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The Aviation Consumer

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WILL THERE BE AN ADS-B GRACE PERIOD?

There might be, but only if you fly an airliner. I wouldn't count on an extension of the 2020 ADS-B equipage mandate for the rest of us. The airlines (through the organization Airlines for America, A4A) have proposed a five-year transition period for complying with the mandate because it says there aren't enough retrofit equipment options to equip its airplanes by 2020. Specifically, these are ADS-B-compatible transponders and the WAAS GPS receivers required to interface with them.

While it's true that early-generation GPS receivers in many Part 121 aircraft simply don't meet the standards outlined in the FAA's AC 20-165A installation matrix, I think the airlines are overstating the challenge.

When it says there aren't enough equipment options, I assume the airlines are referring to upgrades for the GPS currently integrated within existing FMS equipment. Sure, upgrading these older systems to ADS-B-compliant models will require time-consuming certification effort on the part of avionics and aircraft manufacturers, but there could be simpler, less expensive options. I know of at least one system that exists now: FreeFlight's 1203C WAAS sensor.

This GPS is specifically designed for airline transport and business jets. Consisting of an antenna and a lightweight remote receiver, FreeFlight says the $14,000 1203C has a data interface that is compatible with most transport category transponders, has TSO approval and the company is willing to work with any ADS-B transponder manufacturer to ensure both technical and regulatory pairing. FreeFlight's Jessica Power noted that the 1203C solution is currently flying in multiple platforms and is suited for aging models like the 757 and MD80, for example. These might have confederated avionics suites making an ADS-B-compliant standalone WAAS GPS a logical solution. Power hinted that because of the system's low price and small stature (compared to other transport category avionics) the airlines are being dismissive. Come on, guys, how about thinking outside of the box like we do in the GA sector?

I doubt we'll be granted any compliance extensions given the availability of multiple approved position source options, either self-contained in the ADS-B device or through external GPS receivers. As for ADS-B equipment, the retrofit market for light aircraft has recently become flooded with mandate-approved solutions—both 1090ES transponders and UAT devices—while equipment costs continue to drop. Plus, there could be the ultimate solution in the works.

As we reported in the June 2015 issue of *Aviation Consumer*, SkyVision says its $1100 Salus-3 portable transceiver can meet all the performance requirements specified in FAR 91.227. The company also says the product can meet the requirement of the ADS-B equipment TSO, but whether the FAA approves it remains to be seen. AC 20-165A is quite specific when it comes to the WAAS GPS position source. Appendix 2 of that advisory circular outlines various performance standards, including position validity limits, integrity faults, signal-in-space error detection, update rates, plus software design assurance requirements. I have been flying with the device and it's a good performer.

The airlines won't be entirely off the ADS-B hook in 2020. Part 121 aircraft might still be equipped with 1090ES ADS-B Out transponders by the January 1, 2020, but connected with older GPS systems until modern solutions are adopted. That isn't necessarily a good option. Non-WAAS GPS receivers could hinder ADS-B performance, creating periods of ADS-B outages for a given flight and a logistics nightmare, while the traveling public takes it on the chin.

According to FAA spokeswoman Laura Brown, the airlines are proposing that the FAA could use backup radar or an airline could "reschedule flights" if GPS outages are too frequent. That certainly won't paint a rosy picture for the FAA's NextGen. The airlines have known about the 2020 ADS-B equipage mandate for, what, nearly 10 years now? But if I was a betting man I would wager they'll still be flying in 2020, ADS-B-equipped or not.—*Larry Anglisano*

IS THE SALUS-3 APPROVED?

Overall, editor Larry Anglisano did a great job of explaining the Skyvision Salus-3 portable ADS-B Out/In solution and the Xtreme Vision software (June 2015 *Aviation Consumer.*) We were impressed with the article's accuracy and his ability to review it without personal bias. However, there are a few finer points related to certification.

ADS-B Out equipment does not need to be TSO'd due to the FAA's recent rule change (technical amendment 91.336), which recently corrected the original 91.225 final ADS-B rule. As amended, the ADS-B Out rule states that to comply with the 2020 ADS-B mandate, the ADS-B Out equipment only has to meet the performance requirements of TSO-C154c and FAR 91.227 for flights below 18,000 feet.

The amended FAR 91.225 states in part that the installed equipment must meet the performance requirements, but it does not say "permanently installed," therefore we contend that a portable that is installed on the glareshield should meet that part of the requirement.

Further, even though the 91.225 final rule does not state permanent antennas are required for ADS-B Out (including 978 MHz solutions), Skyvision will provide an option for connecting the device to remotely mounted or permanently installed GPS and UAT antennas. With these antennas, the Salus-3 could be remotely located or installed.

The Salus-3 device meets the performance requirements of TSO-C154c and 91.227, per the amended rule. Hence, in our opinion the Salus-3 meets the 2020 mandate for all aircraft flying below 18,000 feet.

The arguments against allowing a portable device to be used to comply with the 2020 mandate were based on fears related to performance (in part) and other factors like permanent antennas, pressure altitude input, having more than one source for squawk code, control panels and automated integrity checking. We feel we have addressed all those issues with the Salus-3 and TransMonSPE transponder module. Some of these arguments were made when there were very few ADS-B ground stations activated and less refined UAT equipment.

Our testing and your inflight evaluation indicated that the Salus-3 performed well, even without external antennas.

To our knowledge, we offer the only portable ADS-B Out product that meets the performance requirements of TSO-C154c as specified in FAR 91.225 and 91.227 as amended by 14CFR 91.336.

Harry Sanders
Skyvision Xtreme

We ran all of that by Bruce DeCleene, manager of the FAA's Flight Technologies and Procedures division. He told us the ADS-B ruling specifically states that the equipment must be installed, and that portable equipment cannot be used to satisfy the mandate, even in experimental aircraft.

Ric Peri, the Aircraft Electronics Association vice president of government and industry affairs, concurs that Skyvision can make the argument that its portable Salus-3 meets the intent of the ADS-B mandate, assuming it meets the required performance requirements. He also said attaching it to the glareshield or windscreen isn't considered "installed" by the FAA's definition.

That means AC 20-165A applies, providing guidance for the installation of ADS-B Out equipment. It requires airworthiness approval through type certification or the supplemental type certification (STC) process for an ADS-B Out system meeting the equipment requirements of 14 CFR 91.227.

Still, we think connecting the Salus-3 to external L-band and GPS antennas could be a fair compromise, giving it a semi-permanent status. If Skyvision could score a baseline STC—meeting the requirement for ADS-B equipment in certified aircraft—it could open the doors for follow-on field approvals and simplified ADS-B compliance.

HOW WE EVALUATE STUFF

In the June 2015 issue of *Aviation Consumer,* reader Peter VerLee wrote in regarding his subjective assessment of various landing lights, and you took him to task, stating, "The data is the data" and therefore you "stand by the conclusions," regardless of his subjective experience.

Yet, in your December 2012 article "ANR on a Budget," you describe your headset testing methods as follows: "We skipped geeky lab analysis and complicated audio engineering data. Instead, we assembled a diverse test group of a half-dozen active pilots and handed these things out like candy on Halloween."

I think you are right to stick with objective data in your testing of landing lights. But, you can't and shouldn't have this both ways.

Because headsets are worn, I don't mind you including subjective data on headset comfort. But I don't understand why you do not also test headsets for objectively and quantifiable measured noise reduction performance and provide the results.

Geof Swain
Milwaukee, Wisconsin

Our approach to evaluating products needs to remain subjective and objective.

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The GPS-enabled Appareo Stratus ESG transponder, left, is aimed at vintage, federated radio stacks needing a new transponder and certified ADS-B Out. It's currently undergoing FAA approval.

AVIONICS MARKET SCAN

Transponder Upgrades: Driven By ADS-B

Before installing ADS-B, check the transponder. For entry-level replacements, we favor Sandia. For 1090ES, Appareo's all-in-one Stratus ESG may be worth the wait.

by Larry Anglisano

For some owners, an ADS-B upgrade could seriously blow the budget since it might also include buying a new transponder system. That's because the requirements in FAR 91.215 still apply, even when the ADS-B mandate takes effect in 2020.

The good news is our recent market sweep uncovered a number of next-generation multifunction transponders that handle all ADS-B and transponder functions in one box, even serving as nifty weather and traffic displays. Better yet, a one-box solution eases concerns about long term cross-brand compatibility. Still, the buying decision is muddied by rapidly changing ADS-B solutions.

In this article, we'll put a fresh eye on new models and interfaces, plus offer tips on evaluating an existing vintage model.

BASIC MODE A/C

With the ADS-B mandate roughly four years away, it's time to evaluate the health, age and supportability of your existing transponder system. It should be addessed as a system because the supporting antenna, cabling and altitude encoder is just as important as the transponder.

As we describe in the sidebar on page 7, if you've neglected the required FAR 91.413 transponder inspection and certification (you do know it's required every 24 calendar months, whether you fly IFR or VFR, don't you?), now is the time get the aircraft to a shop for an evaluation.

If you haven't replaced a transponder in a while, you might be surprised at the advances in even basic models. Few manufacturers still offer plain-vanilla Mode A/C transponders. Instead, the trend has shifted to Mode S technology with 1090ES (extended squitter) ADS-B output. And even the few models that don't have ADS-B output sport advanced features, potentially reducing installation costs and increasing long-term reliability.

For instance, the Sandia Aerospace STX165 is not only designed for tight panels (it can drop into a standard 3-ATI instrument cutout), it also has an integral Mode C altitude encoder, which is certified to 35,000 feet. The encoder can feed pressure altitude data to other onboard systems over the STX165's serial databus.

When installing an ADS-B system (which will likely require pressure altitude input), shops need to evaluate the health of the altitude encoder, as an aging model might not be up to the task. The STX165 solves the dilemma, while also simplifying the interface. It references pressure altitude by connecting directly to the aircraft's static system.

This means the aging static lines that snake through the airframe to the old encoder can be removed. These lines are often a source of leakage, so reducing the number of lines and fittings is a good thing.

You can even advance the interface with Sandia's $350 STP78 temperature probe. The sensor provides an input to the transponder for displaying density altitude, icing alerts and temperature readout.

The STX165 has a simple feature set that consists of dual rotary function knobs, a dedicated VFR squawk button, ident button, plus it has a sunlight-readable and backlit LED display. At $1850, we think the STX165 is a good value for an entry-level upgrade.

BendixKing still makes the KT76C (built to order), a digital model that made its debut when Cessna revived its single-engine airplane line in the

CHECKLIST

- Models with internal WAAS GPS ease the ADS-B equipage dilemma for lower-end aircraft.
- Closed architectures make long-term cross-brand compatibility questionable.
- Encoders, cabling and antenna replacement will increase costs.

late 1990s. The KT76C—which uses surface-mount circuit board technology—(it still uses a cavity tube, despite having a digital front end) is an easy replacement for the mechanical KT76A. It can use the existing wiring and the same mounting rack.

On a side note, the cavity tube in analog transponders is the high-cost component associated with the set's power output. It generates heat, huge amounts of voltage and will inevitably fail. It pays to use caution when buying a used transponder. We suggest first sending it through a careful bench evaluation—paying close attention to the health of the cavity—by a shop you trust.

Garmin dropped its entry-level analog GTX320A transponder, but still offers the digital GTX327. We like that it has a short chassis, making it versatile in panels that have limited clearance behind the radio stack, or when mounting it outside of the center stack.

The GTX327's reliability has been good, although we're hearing of function key failures on units that have been in service for a long time. Flat-rate factory repair is around $600.

The GTX32 is the remote version of the GTX327. It can be channeled from the GTN750 touchscreen navigator, eliminating the need to mount the transponder in the radio stack.

With an RS232 serial data interface, the GTX327/32 interfaces with the GNS and GTN navigators, automatically going into airborne and ground mode, while automatically starting and stopping a flight timer on the takeoff and landing rollout.

But what we really like about the GTX327/32 is its enhanced compatibility with Garmin's GDL88 and GDL84. These UAT ADS-B transceivers don't require remote control panels because they interrogate the transponder and communicate with it through the serial databus, automatically keeping both the ADS-B and Mode A transponder codes in sync. Some other serial

Garmin's solid-state GTX327, top photo, has a serial databus for communicating with Garmin GTN and GNS-series navigators, plus it works seemlessly with the GDL88/84 ADS-B transceivers. Trig's two-piece TT22, bottom, has ADS-B Out and a tiny control head.

bus-equipped models will work with the GDL88 and GDL84, but you'll need to check with your installer to ensure full compatibility.

WANT ADS-B WITH THAT?

If you do, the market is flooded with 1090ES ADS-B Out transponders. Check out the ADS-B buyer's guide in the June 2015 issue of *Aviation Consumer.* The choices are overwhelming, although a choice may be easier when you consider which equipment will be interfaced with the transponder. Think long-term, in terms of software and brand compatibility.

The first step is to decide what you will use for an approved ADS-B WAAS position source. WAAS position is an important piece of ADS-B data required for a 1090ES transponder's data output. That is, if the transponder doesn't have its own GPS receiver. More on that evolving trend in a minute.

The software and databus configuration in Garmin's GTX330ES (and remote GTX33) 1090ES ADS-B transponder is based on an architecture that includes its own GNS530W/430W and GTN-series WAAS navigators, although there is compatibility with Avidyne's IFD540 and IFD440 GPS. These navigators are designed to drop into a GNS530W/430W installation, so it's logical they can work with a GTX330ES.

The BendixKing KT74 ADS-B transponder, right, is advertised as a slide-in for existing KT76A/C-series transponders, but plan on more wiring for interfacing with a WAAS GPS.

MODEL	THEORY	PRICE	COMMENTS
APPAREO			
STRATUS ESG	1090ES	$3490	Integral WAAS GPS, not yet FAA certified
AVIDYNE			
AXP340	1090ES	$3995	Compatible with GNS530W/430W, IFD540
GARMIN			
GTX327	MODE A/C	$2036	$2645 for GTX32 remote version
GTX330ES	1090ES	$3995	GTX330 upgradeable to 1090ES for $1200
TRIG			
TT22	1090ES	$3071	Remote control head/processor
TT31	1090ES	$2605	Partial plug-and-play with KT76A/C
SANDIA			
STX165	MODE A/C	$1850	Built-in altitude encoder, budget price
STX360	MODE A/C, UAT	TBD	Displays FIS-B textual weather, wireless out
BECKER			
ATC4401	MODE A/C	$2075	2.25-inch round, matches 6201 comm
BXP6403'	1090ES	$3785	Fits KT76A rack with an adapter
BENDIX/KING			
KT76C	MODE A/C	$2795	Digital front end, but has analog cavity
KT74	1090ES	$2999	Partial plug-and-play with KT76A/C
L-3 AVIATION			
LYNX NGT9000	1090ES	$8251*	*Starting price. $13,384 with TAS, Diversity
FREEFLIGHT SYSTEMS			
FDL-1090-TX	1090ES	$4495	Remote design, made by Trig Avionics

Still, while cross-brand interfaces like this may work today, they are vulnerable to future software incompatibility. That makes a good argument for sticking to one brand.

In our estimation, Avidyne's AXP340, BendixKing's KT74 and the Trig Avionics TT-series ADS-B transponders could be moving targets when it comes to take-it-to-the-bank long-term compatibility with Garmin's navigators. They work now, but should Garmin tweak its GNS software—leaving a void in the interface—it will be up the manufacturers to ensure continued compatibility.

Avidyne told us its AXP340 has an AML STC (approved model list supplemental type certificate) which includes the IFD540/440 and the GNS530W/430W as approved position sources, but it won't work with the GTN750/650. Avidyne's AXP322 remote ADS-B transponder will be added to that approval list in the near future. It is designed for display on and channeled by the IFD540/440 and is currently in the certification process.

Scotland-based Trig Avionics was an early player with its line of 1090ES models, including the space-saving TT22 and the FDL-1090-TX model it makes for FreeFlight Systems. These transponders are also compatible with Garmin GNS WAAS navigators for position sourcing. Like the KT74, the rack-mounted Trig TT31 transponder can work in an existing KT76A/C installation, but plan on additional wiring for piping in the GPS data—hardly plug-and-play—for which you'll pay.

As we've recently reported, several new multifunction ADS-B products include transponder functionality as standard, plus built-in WAAS GPS and the ability to receiver and display ADS-B weather and traffic.

The first with the most complete and certified all-inclusive rack-mounted solution is L-3 Aviation with the Lynx NGT9000. This is a 1090ES model equipped with an internal WAAS GPS receiver, a dual-band ADS-B traffic and weather receiver, plus a color touchscreen multifunction display.

L-3 doesn't like to label the Lynx 9000 as a transponder. Instead, it's marketed as an ADS-B solution with multifunction capability, including a mandate-compliant 1090ES transponder. Still, the NGT9000 replaces the existing Mode A/C transponder in the radio stack (so we call it

Whether it's an entry-level Mode A/C model like the Sandia STX165, upper left, or the high-end L-3 Aviation Lynx NGT9000 multifunction 1090ES ADS-B combo, bottom, expect a major installation that could include pricey antenna work.

WILL THAT OLD CLUNKER MAKE IT TO 2020?

One way to find out is to use FAR 91.413—the biennial transponder certification—to your advantage. Hauling the airplane to the shop every other year for this inspection (and to comply with FAR 91.411's pitot and static system certification, if you fly IFR) is a hassle and an expense, but it may be the only good way to determine the health and longevity of an aging transponder.

We talked with veteran bench technician Steven Christino at EXXEL Avionics in Hartford, Connecticut, and learned more about transponder diagnostics than we could digest in one sitting. As the ADS-B mandate approaches, transponder repairs and new installations have ramped up—so much that Christino restructured his repair shop and mobile operation to focus primarily on pitot, static and transponder inspections. He has seen enough to easily spot telltale signs that a transponder is ready for the trash bin. He even monitors the health of his customers' transponders by keeping records of critical performance specs. If he sees signs of declining health between inspection intervals, he knows replacement is inevitable.

"Perhaps the most important characteristic I look for in an aging transponder is its transmitter power output—that's the health of that pricey cavity tube we referred to earlier—and MTL specification, for minimum triggering level. That's basically the reply timing circuitry as the unit is interrogated," he noted, as he put a close eye to the pulse waves of an old Cessna RT359A tethered to a bench scope. Christino noted that ramp-checking a transponder doesn't exactly paint a complete picture of its health. It's simply a snapshot of whether it falls within the loose requirements of FAR 91.413—which, incidentally, doesn't even address Mode C performance. That's in FAR 91.411. The real test is a transponder's performance on a bench mockup, using calibrated pulse equipment. You'll pay more for this service, of course, but for aging units, the additional diagnostic fee could be worth the expense. In general, that's a one-hour minimum bench charge. Christino noted that the antenna system is a huge factor in transponder performance and should be replaced with shielded, low-loss coaxial cable during a new retrofit. Similarly, blade-style L-band antennas offer better performance and are simply more durable than delicate stainless steel rod/ball antennas.

Most shops we spoke with suggested replacing orphaned models from Narco, Collins and King. As one tech put it, "Replacing these old clunkers should be considered preventative maintenance. It's only a matter of time."

a transponder), and the system is available in no fewer than four configurations at different price points.

The $8300 base model has a dual-band ADS-B receiver for displaying FIS-B weather, plus ADS-B traffic. There is also a Diversity model (interfacing with top and bottom antennas), plus a model with an integral active traffic alert processor, or TAS. Starting at $10,651, the NGT9000+ can use an existing L-3 Skywatch TAS antenna (the L-3 product has been sold off and is no longer available through L-3), eliminating the need for a remote Skywatch TAS processor. In our trials, we found that the NGT9000 has an easy to manage feature set and a good display.

The flagship NGT9000D+ has TAS and Diversity, plus an eye-widening $13,384 price tag. All of these features could make good sense for higher-end aircraft, but the high price is questionable for basic ones, in our view. We covered the Lynx product line in detail in the April 2015 issue of *Aviation Consumer.*

FUTURE MODELS

There could be good reason to hold off on a transponder upgrade, given the recent announcements from Appareo and Sandia—both with ADS-B transponder solutions catering to the lower end of the market.

First, Appareo, with the $3500 WAAS-equipped Stratus ESG rack-mounted 1090ES transponder. Currently undergoing FAA certification, the ESG solution is targeted at federated panels (with a mix of brands) that might not have a mandate-approved WAAS GPS. Additionally, Appareo says the ESG will come with mostly everything a shop will need to complete a mandate-compliant retrofit, including a WAAS GPS antenna—no hidden costs.

We hoped the ESG would have an integrated altitude encoder, but it doesn't. It will, however, accept both Gray code and serialized pressure altitude from a variety of altitude encoders. We'll look at that market in an upcoming issue.

The ESG is also designed to interface with the popular Stratus and Stratus 2 portable ADS-B receivers, piggybacking with the transponder for receiving power and its GPS signal. This means the Stratus receiver can be remotely mounted, rather than placed on the glareshield.

The ESG doesn't have a lot of gee-whiz functionality, but instead brings a more utilitarian feature set, including an LED display, push-button squawk code entry and an automatic VFR button.

Sandia is also working on an all-inclusive model—the STX360. Unlike every other ADS-B transpon-

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NEW AIRCRAFT DEVELOPMENT

Mooney Reinvented: A New World Trainer

Mooney is betting that the world market wants a stylish, comfortable diesel-powered trainer. A step-up retrac will follow.

by Paul Bertorelli

Frustrated buyers who complain about the stratospheric prices of new airplanes sometimes argue—rightly or wrongly—that manufacturers could offer cheaper products if they would just build simpler airplanes using more automation in construction. With its surprise announcement of two new aircraft at last fall's Zhuhai Airshow in China, Mooney may be about to test the theory. At the least, Mooney is poised to muscle into a market it heretofore barely dabbled in: trainers.

Newly acquired by Chinese interests with capital to spend, Mooney has embarked upon an aggressive plan to develop a basic trainer and a step-up personal airplane, both diesel powered and both sharing the same basic airframe. It's also investing heavily in the Kerrville, Texas, plant where it has made the venerable M20 series for years; the line recently restarted and began deliveries.

While Mooney says it sees potential in China and Asia for trainers, expect to see the company pitch these new products to the North American market, too, where CEO Jerry Chen thinks there's demand, despite dismal sales numbers recently announced by the General Aviation Manufacturers Association. Although it has demurred on announcing prices for the new airplanes, with new Skyhawks and Diamond DA40s topping $400,000, Mooney may have some competitive headroom if its new design and construction can find the sweet spot between volume and manufacturing cost.

Mooney believes the next generation of aircraft will have to appeal to potential buyers whose frame of reference is cars, not aircraft.

But first, the company has to complete the design and certify it. When we visited Mooney's new Chino, California, facility in April, the company was well along with this process. Although no flyable airplane exists yet, the first test article was planned for late summer 2015. We were shown developmental drawings and modeling that has been extensively exposed to computer fluid dynamics trials with wind tunnel tests planned.

NEW COMPANY

Among contemporary aircraft manufacturers, Mooney holds a record of sorts for having been in and out of bankruptcy so many times even stalwart owners lose count. In the company's nearly 90 years of building airplanes, it has been owned by an electronics company, an FBO chain, a steel company and was briefly public. In October 2013, it was bought by a U.S.-based company called Soaring America, whose principal investors are of China's Zhengzhou-based Meijing Group, a real estate and import/export company.

At Sun 'n Fun 2014, the company announced a $50 million recapitalization of Mooney, to include modernization at Kerrville and, although it wasn't announced at the time, at least two new aircraft were envisioned. And Mooney wasted no time in unveiling a mock-up at China's Zhuhai general aviation show in November 2014. The mock-up was the M10T, the base model trainer Mooney intends to use as the platform for a follow-on product, the M10J, a retractable step-up that's a clear bow to the M20J 201, one of the company's most well-regarded designs that remains popular on the used market.

What used to pass for conventional wisdom had it that any manufacturer needed a range of products, from trainers to step-ups, to cruisers to twins. As a niche manufacturer, Mooney never gave more than lip service to the idea, specializing as it did in four-place, high-performance aircraft. It feinted briefly toward two-place trainers when it bought the Alon Ercoupe, revised the airplane with the company's signature reversed vertical fin and sold about 116 before selling the design to Univair in 1973. Ironically, that airplane was the first M10 and was called the Cadet. Before that, Mooney went downmarket with the M20D Master, by fitting fixed gear in place of the folding wheels on an

M20C. It wasn't really a trainer, but was meant to be an economy model. Mooney sold under 100 before killing it.

The new M10T revisits this territory, but unlike the Cadet, it's an original design with a specific world market in mind and Mooney intends it to become a primary product.

DRIVEN BY STYLE

The M10T/J are distinct departures from Mooney's previous offerings, but perhaps not entirely unexpected, given where the market opportunities may lie. Cirrus has the high-performance personal airplane market locked down with the SR22, but while the SR20 finds spots on the training flight line, few consider it a trainer in the way the Cessna Skyhawk is. But the Skyhawk has become so expensive—$400,000-plus—that it may have priced itself out of anything resembling a broad market. Thus, Mooney finds an opening for a trainer-cum-cruiser based on the same airframe. Rather than metal, the M10s are primarily composite combined with some carbon fiber for weight control. Despite being smaller overall than the Ovation/Acclaim series and only slightly smaller than the M20J, the basic M10 cabin is considerably more commodious, by design. It's about four inches wider than the widest M20 cabin, with more headroom, making it closer to a Cirrus in overall feel.

And that feel is intended to be—and is—automotive. CEO Jerry Chen and Mooney's VP for development, Tony Parker, told us the company believes the next generation of aircraft will have to appeal to potential buyers whose frame of reference is cars, not aircraft. Cirrus has already pioneered this, but not to the degree that Mooney is attempting, in our view.

"If we talk about a mature western market in the states, pilots already know what an aircraft interior looks like. But in a new market, China, it's brand new. They don't have the background to understand what airplane operation is or the way it looks," says Chen. So the frame of reference needs to be automotive. Moreover, Chen thinks even the North American market is ready for fresh cosmetics. "People have been waiting long enough to see something change. I think we may have a chance if we go in this direction," he adds. But the change we see is strongly stylistic and modestly technical. We would call it modern but modest. Mooney hired a design house with experience in automotive, Dzyne Technologies, to work up the basic concepts around three briefs: safety, speed and style. Dzyne's Brenden Kennelly showed us iterations of drawings that yielded the M10's final shape.

M10T cockpit, above, feels and looks like a European luxury car interior. Third seat, right, is standard for the M10T and an option for the M10J. Jerry Chen, lower photo: "People have been waiting long enough to see something change. I think we may have a chance if we go in this direction."

"Performance was the main driver and everything kind of feeds that," Kennelly says. "Initially, our windshield was even more raked, which was great for aero and when we did CFD [computational fluid dynamics], we had laminar flow past the rear seat. But that didn't serve visibility or headroom for the occupants," he explains. The cabin was pulled and stretched to yield an interior that's spacious—surprisingly so—in both front and rear. Mooney isn't talking about a four-place airplane, so the initial M10Ts will have a single seat in the back, which is what flight schools said they wanted for an observer. In flight training, four-place airplanes are seldom

The M10T may be the most CAD-CAM-intensive light aircraft program ever, top. Eclipse veteran Tony Parker, lower: "The one thing I learned is to not be too hasty in announcing the prices before you figure out what it really costs to build it."

flown with full seats. Three seats helps minimize weight and gives the rear passenger room—a lot of room.

The step-up M10J will offer the third seat as an option, meaning that the boldest part of Mooney's new airplane may be the fact that it's venturing into the iffy territory of high-performance, two-place airplanes where history offers few market success stories.

LIKE A BENZ

At Chino, we were shown Mooney's wooden ergonomic mock-up which guided the development of the full-size conceptual model shown at Sun 'n Fun. Entering the cabin is to be overwhelmed by the fragrance of expensive leather and a panel reduced to the utter basics. Although it's intending simplicity, the M10T has a Garmin G1000 because focus sessions with flight schools indicated that's what buyers wanted. "We could have gone with the G500 or 600," says Tony Parker, "but it didn't really save much money."

As Dzyne's Kennelly indicated, the interior tends to dominate the impression of the airplane. The sill height makes for an easier ingress than in the M20s and there are two doors, an absolute must in competing with Cessna, Cirrus and Diamond. Detailing is sparse but richly rendered in red and black leather with expressed stitching. Sidestick controllers reside just ahead of the forward edge of the doors and generous armrests ease pressure on the wrists. The panel is absent all but the minimal number of controls, including climate-control knobs, breakers to the far right and a glass back up gyro in a glareshield eyebrow reminiscent of earlier Mooneys. A center console houses the single-level throttle—upholstered in leather—flaps and, for the retractable J-model, a gear switch. Visibility over the glareshield is expansive compared to the M20 series, clearly the beneficiary of Kennelly's stretching exercises.

Construction wise, the M10s are similar to the Cirrus and Diamond line, albeit a combination that will probably include more carbon fiber and a little less glass to keep the weight down.

Manufacturing details are a work in progress, but the airplane will likely be built just as others of its ilk are: Two bonded fuselage halves, clam-shell wing construction and the usual torque tubes for control circuitry. In a departure anyone who's ever crow hopped a Mooney will appreciate, the landing gear will be conventional oleos (including the retractable version) rather than Mooney's iconic rubber donuts.

For the time being, the engine choices are only diesel: Continental's CD-135 for the M10T and the CD-155 for the higher-performance M10J. Cruise speeds for the M10T are claimed as 140 knots (160 knots maximum) and 160 knots for the M10J, making it a near equivalent of the 201, but on at least a third less fuel. The M10T promises to be faster than a Skyhawk—gasoline or diesel—and competitive with Diamond's gasoline DA40.

Mooney COO Tom Bowen said to make these numbers, Mooney will have to mind the drag. It has settled on an unsually high-aspect-ratio wing but details on low-speed devices have yet to be worked out. "It easy to get a wing to go fast or slow," Bowen said, "but a challenge to get it to do both."

Cooling drag will be a challenge, too, since diesels suck a lot of air and have both water radiators and oil coolers. In that regard, Mooney may have an advantage because the design is a clean sheet whose snout can be optimized for diesel, albeit within the constraints of the M10's stylistic requirements. In our view, this has hobbled diesel conversions whose airframes weren't intended for diesel's peculiar requirements.

BUILD ECONOMICS

Two things are pointedly absent from Mooney's spec sheet: weight and prices. Both are important and probably more closely tied than is obvious, since weight reduction can add cost, both in the quest for lighter materials and engineering time to find the ounces and pounds. With not

much surplus power from the diesels, Mooney can't afford a fat airplane if it wants to be competitive. Speaking of that, when asked about price, Mooney said it will be "competitive." But with what? Just competitive, the company says. If that's competitive with Flight Design's C4, the price would be about $250,000; if with the latest models of the Cessna 172, $400,000 would do it. We suspect at least some of the reticence to name a price comes from Tony Parker, who headed engineering at Eclipse and well remembers how that company struggled to meet price points that, in the end, proved unrealistic.

"The one thing I learned is to not be too hasty in announcing the prices before you figure out what it really costs to build it," Parker says. Accordingly, Mooney is using every tool available to understand well ahead of committing to production as much as it can about assembly hours, processes and costs. One of those tools is extensive use of CAD-CAM. Tom Bowen said of all the aircraft projects he's overseen, the M10 is by far the most CAD-CAM intensive and that may extend to any light aircraft, ever. No surprise that many of the engineers we met at Chino came from Boeing or Grumman.

During my tour of Chino, we were shown dozens of drawings in a CAD-CAM suite called Solidworks. "Solidworks has a package called Composer that can incorporate a manufacturing work instruction. It takes the CAD design and by animation shows the mechanic how the airplane goes together and in what order," Parker says. By building the airplane virtually down to the last fastener, Parker believes Mooney will have a better idea of the build-hours budget. And all of that will be integrated into the supply chain, just as it is in high-volume auto plants.

Build time is certain to be a fraction of the hours required for the M20s. Bowen says the traditional metal construction of the M20 series totals 3500 parts; the M10, at 350 parts, is an order of magnitude less. But Bowen, who went from Mooney to Lancair and now back to Mooney and who knows a thing or two about metal and glass, says composite isn't the miracle solution some people assume. There will be a place for metal.

"The good thing about composites is that they're very good for complex shapes and assemblies. The bad news is if you scrap one, you're scrapping a lot of materials," Bowen says, speaking from experience at Lancair. "The most important thing I can bring to the company is the perspective that there are things that should be built out of composite and there are things that are better in metal. And you've got to understand the difference. But metal is not cheaper," Bowen adds.

Mooney hasn't decided where the M10s will be built yet, but Chen says a factory will eventually open in China. The new airplanes could be built in Kerrville or in Chino or a combination. Parker expects production will use as many off-the-shelf components as practical and it's likely composite work will be farmed out, at least initially. For now, job one is building the proof of concept and flying it by late summer 2015. After that, Mooney will have its plate full finishing the cert program, which it promises by late 2017, with deliveries to follow after that.

MEANWHILE, IN KERRVILLE...

If the all-metal, high-build-hour M20 series is a sunset product, Mooney figures it will find some sales in the twilight. In addition to investing heavily in M10T/J design and production, the company has poured at least $1.4 million into its Kerrville, Texas, plant, where Mooneys have been built since 1946.

For as long as we can remember, the airplanes emerged from a series of huge barn-like structures on the Kerrville property and even as the hangars remain, Mooney COO Tom Bowen said the company is finding production efficiencies.

Mooney's Jerry Chen estimates that the airframe requires about 6000 hours of labor and although the company has had production tracking of those hours, it has installed a new digital system to tie inventory, sales, production and accounting into one system that can provide a real-time glimpse of business health for everything it builds. "When we really wanted to get a snapshot, we had to get all these datasets to figure out what they said. Now it's just one system," Bowen said and there are efficiencies to be found in better tracking. "What really drives the build hours down is volume. We're not going to get back to the point where we were in the 1970s with thousands of airframes. Realistically, for the M20, it will plateau probably under a hundred. But that's still a good number," Bowen said.

For metal construction, Mooney has also invested in new chemical treatment processes for annealing and treating its many drop-hammered aluminum parts, replacing an environmentally toxic system in place for years. These processes are automated and more efficient than what they replace. Both the tracking system and other improvements will apply to legacy and new production. These investments might not be justifiable for just restarted legacy manufacturing, but Mooney is looking over the horizon.

"This is the pillar that we're building into Mooney. This is what will grow it into multiple aircraft in international markets," Bowen says.

Gear of the Year: No Slam-Dunk

The editorial year didn't uncover any first-place products or companies, but plenty deserve recognition in our annual editor's choice awards.

Our editor's choice awards are all about innovation and value. As we look back at the last 12 issues of *Aviation Consumer*, we find no shortage of credible products, especially in the ADS-B and aircraft consumable markets. But no single product or company stood out for being the most innovative.

So to keep our high standards in check, we won't hand out an award for product or company of the year. Instead, we'll present a combination of a dozen products and companies that we believe deserve equal recognition for being the best of the best.

BEST AMPHIBIOUS LSA: SEAREY ELITE

We'll start with the Searey Elite pictured in the lead shot above. With a base price of $158,000, the factory-built SLSA Elite isn't a cheap toy. On the other hand, we think Searey Elite buyers will get a lot for the money.

Moreover, we're impressed by the Elite's build quality and refinement, including a simple lightweight carbon fiber hull, aluminum tube upper structure, a durable marine-grade faux leather interior, decent ergos and its Advanced Flight Systems customizable glass avionics suite with landing gear warning system.

The Searey Elite is powered by the 115-horsepower Rotax 914 turbocharged engine, offering more takeoff and climb authority should you operate it around your hot and high mountain lake house.

While the Searey is no stranger to the water (Progressive Aerodyne has been around since 1992), the Elite is a fresh model built in Aerodyne's new manufacturing facility in Taveres, Florida. For more, visit www.searey.com.

BEST WHEELS AND BRAKES: BERINGER AERO

Brake manufacturer Beringer Aero's new line of lightweight wheels and brake technology is born from the French company's success in the motorcycle racing world. With a growing STC list for aftermarket retrofit, Beringer wheels and brakes are now standard equipment on Cirrus, Diamond and Pilatus models. Beringer's new wheel design (with floating brake discs) accommodates tubeless tires and is available as a complete kit, including alloy brake calipers, master cylinders, brake lines and parking brakes.

Part of what continues to impress us is the performance of the Beringer ALIR antiskid system, which uses an adjustable differential braking pressure regulator to prevent wheel locking. Beringer wheel and

brake kits are available in four-, five- and six-inch wheel configurations and sell for around $1100 per wheel. Go to www.beringeraero.com for a complete list of systems, accessories and pricing.

BEST BUDGET IFR UPGRADE: USED GARMIN GNS430W

Yes, Garmin's GNS430W WAAS GPS navigator is a few years out of production. No, it doesn't have a touchscreen. But yes, a GNS430W still makes sense for lesser aircraft in desperate need of a basic and affordable single-box IFR upgrade. Plus, its WAAS GPS engine is an

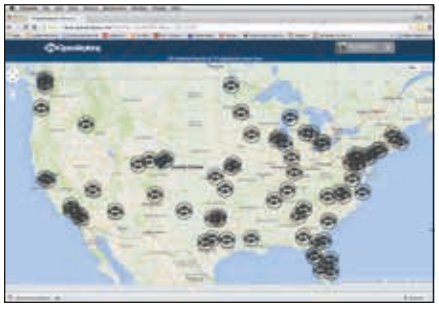
approved position source for driving an ADS-B transponder, including the GTX330ES, KT74 and others.

With a good eye you might score a well-maintained GNS430W from a reputable shop for around $6000. Better yet, Garmin's Flight Stream wireless bluetooth device breathes new life into the GNS430W (and the larger GNS530W) since you can enter victor airways into its flight plan bank via Garmin's Pilot tablet app with a push of a button. Garmin tells us it plans to support the GNS430W well into the future.

BEST AIRCRAFT RENTAL OPTION: OPENAIRPLANE

OpenAirplane says that a single checkout at one FBO allows a pilot to rent aircraft from other FBOs across the country. We tried it. It works.

With just six participating FBOs when the Internet-based OpenAirplane went live in 2012, the service has grown to 79 locations with over



260 rental aircraft available around the country.

The premise is simple—a pilot signs up with OpenAirplane through its website, provides information on his or her flight experience and rental insurance and then schedules a thorough Universal Pilot Checkout flight review.

Signing up for OpenAirplane is free and only the hourly flight time for the rental aircraft is billed (a rate set by the owner, while OpenAirplane takes a 10 percent cut).

Our experience with OpenAirplane was quite favorable. Once checked out, we rented a clean IFR-equipped Cessna 172 at Orchard Beach Aviation in Manistee, Michigan, and found that the OpenAirplane process was as straightforward and convenient as the company advertises. Contact www.openairplane.com.

BEST INLET AIR FILTER: DONALDSON

Just because you rely on your maintenance shop to look after the inlet air filter on your engine doesn't mean all filters are created equally. We evaluated the three FAA-approved filters—Donaldson, Challenger and Brackett—and found that while they are all effective at filtering unwanted contaminates, we think Donaldson's dry pleated design offers the best combination of airflow, good filtering properties and convenient replacement and servicing procedures. For more, visit www.donaldson.com.

BEST FLIGHT BAG: SPORTY'S NAVIGATOR

After some resistance, we ditched a well-worn backpack for good in favor of Sporty's Navigator flight bag. After enduring two years of abuse, it is proving to be rugged and spacious, plus it has plenty of padded pockets in all the right places.

At 10x22x11 inches, it has both headset and tablet computer pockets, plus four additional external pockets of varying shapes and sizes. Our only beef is the amount of space the bag occupies in smaller cabins, but

that's a compromise with many full-sized flight bags.

Still, for housing our growing arsenal of camera gear, tablet computers and test products to transporting inflight munchies, the $99 Sporty's Navigator bag is a good value. Contact www.sportys.com.

BEST PORTABLE CABIN COOLER: B-KOOL

Portable cabin cooling devices may seem crude and perhaps intrusive, but they are a cheaper and simpler alternative to maintenance-intensive aircraft air conditioning systems.

At $299-$429, the B-Kool portable cooler series holds 25 pounds of ice and can pump roughly two hours of cool air. We like its smaller size (11x18x16) compared to other portable coolers we evaluated. Place it in the baggage area and point the flexible ducting into the cabin.

It plugs into a cigarette lighter and is easy to drain the water after the flight. Hot and smelly passengers and pilots will appreciate the comfort. For more information, visit www.b-kool.net.

BEST COCKPIT TABLET COMPUTER: APPLE IPAD MINI3

Just because the dominant iPad is so popular for cockpit use doesn't necessarily mean it's the best choice. To find out for sure, we put Apple's mid-sized mini3 head-to-head with Samsung's mid-sized Galaxy Tab S 8.4. And man, it was a close call.

As impressed as we were with the Samsung Galaxy's display, battery and processing performance, we slightly favored the iPad mini3 because of navigation app and mounting hardware compatibility. There are simply more options for the iPad than there are for the Samsung. As for the full-sized iPad, we think it has a decent screen, but we also think its body is too bulky for use in smaller cockpits.

MOST INNOVATIVE ENGINE MAKER: CONTINENTAL MOTORS

That's because Continental isn't backing off on its Centurion Jet A-burning piston engine technology, even if the current global demand seems to be cooling.

When we visited Continental's diesel manufacturing plant in St. Egiden, Germany, we found it building a couple of Centurion engines a day, while ramping up volume.

Continental is moving forward with its 300-HP six-cylinder diesel, an engine that's based on a Mercedes-Benz automotive engine.

For certain, we think an innovative Continental is positioned to be the industry leader should the diesel aircraft engine market really come alive.

BEST NEW AUDIO PANEL: PS ENGINEERING PMA450

We're continuously impressed with PS Engineering's drive to advance its products. Just as it hits one out of the park, it goes back to the think tank to develope something better. The latest is the $2395 PMA450 audio panel, which takes the already impressive-performing PM8000-series to the next level. The PMA450 has a function it calls IntelliAudio, which is based on the Air Force's dimensional sound technology. With IntelliAudio, you can place each comm radio in different locations within the headset so the brain can more easily discern one source from the other. We flew with it and we liked it better than Garmin's audio panel. Visit www.ps-engineering.com.

BEST REPLACEMENT BATTERY BOX: BOGERT AVIATION HOUSING

One of the more neglected components on the airframe is the aircraft battery enclosure. Its replacement is often deferred because of the riduculous price of many OEM enclosures. When the battery box on one of our evaluation aircraft began spewing corrosive battery acid onto the airframe, we took a closer look at Bogert Aviation's aftermarket boxes and liked what we saw.

Bogert has FAA-and PMA-approved replacement enclosures for most Piper and Cessna applications and they are much improved from original designs. This includes a venting system which allows air inflow and outflow through the box.

What impressed us the most is Bogert's build quality. The boxes are TIG welded and finished with powder coating, while the stainless steel vent tube is welded to copper fittings. The hardware isn't inexpensive ($800-$1100), but we think it's a better choice than many OEM replacements costing three times as much. Visit www.bogertaviation.com for model compatibility.

BEST CABIN DATACOMM DEVICE: DELORME INREACH

There are several new portable options for bringing texting and talking capabilities to the cabin. This includes Iridium's Go and the DeLorme InReach Explorer. We tried them both (in addition to Globalstar's Sat-Fi, but it didn't work in the air), and favored the handheld DeLorme Explorer for its all-in-one text messaging, satellite tracking capability and SOS emergency functionality. The Iridium-based Explorer also impresses with a small, yet rugged case that's easy to manage in the cockpit, plus fantastic battery endurance.

The DeLorme Explorer retails for $379 and requires one of several annual or monthly data service plan options. You'll find this pricing at www.inreachdelorme.com.

Composite Propellers: Longevity, Efficiency

Although pricey, composite props offer reduced weight and vibration, very long blade life and may increase airplane performance.

CHECKLIST

- Composite prop blades have what amounts to an infinite lifespan.
- Weight savings with composite props can be substantial.
- Prices are higher than comparable aluminum propellers.

by Rick Durden

With minimal fanfare, composite propellers have been appearing as original equipment on more and more airplanes and more and more owners are finding that they are an option for their airplanes when it comes time for an overhaul or replacement. Composite props are more expensive than their aluminum counterparts, so we were curious why owners are shelling out the extra bucks—what's the attraction and what's out there to buy?

First of all, what is a composite prop? At its most basic, it's a prop that has blades at least partially made of layers of epoxy fiberglass, Kevlar or carbon fiber. The composite material is on top of a core that is either hollow (rare) or made of foam or wood. The base or ferrule of a constant speed prop is usually aluminum or steel and fits into a hub that may be identical to that of a prop with aluminum blades. A fixed pitch composite propeller may have no metal in it at all.

WEIGHT

While the conservative certification requirements the FAA developed for composite airframes meant the anticipated major weight savings for composite airplanes never happened, composite materials have proven to greatly reduce the weight of propellers. According to MT-Propeller USA's Peter Marshall, the weight saving ranges from five to 20 pounds over aluminum, depending on the prop. For the new prop from McCauley, the weight saving is even greater—35 pounds over the aluminum version.

The weight difference, especially as it occurs at one end of the center of gravity envelope, has a number of benefits, beyond simply increasing useful load—although that by itself is a big deal, especially in Light Sport applications.

Reduced weight of the prop means less gyroscopic and flywheel effect which, to a point, is beneficial for wear and tear on the engine, particularly the crankshaft and engine mounts. All things being equal, a lighter prop means longer engine life. It is especially valuable for airplanes flown regularly for aerobatics—and we've observed that many serious akro pilots have switched to composite props.

Composites allow more subtle and precise shaping of a propeller blade than can be accomplished with aluminum. There are limits to what can be done with an aluminum forging. The result is the ability to get more performance out of the prop,

Three-blade MT composite prop on the King Katmai conversion of a Cessna 182, top. Five-blade Hartzell composite propeller on a TBM 900, right.

MT provides composite propellers for a number of vintage airplanes, such as this Waco, top. Composites allow radical blade shaping not possible on metal blades such as on the wide-chord Hartzell Claw prop on Sean Tucker's Oracle Challenger, second from top. The bottom two photos are a section of a Hartzell composite propeller, leading edge left, showing the nickel erosion strip and foam core.

which results in more performance for the airplane. While we are always skeptical of speed increase claims, we have gotten reports of cruise speed improvements upon switching to a composite prop. The most remarkable we've heard is some eight knots for the Diamond DA-20 with an MT prop.

Hartzell took advantage of the weight savings and ability to fine-tune the shape of a propeller blade with its very wide chord Claw aerobatic props that provide significant additional thrust at low airspeed. The Claw is used by all of the Red Bull racers.

REPAIR

To prevent blade erosion, composite props have some sort of leading edge protection, usually made of steel or nickel. Nicks and dings to the composite material are repaired according to the manufacturer's guidelines—as with aluminum blades, some damage can be field repaired, some has to be repaired in a prop shop and some is so bad the blade cannot be repaired. For field-repairable damage of a composite prop, the usual procedure is to apply an appropriate epoxy to bring the prop back to its original size and shape.

Because composite blades are never filed down in the process of repairing damage, as are metal blades, composite prop blade life is essentially infinite. Hartzell's V.P. of sales and product support, Gary Chafin, told us that some turboprop airliners using Hartzell props have blades that have more than 50,000 hours in service.

TBO of a composite prop is comparable to metal props, however, the owner of a composite prop is never going to get the call from the prop shop telling her that the blades have been filed enough that they are undersized and have to be replaced.

Hartzell's Chafin said that composite props are proving especially valuable in operations where the aircraft has a high utilization rate and repairs for nicks and dings can be handled at out stations when the aircraft is parked during the night, such as on commuter airlines and in bush operations.

Overhaul of a composite prop is similar to that of a constant-speed metal prop.

A side benefit of some MT composite propellers is that in the event of a prop strike, the blade may simply break off and not damage the engine (although a teardown is usually required).

Hartzell's Chafin told us that a composite prop can be thought of as a tuning fork. By changing the diameter of the threads of the composite material, and the direction of the weave, the natural frequency of the propeller can be adjusted to the most desirable area for the engine-propeller combination. That has the effect of increasing the life of the engine. In addition, the wood or foam core of the blade absorbs some vibration.

MORE BLADES

Another benefit of the weight saving of composite blades is that an additional blade or two can be added without exceeding the weight of the original, metal propeller. In addition to just plain looking cool, if designed correctly, more blades can provide multiple benefits: better performance, reduced vibration, reduced noise and greater ground clearance.

About 20 years ago, as the popularity of three-blade metal propellers to replace factory original two-blade propellers grew, we at *Aviation Consumer* surveyed owners regarding the phenomenon. We reported on it twice, more recently in the August 2005 issue. Our overall conclusion was that most owners bought three-blade propellers because more blades were more attractive than fewer. While many reported better initial acceleration and climb as well as less vibration, most said that cruise speed was either the same or they had lost a few knots versus the two-blade prop on the airplane previously. By and large, however, performance didn't matter—esthetics did.

Performance did matter to prop manufacturers and they found

that a scimitar shape—sweeping the blades—fixed the cruise speed problem. With the ability to precisely shape the airfoil and allow some fairly radical blade sweep, we have not heard reports of cruise speed loss when owners switch to composite props with an additional blade. To the contrary, it appears that the more precisely molded, multiple-blade composite props are able to convert more of the engine's power to thrust, improving all areas of performance while looking very good.

As the engine's power pulses are spread over more blades, adding a blade reduces the momentary loads on the airframe, a benefit for airframe life.

HARTZELL

Hartzell marketed its first composite propeller in 1978 for the CASA 212—it was constructed using a prepreg layup system. This was the first of what it now calls its legacy composite props, which are still in production. A metal shank is bonded into a foam core. The core is covered with a hand laid up prepreg material (originally Kevlar, now carbon fiber) and then the assembly is put into a press. Following the curing process, there are a number of operations, including bonding on a nickel erosion shield.

This creates what Gary Chafin referred to as a structural composite—a semi-monocoque, stressed shell structure.

In 2006, Hartzell developed its Advance Structural Composite (ASC) II propeller for the Cirrus SR22T. It uses a dry carbon fiber lay up, rather than prepreg. A sock is pulled over the foam core and a vacuum-assisted resin transfer process pulls the resin through the dry fibers in the mold. It also allows molding in the items that must be added post cure in the legacy props.

Once an ASC II propeller comes out of the mold, all that remains to be done is remove the flashing and add the finish coatings—cutting production time and cost substantially.

Chafin said that Hartzell originally developed its composite props for the airline industry because it could afford the development costs and badly needed propellers that could be repaired at out stations after suffering the kind of damage that routinely occurs in high-usage operations, such as being bumped by a baggage cart.

Composite technology combined with a nickel erosion shield—according to Chafin, it's five times stronger than steel—meant that blade life is almost infinite.

The use of computational fluid dynamics (CFD) has allowed Hartzell to optimize prop shape, notably at the inboard end, to get more boost from its props and performance from the airplanes on which they are installed.

Hartzell composite props are available for a wide range of piston- and turbine-powered airplanes—check with Hartzell to see if one is available for your airplane. The information is not presented on its website, something that surprised us.

Contact Hartzell to get specific pricing for its composite props, however, we were told that for the Mooney Acclaim series prices run between $22,900 and $25,000, depending on ice protection. That compares with $12,700 to $13,300 for a three-blade aluminum scimitar prop. A three-blade composite prop for a Cirrus SR-22 is $33,235; a two-blade for a Husky is $23,075.

Chafin said that Hartzell has ramped up its certification of composite propellers, doubling the number each of the last few years. In the future it will be developing more props for Rotax engines as well as geared diesels.

MT-PROPELLERS

MT-Propeller builds natural composite propellers. They are not structural composite propellers like Hartzell and McCauley, but highly compressed, layered, laminated beech and spruce wood reinforced with layers of epoxy fiberglass, Kevlar or carbon fiber and sealed with acrylic-

BACK IT UP

One of the bugaboos of operating most seaplanes is that once the engine is running, the seaplane is moving forward. To stop moving, you have to either shut the engine off or hit something—neither of which may be desirable. Maneuvering a seaplane in tight quarters, especially when there is a wind blowing or current flowing, can be challenging at the least and expensive if things get out of hand.

Being able to shift the prop into reverse makes a huge difference in the pilot's ability to maneuver a seaplane—yet while common on turboprops, other than the less-than-reliable system on the original Republic Seabees, few piston-powered seaplanes have reversible propellers.

That was the case until recently. There is now an STC for reversible MT propellers for an increasing number of seaplanes. Beginning with the Aviat Husky and Piper Super Cub on floats and the Lake Amphibian, seaplane operators can now buy and install reversible propellers.

Peter Marshall of MT-Propellers USA, said that STCs for the Cessna 180, 182 and 185 on floats are expected soon.

The reversible MT propeller has a single-piece aluminum hub that is corrosion protected and can be painted. The spinner dome is a single-piece unit made of fiber-reinforced Kevlar that is advertised as crack resistant and can is available with a chrome finish.

According to MT's Marshall, there are a number of safety devices and warnings to prevent the prop from reversing in flight.

McCauley's new Black Mac Carbon composite prop on a Cessna 400. Inset is a cutaway drawing of the base of the McCauley blade showing the foam core and blade retention system.

polyurethane paint. An aluminum blade ferrule is attached to the wooden blade root with lag screws. The leading edge has erosion strips of either nickel or steel outboard and a self-adhesive PU strip inboard.

The composite covering of the wood allows precise shaping of the airfoil to maximize performance. Overall, MT props weigh from five to 20 pounds less than comparable aluminum props.

Originally building their lightweight props for aerobatic airplanes, MT almost immediately expanded into turboprops and then into piston airplanes—it now makes composite propellers for a substantial portion of the general aviation fleet, including those that use fixed-pitch props as well as a number of vintage airplanes, such as the Boeing Stearman. As we were researching this article, it seemed as if the STC list on MT-Propeller's website added an airplane every few weeks.

As with other composite props, MT blades have no life limit and are field repairable in accordance with the manufacturer's guidance.

We noted that MT has aggressively gone the route of adding a blade to its props—where the aluminum factory original airplane had two blades, MT offers a three-blade; where the original was a three-blade, MT offers a four-blade replacement.

For pricing, it's necessary to contact MT-Propeller USA. We did a check on a few airplanes: For a Diamond DA-20, $2850; Cessna 182, $12,500; Piper Cherokee Arrow, $12,000 and Beech Baron, $39,000 for a pair.

McCAULEY

Shortly after the Cessna Skycatcher came out, McCauley developed and received ASTM approval for a composite prop that weighed about half what the aluminum propeller did.

In April of this year, it received FAA certification under Part 35 for its first composite propeller targeted at Part 23 (and CAR 3) piston-engine airplanes of up to 350 horsepower. With three blades and weighing a whopping 35 pounds less than its aluminum competition (only 45 pounds installed), the McCauley Black Mac Carbon prop is the lightest of the composite propellers in its class.

McCauley Propeller Systems business leader Scott Howell told us that it is in the "tail end" of the process of receiving STCs for a number of high-performance, single-engine airplanes, including the Cirrus SR-22.

The propeller is a structural composite, with an engineered plastic shank (think roller skate wheel material) with a patented retention system that is a continuous carbon loop around a stainless steel ring. A high-density foam core is covered with carbon fiber making a semi-monocoque structure. There is a full-length nickel leading edge erosion strip that is field replaceable. It uses the standard, oil-filled, single-piece McCauley hub. Overhaul interval is 2400 hours or six years. The propeller is flanged for Continental engines, but Howell told us that they anticipate developing a version for Lycoming engines as well.

In April, the base price was announced as $18,000, although we suspect that number will change.

Over the next few months we expect to see McCauley identifying the airplanes on which the prop has been approved for installation.

CONCLUSION

We think the benefits of a composite propeller upgrade are convincing enough to justify the sizable price premium over traditional props—especially if you plan to keep the aircraft for a long time. These benefits include reduced weight and vibration, better noise reduction, longer service life and decent ramp appeal.

CONTACTS

Hartzell Propeller
800-942-7767
www.hartzellprop.com

McCauley Propeller Systems
800-621-7767
www.mccauleytextron.com

MT-Propeller
386-736-7762
www.mt-propeller.com

Aircraft Finance: A Good Time to Buy

Loan rates are as low as they've been in convenient memory—and look to stay that way for at least the next several months.

by Rick Durden

With the stock market in record territory, the economy still hesitant and fuel prices lower than in convenient memory, we decided to take a look at the state of the aircraft finance world. The Federal Reserve has kept the interest rates at historic lows—has that been reflected in available loan rates for aircraft purchases? Is this a good time to finance an airplane?

The short answer is yes—if you have a credit rating of at least 700, you should be able to qualify for a 20-year, fixed-rate aircraft loan at an annual rate in the sub five percent range. We think that's very attractive.

A bright spot in the recurring gloom and doom we hear in the world of general aviation is that the aircraft finance world is alive, well and banks are competing for customers who want loans to buy airplanes. Jim Blessing, principal of Airfleet Capital, Inc., an aircraft finance broker in Chandler, Arizona, told us that "banks are entering or returning to the aircraft finance market—it's a great environment for buyers." He said that aircraft loan approval rates are back up to where they were in 1997. With interest rates holding at historic low levels, we thought the comment of Bob Howe, president of the country's oldest aircraft finance broker, Dorr Aviation, was telling: "A bad deal in this market is still a great deal."

Dan Garzelloni, head of Mile High Aircraft Finance, explained to us that piston airplane buyers should be able to find a 20-year, fixed-rate loan at an interest rate of just under five percent with as little as 15 percent down. He said that turbine buyers should be able to find five-year, fixed-rate loans amortized over 15 to 20 years, depending on the age of the aircraft.

All of the brokers we spoke with said that even though the current, very low rates have been place for five years and every popular publication has someone who will forecast skyrocketing interest rates to come, things look stable. The Fed has signaled that it may raise the prime rate on lending sometime this year, although it has delayed doing so because economic growth has remained stubbornly slow. According to the brokers, the aircraft lending market looks as it will remain favorable to buyers for at least the next several months.

The one change in the aircraft market over the last year reported to us by the finance brokers was that the percentage of cash sales for airplanes versus financed sales has dropped slightly. In the last 10 years, cash purchases—or some alternative financing such as business loans—have accounted for 65 to 75 percent of sales, with only 25 to 35 percent being financed. The reason was believed to be that because the stock market was sluggish, it was better to put the cash into a durable good. However, in the last year as return on investments has improved, more buyers who would have used cash to buy an airplane are now getting a loan at four percent and putting their cash into the market where they can get a six percent, or better, return. Nevertheless, cash sales still account for the majority of aircraft purchases.

Loan rates are low; now is a good time to finance an aircraft purchase.

EARLY APPROVAL

Jim Blessing encouraged potential buyers, and we strongly agree, to get pre-approved for a loan before

CHECKLIST

- Fixed-rate loans at under five percent are available for piston aircraft.
- Early approval can lock in a loan rate while you find the right airplane.
- Aircraft finance brokers and banks will compete for your business.

FINANCIAL STATEMENT AND APPLICATION – SECTION I

Borrower: _____
Co-Borrower: _____
Address: _____
City: _____ **State:** _____ **Zip:** _____
Number Years this address: _____
Previous Address if less than 3 Years at current address.
Address: _____
City: _____ **State:** _____ **Zip:** _____
Phone Number: _____ **Email:** _____
Social Security # and Tax ID if self employed: _____

Employer: _____
Employer Address: _____
City: _____ **State:** _____ **Zip:** _____
Phone Number: _____
Position or Occupation: _____ **Years In Position:** _____

Salary (Include Bonus and or Commissions):	**$**_____
Dividends:	$_____
Rental Income:	$_____
Other Income: (Specify)	$_____
Total Income:	$_____
Total Last Year Income:	$_____
Are you obligated to pay alimony or child support: __Yes __No Amount:	$_____
Income Tax Settled through:	$_____

Have You ever Declared Bankruptcy: ___ Yes __ No
Are you a defendant in any legal actions: ___ Yes ___No

Assets:		**Liabilities:**	
Bank Accounts:	$_____	Notes payable to Banks and others:	$_____
Government and marketable Securities:	$_____	Mortgage(s) payable:	$_____
Privately Owned Companies:	$_____	Unpaid Income Tax State:	$_____
Partial Interest in Real estate:	$_____	Federal:	$_____
Real estate Owned:	$_____		
Cash Surrender Value of Life Insurance:	$_____	Credit Card or Charge accounts:	$_____
Personal Property:	$_____	Installment Debt:	$_____
Other Assets: (List)		Other Debt: (List)	
_____	$_____	_____	$_____
_____	$_____	_____	$_____
_____	$_____	_____	$_____

Total Assets: **$**_____ **Total Liabilities:** **$**_____

Total Assets less Liabilities: $ _____

Do you have any contingent liabilities or a co-maker on any loans: ___ Yes __ No
If yes explain: _____

Page one of the standard aircraft loan application form.

settling on a specific airplane to buy. Early approval has at least two benefits: It locks in the interest rate for 30 days—a positive if there is a concern about rates going up. It also allows the buyer to move fast when a suitable airplane is found—which may be important if another potential buyer shows up with cash.

PROCEDURE

So, if you have decided that it's time to get into the world of aircraft ownership and you will need to finance the purchase, how do you do it? The chances are that your local bank doesn't make aircraft loans—even if it does, the odds are that the person writing the loan doesn't know a Cirrus SR22 from a Pilatus PC-12 and can't effectively value the specific airplane you have your eye on, especially if it's an older piston single or has had a substantial refurb to bring it up to nearly new standards.

FINANCE BROKERS

We recommend going through and taking advantage of the expertise of an established aircraft finance broker. It's akin to working with an insurance broker—an aircraft finance broker learns about your specifics and shops the market of banks that make aircraft loans to find the best deal for you. The lender, not you, pays the broker's fee.

We agree with Dorr Aviation's Bob Howe who recommended that a buyer contact three or four finance brokers and find out how long they have been in the business and what their experience is with placing loans for the type of airplane you want to buy. Disclose to the brokers that you are talking with other brokers. They will go to bat for you and they will compete for your business.

You'll need to fill out an aircraft loan application—the form is pretty standard. The information required is more involved than financing a car, but less than a house. Plan on providing your income/earnings information, several months of bank statements and at least two years of tax returns. It won't be like applying during the housing bubble where you could just claim you had a solid income—you'll have to prove it and the banks will check.

Provide your finance information to the broker in a package—the way to really mess up a loan application is to provide documentation piecemeal.

Remember that every time someone pulls your credit report, your credit rating takes a five-point hit. Even though a broker may shop your loan to a dozen banks, the broker gets your credit report one time, so it's only one hit per broker, not one hit per bank—unless you don't use a broker and apply to several banks.

With loan approval in hand you can find the right airplane, let the broker know, see the airplane through the pre-buy examination and close on the deal in as little as two or three days. The finance broker will help you through the process.

The one sticking point reported to us by brokers is that some banks rely heavily on aircraft valuations in *Vref* or the *Aircraft Blue Book*.

We were told that on some airplanes, those valuations are too low—particularly on refurbished airplanes. The result is that the bank may only be willing to loan 85 percent of the "book" value, so the buyer has to make a larger down payment, or the broker brings in a consultant with expertise in the value of the particular type of airplane (finance brokers told us that they thought the Pilatus PC-12, Cessna 210 and late-model Bonanzas were currently undervalued).

CONCLUSION

It's a buyer's market in the aircraft finance world—if you're ready to buy, it's a good time to get a loan.

Display Upkeep: iCloth Safe, Effective

Avionics manufacturers have specific instructions for cleaning display lenses, but new specialty products claim to be superior. We put them to the test.

by Larry Anglisano

Here's a valuable lesson one pilot learned the hard way: commercial-grade glass cleaners and avionics display lenses are an expensive combination.

Of course, if he read the pilot's guide for the new Aspen, Garmin and Avidyne flight displays installed in his panel, he would have left the Windex at home.

But there are several new products on the market which claim to safely clean and protect avionics and tablet displays. Are they safe? To find out, we put some serious money on the line and gave them a try. We also asked manufacturers for official guidance on cleaning displays.

MANUFACTURER CAVEATS

Consider that the display lenses (the lens is the outer surface covering the actual display) on most modern avionics displays are manufactured with an antiglare and anti-reflective coating. While most do a good job of cutting sun glare and reflections, none succeed at resisting smudges from your sweaty, oily fingers. Got touchscreen? You understand the challenges of keeping it clean.

We asked several avionics manufacturers if they recognize any of the specialized cleaners as a safe and effective means of caring for displays. None of the products we rounded up were condoned or condemned. Instead, they referred us to the official cleaning instructions stated in the product operating guides.

For instance, Aspen Avionics pointed us to page 2-21 of its Evolution PFD pilot's guide, which cautions that using any chemical or material other than isopropyl alcohol will void the product warranty. The manual warns that the PFD display lens is prone to damage from scratches, smudging and clouding from cleaning agents and abrasive cloths.

Instead, Aspen says to only clean the display (when the power is off) by using a lint-free cloth dampened with a 50/50 solution of isopropyl alcohol and water, a premoistened lens cleaning tissue (it says to use Bausch & Lomb Sight Savers) or a cleaning solution made specifically for LCD displays. A replacement display lens for a single Evolution PFD or MFD is approximately $800.

CHECKLIST

- iCloth's isopropyl-soaked DuPont aerospace-grade cloths worked the best.
- Display lenses aren't covered under manufacturer's warranty.
- Be careful using eyeglass lens sprays and wipes. They could scratch and fog coated display lenses.

Just because a cleaning product is safe for eyeglasses and computer screens doesn't mean it won't trash a panel display. We carefully tried a handful of products with varying results.

The iCloth antistatic non-linting cleaning wipe, top, was designed specifically for aerospace applications. Someone hit the Garmin GNS430 lens, bottom, with a harsh chemical. A factory repair will approach $1000.

Avidyne has similar caveats for all of its display lenses, including the new touchscreen IFD540 navigator and larger Entegra glass displays. These too have an antiglare and antireflective coating. Avidyne says to use a lint-free 3M Ultra-Brite 2011 Cloth and a cleaning solution composed of deionized water or isopropyl alcohol.

For the touchscreen on its IFD540, it goes on to say that methanol and other acidic solutions can damage the optical filter display surface, as can excessive or unnecessary cleaning. Additionally, it warns to never allow excess amounts of cleaning agents to dry if they have formed into pools, streaks or droplets. This avoids spotting of the glass surface.

Here's an important caveat: "The use of any third-party screen protector, especially those that adhere directly to the IFD display glass, is not endorsed by Avidyne due to the touchscreen nature of the display and may void the warranty for any display related issue." Previous cleaning kits supplied by Avidyne include the ammonia-free Sparkle household glass cleaning product made by AJ Funk.

Garmin supplies a microfiber cleaning cloth with its GTN-series touch navigators. These units have a Clean Screen mode which makes the touchscreen inactive for cleaning. Garmin advises to use a soft cloth dampened with clean water, or the supplied cloth.

In our trials, some of the eyeglass cleaning spray and wipes we sourced left a haze on the coated lens. Further, we found that most of the dampened optical wipes were made of a harsh, paper-like material. These created tiny surface scratches, especially as the wipe dried. We advise not to use them on avionics lenses.

During our research, we spotted the pre-cut screen protectors sold by Sporty's, so we ordered one ($20) to try on a Garmin GNS530. This is a peel-and-stick antireflective adhesive film (it is removable) which has good scratch-resistant properties. It was a pain in the shorts to put on and we think it slightly reduces screen readability. The product is available for a wide variety of portable and panel displays, including the G1000. As we describe in the sidebar on page 23, these covers could void the warranty on an Avidyne display.

PURPOSED PRODUCTS

iCloth Avionics has been making cleaning products for sensitive optical surfaces since 2001, first for eyewear and eventually for the entertainment screens and flight deck displays in major airline fleets.

The iCloths are individually wrapped wipes premoistened with a proprietary cleaning solution (the company wouldn't disclose the exact solution) consisting of purified water, less than one percent surfactants and isopropyl alcohol. iCloth Avionics says the wipes—which are the aerospace-grade DuPont Sontara cleaning towels—are safe on polycarbonate, glass, plastics and specially coated lenses.

iCloth says a single 5x7-inch cloth is soaked with enough moisture to wipe one side of an airliner flight deck avionics suite, plus a pilot's eyeglasses. In our trials, the wipe was barely moist enough to clean an Avidyne MFD and two Garmin GNS430 navigators. To be fair, these screens were filthy after we purposely smeared sweaty and greasy hands across the display. Additionally, the screens were coated with a fairly thick layer of tree pollen, so we worked the wipe pretty hard. On a cleaner display littered with some fingerprints, a fresh iCloth dried quickly and didn't leave any streaking or fogging.

It's worth noting that there is a correct process for using these and any wipes on a display lens. It's important to not apply too much pressure on the lens, or rub in a circular motion because surface contaminants will scratch it.

iCloth advises to first remove visible surface debris with the folded edge of the wipe when you remove it from the package (roughly the size of a condom wrapper), and then unfold it for the final swipe.

Once the wipe dries we found that it wasn't as effective, creating some smudging. iCloth's Peter Hartlen cautions that a dry cloth won't absorb surface debris, essentially becoming a microfiber towel—polishing the debris back into the screen.

As for microfiber cloths, there is reason not to use them on coated lenses. While they are effective the first time you use them, they need to be cleaned before every use. Who has time for that?

A pack of 48 iCloth wipes sells for $24.99, or $34.99 for 100 wipes. If you want to buy in bulk, a pack of 500 is $129.99. We found them on Amazon.com for a bit cheaper.

Another avionics/tablet computer prepackaged cleaning product is the ArmorWipe sold by MyGoFlight. These wipes are made of a spun, lint-free soft fabric that MyGoFlight says is similar to the 3M aviation cloth.

AVIDYNE'S UPDATED WARRANTY: GLASS EXCLUDED

Avidyne once had a glass and bezel refurbishment add-on for its AeroPlan extended warranty, but it says that glass and bezel restoration coverage is now excluded from all Avidyne warranty plans. In fact, even if you do send a unit in for warranty repair, Avidyne will likely charge an additional fee to replace the bezel glass.

According to the terms of AeroPlan, additional charges may apply for products that have been subject to excessive wear and tear. When it comes to bezel glass, this applies to just about every imperfection—scratches, discoloration and worn lens coating that might be the result of improper cleaning. That's enough incentive for us to be extra careful while cleaning the displays. The repair bill will be real money.

For example, glass and bezel restoration for Avidyne's new IFD540 touchscreen navigator will cost an additional $1300—even if the unit is still covered under the new product warranty. The same pricing schedule applies to the EX600 aftermarket MFD, first generation 5000-series Entegra PFD and MFD. Glass and bezel restoration for the later Entegra R9 displays is $1500.

Some Avidyne owners have been performing their own display mods to remedy damaged lenses. The drill is to remove the original antiglare coating entirely (it's rumored that folks are hitting the lens with Armor All) and then installing plastic screen covers. While this might improve the appearance of the unit, Avidyne told us it is not an approved modification. This means if you send the unit back for repair, Avidyne won't return it to service with this unapproved field mod. In addition to the flat-rate repair cost, you'll have to pay full price for bezel restoration.

While on the topic of Avidyne's controversial AeroPlan warranty, which requires the buyers to sign an indemnity agreement stating they won't sue Avidyne after an accident (and agrees to pay all of the legal costs for Avidyne to defend the lawsuit and any settlement it has to pay), Avidyne now offers an out. It added an opt-out clause allowing any customer who has signed up for AeroPlan a 30-day grace period to cancel the agreement, as long as they haven't used any benefits of the warranty. We'll revisit extended warranty plans in a future issue.

Bottom line? Trash an Avidyne display by improperly cleaning or modifying it and you'll have to eat the hefty cost of a replacement—warranty or not.

Unlike the iCloth, the ArmorWipe doesn't contain isopropyl alcohol. Instead, it has a mixture of Alkyl Polyglycoside (APG) and water. APG is a widely used non-toxic household cleaning agent that's effective at removing dirt by loosening it from the surface, while providing good anti-streaking characteristics.

The ArmorWipes ($9.99 for a box of 25 wipes) are similar in size to iCloth's DuPont Sontara wipe, but seem to be more saturated. In our evaluation, this created more pooling and liquid trails that required more wiping than the iCloth. Still, they didn't streak, cloud or leave any swirls on our test displays. MyGoFlight also sells the $9.99 ArmorWax. This is a liquid that you rub into the display with a fingertip and then buff it off. We didn't use it on our cockpit display, but instead on a few tablet computers and smartphones. It leaves the surface smooth and our sense is that it reduces smudges.

CONTACTS

iCloth Avionics
877-631-4111
www.iclothavionics.com

MyGoFlight
303-364-7400
www.mygoflight.com

Sporty's Pilot Shop
800-776-7897
www.sportys.com

DO YOU REALLY NEED THESE PRODUCTS?

In our estimation, we think they are inexpensive and convenient enough to make it worth the effort. If you are germophobic, you'll appreciate the Benzalkonium Chloride antibacterial added in the ArmorWipes, the same agent used in hand sanitizers. We do.

Remember, how you clean the display is about as important as the products you use. Push too hard—grinding in surface debris—and you'll damage a lens, no matter how safe the cleanser is.

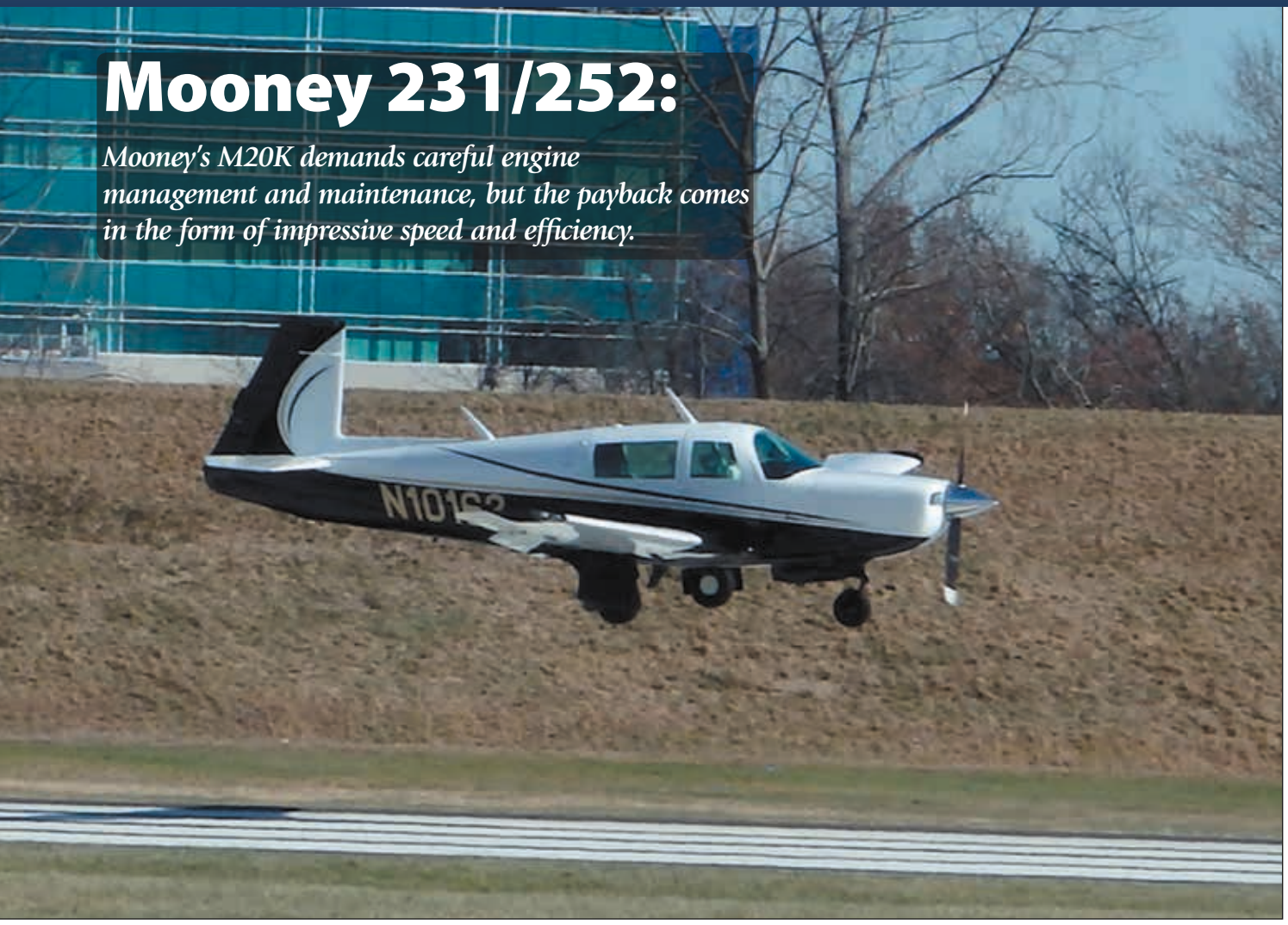
We like that the iCloth and ArmorWipe products are conveniently packaged and can serve double-duty for cleaning other stuff in and outside of the cockpit. We used them on instruments, rocker switches, radio bezels, side windows, on an expensive motorcycle helmet face shield and on sunglasses, with good results.

If we had to pick one product over the other, we would choose the iCloth. We're mainly sold on the commercially approved DuPont cleaning towel iCloth uses, which seems softer than the MyGoFlight's. The benefit here is potentially less screen damage when the cloth dries.

Alternatively, carefully follow the manufacturer's cleaning instructions we outlined here, while avoiding eyeglass cleaning sprays and harsh wipes. Ultimately, this could be the best way to avoid writing a big check for a new display.

Mooney 231/252:

Mooney's M20K demands careful engine management and maintenance, but the payback comes in the form of impressive speed and efficiency.



If age mellows people, the same might be said for airplanes, at least if the airplane in question is Mooney's M20K series. The airplane arrived in the GA market at a time when turbocharging was relatively new and the demand for high-flying aircraft was thin.

Mooney didn't get the M20K's turbocharging system right on the first try and the airplane developed a reputation as a maintenance hog. Thirty years later, that reputation has been mostly burnished and the fact that the M20K bores along between 160 and 200 knots on relatively little fuel has improved the model's used price.

Still, the cabin is small and with a single door, hard to get into. For that reason and others, Mooneys have a bit of cult status to them. They are in no way everyman's airplane in the way that a Cessna or a Piper is. But if cruising fast yet miserly is your desire, the M20K models—the 231, the 252 and the Encore—are strong contenders.

MODEL HISTORY

Mooney came into the turbocharging game relatively late compared to other manufacturers. In 1966, Cessna pioneered the market with the T210 and made a strong showing in the single-engine, high-altitude market. Beech brought out the V35TC in 1966, but it was never as strong a seller as the A36.

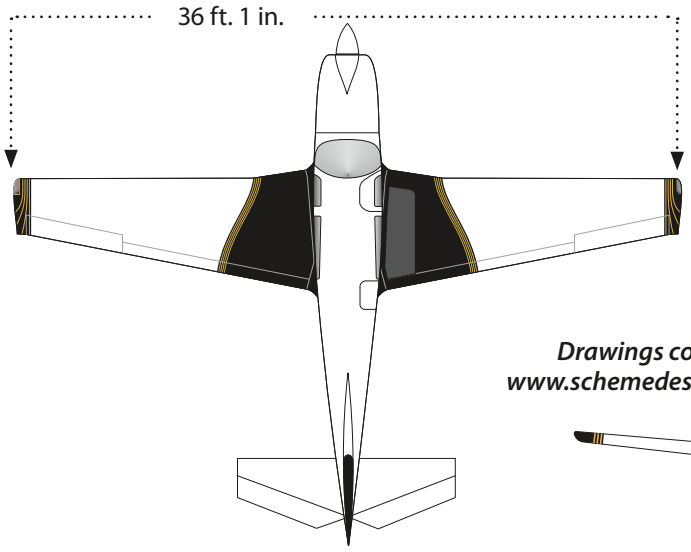
The 231 lives in a league of its own when measured against the narrow market segment of four-place, turbo retractables.

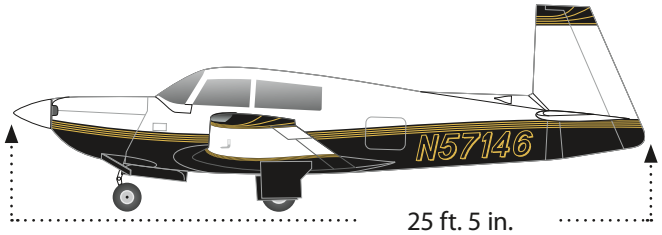
Mooney wasn't completely flat footed during the 1960s, introducing the 310-HP M22 Mustang in 1967, a big brute of an airplane that was, to some, as ugly as it was unsuccessful.

Through the 1970s, Mooney did well with small, efficient airplanes powered by Lycoming four-bangers. Mooney's big breakthrough came in 1977, when the M20J 201 was introduced as the fruit of a clever Roy LoPresti-led aerodynamic cleanup of the venerable F-model. The 201—named for its maximum speed in miles per hour—marked a turning point for Mooney, even if the claimed speed was somewhat optimistic. In 1977, Piper had the Turbo Arrow and Mooney realized it needed to compete in this market.

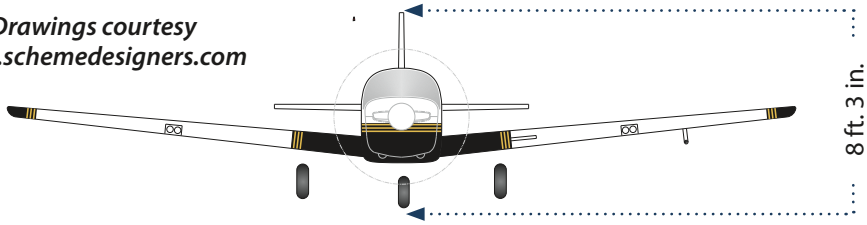
Every Mooney pilot should do what Tony Crespi is doing in his model 231—practice landings, main photo. Proficiency is the key to avoiding runway prangs.

MOONEY 231/252





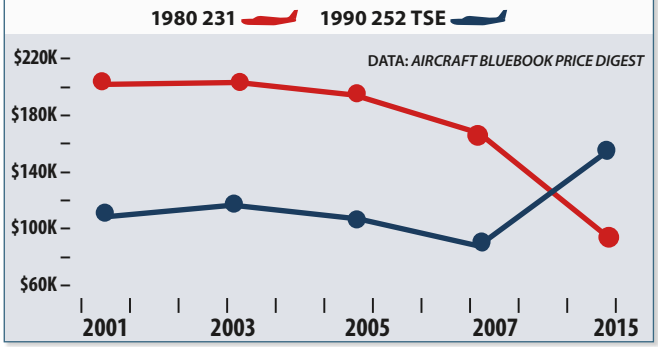
Drawings courtesy www.schemedesigners.com



MOONEY 231/252 MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1979-1980 231 (M20K)	210-HP TCM TSIO-360-GB	1800	$40,000	75	1100	191 KTS	±$81,000
1981-1983 231 (M20K)	210-HP TCM TSIO-360-GB	1800	$40,000	75	1100	191 KTS	±$88,000
1984-1985 231 (M20K)	210-HP TCM TSIO-360-LB1B	1800	$40,000	75	1100	191 KTS	±$98,000
1985 231 L/M (M20K)	210-HP TCM TSIO-360-LB1B	1800	$40,000	75	1100	191 KTS	±$74,000
1986-1987 252TSE (M20K)	210-HP TCM TSIO-360-MB1	1800	$40,000	75	1100	201 KTS	±$125,000
1988-1989 252TSE (M20K)	210-HP TCM TSIO-360-MB1	1800	$40,000	75	1100	201 KTS	±$145,000
1990 252 TSE	210-HP TCM TSIO-360-MB1	1800	$40,000	75	1100	201 KTS	±$160,000
1997-1998 M20K ENCORE	220-HP TCM TSIO-360-SB	1800	$45,000	80	1100	197 KTS	±$172,000

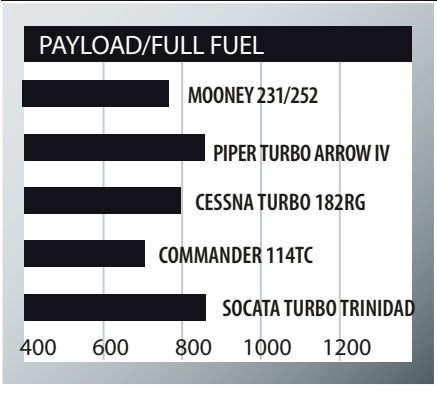
MOONEY 231/252 RESALE VALUES

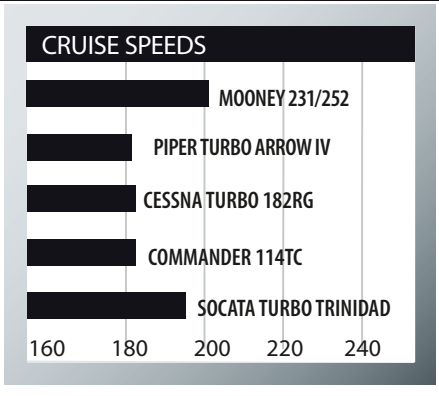


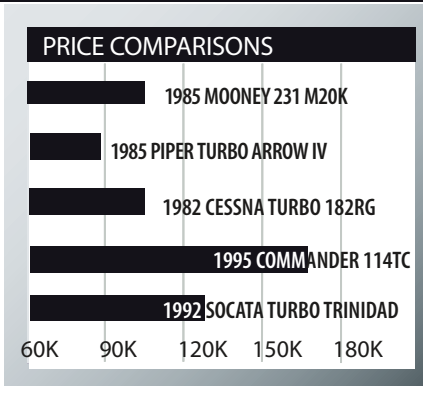
SELECT HISTORICAL ADs

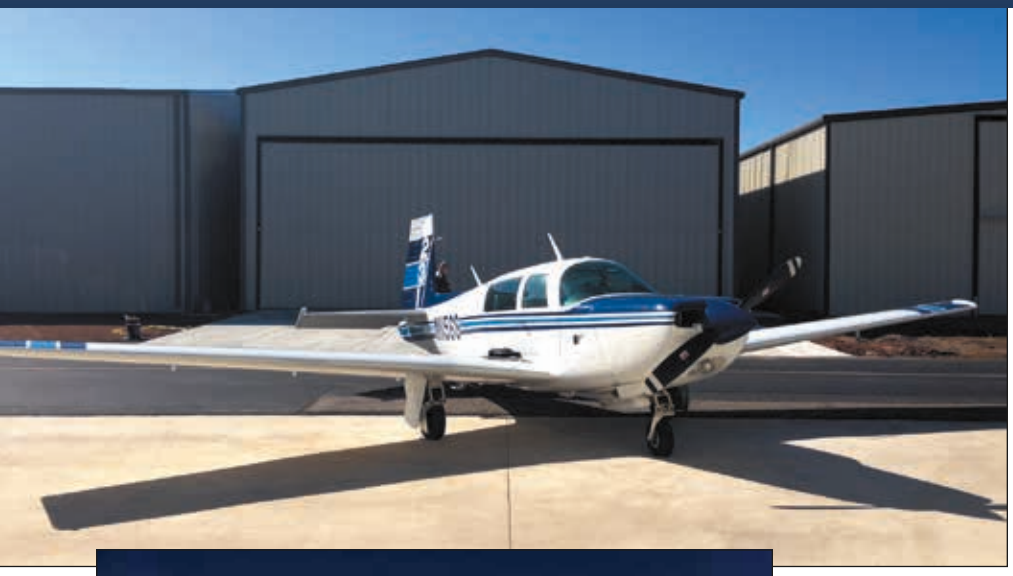
AD 2009-24-52	INSPECT/REPLACE RECENTLY INSTALLED HYDRAULIC VALVE LIFTERS
AD 98-24-11	INSPECT AILERON CONTROL LINKS FOR GUSSET OR CRACKS
AD 98-21-26	INSPECT MAIN LANDING GEAR LEG BRACKET FOR CRACKS
AD 95-17-06	INSPECT ROCKET CONVERSION EXHAUST AND TURBO MOUNT FOR CRACKS

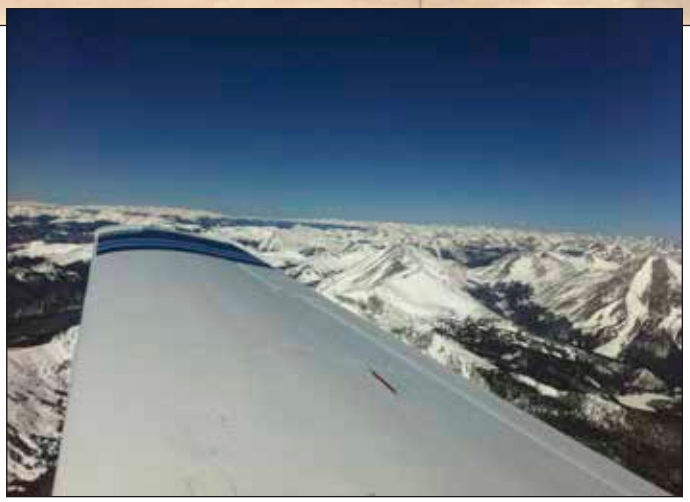
SELECT LATE-MODEL COMPARISONS











Mountain flying was the driving reason why Michael Williams bought his 1981 Mooney 231, top photo. He takes great pleasure in seeing 200-knot-plus groundspeeds as a bonus.

The result appeared in 1979 as the 231—again, named for its top speed—or M20K. It was essentially a 201 with a six-cylinder, 210-HP Continental TSIO-360-GB in place of the 201's 200-HP Lycoming IO-360.

The airframe had a lot going for it. It was strongly built of welded 4130 steel, the gear system was all but indestructible and the handling was mannerly, easily flown by a pilot with minimal retrac experience. By modern standards, Mooney had a smash hit on its hands. It sold 246 airplanes the first year, outdistancing the 201 by nearly two to one. The fact that the two airplanes were so similar simplified the build process and likely made the project profitable from the first year.

The differences are in minor aerodynamic refinements. The K-model's fuel capacity is 10 gallons more than the J-model, and both empty and gross weights are 160 pounds higher. Designwise, the 231 was exactly what the buyers were looking for: a turbocharged 201.

But if buyers were hoping for the 201's excellent dispatch rate, they got something less. Problems with the 231's Continental engine were several fold and hurt the model's initial reputation. The new cowling didn't cool the engine adequately; the fixed-wastegate turbo required constant attention and was easy to mismanage; overboosting and high heat put undue stress on the engine, and it was prone to cracking cylinders and cases.

The connecting rods were prone to failure and the original magnetos were unpressurized, and would arc at high altitude. On top of all this, the TBO of the first engines was a miserly 1400 hours, later upped to 1800 hours, where it still stands.

Even with all these faults—and they were considerable—some owners achieved impressive maintenance reliability by obsessive attention to operating technique. Specifically, that meant careful leaning and attention to cowl flaps and preventive maintenance of the turbo. But not all owners were so careful—premature engine crumps were common.

REFINEMENTS

With a couple of years of experience under its belt, Mooney undertook some improvements, adding a split rear cargo seat in 1982, while in 1984, a new variant of the engine—the LB1B, which is approved as a replacement for the GB—was introduced with better cooling and overboost protection. Mooney also included some aerodynamic tweaks that added 3 to 5 knots: sealed nose gear doors, a belly pan, a more streamlined tailcone and removal of one of the vent intakes. The alternate air intake system changed to address reports of icing-induced power loss.

While these fixes certainly helped, the improvements were hardly night and day. By 1986, further retooling produced the 252TSE for Turbo Special Edition. The 252, while still an M20K, is significantly different from the 231. Another variant of the engine was fitted, the -MB1. The induction and cooling systems were reworked and a new intercooled, density-controlled, variable wastegate AiResearch turbocharger replaced the original, fixed wastegate Rajay/Rotomaster unit. Other changes included infinitely adjustable electric cowl flaps to replace the original dual manual flaps. There was a vernier throttle control, more elbow room and new-look radiused windows.

The 231's original 60-amp, 14-volt electrical system was upgraded to a 70-amp, 28-volt system. This was much needed, since a fully loaded K-model could max out the electrics long before the days of moving maps. An electrically driven backup vacuum pump was made standard equipment.

The 252 also got further aerodynamic tweaking in the form of gear doors that fully enclose the wheels when retracted and cover the wells when the gear is extended. The 252 also got an increase in gear-extension speed to 140 knots, up from 132 knots. Maximum speed with gear extended is 165 knots for the 252. In all, 889 231s were produced between its introduction in 1979 and 1985. The 252, introduced in the middle of the GA slump of the 1980s, is less numerous. Production totaled, ironi-

Two rockets—the Rocket Engineering mod has a TSIO-520-NB with a three-blade, feathering propeller—and the 252TSE in 1980s marketing propoganda.

cally, 231 airplanes. The K-model made a brief resurgence in 1997 as the Encore, when Mooney was going through yet another of its many reorganizations. But it was not to be and the model was dropped again in 1998. Meanwhile, the so-called long-body models, specifically the M20M TLS and later the M20R Ovation and Acclaim eventually came to dominate the Mooney line.

PERFORMANCE

The K-model lives in a league of its own when measured against the narrow market segment of four-place, turbo retractables. At cruise, the 231 outstrips its competitors—the turbo Arrow, the 182 RG and Commander TC—by roughly 20 knots, despite the fact that the 231 MPH (196 knots) top speed isn't reachable under real-world conditions and probably at all.

Realistic max cruise is about 190 knots for the 231, but 170 to 175 knots is more like it. The 252 is about 10 knots faster, thanks to intercooling. Both M20Ks win the altitude battle as well, with a maximum operating altitude of 24,000 feet for the 231 and 28,000 feet for the 252, versus 20,000 feet for the Cessna and Piper. The Mooneys outclimb the others by about 150 FPM.

Due to physiological considerations, however, high teens to low 20s are the airplane's best envelope. At lower altitudes, turbocharged airplanes aren't much faster than their normally aspirated siblings.

In fact, the 231 is actually slower than the 201 below 8000 feet, due to cooling drag. The J-model will also outclimb the K-model below 8000 feet.

Many owners operate 252s conservatively. One owner told us that 65 percent power yields 170 knots at 10,000 feet and 200 knots at FL210, burning 11.5 GPH. The 231's numbers are proportionately lower at high altitudes, although the difference lessens the lower one goes.

With 75.6 gallons of usable fuel, the 252 can climb to FL280 and operate a total of 4.9 hours, or just under 990 nautical miles still-air range with reserves. The 231 has comparable range and endurance, but can't fly as high.

231/252: HOW THEY DIFFER

The improved powerplant installation makes for a significant operational difference between the 231 and 252. The engine still produces 210 HP, but it does so at a markedly lower manifold pressure: 36 inches for the 252 versus 40 inches for the 231, thanks to the improvements in the tuned induction, cooling and the turbo system.

The 252's induction and cooling air intakes are separate from one another. Induction air enters through a NACA scoop on the side of the cowling, is turned 90 degrees to minimize induction icing through inertial separation and passes through a larger, less-restrictive air filter. It's then compressed and run through a 42-square-inch intercooler.

The result is dramatically lower temperatures for the induction air, from 60 degrees F at lower altitudes to 120 degrees F up high. That means more power at higher altitudes and a wider detonation margin. The 231's critical altitude is only 14,000 feet, while the 252's critical altitude is 24,000 feet. In practical terms, this means that the 252 can continue to climb at about 1000 FPM into the mid-20s, can fly higher and is faster once up there.

The most important difference between the 231 and 252 lies in engine management. The revised powerplant installation in the 252 made an enormous difference and makes the 252 a more desirable airplane. Because the 231 has a fixed wastegate, the pilot must constantly

*The 231 is worthy of serious avionics upgrades. This is N40CC—*Aviation Consumer's *old ride—sporting a three-screen Aspen suite, S-TEC 55X autopilot and a Garmin GNS530W.*

monitor manifold pressure and fiddle with the throttle to keep it within limits. Bootstrapping and overboosting are constant worries. Thanks to its automatic wastegate, the 252 doesn't suffer these foibles.

HANDLING

The 231/252 series handle like typical Mooneys: relatively heavy in roll and pitch, with good stability. The K-models have greater pitch authority, thanks to a slightly larger elevator and the longer engine makes it somewhat nose heavy. That can make flaring a challenge with a forward CG, but nothing like, say, a Cessna 182.

Pitch change with gear extension/retraction is slight, but flap extension produces a nose-down moment. Transition from full flaps to trimmed for go-around takes heavy pressure on the yoke and fast action on the trim. Using the electric trim, anticipation of configuration changes helps reduce pilot effort.

Speed control is essential when approaching and landing any Mooney. Approach too fast and the K-model will float. Try to plant it on the ground and it will fight back, porpoising vigorously and striking the prop if uncorrected. This is a common accident for all Mooneys, not just the K-model.

Because of its ability to fly fast, some owners say the best addition ever devised for Mooneys are speed brakes. These are especially useful for the 231, which doesn't have the 252's higher gear limits. (Speed brakes are standard on 252s.)

Ground handling isn't great. The airplane is low slung and the Mooney's stretched-out seating position hinders visibility on the ground. It also makes gaining purchase on the brakes difficult. The wing span (36 feet, 1 inch), combined with the wide turning radius of 41 feet, makes negotiating a crowded ramp challenging. One other caution: Many Mooneys suffer damage to the nose gear trunion when towing turn limits are exceeded via power towing. Owners learn to watch the ramp rats carefully.

PAYLOAD/CABIN

On paper, the 231 and 252 have the same loading characteristics. In reality, however, the typical 252 weighs more, simply because it has more equipment. Neither airplane is a stellar load-hauler. Gross weight is 2900 pounds and basic empty weight is 1800 pounds, usually more. Real-world, full-fuel payloads are on the order of 400 to 500 pounds, making the M20K a useful two-place airplane, with generous baggage. Thanks to its fuel efficiency and good endurance, however, there's flexibility built into the load-carrying equation. The latest M20K, the Encore, has about 200 pounds of additional load, thanks to beefier landing gear. Staying within the CG is easy and there's no worry of attending CG as fuel is burned off.

The baggage compartment is large, with a capacity of 120 pounds, although the high sill door makes it difficult to wrestle large objects into the airplane. Baggage capacity can be increased by folding the rear seat backs down together or individually.

Mooneys are fast and efficient because they have low-drag airframes with a small frontal area. That translates into cramped quarters. The seating position is quite different from that of most airplanes. It's more of a sports-car posture than an upright seating regime. There's plenty of leg room fore and aft, but less lateral room. Those of below-average height may find that they can't reach the rudder pedals without a booster cushion behind their backs or pedal extensions.

Early Mooneys tended to be Spartan in interior arrangements. But by the time the 231/252 appeared, Mooney recognized the need for more modern if not luxurious appointments. Thanks to a bit more elbow room and somewhat plusher finish, the 252 is more comfortable than the 231. The 252 is also quieter and many feel it's the quietest of all Mooneys, thanks in part to the induction system and the fact that things quiet down the higher you fly.

The panel layout is quite good, with one seemingly obvious feature that has probably averted many incidents: The gear selector is located high in the middle of the panel so it's hard to miss. The flap switch is located low on the center console, along with the trim/flap indicators and, in the 252, cowl flap controls.

The power gauges are on the far right and angled toward the pilot. Engine gauges are well-placed, right under the glareshield in front of the pilot. The panel also has a good selection of annunciator lights at the top of the radio stack.

MAINTENANCE

Airframe-wise, Mooneys are relatively trouble-free. Long-standing caveats include the potential for corrosion of the cabin frame tubes—particularly if the windows develop leaks—and the typical fuel tank leaks that plague all Mooneys.

Systems in general are simple and robust. The steel gear legs gear have no oleo struts, relying instead on rubber donuts for shock absorption. These need to be replaced periodically. There's no complex electro-hydraulic system driving the gear as is found on Cessnas—Mooneys are electromechanical. The flaps, too, are electric, and both are relatively trouble-free.

The powerplant, however, is another matter. Difficulties fall into several categories: magnetos, con rods, cylinders and turbos. Most airplanes have been retrofitted with pressurized mags, but check any used model to be sure. The same applies to connecting rods. The suspect rods are Continental part number 626119 and have a C logo with a circle around it. Only a barn dweller would still have the old ones.

Many turbocharged models encounter mid-run cylinder problems of some sort and the K-model is no different. These include the full litany: worn valves and guides, broken rings and cracked jugs. Mid-time turbo and magneto replacements aren't uncommon, but they aren't a sure bet, either. The 231's fixed wastegate means the turbo is working constantly and the engine is susceptible to overboosting.

The 252 doesn't suffer these problems, although it had trouble with cracked tubes in the induction system before Continental came up with flexible tubing. Even though the 252's engine installation is less troublesome than the 231, temperatures and stresses on turbocharged engines are greater than on normally aspirated engines. Regular inspections and proactive maintenance is a must for reliable dispatch rates.

MODS/CLUBS

By far the most desirable mods for the 231 are those that make it more like the 252. These include intercoolers from Aircraft Modifications, Inc. (253-851-6440) and the Merlyn Black Magic upper deck controller; contact www.merlynproducts.com or 800-828-7500. Both work as advertised and help eliminate the 231's engine problems. They also make the 231 perform almost as well as a 252. We consider the Merlyn a must-have for the 231.

There are fewer speed mods for the K-model than for earlier Mooney types, such as the C, F and J models. Single-piece belly skins, minor speed mods, rudder and elevator hinge covers and oversized bushing kits for the nose gear are available from Lake Aero Style and Repair (www.lasar.com, 800-954-5619).

Precise Flight (www.preciseflight.com, 800-547-2558) offers speed brakes for the K-models. LoPresti Speed Merchants (www.speedmods.com, 800-859-4757) has an HID landing light for the K-model and hub caps with filler valve access holes Mod Works, another well-known Mooney house, retains some 39 STCs for Mooneys. However, the facility was wiped out during Hurricane Charley in 2004 and is out of operation indefinitely. Mod Works can still be reached at 941-637-6770.

A big-dollar mod, the Rocket conversion, replaces the TSIO-360 with a 305-HP Continental TSIO-520-NB, yielding 220-knot-plus cruise speeds. Although the conversion is discontinued, these turn up on the used market. Contact www.rocketengineering.com. The thirstier engine in that mod will benefit from larger fuel tanks. Monroy Aerospace (www.monroyaero.com) has an STC to raise capacity to 106 gallons. Hartzell offers three-blade prop conversions (www.hartzellprop.com).

Currently, there are two Mooney Associations, the Mooney Aircraft Pilots Association and Mooney Owners of America. Both have membership benefits, technical support and magazines. Contact MAPA at www.mooneypilots.com and MOA at www.mooneyowners.com.

OWNER FEEDBACK

I purchased my 1981 Mooney 231 when I lived in Colorado. A turbocharged plane was necessary to fly west over the mountains. This made it possible to go to Steamboat Springs for breakfast or lunch, plus it enabled a more direct route to Scottsdale, Arizona.

My 231 has built-in oxygen for all seats and a large oxygen bottle which must be periodically removed from the battery compartment for recertification. This is not an inexpensive proposition and may keep the airplane on the ground, or at least at lower altitudes, until it's accomplished.

MOONEY MISCUES: ENGINES, OTHER

Our scan of the last 100 Mooney 231 accidents revealed 22 engine power loss events—slightly over half of which were due to something being installed improperly. In most of the remainder, the cause could not be determined.

The 10 runway loss of control accidents were slightly below what we expect to see for nosewheel airplanes. However, about half of them were initiated by pilot induced oscillation events following a bounced landing—a high number. We also noted that virtually all of the accidents on go-arounds came about after the pilot had gone around because of PIO. With more than 15 accident chains that started with PIO, we think avoidance and recovery training is a good idea.

Only four accidents due to stalls isn't bad—two occurred on short final for landing and the circumstances of the other two led us to think that airframe icing was involved.

As is expected of retractable landing gear airplanes, a few pilots forgot to extend the gear. While a gear-up landing generally does not meet the NTSB's defiintion of reportable accident, four were reported. Unexpected good news was the almost total absence of gear collapse events—we found one report of a left main gear folding during rollout.

We did find one pilot who, sadly, managed to be the subject of two reports. After landing gear up, he pulled the damaged three-blade prop off of his modified 231. He provided a two-blade prop to the mechanic, who installed it and discovered the spinner would not fit. The mechanic refused to sign the airplane off for return to service. Another mechanic did an engine run and some homework, and found that the prop was not approved for the installation. He refused to sign off the airplane. The pilot then decided to ferry it elsewhere for the remaining repairs. Not long after takeoff, the prop came apart, tearing out five of the six retaining studs. The report stated that the engine-propeller combination was subjected to a "severe spectrum of cyclic loading."

Ten pilots either ran out of fuel or didn't select the tank that had fuel in it. That's about par for the course for airplanes that can only draw from one fuel tank at a time.

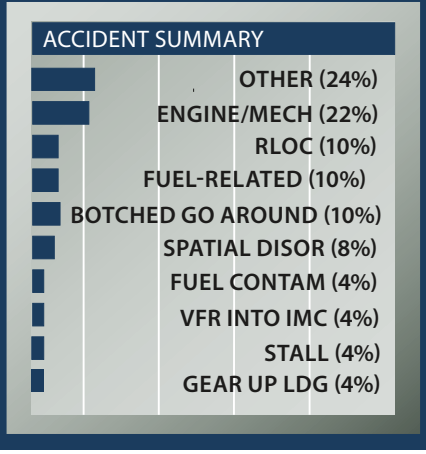
There were two inflight breakups. In both, reconstruction of radar data showed the pilots were flying well over redline.

We noted eight events that were pretty clearly spatial disorientation—all of the pilots were instrument rated. Two lost it on climbout on a missed approach. One pilot took off when visibility was but a quarter mile and the ceiling 100 feet. He got almost 350 feet above the ground before entering a descending spiral.

Two pilots continued descending on instrument approaches hoping to see something, and hit the ground. Four pilots tried to fly VFR in IMC and found they could do so for only a limited time.

A lineman fueling a 231 asked the pilot if he was going to remove the ice coating much of the airplane. The pilot said there "wasn't enough to make any difference." He and his passenger crashed shortly after takeoff.

A fire and explosion rocked a 231 shortly after a pilot had the FBO plug a 28-volt start cart into his airplane's 12-volt system.



One of the pleasures is seeing the GPS recording in excess of 200 knots ground speed returning from the mountains to the flatlands under normal power settings. Speed brakes are essential to come down from 17,000 without super cooling the engine. However, I used around 150 to 165 knots for normal flight planning.

Learning to land the Mooney was problematic for some reason. Coming in with half flaps and adding a little power prior to touchdown seemed to help, but I am still working on consistency without ballooning or dropping it in. Sometimes it is difficult to judge how high you are above the runway compared to other airplanes. The rudder pedals are small and one needs to make sure that you are not landing with your feet on the brakes.

Michael Williams
Horseshoe Bay, Texas

After renting Mooneys for almost 20 years, I became involved in a flying club that had Piper Cherokee 180s (108 knots on 8.2 GPH). My wife scared me on a Cherokee flight asking, "What's wrong with the plane?" After I checked everything, she responded that it was taking so long to arrive at our destination. That's why in 2001 we purchased a 1980 Mooney 231.

It has several upgrades, including a three-blade McCauley prop, electric standby vacuum pump, intercooler for the turbocharger, the Garmin GNS530/430 combination in lieu of the standard BendixKing radios and an Aspen PFD.

As this is primarily a go-higher, go-faster plane with a reputation for an engine that runs hot, I changed to GAMI fuel injectors and took out the old mechanical engine gauges after installing a JPI EDM930. The EDM930 is a critical change and allows me to operate LOP in cruise, which totally controls the propensity for hot CHTs. During ROP in cruise, it was not uncommon to see cylinders in the 385-425 degree range. Operating LOP, the temps are 345-380. Flying at 12,000 feet, LOP and at 65 percent power I experience 160-165 knots at 9.7-10.1 GPH. At 14,000 feet the fuel burn is almost the same, but the speed is bumped to 166-170 knots.

The fuel tanks on Mooneys seem to leak at 20-year intervals so I had mine resealed, while also adding two 20-gallon aux tanks. The fuel selector remains simple—left and right—so there is no added complexity. If I can accommodate the weight, I could fly 1400 NM nonstop. I make several six-hour nonstop trips a year from Tampa, Florida, to Traverse City, Michigan, on about 72-76 gallons (no-wind flight planning). That leaves plenty of fuel reserve.

Mechanically, the aircraft is very robust with major components like the landing gear requiring few if any repairs. The landing gear in all the Mooneys I've flown has been bulletproof; the electric gear is rapid actuating and useful to slow things in the pattern if the aircraft is not fitted with speed brakes. The K-model can be fitted with either long-range tanks or speed brakes, but not both.

Annual inspections are typically less than $1600 unless there is an issue (which thankfully hasn't happened in several years). Parts availability has always been good.

As it is hangared in Florida, I had the tubular steel structure checked for rust and corrosion and none was found. The aluminum had only two places of corrosion smaller than the size of a dime around the fuel filler cap. The TSIO-360LB engine was a source of issues, including Continental cylinders which developed cracks between the valves and become nonrepairable. My current cylinders have over four years in service without a problem. Zephyr Engines here in Central Florida has been excellent both during and after the installation of the rebuilt engine, offering outstanding support.

Alternators (there is only one on the early 231 models) tend to be a sore spot and I have installed three in 10 years. It is the gear-driven design on the rear of the engine which is subject to heat. Finally, there is an STC for a modern model, which is much lighter and hopefully more durable.

As this is a slick, relatively high-performance machine, I take recurrent training offered through MAPA. It offers a two-day course in various locations, and the course and instructors are truly outstanding. If you plan to operate an aircraft like this, recurrent training is a must.

I really like my 231. It is fun to fly, it can fly approaches at 130-plus knots when required to sequence in with the jets, it is durable—with great parts availability—and it can sip gas (while LOP) and still make decent speeds.

Bob Cochell
Tampa, Florida

My Mooney 231, N10162, was originally showcased in a Mooney company product photo shoot. Purchased approximately eight years ago following an extensive renovation in Texas and ferried to Connecticut, I quickly completed type-specific training with local designated examiner Wally Moran. Our 231 had approximately 700 hours total time when we took delivery, plus it had new paint and a new interior.

We fly the airplane approximately 50 hours per year, and as an instrument-rated commercial pilot I typically complete a minimum of two IPCs annually, as well as at least one FAA Wings program phase.

We base the aircraft at Hartford Brainard Airport in Connecticut and have it maintained by Total Aircraft Maintenance on the field. N10162 boasts an intercooler, RayJay turbocharger, King KFC200 autopilot, a Garmin GNS430, plus an HSI system.

We make good use of the oxygen system, since the aircraft can cruise up to 24,000 feet. We typically cruise at 170 knots at 58 percent power while burning roughly 10.5 GPH.

The aircraft is always hangared. Including hangar fees, insurance, annual inspections, plus our careful attention to avionics and maintenance work, the hourly cost of operation is approximately $275.

With a comfortable interior—and with styling similar to a sports car—my wife Cheryl and I typically enjoy flights from Connecticut to Maine and Nantucket, Massachusetts. So far our longest flights have been to Michigan and Minnesota.

Like so many Mooney pilots we adore our 231's speed and efficiency. We live by the Mooney creed: We love to fly—fast.

Tony Crespi
Hartford, Connecticut

The Aviation Consumer

Transponders

(continued from page 7)

der, the STX360 has a built-in 978 MHz UAT transceiver, rather than 1090ES. This means it isn't a player for high-flyers. It can display textual FIS-B data and ADS-B traffic targets on its OLED screen. The transponder will also be equipped with a wireless output for displaying weather graphics on tablet computers. The downside? It lacks an internal WAAS GPS receiver, although Sandia said it is planning on a future GPS solution and a remote model to interface with third-party EFIS. Pricing is expected to be below $3500 when the STX360 is released early next year.

DECISION TIME

When it comes to transponders, one size does not fit all. Our advice is to carefully consider the transponder as you plan your ADS-B upgrade. That's easy if you plan to fly above 18,000 feet because you'll have no choice but to buy a 1090ES ADS-B model. For basic, non-ADS-B Mode A/C functions, we favor Sandia's STX165 for its generous features and low price. Shops we spoke with report a straight-forward installation process and good reliability.

When planning a 1090ES transponder upgrade, we think the existing WAAS GPS navigator should have some influence in the decision. Are you comfortable that a third-party transponder will have long-term compatibility with the market-dominant Garmin navigators? While we have confidence that long-established and proven companies like Trig Avionics and Avidyne have the know-how to keep up with changing compatibilities, Garmin has made it clear that it designs products to work primarily in its own architecture. Shops know this and the ones we talked with reiterated that they don't want to be left holding the money bag should an interface it installs today is abandoned down the road.

If you already have a Garmin GTN750 or 650, our top pick is the GTX330ES (or remote GTX33 if you're out of panel space). For G1000 (WAAS) panels, the GTX33 is perhaps the only choice, and only if the OEM has approval in place for your specific model.

Just invested in an Avidyne IFD540 navigator? We think Avidyne's own AXP340 model is the best choice.

For specialty applications with limited panel space—including some gliders and even helicopters—consider a solution from German-manufacturer Becker Avionics. It makes a line of power-saving comm and transponder models designed to fit in 2-inch instrument cutouts.

Last, the safest solution for sure-thing long-term compatibility is a transponder that has standalone ADS-B compatibility, with its own WAAS GPS. If you don't want to drop the big bucks on L-3's feature-rich NGT9000, we think the self-contained and budget-focused Appareo ESG transponder is a solution worth waiting for.

LETTERS

(continued from page 2)

We learned a long time ago that just because a product excels in lab testing doesn't mean it's a favorite and an overall top value in the real world.

We do make use of controlled laboratory and bench/shop testing when appropriate, as we did in the HID/LED comparison article and many others.

When it comes to a product as personal as a headset, we think judging its control set, comfort, appearance, the way it fits with and without eyeglasses and ballcaps, in addition to evaluating its ANR performance in a variety of aircraft is far more telling than relying on lab testing alone.

That's why we assemble a diverse group of pilots and passengers to use them, we compile the data and rate them based on a variety of traits, including manufacturer-provided ANR circuitry specs, our own bench evaluation results and the results of their performance in the aircraft.

FEEDBACK WANTED

BEECH BARON 55

For the October 2015 issue of *Aviation Consumer,* our Used Aircraft Guide will be on the Beech Baron 55. We want to know what it's like to own these planes, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs (full-size, high-resolution) you'd like to share to the email below. We welcome information on mods, support organizations or any other comments. Send correspondence on the Baron 55 by August 1, 2015, to:

Aviation Consumer
e-mail at:
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