version rated at a conservative 250 HP. The turbocharged TB-21TC combines the AB1AD version of the same powerplant, also rated at 250 HP, with a variable wastegate-controller Garrett

Gull wing doors enhance attractive lines but raise concerns about egress if the airplane flips.

AiResearch turbocharger. Recommended TBO for both is 2000 hours, which is a plus. But that doesn't mean TB-20 owners have an easy time of it. As with any large engine, overhaul costs are relatively high. In a phenomenon unique in recent experience, there's actually good news about the cost of operating the turbocharged engine.

When we covered the Trinidad some years ago, our sources quoted an average overhaul cost for the turbocharged engine of a whopping \$30,000. During the early 2000s, thanks to competition in the cylinder markets, overhaul costs actually dropped for awhile. But according to *Aircraft Bluebook Digest*, the turbo version now overhauls for about \$50,000, compared to \$35,000 for the normally aspirated model.

CABIN COMFORT, LOADING

Another feature that distinguishes the TB series is the top-hinged, gull-wing cabin doors. These make access to any seat quite simple, with a minimum of fumbling and clambering. The cockpit/cabin is modern looking and is well organized.

It's 50 inches wide, the most expansive in its class. In fact, it's one inch wider than the Piper PA-32 family of cabin-class singles. The Trinidad can accommodate up to five people, with three on the rear bench seat when optional center lap belts are installed. There are individual bucket seats up front. The airplane is quite comfortable for four, although tall individuals have noted tight headroom, particularly in the rear. The newer GT models address this. The seats include an adjustable lumbar support.

To go with its notable spaciousness and comfort, the Trinidad can carry a comparatively hefty payload. It's almost a full-tanks and full-seats airplane, which is unusual for singles and light twins. It also has a generous CG range to permit loading flexibility.

At an average equipped weight of 1990 pounds, payload with full fuel (86.2 gallons usable/517.2 pounds)

Modular panel has right-side gauges angled to face the pilot.

is 589 pounds. That works out to 3.5 170-pounders.

To put things in perspective, its full-fuel payload exceeds that of any other four-place single and even beats the A36 and B36TC Bonanzas. Among singles, only the Cessna 210 surpasses the TB-20's payload capability, but with less comfort, at least with regard to seat design and ingress/egress.

Visibility from all seats is first rate. The windshield and side windows wrap up into the roof line and the windshield extends down alongside the panel, meaning that the pilot can actually see down and forward a bit. That's unusual in low-wing airplanes and is a nice benefit.

Further, the seating position is high and the window sills are low, rather like modern fighter aircraft. Ergonomically, the cockpit is well organized. The panel is a modular arrangement with the right-side gauges mounted at an angle to face the pilot squarely. The center console has a trim wheel cleverly placed directly under the pilot's hand when it's on the throttle; trim adjustments during final approach are easy.

Models built before 1987 have the fuel selector mounted to the left of and just below the pilot's yoke, an arrangement that was the subject of an AD. The three panel modules can be released quickly and tilted back for maintenance access to the instruments and avionics, making for easier repairs. The interior is well thought out, in our view, providing a lot of pockets and crannies for manuals, charts and odd pieces of gear. The biggest drawback is the relatively small, odd-shaped baggage door. It's hinged at the bottom and when fully opened, it projects quite a ways.

Care must be taken when loading the baggage bay. Access to the baggage bay for bulkier items than can fit through the door can be gained from inside the cabin. The rear seat back can be folded down or removed, which opens up a spacious area behind the two forward seats.

HANDLING, PERFORMANCE

There's nothing peculiar about operating the TB-20. From pre- to



post-flight, the airplane is quite conventional; anyone stepping up from a Piper or Cessna will have no trouble with it.

There are some quirks: Inspection of the engine compartment is difficult because a number of fasteners must be unscrewed. Then, the one-piece cowl has to be put in a safe place while the inspection is performed so that a gust doesn't send it sailing down the ramp.

Many owners probably won't bother frequently enough to catch the odd deteriorating hose, loose connection or nesting bird before such oversights become a problem. (Mooneys suffer a similar shortcoming.) The cockpit layout is generally good, but it takes some getting used to. For example, the instruments have vertical temperature and pressure gauges, not analog dials.

Getting airborne is nothing unusual. Normal takeoffs call for 10 degrees of flap. The standard flap control is an electric switch that permits settings anywhere from up to full-down (40 degrees) to any increment in between. It must be monitored during operation to get the right setting.

Many Trinidads are fitted with the optional pre-select switch, which offers flaps retracted, 10 and 40 degrees. In maximum performance takeoffs, and climbing at best angle, the forward view is filled with cowl-ing. You'll need to S-turn a little to get a full view of what's ahead.

Rate of climb at Vy of 95 KIAS is 1250 FPM. Critical speeds are Vne, 187 KIAS; Va (maneuvering) 129 KIAS; Vlo (gear operating) 129 KIAS;

and Vfe (max flap extended) 103 KIAS

The airplane is not blisteringly fast for having such a large engine nor is it as slick in the descent as even some older Mooneys. Nonetheless, descent takes some planning, due to relatively low Vlo and Vfe. One option is to lower the gear at the top of descent and use the wheels as speed brakes.

The Trinidad's control response is good, with the highest noticeable effort in roll. The ailerons aren't large and under airload, the push rods may pick up some operating friction. This won't be objectionable to anyone stepping into a Trinidad from a Cessna, but a Bonanza pilot will notice. Pitch and yaw control effort is lower. So it's more an issue of balance, or control harmony, than hard work.

The good tradeoff is that the airplane, thanks also in part to its comparatively high wing loading, handles turbulence well. It also displays good manners in the clouds, with no tendency toward pitch twitchiness or wing fall off.

Slow flight handling is good, too. While the stall speeds are marginally higher than with other singles, the stall is mild. The typical result is more of a high rate of sink rather than a pronounced break. The flight controls are fully functional right through the stall. Intentionally cross-controlling near the stall or even in it produces sink rather than a snap.

Pitch change with initial flap extension is minimal. It's more pronounced when full flaps are selected, particularly at the higher end of the allowable speed range. Saving full

TRINIDAD WRECKS: POOR JUDGMENT

While the Socata Trinidad was not produced in massive numbers, we were still surprised when we looked at the last 15 years of NTSB records and found only 15 Trinidad accidents, two of which were outside the U.S. That's certainly not enough for any sort of universe for statistical analysis—nevertheless, what stood out was that virtually every one of the domestic crashes could be traced to a lack of skill and judgment on the part of the pilot.

We'll get the mechanical accidents out of the way first: there was one engine failure for undetermined reasons and a catastrophic engine failure in flight due to oil loss a half hour after the vacuum pump was replaced and the wrong gasket was used when mounting it.

A pair of pilots launched in a TB-20 and the right-hand, gull wing door popped open. According to the accident report, a door opening is not considered an emergency in a Trinidad.

The right seat pilot held the door closed while the left seat pilot maneuvered for landing, but blew the approach and decided to go around. For reasons unknown, the door got away from the right seat pilot and again opened, distracting the flying pilot. The airplane rolled left and impacted the ground, killing the right seat pilot.

There were two VFR-into-IMC fatal accidents. In one, a VFR pilot called ATC to say he was having trouble descending through clouds. The controller attempted to help the pilot, but radio contact was lost almost immediately as the pilot lost control of the airplane and crashed.

In the second event, the pilot departed from an island in Lake Michigan intending to go sight-seeing—when the weather was marginal VFR with low ceilings and visibility. His body was later found in the straits between the island and the mainland and parts of the wreckage eventually washed up on the shore.

An instrument-rated pilot made a series of calls to FSS checking weather for a flight home. Initially, he was reported as “conservative” when told the weather was going to be IFR for the flight. As he continued to make calls to FSS, he began to exhibit determination to go and eventually filed an IFR flight plan.

Upon getting his clearance, the pilot told ground control he was a new instrument pilot and hadn't flown instruments in a long time. He repeated the announcement to each of the subsequent controllers he spoke with. Trying to get back on the assigned airway while en route in heavy rain, the pilot became spatially disoriented, entered a diving spiral and crashed.

One pilot decided to make an intersection takeoff from a runway of modest length. Not convinced he was going to get off the ground, he aborted the takeoff, went off the end of the runway, down a hill and into a fence.

Two pilots on a sales demo flight in a turbocharged Trinidad on a clear, dark night flew level into rising terrain.

Departing into known icing, a Trinidad pilot elected to divert and land once his aircraft began collecting what was forecast. At about 500 feet up on landing, his passenger grabbed the yoke and the airplane stalled—fortunately, all survived the impact.

After losing control on rollout in a crosswind, the pilot stopped his Trinidad by hitting a runway sign and crushing the leading edge of the outboard right wing. A mechanic told the pilot the airplane should not be flown. The pilot ignored the advice and flew home successfully. The report did not discuss what action the FAA took against the pilot.

Finally, a Trinidad owner was served with a restraining order and escorted from his house. The next day he went to the airport, got into his TB-20, took off and committed suicide by diving it into his house.

flaps until the landing is assured means adjusting trim or accepting high pitch forces down to the flare, at which point the up trim has to be put back in.

Full flaps generate a lot of drag, which means either accepting a steeper approach (good for obstacle clearance) or a partial-power approach. Low-speed technique is rewarded with satisfyingly short landing performance. In this respect, the TB-20 shows a bit of the Rallye heritage. Landings, except for the most highly botched and abusive, can be done repeatedly with grace. Lightly loaded, with just the pilot, it takes more attention, because CG is forward. But its manners (and willingness to forgive) are good.

It's axiomatic in airplanes that you never get something for nothing. In the Trinidad, this translates to modest cruise performance, thanks partly to that wide cabin. According to factory figures, 75 percent power at 8000 feet nets a true airspeed of 159 knots. Endurance with 45-minute reserve is 5.65 hours.

At the same altitude, 65 percent generates 149 knots and a bladder-busting 6.4 hours endurance. The turbocharged version doesn't perform quite as well at lower altitudes, which is typical of most turbo models.

The crossover point comes at about 12,000 feet. At its maximum operating altitude of 25,000 feet, 75 percent power generates a true airspeed of 187 knots and endurance of 4.5 hours; 65 percent power produces 169 knots and 6.2 hours. In the real world, say owners, the airplanes are a bit slower than the POH values.

MAINTENANCE, ADS

Owners report no characteristic maintenance bugaboos and we get mixed opinions on parts support. Parts are generally expensive, however. One of our least favorite features in any airplane is gullwing doors. They're a bad idea because they can trap occupants after a roll-over accident.

Most of the changes made to the TBs are reflected in service bulletins and airworthiness directives. About a dozen ADs had been issued on the TB-20 and -21 by early 2003. Most of these are blanket ADs affecting many



Windows that extend down to the pilot's elbow help make for excellent visibility.

different aircraft: paper induction air filters, Bendix ignition switches, Bendix magneto impulse couplings, Hartzell propellers and Airborne vacuum pumps. Several blanket ADs cover various aspects of Lycoming engines (91-14-22, calling for inspection of the crank and associated parts for corrosion following a prop strike or at overhaul).

An AD issued in 1990 requires a one-time inspection of oil coolers on all TB series airplanes for cracks and what the text merely calls "distortions." If anything is amiss, the oil cooler must be replaced. The AD on the fuel system mentioned earlier was issued to deal with a few instances of fuel starvation.

In the original design, fuel lines run from the tanks forward and up to the panel-mounted fuel selector. Two conditions could occur: Fuel could drain to the low point, causing the fuel pump to cavitate. The original Dukes fuel boost pump is lubricated by fuel. Dry lines resulted in its failure. Or, vapor lock could occur, blocking normal fuel flow. The fix for the original system is to replace the boost pump with a wet-or-dry Weldon pump and to install a check valve in the line to preclude draining.

In 1987 and later models, the fuel selector has been relocated to the center console. Also, it has been modified so that it's not necessary to pass through "off" when changing tanks.

Three ADs have been issued on the horizontal tail; two of them require repetitive inspections. One requires replacement of the elevator trim tab control attachment. The second requires repetitive (every 100 hours) inspection of the stabilator actuator rod end assembly and attach fittings. Another repetitive AD affects the ailerons. The skin and balance weight attach rivets must be inspected every 100 hours. Substantial cracking requires aileron replacement.

OWNER COMMENTS

I have owned a 1993 Trinidad TB-20 since 2007 and fly between 50 and 70 hours per year. The airplane had about 1100 hours total time when I purchased it. The three previous owners had taken very good care of it so it did not require any remedial or catchup maintenance. In addition, Frederick Aviation (now Landmark Aviation) in Frederick, Maryland, has performed excellent maintenance on the aircraft.

Annual inspections have averaged \$3587, and have typically included some preventive maintenance and parts replacement to prevent failures—such as gear relays, a vacuum pump, door seals—as well as upgrades such as a Pulselite and reupholstering of the front seats.

Even though the aircraft is no longer in production, parts availability is generally good through Socata North America in Pembroke Pines, Florida, or my local dealer, Muncie Aviation in Muncie, Indiana.

Insurance has averaged \$2278 for a \$145,000 hull value and \$1 million smooth liability coverage.

The airplane is a joy to fly and

The Aviation Consumer

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very comfortable on long trips, although headroom is limited for tall people. Thanks to the trailing link landing gear, landings can be made very smoothly. It gets admiring comments at most airports. I make most landings with just 10 degrees of flap as full flaps, 40 degrees, generate a lot of drag and considerable initial pitch up. Lowering the gear and simultaneously selecting 10 degrees of flaps means no pitch up and allows a smooth transition to descent.

Performance is pretty much per book: I flight plan for 150 knots at 8500 feet with fuel consumption of 12 GPH.

The gull wing doors could use stronger hydraulic struts to keep them securely open when there is any wind—watch out in any strong or gusty wind. Baggage compartment accessibility is limited due to the triangular shape of the door. If you want to use hard-shell suitcases, make sure they will fit.

There is an outstanding user group at www.socata.org that provides a great deal of useful information, including a searchable message board. It also has complete service and parts manuals on the line. I recommend that any prospective buyer join and make use of the resources.

Rolf H. Scholz
Via e-mail

I really love my 2000 Trinidad TB21 GT. I flew hundreds of hours in a Piper Arrow, but was ready for an upgrade. Having looked at lots of options, I was ready to sign for the purchase of a new Piper when a local aircraft broker said, "Just take one test flight in a Trinidad before you buy that Piper." And that's all it took. The design, comfort, speed, range and solid flight characteristics sold me within the first 10 hours.

Power is provided by the Lycoming IO-540 series, a reliable if not economical choice.

My kids call it our flying sports car and we easily and comfortably fit our family of four (and all our baggage) on three- to four-hour flights. I am over 6 feet tall and find the cabin has good headroom and plenty of elbow room. I often fly it with three or four passengers. Kids use the optional fifth seat.

The quality of construction is excellent and despite much talk about limited availability of parts, I have found it to be actually better and faster than dealing with Piper. The visibility is very good and the handling is exceptional. I typically cruise at 8000 to 12,000 feet and plan for 160 to 165 knots, burning 16 GPH.

My annuals run around \$2500 to \$3000 per year and I understand that mechanics find it an easy airplane to work on. I do the recommended 25-

The door sill is higher than on a Piper or Beech, but the large opening helps ease boarding.

hour oil changes and also complete lubrication of the control surfaces every two years. The Trinidad is an exceptional aircraft that has few equals.

Gregory Maxwell Applegarth
Kentfield, California

I'm an *Aviation Consumer* subscriber. I also own a share in a Trinidad, G-OMAO, based at Shoreham, on the South Coast in the UK.

I think it best to point you to the definitive source of pretty much all there is to know about operating a TB-20. This is a website created by Peter Holy, who has been operating a TB-20 since he bought it in 2002. See: <http://tinyurl.com/k9uqrx2>.

This website is so comprehensive and so valued by other TB-20 operators that when I stumbled across it, I contacted Peter and offered him free hosting. We have since become friends.

Bob Gilchrist
Via e-mail

The TB-20 is one fabulous airplane. I have a 2001 GT model, with ultimate 20th-century (pre-glass panel) avionics, including GNS530W, GNS430W, GDL-69 XM Weather, WX-500 Stormscope (which play on the Garmins) and Ryan TAS-600 traffic. I have a Bendix/King autopilot with flight director. Several TB-20 and -21 pilots that I know have made the leap to Garmin 500 or Aspen panels. The install is straightforward and the result looks very nice.

The TB cockpit feels like being in a sports car. It is comfortable for long trips. I flew last summer from Durango to Baltimore with two fuel stops. The trip took 11 hours but was not particularly tiring. It was certainly more relaxing than driving for 11 hours! I love the two doors, especially with passengers who are not expert in getting into low-wing singles. However, the gullwing doors can easily fly up if they're not latched securely. This can be a big distraction on a takeoff roll, or, as once



The Trinidad displays good manners on landing—our accident survey found only one rollout loss of control event.

happened to me, when turning from crosswind to downwind.

The plane is stable as a rock, flies really well at low speed, and climbs at over 1000 FPM up to 8000 feet. Above that point, she slows down, but I've taken her several times to above 16,000 feet in the summer over Colorado, where she's still climbing at 200 FPM. (I do wish I had turbocharging, though. Sadly, I don't think there's an aftermarket turbo.) On long trips, I fly at 65 percent power, which translates to 14 GPH and 150 knots at 7000 feet. At this burn, I can go five hours and have one hour in reserve.

I bought my airplane used in 2005, with 450 hours. The crankshaft was replaced (free of charge) by Lycoming at 500 hours, following a blanket AD. At 1400 hours, I am still on the original engine. I replaced the vacuum pump as a precaution when I purchased the airplane (at 450 hours) and then at 1100 hours. I've had no other significant repairs. I keep the ailerons, elevator and rudder lubricated, and replace at every annual the Sachs rods for the front gear.

There is a superb user's group (www.socata.org), which is a wonderful technical and social resource for TB-20 pilots. I've met many friends through this group and through the annual fly-ins that the

group organizes. The airplane at max weight is slightly over 3000 pounds, about 500 pounds lighter than a Corvalis or Bonanza. This makes a big difference when you're pulling the airplane out of a hangar.

The visibility is terrific, but all that glass raises the interior heat level in the summer. Having a pilot's side door that can be kept cracked open greatly helps, but I'd really appreciate an air conditioner. I got one estimate for an aftermarket Keith AC, but I wasn't ready to pay \$35,000. I use an Arctic Air cooler, which takes the edge off, but is not the same thing.

I have 1800 hours, of which more than 1000 are in my TB-20. I fly between 150 and 200 hours a year, with many local flights and some longer cross-countries. On the longer trips, I'm either alone or with one passenger. Next summer, I'm flying from Baltimore to Salt Lake City. The airplane is well suited to my mix of short and long trips. Naturally, I'd like something faster, but feel very fortunate to own a TB-20.

My recent annuals have cost about \$3000. Most of the parts I've needed are made in the U.S. Once, I needed a fairly specialized part from France. My mechanic had it within a week.

My TB-20 looks sexy and is sufficiently exotic that I often get compliments. Once, I was rolling off the active at Concord, North Carolina (the home of NASCAR). Someone on the freq (either the tower or a bizjet pilot) said, "Very nice paint job."

Was I very pleased!

Millard Alexander
Via e-mail

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Pipistrel Panthera

(continued from page 13)

its own. We didn't poke the cat's cage with abusive inputs, but what we saw looked promising. But a little less so on the cruise speed. Pilot Robert Likar trimmed the airplane for level flight at 6000 feet, leaned to 39 liters (10.5 GPH) and we recorded about 174 knots TAS. What happened to the promised 200 knots? Tomazic says several things are at work. First, original modeling anticipated antennas buried in the fuselage, but initial certification reviews precluded that. Second, the company has been through five props and isn't certain it's got the right one yet. Tomazic says the IO-540, because of its additional takeoff thrust, will allow prop selection to bias toward cruise speed without having to compromise toward takeoff performance. He insists the airplane will be capable of 200 knots with the prop and drag cleanup. In our estimation, that's a lot of speed to find. We're hopeful, but not convinced yet, either.

CONCLUSION

Even without the promised cruise speed, the Panthera already hits a solid mark. Like Mooney, Pipistrel's grail is efficiency and at 174 knots on 10.5 GPH, the Panthera raises the bar, if only incrementally. That's 16.6 NMPG and we can't find another four-place airframe that beats that. If Pipistrel can eke out another 10 knots on a half gallon with more robust takeoff performance, it'll have a contender, in our view, perhaps just on looks alone. Its best-case useful load is shy of the Cirrus SR22 line, but its fuel economy is far better.

The Panthera has become somewhat of a poster child for less expensive aircraft certified under the CS23 revision. That's what will allow the company to use uncertified avionics like the Skyview or G3X. Simpler certification requirements are supposed to reduce costs throughout the cert process.

When it debuted, the Panthera's price was expected to be about \$500,000. But Pipistrel's latest price for the certified gasoline version is \$614,000 (€445,000). That's less than an equipped Cirrus, but only by a couple of percent.

We're not surprised. CS23 or not, no one has yet delivered on the less expensive, fully capable new airplane. The reality is likely to be that airplanes of this class will cost \$600,000 or more; \$500,000 would a winner, but at this juncture, it doesn't look realistic.

Letters

(continued from page 3)

a tenfold increase in sound power. That being the case, the positive effect of a 10-decibel decrease in cabin noise level was understated in the article. However, we stand by our claim for the risk of hearing loss in a 92-decibel cabin environment, based on the material reviewed in researching the article.

PIPER'S DIESEL ARCHER

In your recent article on the Piper Archer DX (June 2014 *Aviation Consumer*), there is this statement, "Also, there's a low fuel tank temp limit for starting (-32 degrees F for Jet A; at least 32 degrees F for diesel)." Does this imply that the engine is certified for operation on automotive diesel?

FEEDBACK WANTED

BELLANCA VIKING



For the October 2014 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Bellanca Viking, the wood-wing four-seat retractable. We want to know what it's like to own these airplanes, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your Viking to appear in the magazine, send us any photos you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or any other pertinent comments. Please send correspondence on the Viking by August 1, 2014, to:

Aviation Consumer
e-mail at:
ConsumerEditor@
hotmail.com

Mike White
Kennewick, Washington

The Centurion C2.0s engine in the Archer DX is certified to use both Jet-A and diesel fuel or with the two fuels in any mixture ratio.

TSO'D ALTIMETERS

A question has puzzled our group of pilots for some time. Self-proclaimed experts say a replacement altimeter must be TSO'd, but we can't find documentation to support this.

Owen C. Baker
via email

There's no regulation we could find that directly says you need a TSO'd altimeter, but the type certificate of the aircraft could require one. The standards for passing 91.413, Appendix E certification for IFR flight, however, might only be fulfilled with a TSO'd altimeter.