

The
consumer
resource for
pilots and
aircraft
owners

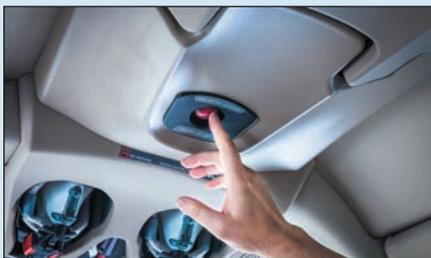


The Aviation Consumer®



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FIRST WORD

A GLIMPSE AT THE NEXT-GEN NAVION

Whether it's cars, motorcycles or airplanes, enough dough can make anything like-new again. But if you have classic cars in your hangar (and I know a lot of you do—keep the pics coming, I love old stuff) you know that a restored '59 Vette won't be a practical daily traveler. But classic airplanes can be, serving duty as the family ride to the vacation home, work meetings and fly-ins. Unimproved strip? Hot and heavy? There are plenty of classic airplanes that are up to the task if you are. But are they?

When we ran our field report on buying and owning classics and warbirds in the March 2020 *Aviation Consumer*, we got mail asking if it's realistic to join the

ranks of vintage aircraft ownership expecting new-Cirrus-like dispatch reliability. I used to think the answer was an affirmative no. Don't even try. Really old airplanes are hangar queens. But while preparing this month's used aircraft guide on the North American Navion, I changed my mind. The earliest Navions are old gals—70-something years—and account for the majority of the roughly 500 Navions still flying, plus some parked Navions that could fly again with a healthy dose of love, money and patience. And what else does it take to get a 70-something-year-old airplane in go-anywhere-now condition? I'm not necessarily talking about barn finds. This assumes you buy an airworthy bird. I've had my hands in enough classics to know that airworthy might be a relative term when talking 70-plus-year-old airplanes that are light on maintenance and paperwork. Can one ever be good as new?

My go-to on this was Chris Gardner at Sierra Hotel Aero in St. Paul, Minnesota. Gardner grew up with Navions. His dad commuted with them while working as an Air Force fighter pilot, while the younger Gardner—an A&P and airline crew chief—wrenched them, and P-51 Mustangs. He also did the Navion's baggage door STC. Won at auction in Bowling Green, Ohio, his company owns the coveted type certificate, tooling, service letters, drawings, PMAs, parts and some STCs for the Navion fleet, and he has built a respected shop that supports, refurbishes, services and modifies Navions (and other classics) from all over the world. Some of Sierra Hotel's latest Navion refurb projects are so modern you might not initially recognize one as a Navion. The images above are proof, and hints at what an \$850,000 2024 model-year Navion might look like.

Gardner told me that many of the Navions that have been through his shop for a ground-up refurb were purchased for around \$30,000 and flew away with over \$400,000 invested in them. It may be a challenge to convince your insurer or money lender to adjust the hull value accordingly, as Gardner put it. But those are far and few in between. For most of the old Navions with managed neglect, Gardner matter-of-factly warned that you'll spend at least \$70,000 to get it up to snuff for reliable traveling. Of course that may not include modern avionics and panel upgrades, which could be \$70,000 alone. Don't forget paint, interior and speed mods. If there's a bright side to throwing that kind of dough at a 70-year-old airplane it's that you're essentially getting specialized, reliable and factory-like support, which should be a big influencer in buying any old (or new) airplane. As for the Navion, it's a solid airframe that for some is worth a high-dollar refurb investment. And to them and others, so might a brand-new one.

A new J-model Navion could be a reality in a few years. Gardner has been heavily focused on producing the next-gen Navion—making good use of the data collected by upgrading old Navions—and planning to utilize modern manufacturing methods, domestic manufacturing and equipping the airplane with modern systems (including automotive styling) buyers would expect. He wouldn't tell me what powerplant might be used to power a new Navion, but I'd put money on there being at least an option for a Jet-A-burning variant to serve other countries. Priced similarly with its contemporaries, but bettering them with a near 4000-pound gross weight, steady and forgiving handling and truck-like build quality, the next-gen Navion could be one of the best classic remakes we've seen. —Larry Anglisano



AVIATION CONSUMER
(ISSN #0147-9911) is published monthly by Belvoir Aviation Group LLC, an affiliate of Belvoir Media Group, 535 Connecticut Avenue, Norwalk, CT 06854-1713. Robert Englander, Chairman and CEO; Timothy H. Cole, Chief Content Officer; Philip L. Penny, Chief Operating Officer; Greg King, Chief Marketing Officer; Ron Goldberg, Chief Financial Officer; Tom Canfield, Chief Circulation Officer.

Periodicals postage paid at Norwalk, CT, and at additional mailing offices. Revenue Canada GST Account #128044658. Subscriptions: \$84 annually. Bulk rate subscriptions for organizations are available. Copyright © 2020 Belvoir Aviation Group LLC. All rights reserved. Reproduction in whole or in part is prohibited. Printed in the USA.

Postmaster: Send address corrections to AVIATION CONSUMER, P.O. Box 8535, Big Sandy, TX 75755-8535. In Canada, P.O. Box 39 Norwich, ON NO1P0, Canada. Publishing Agreement Number #40016479

MORE TECH THEORY ON USED COMPOSITES

The April 2020 issue of *Aviation Consumer* had an excellent article about purchasing used composite aircraft. I believe that a better understanding between composite versus metal structures may improve the understanding of what is being inspected when purchasing these aircraft.

The expert advice and recommendations from Diamond, Cirrus and Textron (Columbia/Cessna models) provide a fundamental approach for Condition Inspections



regarding primary airframe and wing composite structures. Finding delaminations in composites potentially indicates: degradation of resin over time, an impact site from hangar rash, high-cycle training degradation or structural overload. The purpose of the repetitive 2000- or 3000-hour inspections is to provide for a visual identification of structural integrity. In composites the resin is potentially weakened by normal usage, exposure and cycle time, but not the structural fibers.

So, comparing composite delamination inspections or composite life limits to metal failure mechanisms such as metal fatigue is flawed. The structural, static and fatigue qualities between metal and composites are very different. For example, the noted inflight failure of a Piper or Cessna wing develops from metal structural degradation. This degradation reduced wing strength because exposure to water increases corrosion potential. Material corrosion increases local stresses, which increases the likelihood of fatigue development. (Fatigue loads may be 1/3 of static yield loads.)

As noted, extensive flight cycles

increased fatigue frequency. And, metal overload causes yielding, which hardens metal and can accelerate fatigue initiation and propagation.

Historically, life limits of metal airframe structures were rarely if ever considered until the 1950s and 1960s when commercial aircraft experienced airframe pressure vessel failures. In other words, the theory that a basic airframe should last forever is not correct. Restorations of older aircraft are more described as rebuilds with newly manufactured parts. The

GA metal airframe industry in the 1940s to the 1960s did not have the exposure to more recent knowledge of metal fracture characteristics and design capabilities.

When composites were introduced into GA structural components such as wings and airframe structure, the material qualities and knowledge of composites during GA aircraft certification in the 1990s were advanced by military and commercial experience. Data supporting the theory that degradation caused by UV rays, heat and loading data was available for design teams, and the FAA was able to apply levels of inspection based on testing and design margins.

This may not be a comprehensive composite versus metal comparison, but it reflects the differences in material qualities and knowledge of material properties during development. It also supports the advice to look carefully at composite structure during a prepurchase inspection.

*Philip G. Potts
via email*

Thanks for weighing in. Potts is a retired composite structure engineer

with years of experience specializing in composite design for a popular rotorcraft OEM.

THE BEST LIGHT TWIN?

In the recent *Aviation Consumer* e-newsletter report on the Piper Twin Comanche there was an error in your data page that showed the gross weight of the PA-39 C/R Twin Comanche as 3725 pounds. This is for the turbo version. The normally aspirated models have a 3600-pound gross weight. I know because I own one, and in over 44 years owning 84 airplanes, the Twin Comanche has been the best value of them all. It's an amazing little twin and highly reliable.

Randy J. Africano
Chicago, Illinois

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On The Cover: Our appreciation goes to pilot supply retailer MyGoFlight (www.mygoflight.com) for the shot of an iPad secured to a Daher TBM control yoke with MyGoFlight's iPad Sport Case attached to the Universal Sport Mount. Not sure which tablet is the right fit for you? We help sort it out with a report on our latest tablet market survey, which begins on page 4.

Which Tablet? iPad vs. Android

Love it or hate it, the iPad owns the aviation app and hardware market. But Android devices are cheaper and available in more choices.

by Paul Bertorelli

Lost to the sands of time is the quaint notion that a mechanical E6B or—gasp!—an eraser-equipped pencil were cockpit essentials. Now, it's not just a question of having a smartphone or a tablet for aviating, but how many. Not kidding here, some owners have and use several.

But which are the best buys? Which platform is the better performer and if you're an old hand at tablets, is an upgrade worth it? Answering this with accuracy beyond over-the-shoulder dart throwing gives new meaning to the fool's futile errand. But that's never stopped us before, so herewith is a glimpse at the current state of play in the app, tablet and smartphone market. No new trends seem to have

emerged since last we examined this, but our survey of 947 owners and pilots revealed some nuggets.

IT'S AN APPLE WORD

This one you probably already knew: Apple dominates the cockpit to a degree that even surprised us. According to our survey, 76 percent of pilots use an iOS device from Apple, while 16 percent use Android-powered devices. Eight percent use both and that's often an iPhone used with a cheaper-to-buy Android tablet. For what it's worth, in the unsheltered world beyond aviation, the market share is the opposite—67 percent for Android and 27 percent for iOS. The rest is owned by Windows tablets, which didn't figure in our survey. There are

CHECKLIST



iOS devices are rated higher by owners for performance and durability.



Android hardware is less expensive and owners say it's a better value.



iPads overheat and crash, Androids just crash. Perfection eludes both.

aviation apps for these tablets, but nothing like what's available for the market leaders.

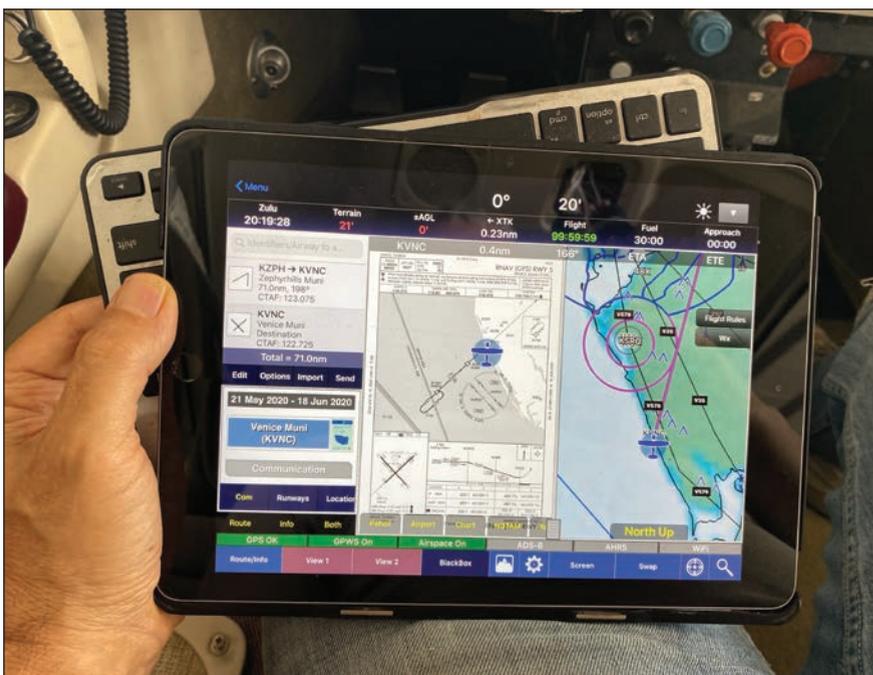
The focus of our survey wasn't apps, but we did ask a few questions about what owners are using. As Apple owns the platform, ForeFlight owns the app market. Some 60 percent told us they primarily use iOS-only ForeFlight for planning and navigation. As the chart at right shows, Garmin has the next biggest chunk and other providers split what's left. Two companies—iFly GPS and Aware—the latter not really a company—dinged us for overlooking them in the survey, so we'll examine them in a future review.

The reason for the iPad's dominance probably has less to do with it being a superior product than with being there firstest with the mostest. Apple established its app store before Android apps were much more than a thought and ForeFlight has been in that market since 2007—13 years. Even with competition fierce, market inertia and loyalty evidently still count for something.

WHICH TABLET?

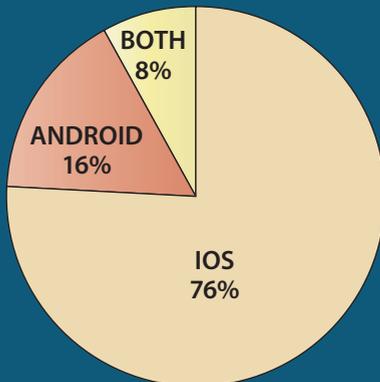
Our survey revealed that iPad and Android usage is all over the map in terms of models and vintage. Our primary focus here is iOS devices—both buying new and upgrading—so we'll tilt in that direction. There are several determinants here in making a buying decision: What

The iPad Air, left, combines a medium size with a sharp display. But many users find it a little too big and not a good yoke mount option.



DATA AT A GLANCE

Which platform do you use?



Do you use apps on both tablet and phone?

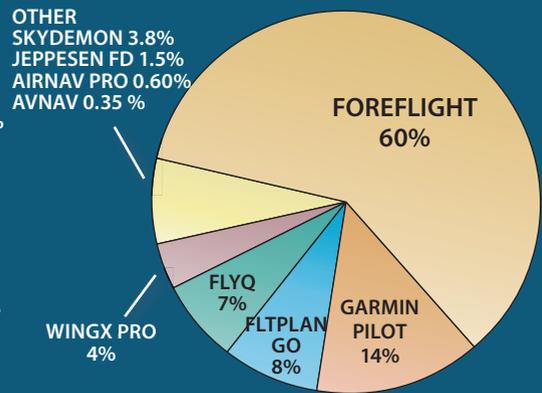
IOS



ANDROID



Which is your most-used app?



USER COMMENTS

The iPad Pro 11 is a little bit too big for most cockpits but the iPad is too nice to change.

—Andrew Morris

Galaxy S2. It's fine. A bit large, but lightweight.

—Tom Ashenfelter

Ipad Pro 9.7 first gen. Size profile works great! Bigger and more powerful than a iPad mini. Ability to use Apple Pencil makes paper an afterthought. It's tucked in the flight bag just in case something bad happens. Battery life will last several long legs and a backup

battery pack has no issues keeping it charged for all-day excursions or flight lessons.

—Brandon Briggs

I think it best to have the two sizes. I use the Pro for most planning and the mini for flying. The ability to sync information between the two units makes this approach simple. The Pro also then serves as a ready standby should anything happen to the mini.

—Walter Gordon

IPad mini 4. I like it mainly 'cuz it doesn't obscure the rest of my panel,

but it's small enough that my old eyes are having trouble seeing it, and heaven help me if the sun reflects off the screen.

—Merl Raisbeck

Samsung Tab S2. Numerous lockups, loss of maps, refusal to start with expired maps, losing settings between Android boots.

—Elliot Hamilton

I use the latest iPad mini on a yoke mount. Fits well, easy access and does not obstruct flight controls nor does it obscure instruments behind it.

—Alex Grinning

apps will you run? What else will you do with the tablet? What size can you tolerate? Tolerate is used purposefully here because users tell us too large can be just as irritating as too small. Too small relates to being able to see the display with eyes not as eagle-like as they once were. In a single comment, reader Merl Raisbeck flashed both sides of the double-bladed axe. "I have the iPad mini 4. I like it mainly 'cuz it doesn't obscure the rest of my panel, but it's small enough that my old eyes are having trouble seeing it. And heaven help me if the sun reflects off the screen," he said.

If there's a plurality of taste, it seems to coalesce around some version of the mini as the best every-pilot's choice. Thirty-one percent of the survey respondents use the mini and ForeFlight tells us more than 40

percent of their subscribers do. The other iPad models—Pro, Air and legacy iPad—have 10 to 13 percent each. But many users also have an iPhone and some have given up tablets entirely as just not worth the bother. "My iPhone 7 Plus is perfect in my yoke mount. Some people scoff as this, but hey, the screen's way bigger than the Magellan portable that I was using 30 years ago," said Mike Beckoff.

And speaking of yoke mounts, this is another buyer consideration related to the size of tablet you select, regardless of the platform. There are plenty of mount choices to plant a tablet about anywhere you want it in an airplane. That's not the problem. The problem is keeping it there and not obscuring the instruments while still getting utilitarian benefit out of the device. "I have a

Samsung Tab A8. Before that, I had a Nexus 7. All great tablets. Works great in the cockpit using a RAM mount on the yoke with power from a USB charger. Sole source reference for IFR maps and approaches. Use the same tablet for reading and for sailing navigation apps," said Nick Pfeiffer. A few readers had similar comments, suggesting many use their tablets for multiple activities.

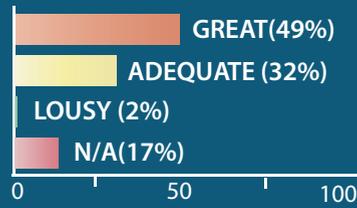
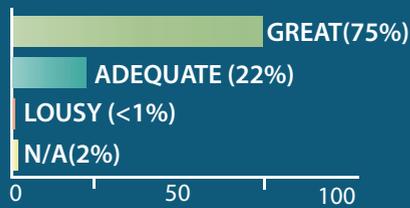
A slice of the aviation iOS market belongs to Apple's top-of-the-line, ginormous Pro series iPads. These strike us as just too large for the cockpit and although some readers confirmed this, a handful love them. "I actually think it's best to have the two sizes," said Walter Gordon. "I use the Pro for most planning and the mini for flying. The ability to sync information between the two units makes this approach

WHAT USERS THINK

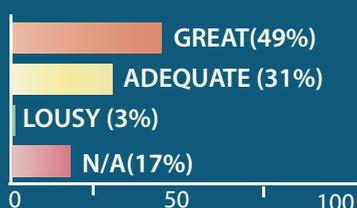
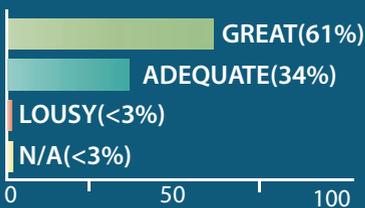
IOS

ANDROID

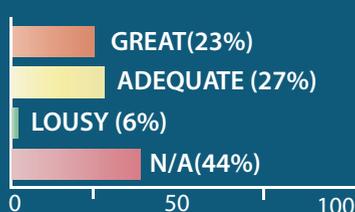
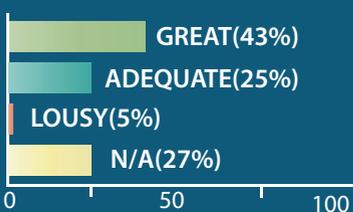
How do you rate overall performance?



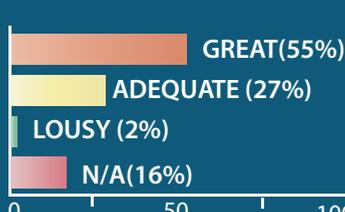
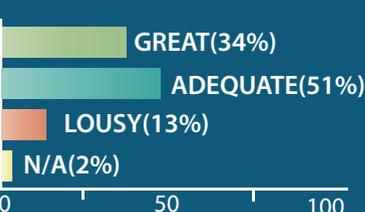
How do you rate durability?



How do you rate service and support?



How do you rate overall price/value?



simple. The Pro also then serves as a ready standby should anything happen to the mini."

FEATURES

Related to physical size is the data storage size the tablet has. What's best is almost impossible to answer because it depends not just on the aviation app you use, but what other apps you'll load, especially if they're as data intensive as aviation navigation apps tend to be. We suggest making a list of potential apps and checking the specs for required storage. If you fly regionally with ForeFlight, for instance, 32 GB is probably sufficient, while 64 GB would be a nice to have. Increasingly, Apple

has made this a moot point in its maddening storage capacity pricing. Only the seventh generation of the original iPad offers a 32 GB option, then for another \$100, it jumps to 128 GB. The mini's minimum storage is 64 GB, which is plenty. Apple also dings the buyer on the option of adding cellular to the standard Wi-Fi as a \$130 upsell. Add another \$20 to \$40 a month for the cellular plan. Worth it? We aren't impressed, considering most cellphones offer a Wi-Fi hotspot that will tether the tablet to the phone. We don't see the value for aviation.

While it's true that the cellular versions include a GPS chip while the Wi-Fi only models don't, you

may already have a better GPS source aboard the aircraft through the avionics or a portable ADS-B In receiver. The tablet's GPS can provide a backup, but not necessarily a very good one. We say skip the cellular option and save the bucks.

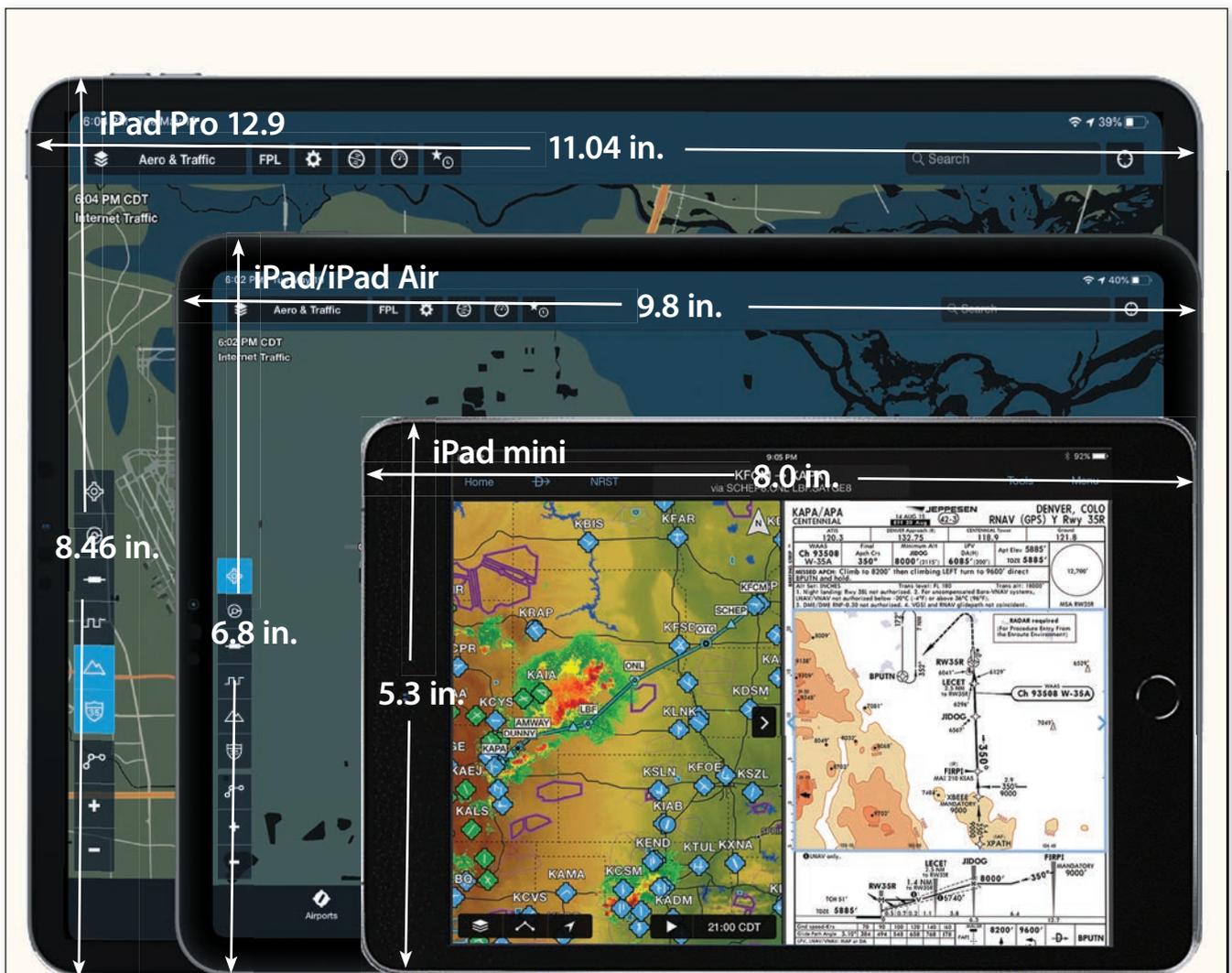
LOVE IT, HATE IT

OK, so no one really hates tablets with the burning rage that, say, Washington fans hate the Dallas Cowboys. But there's a measurable difference between iOS love and Android love. As the chart at left shows, 75 percent of iOS users say the products perform great. But not even 50 percent of Android users say the same of their tablets.

iOS users similarly give the tablets higher marks for durability and product support. Part of this may relate to how the performance is perceived and how Apple manages the apps that play on its tablets. The app store famously lords over developers and reviews apps before they're approved for release. Although this hardly assures perfection, there are fewer apps that crash, fail to perform or are just useless.

The Google Play Store where Android apps are found is more of a digital tragedy of the commons. Buyers are on their own to discover if an app will work and users report plenty of issues. "Samsung Tab S2. Numerous lockups, loss of maps, refusal to start with expired maps, losing settings between Android boots," reports Elliot Hamilton in a typical reaction.

But let's not give the wrong impression here. Android devices generally perform well, they just crash and lock up a bit more than iOS tablets do. But they don't appear to suffer that still-common problem of heat shutdowns. This has plagued iPads from day one and the fact that it probably happens less often now than it used to is because pilots have learned to work around it. "I have a sixth-gen iPad 9.7. Heat shutdowns are a problem if the tablet is in direct sunlight, as in a Bonanza yoke pivot mount," said Frank Weissig. Veteran iPad users know never to place the tablet on the glareshield for longer than a few moments and to hide it from sunlight streaming through a window. A few minutes of cooling will bring the display back.



Images above show the relative scale of the mini, iPad and Air and the iPad Pro 12 in relative scales. The iPad and Air are the same overall size, but the Air has a larger display area.

TABLET	BASE	STORAGE	CELLULAR
IPAD PRO 12.9	\$999	256 GB = \$1099	\$150
IPAD 7TH GEN	\$329	128 GB = \$429	\$130
IPAD AIR	\$499	256 GB = \$659	\$130
IPAD MINI	\$399	256 GB = \$549	\$130

But it's better not to overheat it in the first place.

Some owners go to extremes to cool hot iPads. "For my Android tablet I currently use, I have never had any heat shutdowns or slowdowns, though I have occasionally had the EFB app crash and have to be restarted. For some of my older Android tablets, I have had them slow down due to heat, but never had any heat shutdowns. For my iPad, I have had a heat shutdown and purchased a fan/leg strap attachment for it, but haven't had a chance to try it out in the aircraft yet," said Gary Baluha.

RECOMMENDATIONS

Despite the iPad's lopsided market share, we think the Android tablets and phones are comparable performers and the tablets are less

expensive and available from a broader range of providers. Overall, the Android market has more apps than Apple's app store does, but not necessarily more mainstream aviation apps.

As for buying an iPad, the current Apple lineup is anchored at one end by the mini and the other by the iPad Pro, a niche product, in our view. It's just too big for most cockpits.

The mini—currently in its fifth generation—is an easy first choice. It's the most popular size for pilots in the survey because it's big enough to see the display without blocking the panel. It can mount on the yoke or a suction cup. With 64 GB of storage, sans the cellular, it sells for \$399. The next storage space step up is to 256 GB for an additional

\$150. That's just not needed for aviation apps, but it might be for other purposes.

Evidently, Apple still finds sales in offering the seventh-gen original iPad. This is purely a budget buy against the newer iPad air, now into its third generation. The Air is the same size physically but has a slightly larger display and is a bit lighter. It has a marginally faster chip, but perhaps not so much that you'd notice unless the two were side by side. With 32 GB of storage—not enough—it sells for \$329 or \$70 less than the mini with twice the storage. The seventh-gen storage step up leaps to 128 GB for a price of \$429. The Air starts at \$499 with 64 GB of storage and it's the one we would pick if the mini's display doesn't appeal.



Pressing the red button in the cabin's overhead turns command over to Garmin Autoland, which precisely puts the airplane back on the best runway when the pilot can't. Editor's Choice worthy, indeed.

Gear Of The Year: Garmin Autoland

No product came close to topping Garmin's Emergency Autoland this past editorial year. But there were others that easily make the list of faves.

Staff report

We didn't know what to expect when Garmin invited us to its Olathe, Kansas, testing grounds to fly Autoland. But sitting shotgun in a new Piper M600 turboprop observing Garmin's latest layer of safety backstop systems called Autonomi, there was no question Autoland would win *Aviation Consumer's* prestigious Gear of the Year award.

EDITOR'S CHOICE

It was equally impressive when we put the system through its paces in a Cirrus SF-50 Vision Jet, where it's called Safe Return. As we go to press in May 2020, Daher announced the system trademarked as Homesafe Emergency Autoland for the TBM940 turboprop. Piper has earned FAA certification (via type certification) for Autoland on its M600, and approval for Cirrus and Daher is imminent.

Other than flying an instrument procedure to landing and shutting the engine down so passengers can safely egress, Autoland takes into account the weather enroute to and at the destination airport, while clearing terrain and obstacles along

the way, and it selects the most suitable runway based on weather, the aircraft's performance and available ground support services. Emergency Autoland can be activated by anyone in the cabin and deactivated at any time (with the autopilot disconnect switch) and if the pilot doesn't respond to prompts from the G3000 avionics—the supporting avionics platform—the system engages automatically.

You can read a full report on Garmin's Autoland in the December 2019 *Aviation Consumer*, and link to the flight demo video at tinyurl.com/yag6b7xe.

BEST PORTABLE RADIO: SPORTY'S PJ2

Portable comm transceivers still live on because we need them for backup and sometimes as primary talkers. They need to be easy to use and rugged and easily connect with aviation headsets. Based on our long-term trial with the PJ2 radio, Sporty's delivers all of that for a reasonable \$199 price point.

Where other portables require a headset adapter to plug in avia-

tion headsets, the PJ2 has a direct plug-in interface. In our flight and bench trials we found the unit's receiver performance to be acceptable without an external antenna, but like all low-power transmitters you'll need an external antenna for high altitudes and long-distance transmissions. Apparently there's big demand for a modern portable radio. "The PJ2 has been a great seller—in fact, the best sales of any portable radio we've had in a long time," John Zimmerman at Sporty's told us. Contact www.sportys.com.

MOST CREATIVE ADS-B DESIGN: UAVIONIX TAILBEACONX

Who ever thought you could install a transponder in a tail light? Not us, but uAvionix thought it out and built the tailBeaconX, a 1090ES ADS-B Out transponder that's engineered to meet the proposed space-based ADS-B infrastructure currently on the table for use in Canada and beyond. That spec includes the requirement for transponder Diversity, which is a twin-blade antenna configuration and built-in circuitry for playing with a satellite-based ADS-B network.

The tailBeaconX weighs in at 3.5 ounces and measures 4.4 inches tall by 4.4 inches deep and has a built-in Mode S transponder, altitude encoder and an LED tail light for mounting—you guessed it—in place of the existing incandescent tail light on a variety of airframes. Unlike the wingtip-mounted sky-Beacon, the tailBeaconX doesn't have integral strobe lighting.

Since the tailBeaconX is a completely remote-mounted system, you'll need a way to control and tune the system from the cockpit. That's where the uAvionix AV-20 (2.25-inch) and full-sized AV-30 (3-inch round cutout) EFIS displays come in. These instruments offer onscreen control and connect to the

tailBeaconX over a two-wire RS-232 databus.

As for performance, the system excelled. In our Glastar test bed, it passed the inflight performance report with flying colors, scoring high numbers for accuracy and signal quality at low and high altitudes. Visit www.uavionix.com and read a full report in the March 2020 *Aviation Consumer*.

BEST IN-EAR HEADSETS: CLARITY ALOFT FLEX

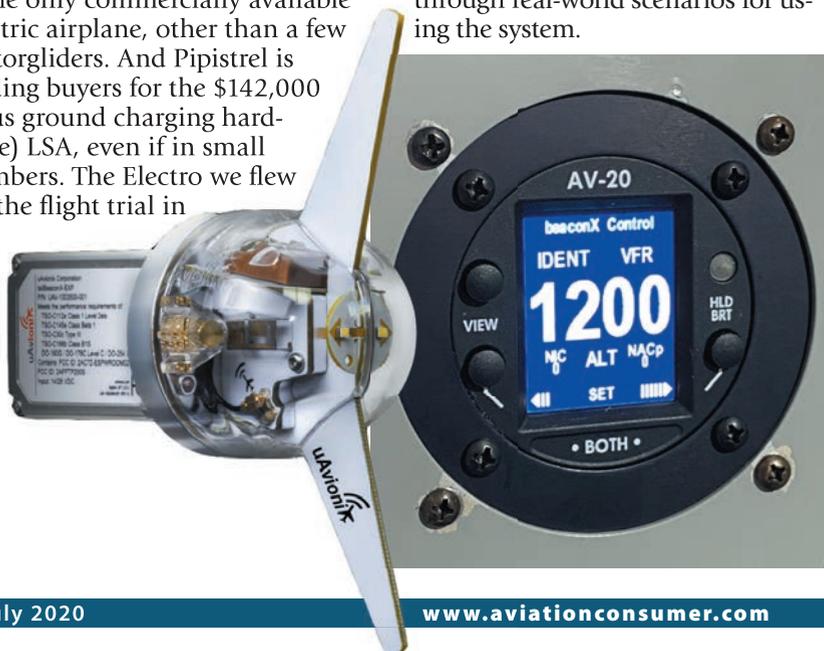


There's a certain freedom that tags along with earbud-style headsets and we've always found the Clarity Aloft models to be solid performers. That's why we were anxious to try the company's latest Flex model. We weren't disappointed, but we did wish the \$775 set had Bluetooth connectivity.

Still, the Flex's fit, finish, build and audio quality are excellent and it provides ANR-like noise reduction performance. Visit www.clarityaloft.com.

MOST ADVANCED ELECTRIC TRAINER: PIPISTREL ELECTRO

In fact, the Pipistrel Alpha Electro is the only commercially available electric airplane, other than a few motorgliders. And Pipistrel is finding buyers for the \$142,000 (plus ground charging hardware) LSA, even if in small numbers. The Electro we flew for the flight trial in



Sporty's gets our tip of the editorial hat for its well-rounded PJ2 portable transceiver. It has just enough modern tech, an easy feature set and a fair price.

the August 2019 *Aviation Consumer* was much improved over the version we flew in 2015, and the next-gen airplane will have better batteries that will be water cooled for discharge and recharge, which promises to nearly double the effective battery life, while knocking as much as \$5 per hour off battery replacement costs. We salute Pipistrel for its progress and determination. Visit www.pipistrel-aircraft.com.

BEST G1000 STUDY AID: JEPPESEN VFR/IFR COURSE

Eventually you might be tasked with mastering Garmin's popular G1000 integrated avionics, so we set out to find the best e-study aids to help get it done. Among a handful of courses, Jeppesen's Garmin G1000 VFR & IFR Procedures Course impressed us the most. It uses an interactive G1000 simulator to guide the student through real-world scenarios for using the system.

The IFR and VFR sections are offered separately or in a bundle, and we like that the simulator mimics a typical G1000 setup in a Diamond piston single—the first airplane with a G1000 as part of its type certificate. If we had a nit to pick it would be that the trainer is limited to desktop computers (Mac and Windows) and won't work on a smartphone. Still, we think the VFR and IFR bundle is a good value at \$199.96. Contact www.jeppesen.com.

MOST MODERN PULSE OX: AITHRE ILLYRIAN

The problem with a fingertip pulse oximeter is that it doesn't offer full-time monitoring. That means if you're hypoxic, you might not have the smarts to stick your finger in the thing to take a reading when you need it the most. That very scenario is what led to the creation of the Illyrian from Idaho-based Aithre. After a close call with hypoxia in his Van's RV-10, company founder and endurance athlete Jim Ruttler developed the \$169 device that has a wireless sensor that measures under the eartip, allowing for full-time monitoring with the Connect app.

The uAvionix tailBeaconX, far left, and AV-20, right, save space, are compatible with space-based ADS-B and performed well in our flight trials.





The sensor fits under the cup of a headset (above) and requires a USB-connected battery pack (provided) or can plug into panel USB power. The device is also compatible with a companion WatchOS app for the Apple Watch. Read the full report in the February 2020 *Aviation Consumer* and visit www.aithreaviation.com.

MOST PROMISING SMART BATTERY: EARTH X

We say “promising” because for a lithium-ion aircraft battery to work for a wide variety of GA airplanes it needs to be affordable, lightweight and have appropriate failsafe built in. When we scanned the market in our May 2020 issue, we were impressed with the True Blue Power Lithium smart battery, but its price just isn’t practical for the market’s lower end. The earthX batteries, which are based upon lithium iron phosphate chemistry, have gained market traction in the experimental market and the ETX900-TSO (for replacing 25 or 35 Ah lead acid batteries) is the battery to watch. It’s currently in the FAA approval process and is expected to sell for \$899. Visit www.earthxbatteries.com.

BEST YOUTH HEADSET: DAVID CLARK H10-13Y



The problem with investing in aviation headsets for kids is they’ll outgrow them before you know it. That’s why the perfect set should be

upgradable to an adult-sized headset, or at least one that fits bigger kids. David Clark’s H10-13Y (street priced around \$320) weighs 16.5 ounces and has a NRR (noise reduction rating) of 23 dB. It was a favorite in the youth headset flight trial in our June 2020 issue. We found it to have excellent build quality, good audio and a decent

one-piece flexible boom mic. Visit www.davidclark.com.

BEST BUDGET GPS NAVIGATOR: GARMIN GNX 375



As we’ve been reporting, Garmin’s new line of budget-based GPS navigators don’t have ground-based VHF navigation capability, but they do have WAAS GPS, suitable for shooting ILS-like precision GPS approaches. One model in the lineup is the GNX 375, which also has a built-in ADS-B transponder. For aircraft that need both IFR GPS and ADS-B, we think it makes good sense.

Think of the GNX 375 as a slightly smaller GTN 650, less comm radio and VHF nav receiver. It has a 4.8-inch color touch display, built-in Flight Stream wireless hub for streaming ADS-B weather and traffic to a tablet running the Garmin Pilot or ForeFlight app and best of all, it’s compatible with a wide variety of third-party nav heads and autopilots. At \$7995, we think it makes sense for airplanes begging for both ADS-B and an IFR GPS, but that can do without VHF nav. Visit www.garmin.com.

BEST BUDGET TRANSPONDER: SANDIA STX 165

If your aircraft already has an IFR navigator and ADS-B, but its transponder is on the fritz, we think the Sandia STX 165 is a budget-based model worth looking at. It’s a space saver with its 3 ATI bezel and has a decent OLED display that works well in sun-splashed cabins. That’s the unit pictured above. Perhaps



what we like best is that it has a built-in altitude encoder. There’s also a built-in timer and there’s an option for connecting with an OAT probe. At around \$1950, we think the STX 165 is a good value. Visit www.sandia.aero.

BEST PLAN FOR A HARDENED INSURANCE MARKET

Last, some advice for surviving the hardened insurance market, especially if you’re an aging pilot with a complex aircraft—turbines in particular. Our go-to insurance pros suggest you up your training and start an open and transparent discussion with your broker. Ask specifically what you can do to keep your rates as low as possible and perhaps even to ensure a renewal. It may mean downgrading to a less complex model. If you’ve been thinking about getting a new rating, now might be the time. Insurers like diverse experience. Type ratings, sea-plane ratings, glider ratings—they’re all good. It’s all about proving that you aren’t a high-risk customer.

EarthX is a popular lithium battery option for experimentals and the company is working on a TSO’d version for certified aircraft.



Sporty's Test Prep: The Commercial Ticket

Sporty's new Commercial Pilot Test Prep Course is more than its name implies. It includes excellent videos on the maneuvers and a reference library.

by Rick Durden

Sporty's (www.sportys.com) recently expanded its line of interactive training materials with a Commercial Pilot Test Prep Course it offers for \$149.99. Although advertised as a test prep course, it is, in our opinion, much more. It starts with the industry standard procedure for test prep courses—the student answers test questions, gets feedback as to why an answer is right or wrong and is directed to the appropriate reference (such as the FAA's *Pilot's Handbook of Aeronautical Knowledge*), and the software keeps track of the student's score so review can focus on weak areas.

However, the Sporty's course goes further by providing solid preparation for the oral portion of the practical test, more than 90 minutes of video animations of commercial maneuvers and complex airplane operation as well as an impressive reference library.

THE BASICS

This course is designed as a test prep; it is not a ground school. Sporty's John Zimmerman told us that the course, and its content, were produced in response to what customers told Sporty's they needed. "They wanted the test, maneuvers and the oral," Zimmerman said. He advised us that by not

Commercial maneuvers are "flown" graphically on videos, above, and described in text, with performance standards set out as well as common errors, below.

doing a full-blown ground school, the customer is saved about \$100.

While Zimmerman said that Sporty's may do a full commercial ground school course in the future, we're of the opinion that a private pilot who studied the *Airplane Flying Handbook*, *Pilot's Handbook of Aeronautical Knowledge* and *Aeronautical Information Manual* can prepare for the commercial written exam

effectively using nothing more than the Sporty's course.

By working through the database of more than 800 test questions and reviewing the references for correct and incorrect answers, the student gets a hands-on immersion into all areas needed to pass the written exam. Where relevant, questions direct the student to the appropriate FAA graphics, such as aeronautical charts and performance graphs, needed to answer the question—so the student sees material as it will appear on the FAA written.

Once the student has completed the question battery the next step is a Smart Study Session where the software focuses on the areas of weakness. The student can direct the system to present only questions missed previously and can mark questions for follow-up or last-minute review.

When the student feels ready, it's time to take practice tests. Once the student passes two practice tests with a score of 80 percent or better,



Lazy Eights

To develop the feel for varying control forces and the ability to accurately maneuver the airplane while demonstrating good planning and orientation.

Standards:

Airspeed: +10 knots @ 180° points, Altitude: +100 feet @ 180° points, Heading: +10° @ 180° points, Bank: Approximately 30° at steepest point

Conditions:

Description:

1. Select an altitude that will allow the maneuver to be performed no lower than 1500 feet AGL. Select a reference point on or near the horizon, 90° from the heading of the airplane (straight-line reference may also help). Perform the Pre-Maneuver Checklist. Clear the area. Establish manufacturer's recommended entry speed or VA, if one is not recommended.
2. Begin a gradual coordinated climbing turn in the direction of the 90° reference point. When the 90° reference point is half way between the wing tip and the nose, the aircraft should be at its maximum pitch attitude and at approximately one-half the maximum bank angle. The bank angle should continue to increase until the 90° point is off the nose, while the pitch attitude should slowly decrease to the level flight attitude.
3. As the nose of the airplane passes through the 90° reference point, the pitch attitude passes through level flight. The bank angle should be at 30°. The airspeed should be at its minimum.
4. Both the pitch attitude and the bank angle should continue to decrease so that when the 90° reference point is halfway between the nose and the opposite wing tip, the pitch attitude reaches its lowest point and approximately one-half of the maximum bank angle remains.
5. The pitch attitude is slowly increased, bank angle is slowly decreased, so that the aircraft returns to straight and level flight at the entry altitude and airspeed as the 90° reference point is off the opposite wing tip.
6. When complete, immediately begin a gradual, coordinated climbing turn in the opposite direction toward the selected 90° reference point. Repeat the steps above starting with "Begin a gradual coordinated climbing turn."

Common Errors:

- Failure to adequately clear the area.
- Using the nose, or top of engine cowling, instead of the true longitudinal axis, resulting in unsymmetrical loops.
- Watching the airplane instead of the reference points.
- Inadequate planning, resulting in the peaks of the loops both above and below the horizon not coming in the proper place.
- Control roughness, usually caused by attempts to counteract poor planning.
- Persistent gain or loss of altitude with the completion of each eight.
- Attempting to perform the maneuver rhythmically, resulting in poor pattern symmetry.
- Allowing the airplane to "fall" out of the tops of the loops rather than flying the airplane through the maneuver.
- Slipping and/or skidding.
- Failure to scan for other traffic.
- Failure to recognize that the level flight attitude at the top of the loop is a slow flight attitude.

THE COMMERCIAL PRACTICAL TEST: A DPE'S PERSPECTIVE

Over the last several years of observation, we've generally been pleased with the manner in which implementation of the Airman Certification Standards (ACS) for each certificate or rating has brought more standardization and objectivity to practical tests. We remember the bad old days of sending pilots for checkrides with Designated Pilot Examiners (DPE—individuals not employed by the FAA but having completed FAA training and designated as a pilot examiner) when it was essential to cater to the whims and quirks of a particular DPE.

We are of the opinion that the ACS concept has made it much clearer to applicants as to what they must know and do—and to what standard—on a practical test.

Nevertheless, any time a pilot is going for a checkride, it's guaranteed that the applicant wants to know what's going through the examiner's head and what it's going to take to show the examiner that the applicant deserves to pass.

To find out, we sat down with Catherine Cavagnaro, proprietor of Ace Aerobatic School in Sewanee, Tennessee, who is a DPE on top of being a professor of mathematics at the University of the South and recognized as the 2020 National Certificated Flight Instructor of the Year by the General Aviation Awards Program. (That's her in the picture between FAA inspector Jim Bostrom on the left and brand-new instrument pilot Greg Bieck.) We wanted to know what a DPE looks for on a commercial practical test, especially as opposed to the other VFR practical test that a pilot may have taken—the private.

"We've all heard that the private pilot ticket is the license to learn," Cavagnaro told us, "so I'm looking to see that the private applicant can safely go out and continue the educational process. For the commercial certificate, I want to see a pilot who demonstrates a mastery of the airplane while showing a consideration for the comfort of passengers.

"The pilot should smoothly and authoritatively guide the aircraft while multitasking—looking for traffic, keeping passengers comfortable and maintaining positional awareness."

Cavagnaro gave an example of the level of smoothness expected of a commercial pilot: "On a private pilot flight test it's pretty common for the pilot to do a brake test so hard that it throws the passengers against the shoulder harness. A commercial pilot should do it as you do in your car, apply the brakes and then ease up so that the airplane comes to a stop smoothly and slowly."

She went on to talk about the little things that are expected of a commercial pilot such as not shoving the constant-speed propeller control forward while on downwind. "It makes a lot of unnecessary noise and can upset passengers and certainly upset people who live around the airport. Wait until the manifold pressure is low enough that the propeller isn't governing so there's no change when the prop control is moved forward prior to landing."

We discussed the commercial pilot requirement change to allow 10 hours of training in a Technically Advanced Aircraft (TAA) instead of a complex airplane and asked how that has changed the practical test.

She told us that since the FAA also dropped the requirement to bring a complex airplane (or TAA) to the practical test, she doesn't often see applicants show up with a TAA. "Even when they do," she commented, "there's not much in the ACS that makes a difference in the flight test as to whether the airplane is a TAA."

That brought up the endorsements that must be in an applicant's logbook. Cavagnaro told us that she sometimes cannot give a checkride because the applicant shows up without the appropriate endorsements in her or his log-

book or with aircraft logbooks that don't have signoffs for required maintenance. She said that by the time a pilot is going for a commercial certificate, that pilot should know the FARs well enough to make sure that all the required endorsements are in place.

The FAA requires that the applicant's CFI review the areas that the applicant missed on the written test and attest to that in the applicant's logbook. Among the first questions she asks applicants are in areas they missed on the written—sometimes it's obvious that their CFIs didn't review those areas. "One way to ace the oral part of the practical is to come in ready to answer questions on the areas you missed on the written," she said.

Cavagnaro said that she expects applicants to be able to fly the maneuvers, such as the chandelle, lazy 8, and power-off 180/spot landing smoothly, while watching for traffic.

A common problem on the power-off 180 is adding flaps too early, she advised. When the airplane is clean, a slip is more effective and demonstrates a mastery of the airplane. She also said that if a pilot is a little sloppy on a chandelle or lazy 8 because he or she is looking for traffic, she prefers that to the pilot who does them perfectly but isn't paying attention to the world outside.



Tests are timed, correct and incorrect answers have references for further study and the software keeps track of test scores so the student can focus on weak areas, above. There's also a video with recommendations to help ace the checkride, below.

Sporty's issues a written test endorsement.

We like that the course can be used on multiple formats—iPhone, iPad, Android and online. There is also a dedicated section for taking notes, so the course is completely portable—if the student has a device or access to the internet, she or he can study.

THE ORAL

We've observed students who have done well on the written exam and fly well, but can't seem to express themselves and have trouble on the oral portion of the practical exam. We think Sporty's course will help any applicant avoid the deer in the headlights look when it's time to sit down with a DPE and answer questions.

Sporty's Commercial Pilot Test Prep Course includes two areas of oral exam prep. First is 420 flash cards with questions that may be expected on the oral. They do take a little effort and honesty on the part of the student. Before turning the card over on the screen, the student should answer the question out loud—practice a little public speaking and make the exercise as real as possible.

Once the student has expressed an answer, the card is flipped and the student compares what she or he has just said to the course's answer (with reference to the appropriate FAA publication) and decides whether he or she got the answer right. That's where intellectual honesty comes in.

The student self-grades and the software keeps track. Once the student has taken all of the questions, the Smart Review system will pull up and replay the ones missed.

The second portion of the oral review is video by well-known DPE Jason Blair with tips and tricks on passing a checkride. It's over an

hour long and struck us as akin to sitting down with an experienced DPE to get the inside dope on successfully completing a checkride.

MANEUVERS

The biggest part of the commercial flight test is the maneuvers. They are designed to teach a pilot to get the most out of an airplane, often requiring a pilot to be able to cause the machine to fly a desired three-dimensional track while airspeed, altitude, bank angle and control pressures are constantly changing.

In our opinion, once a pilot is able to visualize a maneuver, she or he is well on the way to being able to fly it. For that reason, we like the maneuver videos included with Sporty's commercial course. They do a good job of depicting, in two dimensions, something that takes place in three. The narration accompanies the flight path of the depicted airplane well, explaining what is supposed to happen and why. It also sets out common errors with each maneuver.

Scrolling down from the video there is text that further describes the maneuver and common errors plus the performance standards for the maneuver from the ACS.

We were pleasantly surprised to find that more than just the standard commercial maneuvers were included in the video library. There is an extensive video on flying complex and high-performance airplanes—with autopilot best practices and engine management tips, a

pre-maneuver checklist (we think of the many times we have heard examiners complain that applicants don't know what to do to make sure that they and the airplane are ready to perform commercial maneuvers), cross-country departure procedures, how to divert to an alternate airport and lost procedures, to name a few.

We think the videos will be reviewed often by commercial students as they are so data rich that it takes more than one viewing to take everything in.

REFERENCES

We were also impressed by the volume of reference material included with the course. We were delighted to see such publications as *Aerodynamics for Naval Aviators*, *GA Pilot's Guide to Preflight Weather Planning*, *Mountain Flying*, *Pilot Controller Glossary*, *Weight and Balance Handbook* and a link to all FAA Advisory Circulars.

CONCLUSION

We were impressed by what we saw in Sporty's Commercial Pilot Test Prep Course. In our opinion, it's among the top tier of test prep courses that we've reviewed over the years.



Panel Teardowns: More Than Metal Work

Big-screen retrofits usually mean major modifications to cut or replace the panel. From drawing it to painting it, these are big projects.

Most existing round-gauge airplanes have instrument panels that simply weren't designed for big-screen displays. That means your shop will likely be tasked with cutting a new metal panel to make it all fit. And even if your proposed upgrade doesn't require lots of cutting, an avionics project is the opportunity to upgrade the panel's aesthetics from, in some cases, 1970s or earlier designs. Replacing the brittle, cracked and faded Royalite plastic overlay for a cleaner, more durable metal panel has benefits. Plus,

LARRY ANGLISANO

the right paint choice can improve the panel lighting and complement a new cabin interior.

But to get there, your shop will tear the airplane to its core, removing, rewiring and installing large wiring bundles. There's paint, placarding and if the modification alters the structure, the shop will need to get FAA approval. Yes, these are big invoices and in this article we'll

look at why it takes more planning, downtime and investment than you might appreciate. Truth is, skilled shops are turning out refurbished panels that are better than some OEM ones.

MINOR AND MAJOR ALTERATIONS

Not so fast with the cutting wheel. Before a tech cuts into any panel, he's mindful of the force-fed FAA AC 43.13-2B. This Advisory Circular deals with mechanical guidance, acceptable methods and techniques and practices for airframe alterations, and can be used to help determine if the work will result in a major or minor alteration.

Generally, any structural modification to the panel is considered major and will require additional approval. This can include an STC (some distributors sell STC'd panels) or a one-time FAA field approval. Before committing to a job ask if the panel work will be a major or minor alteration, and will the finished product come with the ap-

CHECKLIST



CNC-produced panels increase ergonomics, which could reduce pilot workload.



New panels enhance interior mods and can increase the aircraft value.



This is custom work that involves substantial teardown, painting, placarding and rewiring.

propriate signoffs and maintenance endorsements. We've seen aircraft get flagged during prepurchase evaluations because the panel work didn't have proper documentation. We think the better alternative to lengthy field approvals is sourcing a replacement panel that's already PMA and STC approved. But even panel work that isn't considered a major alteration has guidelines.

AC 43.13-2B, supplemented by AC 43.13-1B (which deals with the specifics of structural metal modifications), offers guidance on instrument panels. The go-to is the section on structural and non-structural stationary panels. The first step in the guidance is to verify if any cutting (including enlargement of existing cutouts) will be made to the primary structure.

If the panel is structural, the circular advises to make additional cutouts or the enlargement of

That's a Piper Mirage panel in the works at Sarasota Avionics in Florida, top image. Planning and drawing it out first is a critical first step in a new panel retrofit.

The Mooney panel at the top sporting new Garmin avionics and an iPad was reworked by Sure-Flight Aircraft Completions in Coatesville, Pennsylvania. Dynon's Certified HDX avionics generally require a new panel and the Cessna in the middle was done by Thrust Avionics in Texas. The main panel isn't the only work in a full-up panel refurb. The circuit breaker and switch subpanel, bottom, is often reworked.



existing cutouts in accordance with the aircraft manufacturers' instructions, or substantiate the structural integrity of the altered panel in a "manner acceptable to the FAA." It's up to the installer to determine the appropriate course of approval. It's not just about structure. There are also weight and load considerations.

For example, Garmin's STC installation manual for the G500/600 TXi retrofit flight displays cautions that the total weight of the new equipment installed in the existing instrument panel may not exceed the total weight of the equipment that will be removed. That's unless the total weight of all the equipment installed in the panel is within the weight limit established for the panel by the aircraft manufacturer. In other words, the new stuff may be too heavy.

On the other hand, it's likely that the majority of retrofit flight displays could be lighter than the iron gyros that are being removed. After all, the weight savings is one bonus of the teardown upgrade, especially when removing the vacuum system.



BETTER THAN OEM

The shops we talked with in our research all agreed that the less structure you touch, the easier it is (easy is a relative term when it comes to panel refurbs) on the overall effort, downtime and cost.

Dave Fetherston at Nexair Avionics in Plymouth, Massachusetts, told us that panel refurbishment is front and center in his shop's busy hangar. Nexair is equipped with a modern CNC machine for cutting metal panels in-house. Then it sends them to a local finishing

shop for custom powder coating. When they come back Nexair works with a laser engraver that cuts in the placarding and fills it with white epoxy paint.

"They come out looking better than new panels from the OEMs," Fetherston told us. He's right. We saw some of this top-notch craftsmanship firsthand during a recent visit to the shop—including a look at the level of teardown that's re-

quired to get the job done.

The work is done by strictly following AC 43.13 guidance and is a minor modification if you are not changing structure. Some avionics manufacturers offer their own guidance in the installation data, including specifying the panel thickness required to accommodate a given display. Panels generally aren't provided as part of the installation kit and it's up to the installer to build



One benefit of new panel construction is it allows for easy access to wiring bundles, top. The other is a clean and custom layout. That's a B36TC Bonanza in the middle and an older Cessna 182 at the bottom.

Sticking with the Garmin TXi PFD/MFD as an example, the display must be located such that the screen is entirely viewable and within reach of the pilot. The manual goes on to say "it is preferable for the display to be located as far up the instrument panel as practical, and the position of the GDU display must not interfere with the installation of flight control items or control lock devices."



requirements for planning the panel layout. For instance, the manual says that GDUs (displays) with integrated ADAHRS must be rigidly mounted without shock mounts. Nearly all primary instrument panels with spinning gyros have some sort of shock mounting to lessen vibration to help extend the life of the instruments. With respect to display readability, Garmin's guidance for the TXi display installation says that the panel tilt cannot exceed +/-6 degrees in roll and +/-8 degrees in pitch. The panel must be perpendicular to

As for field of view, that guidance is defined in FAA AC 23.1311-1C. It's an exercise in comprehension and says the primary field-of-view (sitting in the pilot's seat) values are roughly 35 degrees horizontal, 40 degrees up and -20 degrees down vertically from the pilot's eye reference point. Get all that? The Garmin STC manual specifies that when fabricating a new panel for the GDU 700/1060, the GCU 485 controller and the location to house the standby instruments, use the same material type, thickness (not less than 0.090 inches) and corrosion protection as the original instrument panel. Corrosion protection must be in accordance with an aircraft model-specific standard practices manual, or alternatively, a chemical conversion coating per MIL-DTL-5541 Type II, or MIL-DTL-81706 Type II, and high-solids chemical and solvent resistant epoxy primer per MIL-PRF-23377, Class N. The methods, techniques and practices defined in AC 43.13-1B Chapter 4, Section 4 (Metal Repair Procedures) are acceptable and good shops will follow it to the letter.



the longitudinal axis of the aircraft yaw.

Aircraft with more traditional instrument panels will be easier to work with. But others might not accommodate the layout to your liking—or the way the equipment's STC prescribes. This includes staying within field-of-view guidelines.

or source one. But that's not where the work ends. There will be sizable amounts of planning before even thinking about cutting a panel. Don't rush the process.

LAYOUT SPECIFICS

Digging deeper into Garmin's TXi-series manual reveals specific

PLAN IT OUT—CAREFULLY

The point is that panel replacement done in conjunction with major avionics upgrades will require a lot of planning that should involve the owner. This should start during the proposal process because the panel layout you want may not be the one the equipment's STC allows. Even it does, it may require sizable

THE ANATOMY OF A PANEL REBUILD

by TJ Spitzmiller

The energy that drives an interest in selecting the next avionics upgrade has many asking the question of how deep to venture into the actual panel modification. The answer becomes obvious when it comes to a full glass panel upgrade. However, the addition of a small-screen EFIS, changes to the center stack or the desire to reconfigure an unconventional instrument layout to a standardized six pack requires some serious thought and creativity.

The final product is ultimately driven by budget, unknown interferences behind the panel and the creativity of the team to create a unique, aesthetically pleasing and functional panel. But expect a lot of work along the way. When an aircraft arrives at our shop, the first task is performing a full functional check on the existing equipment. This eliminates the contentious argument of whether it worked before the shop tore into the panel.

Once the panel is disassembled to the level required for the job, a prototype template is derived from both the existing panel and rough cutouts. The template is then sent to our outside panel fabricator who creates an Auto-CAD drawing and sends us the file in PDF format for review. Once

approved by the customer, an acrylic panel is sent our way. This allows us to make modifications for proper instrument placement while modifying for trimming or the addition of material for the next round of acrylic.

The panel replacement (these are overlays, with structure left in tact) is always the long pole in the tent so getting that process started right away allows the shop to concen-

harnesses from front to the rear for cabin headset jacks, USB ports, magnetometers, autopilot servos and a variety of the other accessories.

Once the wiring is complete and the shop waits for the panel, there is no better time to power up the new systems and fix any wiring and interface issues. The aircraft is easily accessible inside and out, and a simple wiring or grounding issue

can be quickly solved now rather than later when it's reassembled. It's also a good time to take care of squawks that have been neglected. Common actions include correcting lighting, fixing power ports or tackling air vent issues.

Of course, custom metal panel replacement and powder coating isn't the only solution to spiffing up an old cockpit. If you decide on an incremental upgrade with Garmin's G1275 round electronic flight instruments, the shop

might not have to do any cutting at all. But it might be a good time to replace the old plastic panel overlay that exists in so many aircraft. For that work, Plane Plastics (www.planeplastics.com) has been our number one go-to source for replacement plastic, but that's not without extra work and it isn't a slap-and-go process. We modify them to fit around retrofit systems like an Aspen Evolution flight display or a Garmin G5 EFIS, both of which have bezels that won't work with an overlay cut for traditional round-gauge flight instruments. The good thing is the new plastic panels aren't aged and brittle so they are fairly easy to work with. Done right, the cutouts can yield a nice clean look that's a worthy alternative to a completely new metal panel overlay.

TJ Spitzmiller is the general manager of Sarasota Avionics and Maintenance in Sarasota, Florida.



trate on cleaning up old wiring and rewiring for the new instrumentation. Many customers are surprised that the entire interior is usually removed when performing heavy modification. This allows access to interface with existing equipment that may be placed in the empennage. This also makes room for new LRUs (Line Replaceable Units) to be added as there is usually plenty of shelf space when obsolete equipment is removed. As noted in the main article, having the interior out is a fine time to address its condition and many will use this opportunity

to have it reconditioned or at least recovered. Removing the interior also allows for running wiring





We're finding that better shops are offering total cabin refurb packages to include avionics, color-coordinated panel replacement and seating/trim upgrades. Those are older Cessna, top and inset, and Cirrus, bottom, makeovers completed by Nexair Avionics in Massachusetts. There's value to one-stop shopping given the extensive teardown to do both panel and interior upgrades.

involved in both hardware and components. Lighting has come a long way.

WRAP IT UP

Some shops we talked with said many projects are difficult to quote accurately because they just don't know what they'll run into once they tear the old panel down. Plan for cost and schedule overruns. Inevitably there will be some required rewiring that wasn't planned for, especially if it's been awhile since the aircraft has seen an avionics upgrade.

When it comes to panel refurbishment we strongly suggest selecting a shop that you can easily visit during the planning, building and finishing process. Since you are the one who will be sitting in front of the panel every time you fly the aircraft, you should be heavily involved in the planning. This means signing off on the final layout before the shop starts cutting.

While you're at it, plan for future upgrades as best as practical. If a big-screen engine monitor is your goal down the road, leave an empty spot for it. Empty space is OK because why pay to have another panel built and finished during the second phase when you could reserve a spot for upgrades now?

It's virtually impossible to nail pricing for projects of this size, but for a typical non-pressurized aircraft we would play it safe and budget at least \$10,000 for a full-up replacement including paint, placards, rewiring and all the other stuff that tags along with metal panel refurb. It's a huge investment, but it's one of the more satisfying improvements you can make to an aging aircraft.



certificate. In many cases the font text, size and color on the new placard is prescribed to be the same as the old placard it is replacing, and not obscured by the glare shield or any other component in vicinity.

We'll cover lighting upgrades in a separate article, but it's worth touching on here. As you might have discovered, the existing lighting circuits, dimming potentiometers and power supplies that have been in the aircraft for years might not be in good shape.

If you plan to use them with a new panel, have the shop test them carefully and if you're going through the expense of cutting a new panel, we advise not skimping on lighting. It can make or break a new panel, and simple DIY testing can indicate if a lighting system needs work: Is the dimming linear? That is, for full travel of the dimming control from brightest to dimmest, does the lighting respond evenly to the dimmer? If it doesn't, now is the time to fix it.

Don't underestimate the cost



amounts of rewiring for existing systems. Sit with the shop and envision your ultimate layout, paying particular attention to where on the panel you want the autopilot control head, as one example. The same goes for toggle and rocker switches, external annunciator panels and backup flight instruments.

Does the new panel include a primary OEM-replacement big-screen engine display? You'll want to place it as close to your primary scan as possible. Don't forget placards, which are required by the type

AD Compliance 101: FAA AC 39-7D Rules

As the aircraft's owner, you are directly responsible for airworthiness directives. Sifting through the regulatory jargon is tricky.

by Larry Anglisano

We got a call awhile back from the seller of a light twin who was in a panic when the aircraft was snagged in a prepurchase inspection because an old AD wasn't signed off. The lack of AD compliance rightfully raised some red flags about the overall upkeep of the airplane, and the buyer was ready to walk away from it.

While the seller was quick to blame his maintenance shop for either forgetting the logbook sign-off or missing the AD compliance altogether (it required substantial teardown to determine if the AD was complied with), we reminded him that ultimately it is the owner's responsibility to look after AD compliance, and not the mechanic's. This topic is worth a look.

ADS FOR DUMMIES

Even as experienced maintenance folk, we struggle with FAA verbiage, and AD language in particular. A review is in order. You should consider airworthiness directives (published in the Federal registry) an extension of enforceable FAA regulations. The FAA spells it all out in its Advisory Circular 39-7D, and pursuant to Part 39, reinforces that it has the authority at any time to reinspect and re-examine a civil aircraft, aircraft engine, propeller or appliance that it has already approved.

We all know that the FAA issues ADs when a potentially unsafe condition is found to exist in not only a particular aircraft model (or component), but also in the type design of others. And, the dreaded ADs are used by the FAA to notify aircraft owners and operators of this unsafe condition, and to require their cor-

rection within a time frame considered to be within the bounds of safety, yet still reasonably achievable by owners of affected aircraft. In other words, don't waste any time getting the condition fixed, but you don't have to do it before you fly the aircraft again. On the other hand, safety of flight conditions are urgent and the FAA has a plan for dealing with them with emergency ADs.

These can ground an entire fleet, as emergency ADs are a special class of AD that provide for an even more expeditious resolution of an unsafe condition. It goes without saying that it's important for you as the owner/operator to remain aware of any AD status applicable to the aircraft. Legally, you and your estate could be on the hook if the aircraft crashes and you were found negligent by not complying with an outstanding AD. It's also the owner's responsibility to make sure any lessee is aware of an AD.

Several years ago the FAA began notifying registered owners of emergency ADs by first-class mail,

but we think the communication effort is also the responsibility of the manufacturer. The better ones are on it immediately. Electronic versions of ADs are available from the FAA's website (www.faa.gov) and you can search by manufacturer, model or AD number.

AD content usually includes a description of the unsafe condition, the product to which the AD applies and any reference to service bulletins. It lists the required corrective action or operating limitations (or both), the AD's effective date, a compliance time frame, where to go for more information and information on alternative methods of compliance with the requirements of the AD.

If you've ever tried to figure out the coding of a particular AD you might have given up deciphering the three-part number designator. For AD 2005-20-25, for example (an avionics electrical bus AD against the Cessna 425), the first part is the calendar year of issuance, the second part is the biweekly period of the year when the number is assigned and the third part is issued sequentially within each biweekly period.

The confusing language that tags

When a Cirrus Vision Jet melted on a ramp earlier this year after an audio amplifier overheated in a cabin sidewall, Cirrus Aircraft showed how a manufacturer should handle an emergency AD. It notified every SF-50 jet owner within 24 hours and remarkably had the near-200 aircraft fleet modified in under two weeks.



along with ADs is notice of proposed rulemaking, or NPRM, followed by final ruling, which is the most common type of AD. An NPRM is issued whenever safety considerations do not require the immediate imposition of action under an AD. With an NPRM, anyone is invited to comment by submitting written concerns to the FAA. After the comment period closes, the final ruling is prepared, taking into account the comments received.

DOES THAT AD APPLY TO MINE?

Generally, type certificate and airworthiness certification data is used to identify the product that's affected by an AD. Limitations may be placed on applicability by specifying the serial number or number series to which the AD is applicable. When there is no reference to serial numbers, all serial numbers are affected. Still, determining what aircraft the AD is applicable to, and even whether it applies to an experimental homebuilt aircraft (generally, ADs apply to type-certified aircraft) can be tricky, although the latest AC 39-7D does a better job than previous guidance when it comes to calling out experimentals. Moreover, from our experience newer ADs seem better written than older ones

An Eddy current inspection on a Hartzel propeller hub is an example of a repetitive AD, requiring inspection on an ongoing basis.



and generally the AD will specify if experimentals are included. But keep in mind that many experimentals have type-certified engines and propellers so being on the electronic list of new ADs (while keeping tabs on the AD library) is wise.

In the case of the previously mentioned twin for sale, the AD was found to be complied with, but wasn't signed off in the maintenance records. Shops are required to keep work orders on file for a specific amount of time and luckily the work was documented. But in the eyes of the FAA—forever a stickler for the right paperwork—without an endorsement, the AD essentially wasn't complied with. Additionally, the belief that AD compliance is only required at the time of a required inspection (as in during an annual or phase inspection, for example) just isn't correct. The aircraft can come out of the most thorough annual (or a total refurb for that matter), but if the AD wasn't signed off, the aircraft is officially unairworthy, at least from a paperwork standpoint.

ALTERNATE COMPLIANCE

The AD specifically states the compliance time, and the aircraft cannot be operated (legally) after that time has expired without an alternate means of compliance, known as an AMOC. That might be an STC modification, as one example. Here's where it gets sticky, and why it's best to deal with the AD as soon as possible—not years later when the airplane is in for a prebuy look-over.

By definition, an AMOC is a different way (other than the one specified in the AD) to address the unsafe condition, and is an FAA-approved alternative to address the specific requirements of the AD. It can include a change in the required time to accomplish the AD. An AMOC is handled through an FAA principal inspector, or PI. The PI might weigh in on the AMOC method proposed and then forwards the request to the manager of the FAA office identified in the AD. If there's no PI (as in the case of a design approval holder), you could send the AMOC request directly to the FAA office. Ultimately, the regional FAA ACO (aircraft certification office) has the final say whether the AMOC provides an acceptable level of safety in addressing the AD. This won't be an easy process and you should have your paperwork and engineering data in good order.

Regardless of how the AD is complied with, the regs say that an AD has to be dealt with and signed off by a person or agency that's qualified and certified to do the work prescribed by the AD. For the most basic AD compliance—maybe a simple inspection and verifying a component's part number—the AD might even say the aircraft's owner can sign off on it. During annual inspection the A&P/IA will backstop it and verify that you, as the aircraft's owner, handled the AD properly.

But that might not be the end of it. Some ADs require repetitive or periodic inspection. In order to provide for flexibility, an AD may allow for adjustment of the inspection interval to coincide with other inspections required by Part 91 (during the next annual, for example), or other regulations. The conditions and approval requirements under which adjustments may be allowed are generally stated in the AD. If the AD does not contain such provisions, adjustments are usually not permitted. However, amendment, modification or adjustment of the terms of the AD may be requested by contacting the office that issued the AD or by following the petition procedures in Part 91.

Many ADs indicate the acceptability of one or more alternative methods of compliance. Any AMOC or adjustment of compliance time other than what is listed in the AD must be substantiated and approved by

COFLYT MAINTENANCE APP

It may seem like a basic chore of responsible aircraft ownership, but keeping track of scheduled maintenance—and keeping on top of AD compliance—may not be as easy as you think. Between oil changes, annual inspections, transponder and pitot/static inspections, ELT battery replacement and even documenting mechanical squawks in a multi-pilot (and multi-airplane) partnership, it can be easy to get behind the record-keeping curve, even forgetting to drag the aircraft to the shop. Worse, you might overlook a critical AD. It happens, but a new smartphone app called Coflyt can help manage the task.

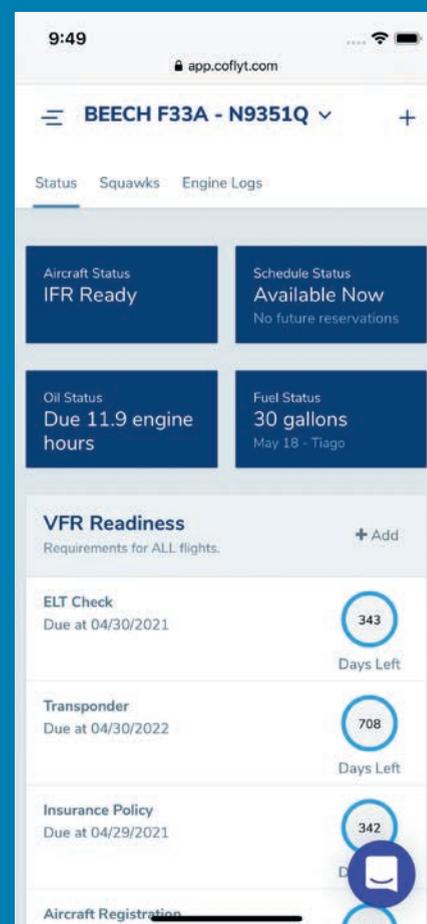
The iOS/Android app's \$14 monthly Solo plan allows you to track the aircraft's maintenance events, see its VFR/IFR readiness and view/log squawks. The Maintenance Insights feature is intended as an ongoing squawk log that you can share with a mechanic (via email link) or among partners in what it calls the Ownership Circle. The \$36 monthly Multi Pilot Plan

adds a scheduling and financial management utility.

At the core of the program is the Aircraft Status utility where you can track VFR/IFR inspections, oil change dates and add custom maintenance reminders. Using the aircraft's registration number, Coflyt posts maintenance intervals like oil changes, 100-hour inspections and recurring ADs tracked by calendar and Hobbs time.

As good as I think the app is for keeping a sharp focus on maintenance scheduling, especially in multi-aircraft clubs, it could be better if it had digital maintenance logging to backup paper entries. Company cofounder Pace Clark—a Beech Baron owner—agrees and told me it's in the works for an update this coming fall. I'll take another look when that happens. For now, the \$14 monthly subscription can work well as a well-executed (and simple) maintenance tracker. Visit www.coflyt.com.

—Larry Anglisano



the FAA before it may be used. That may not be easy to pull off. But it's worth a try, and normally the office or person authorized to approve an alternative method of compliance is where to start, and they are indicated in the AD.

BUYING TIME

The advisory circular is pretty clear and says in part that some ADs are of such a serious nature they require compliance before further flight. For example: "To prevent uncommanded engine shutdown with the inability to restart the engine, prior to further flight," you should inspect this or that.

But other ADs express compliance time in terms of a specific number of hours in operation. For example the AD might say: "Compliance is required within the next 50 hours time in service after the effective date of this AD." Compliance times are also expressed in operational terms, such as: "Within the next 10 landings after the effective date of this AD ..."

Also, when a direct relationship

between airworthiness and calendar time is identified, compliance time may be expressed as a calendar date. For example, if the compliance time is specified as "within 12 months after the effective date of this AD ..." with an effective date of Dec. 21, 2020, then the deadline for compliance is Dec. 21, 2021.

But you still may be able to fly the aircraft after the compliance date has run out if you have a special flight/ferry permit, but only if the AD specifically allows for it. Depending on your comfort level (and severity of the condition that prompted the AD), you might not want to fly it.

The AD guidance stresses that to operate not only means piloting the aircraft, but also causing or authorizing the product to be used for the purpose of air navigation. It could be a faulty avionics component, for example, or something as basic as a strobe light power supply.

Last, in some situations where an acceptable level of safety can be shown, the FAA recognizes that it might be convenient (for an op-

erator) to adjust the AD compliance time, and it offers flexibility with a statement in the AD allowing adjustment of the specified compliance interval. But you aren't off the compliance hook. You're still required to submit data substantiating the proposed adjustment to the local FAA Flight Standards District Office (FSDO) or other designated FAA office for consideration. This will generally be specified in the AD.

YOU'RE RESPONSIBLE

An important takeaway is that the owner or operator of the aircraft is directly responsible for the compliance of any AD. The argument that you expected your shop or mechanic to address the AD during annual inspection won't hold water. But good techs have their finger on the pulse of ADs (and the service bulletins that generally tag along), and thanks to the digital age, you should, too.

If you're shopping for a used aircraft and find long-outstanding ADs, it could say something about how it was maintained. Dig deep.

Unwanted Flight Test: The FAA's 709 Ride

You groundlooped the Decathlon in a gusty crosswind. Now the FAA is demanding that you take a checkride. How are you going to handle it?

by Rick Durden

Correspondence from the FAA is enough to elevate a pilot's heart rate well into triple digits. A letter from the FAA stating that the pilot's competence has been called into question and requesting that the pilot take a reexamination checkride with an FAA inspector will make even the toughest pilot go weak in the knees.

Pilot reexamination—what does it mean? Can the FAA do that to me? What triggered the FAA's sudden interest in me? How do I deal with it? Can I make it go away? Who do they think they are?

We'll answer all of those questions, and toss in some recommendations for actions you should take if you ever get an FAA letter asking you to appear for a checkride to reexamine your competence as an aviator. We'll also talk about some questions that you should ask yourself if you ever get such a letter.

THE LEGALITIES

When Congress established the FAA, it gave it wide powers to take action needed to carry out its

mission to make aviation as safe as possible for the general public. That included permitting the FAA "to reexamine an airman holding a pilot certificate." When can the FAA do this, you ask? According to the law, 49 U.S.C. 44709(a), the answer is "any time."

That's scary. Congress gave the FAA free rein to reexamine pilots. Fortunately, when the FAA set up its own operational standards by which it would enforce the law—FAA Order 8900.1 *Flight Standards Information Management System*—it did not give its inspectors the authority to reexamine pilots any time they felt so inclined. Instead, the FAA required that there must be some reasonable basis for the FAA to question the pilot's competence before it can require a reexamination checkride—suspicion is not enough.

THE TRIGGER

Order 8900.1 gives a succinct description as to what most commonly triggers a request that a pilot take a 709 ride: "In most cases a

reexamination will result from the inspector's investigation of an accident or incident where the airman's competence was the apparent cause of the occurrence." In talking with FAA inspectors we were told that the most common pilot competence events that triggered 709 rides were running out of fuel, a groundloop (with damage) or inadvertently landing gear up.

THE LETTER

The FAA starts the 709 procedure by sending you a letter by certified mail describing the situation and inviting you demonstrate to the FAA that you still have the qualifications and skills for your certificates and ratings within 15 days. The letter will explain the details of the reexamination, including what areas are to be tested and the type of aircraft to be used.

While it is an invitation, attendance is mandatory. If you ignore the letter the FAA will begin an emergency enforcement action to suspend your certificate.

We have looked at some of the cases where a pilot tried to fight the certificate action by alleging that the FAA didn't have the right to reexamine the pilot (never successful) or that it didn't have sufficient cause for the reexamination (we found none that were successful).

At the same time, we're aware of times that the FAA was considering a 709 ride for a pilot, but the pilot had stayed in touch with the FAA inspector who investigated the accident and was able to show that—in one case—the airplane ran off of the runway due to a mechanical failure in the nosegear steering mechanism. The FAA closed its file without taking any action.

NOW WHAT?

The chances are that you're still suffering embarrassment that you've scratched an airplane and now you feel like the FAA wants to kick you while you're down. Nevertheless,

"I did feel like I was forgetting something." An inadvertent gear-up landing may result in the FAA requesting that you take a 709 ride.



And around we go. A groundloop that results in damage or injuries may bring you a 709 invitation letter from the FAA, above. Before taking a 709 ride, take some dual instruction, below.

we suggest that you spend about 15 seconds feeling good and sorry for yourself and then start taking action. First, contact an aviation lawyer. We recommend that pilots subscribe to AOPA's (www.aopa.org) Pilot Protection Services—it's designed for situations like this. Even if you're not a subscriber, you can call them and get names of aviation attorneys in your area. Talk with an attorney about your situation and get advice before going further.

In general, the next step will be for you to call the FAA inspector who sent the letter and discuss getting the checkride scheduled as well as talking a little about the incident. The FAA has some leeway on the 15-day requirement, especially if you were injured or there is some difficulty for you to get access to a similar airplane. No matter what, the idea is to make contact and start things moving toward taking the 709 ride so that you don't run out the clock and face an enforcement action.

Then, and we can't emphasize this enough—go to a trusted CFI and take dual on the areas that will be examined on your ride. Insist that the instructor be completely honest with you as to whether she or he thinks that you can meet the Airman Certification Standards (ACS) for your certificates and that you can pass the ride.

If the instructor says that you can't, get a second opinion. If that instructor says you can't, it may be time for a long talk with yourself as to whether you should continue flying. FAA inspectors and CFIs tell us that in about 10 percent of the 709 ride matters the pilot involved has kept flying too long and, because of the realities of aging, can no longer meet ACS standards.

If you decide that you probably won't pass the 709 ride, it may be time to surrender your certificate. Talk with your attorney before doing so as there may be some options



such as just giving up your instrument rating and continuing to fly VFR.

THE RIDE

A 709 ride is a checkride that covers only limited areas, but it is to the ACS for the certificates you hold. Pilots who have reported to us after a 709 ride have all remarked that the inspector was fully aware that the pilot was extremely nervous and embarrassed to be there and worked to create a non-threatening atmosphere.

While you may be there to demonstrate landings and they will probably be the primary focus of the conversation you have prior to flight, you'll be expected to know the systems, V speeds and emergency procedures for the airplane you're flying.

The flight will probably be fairly short—assuming you demonstrate mastery of the aircraft. If the focus is landings, the flight should not include steep turns under the hood; it must be focused on the reason you were called in to demonstrate your abilities.

If you pass—and from what our research shows, 90 to 95 percent of pilots do—that's it. The inspector takes care of paperwork and you go on to what we hope are many more years of enjoyable flying.

FAILING THE RIDE

If you fail you have some options. You can surrender your certificate. There are formalities associated with that, including that you have to do it in writing. Alternatively,



you can request another checkride. Inspectors told us that they almost always agree and also set it up with another inspector to avoid any claim that the inspector was biased.

Our discussions with inspectors revealed that they don't like failing pilots on 709 rides and that a failure is rarely a "near thing." When pilots fail a 709, they apparently do it in a big way, being unable to come close to objective standards such as airspeed, altitude and heading tolerances.

We also learned that only a tiny minority of pilots who fail a 709 ride pass it on the second try.

If, after failure, the pilot refuses to surrender her or his pilot certificate, the FAA starts an emergency revocation action. We could not find one pilot who was able to win one and we saw some pretty intense (and sometimes irrational) efforts by pilots to show that the FAA was out to get them. Some of those showed indications that the pilots involved may also not have had both oars in the water.

In our opinion, if you fail a 709 ride, it's time to have a long talk with your family, a trusted CFI and aviation lawyer, consider the good long run you've had in aviation and give serious thought to surrendering your certificate with dignity rather than having it taken away.

North American Navion:

With P-51 Mustang DNA, the Navion has crisp handling and plenty of ramp appeal. You'll pay big for quality restorations.



Let's clear up any misconceptions. While the North American Navion (pronounced "navy-on") came from the same company that built the P-51, it's no Mustang. It doesn't have a roaring Merlin engine, doesn't come close to hauling along at 400-plus MPH and won't be valued north of one million bucks.

The Navion is a well-built utility airplane with gentleman-like flying characteristics, and a fine choice for the buyer looking to dip a toe into world of classic aircraft. Done correctly, Navion ownership won't be cheap and ones that are at or below suggested retail pricing will likely need some work. *Aircraft Bluebook* suggests that a late-model 1976 Rangemaster sells for around \$63,000. But a lot of these might be project airplanes in various stages of restoration, lightly modded or in desperate need of a full-up restore. That could mean shelling out over twice its selling price in refurbishment and desirable mods.

You could also look for one that's been loved, and you'll pay for it. Here's a fresh look at the Navion market, with some commentary from the pros who work with them.

MODEL HISTORY

Although not many were made starting around 1946 (about 2700

total), the Navion lasted all the way to 1976, having been manufactured by different companies in various models and incarnations. It had good looks and rugged build quality but while it looked fast standing still, it couldn't come close to keeping up with a 175-MPH V-tail Bonanza. Best you could chi-chi from a stock Navion was around 140 MPH. These days that problem is solved by serious engine, prop and airframe mods.

The Navion was originally intended for military duty, which is why the airplane is built so well. But while North American hoped to sell thousands to military, it didn't sell close to that. The good news is the sales included spares, which means, in general, parts for the small Navion fleet aren't a real problem. Still, maintaining a Navion won't be like that of a Cessna. Like most old airplanes, you might have to work to find certain parts.

The first Navion had a Continental 185-HP engine with a takeoff rating of 205 HP. After building 1100 of these airplanes, North American sold its rights in 1948 to Ryan of San Diego, the same Ryan that built the Spirit of St. Louis for Charles Lindbergh. Ryan dubbed its Navion the A model and built another 1200 before ceasing production three years later. Some of

CHECKLIST

- +
A rugged, well-engineered complex retract with an old military fighter feel.
- +
Thanks to speed and engine mods, you can make Navions go fast.
- ~
Don't be fooled by low sales prices. This is an old airplane that will require constant care and feeding.

the later Ryan models had a 225-HP Continental E-225. The last B model, which used a 260-HP geared Lycoming GO-435 engine, was the last model of the original genuine Navion.

But that wasn't the end of the Navion. It remained out of production until 1955, when rights were sold to Tubular Steel Corporation (TUSCO), which specialized in rebuilding and updating old Navions with Continental IO-470 engines of 240, 250 and 260 HP. These are known as the D, E and F models, re-

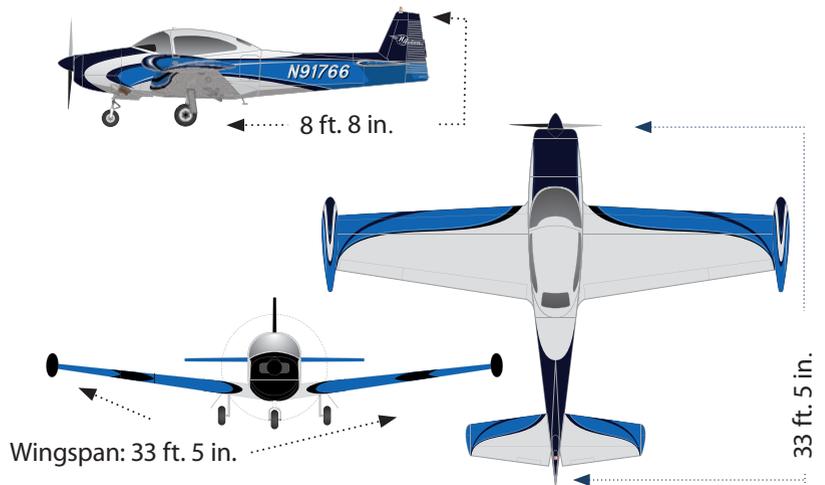
Ron Hanselman sent in the fabulous image of a Navion in full smoke show, above. Owners love these airplanes for their strong construction and a long list of available modifications.

NORTH AMERICAN NAVION

Drawings courtesy
www.schemedesigners.com



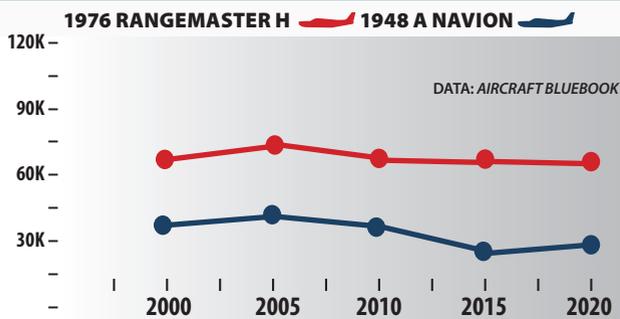
Photo courtesy Rusty Herrington



NORTH AMERICAN NAVION MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1946-1947 NAVION	185-HP CONT. E-185	1500	\$30,000	40/60	900	135 KTS	±\$27,000
1948-1950 A NAVION	205-HP CONT. E-185	1500	\$30,000	40/60	900	135 KTS	±\$30,000
1951 B NAVION	260-HP LYC. GO-435-C2	1200	\$30,000	40/60	968	135 KTS	±\$32,000
1958 D NAVION	240-HP CONT. O-470-P	1500	\$30,000	108	1000	143 KTS	±\$37,000
1959 E NAVION	250-HP CONT. IO-470-C	1500	\$35,000	108	1000	148 KTS	±\$38,000
1960 F NAVION	260-HP CONT. IO-470-H	1500	\$35,000	108	1000	152 KTS	±\$39,000
1961 RANGEMASTER	260-HP CONT. IO-470-H	1500	\$35,000	108	1290	156 KTS	±\$49,000
1962-1964 RANGEMASTER	260-HP CONT. IO-470-H	1500	\$35,000	108	1390	156 KTS	±\$51,000
1967-1969 RANGEMASTER	285-HP CONT. IO-520-B	1700	\$35,000	108	1315	166 KTS	±\$56,000
1970 H DELUX	285-HP CONT. IO-520-B	1700	\$35,000	108	1315	166 KTS	±\$59,000
1975 -1976 RANGEMASTER	285-HP CONT. IO-520-B	1700	\$35,000	108	1315	166 KTS	±\$62,000

RESALE VALUES

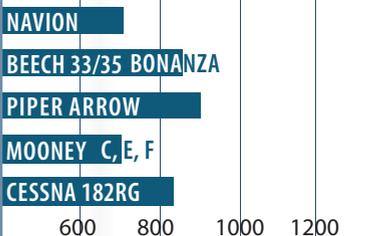


SELECT HISTORICAL ADS

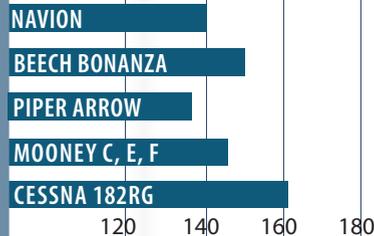
- AD 75-05-02 AIR/OIL SEPARATOR INSPECTION
- AD 59-06-04 INSPECT FLAP ACTUATING CYLINDERS
- AD 55-01-01 FUSELAGE FRAME CRACK INSPECTION
- AD 49-28-01 PROP SPINNER INSPECTION
- AD 47-21-07 REMOVE CORK/RUBBER INDUCTION FILLER STRIP

SELECT MODEL COMPARISONS

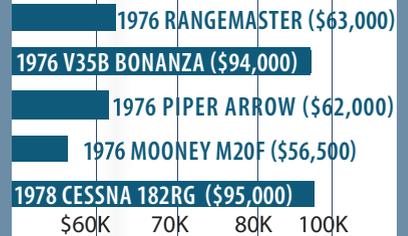
PAYLOAD/FULL FUEL, POUNDS



CRUISE SPEEDS, KNOTS



PRICE COMPARISONS





There is plenty of space to work with on Navion panels. The 1971 Rangemaster at the top is headed from Brazil to type certificate holder Sierra Hotel Aero in Minnesota, for an overdue avionics upgrade. That's a King KX170B and KR85 ADF in the right stack. The overhead panel, middle image, logically houses fuel gauges and toggle switches. The clean panel at the bottom sports a big-screen engine display and Garmin PFD/MFD.



Some of its members bought the Navion rights and in 1967, they began building a handful of Rangemaster H models, which had a 285-HP Continental IO-520 engine. But that company folded, too. Twice in the mid-1970s there were attempts to revive the Rangemaster. Only a half-dozen or so airplanes were built.

Today, the type certificate and manufacturing jigs are owned by Sierra Hotel Aero, which provides service and parts.

There are also a number of well-regarded mod

spectively. TUSCO resumed production in 1958 and introduced some refinements. The sliding canopy was replaced with a door, fuel capacity was greatly increased and a 260-HP Continental was added. Thus was born the so-called Rangemaster G model, but production was short-lived. About 50 were built before hurricane Carla wiped out the factory in 1961.

Still, the Navion endured, thanks to the American Navion Society.

shops that support the Navion and like a handful of other models, the type has an excellent owner organization in the American Navion Society. Reach it at www.navionsociety.org. There's also Southern Navion Air Group at www.goflyyournavion.com. We also found the Navion forum at www.navioninfo.com, but it didn't seem very active (posts were at least six months old) at press time in May 2020. Still, between Sierra Hotel Aero, the American Navion Society

and specialty shops like Navion Customs, the airplane is surprisingly well supported despite its age.

PERFORMANCE

For the prospective buyer, the Navion immediately distinguishes itself in one respect: It ranks as one of the lower-cost retractables on the pre-owned market, according to the *Aircraft Bluebook*. A late-model Rangemaster H has a typical retail price of \$63,000. A 1960 F model is listed at \$39,000. But for certain, pristine models with lots of mods rightfully sell for a lot more. But no matter the price or condition, a potential buyer should go into the deal with eyes open. An older Navion may need a lot of work. The support is there, but you'll still need to pay for it.

With an estimated 500 actively flying, Navions may be hard to find. During our research in spring 2020, we only found a handful for sale in the U.S. Some were North American models, some Ryan and a TUSCO or two. Serious buyer? We say the first step is to join up with the Navion Society, and other online groups, before even considering a purchase.

You'll learn a lot about ways to make the airplane better. To make up for its lackluster performance, many owners have modified and rebuilt their airplanes to a degree matched by few other models. It's safe to say that most of the airplanes have been modified and you'll need help from an expert to sort out what's been done. Some will be light on paperwork and others will have impeccable records. The latter deserves a

The 1950 A-model Navion at the top has a Continental IO-550R STC'd engine mod and an MT composite propeller from Navion Customs in California. An overhauled Continental IO-470, middle, typically runs around \$40,000, plus labor. That's a fire-breathing eight-cylinder Lycoming TSIO-720 experimental conversion at the bottom.

price premium. Ones without a lot of mods are candidates for performance mods, if you have a need for speed. And who wouldn't want to go faster? If you don't, the Navion can be economical, while still going fast enough.

Early 205-HP Navions cruise at about 140 MPH on 11 GPH. The 225-HP versions add about 5 MPH to that number in exchange for a gallon more of fuel burn.

You'll go about 155 MPH or so in the 240-, 250- and 260-HP second-generation D, E and F Navions. In contrast, the 1951 B model, with the geared 260-HP Lycoming, ranks as the most inefficient Navion built: It can manage only about 153 MPH on 13.1 GPH. Other low-priced used retractables such as the Comanche 180 and early Mooneys fly faster and use less fuel, but they're also more expensive and lack the Navion's expansive cabin comfort.

We're told that a 1961 model G Rangemaster powered by a TCM 260-HP IO-470-H engine with GAMInjectors has typical lean-of-peak true airspeeds in the 155 to 158 MPH range on around 11.5 GPH.

Takeoff performance varies by engine installation, of course, but this is generally one of the Navion's selling points. According to early sales claims, the A model had a takeoff ground run of only 560 feet while Rangemasters hop off the pavement in 425 feet. However, so many airplanes have been upgraded with larger engines—all the way up to a Continental IO-550—that performance is all over the map. "The fat wing will still get off the ground in 600 to 1000 feet, depending upon engine, and cruise at 125



to 165 knots, again, depending on engine," writes owner Case Ketting. In any case, the Navion is better than average at short-field work and will get into short runways comfortably.

PAYLOAD, CABIN EXPERIENCE

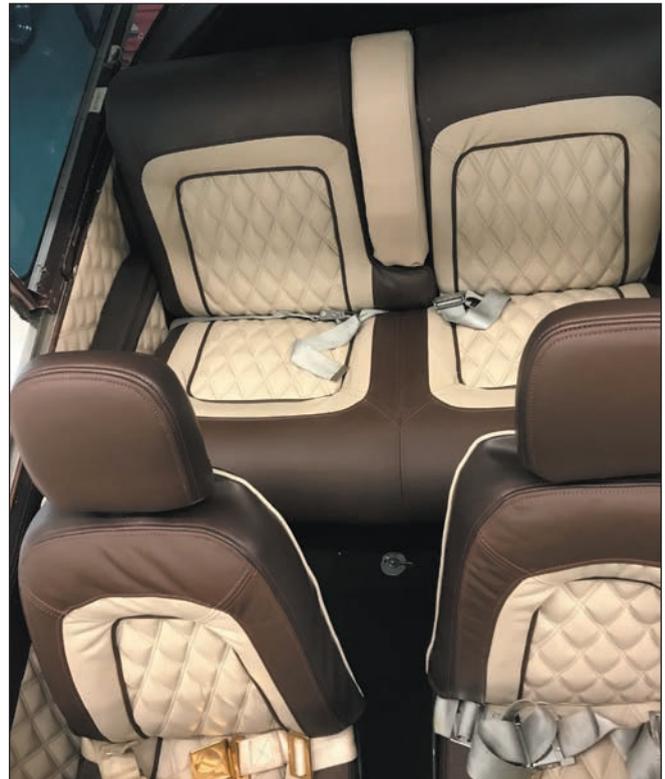
Fuel capacity differs widely from one Navion to another, so it takes effort to pin down actual payload numbers. Although the basic fuel system has 40 gallons, many Navions have an extra 20-gallon tank under the rear seat or in the baggage compartment. Also, there are several different types of tip tanks available, which some owners say can yield a range of 1000 miles.

Late-model Rangemasters had fuel capacities of up to 108 gallons, although that much fuel would limit payload. Generally, expect still-air range of about 600 miles in an older



Navion with 60-gallon tanks. This will be reduced somewhat as extra passengers and baggage are added.

Despite its beefy construction, the Navion weighs 1900 to 2000 pounds empty with a gross weight of either 2750 or 2850 pounds, giving it a useful load of around 800 pounds. The



The Navion cabin is simply utilitarian. Bring good headsets.

gross weight on the G Rangemasters can be as much as 3315 pounds. At the lower weights, with four people and 100 pounds of baggage, there isn't a lot of room for fuel. The 260-HP version has a useful load just a little better than the A model's. Unfortunately, it burns 20 percent more fuel, so on the same trip, the load would even be more limited.

More practical for longer trips are the re-engined D, E and F models, which have increased gross weights. For the typical 260-HP Rangemaster, the useful load is about 1200 pounds. This provides for decent range with four passengers and 100 pounds of luggage. Although not recommended, thanks to its fat wing, owners tell us the Rangemaster will take off and climb with about anything you can stuff into it.

And that turns out to be a lot. By any standards, the airplane is quite large, with an enormous cabin whose seating style is best described as regal. Once inside, passengers will be more comfortable than they

would be in a Mooney or a Bonanza and with a better view. The rear seat is straight out of a 1950s sedan, a broad bench that will fit three people in acceptable comfort.

"The Navion's spacious cabin allows passengers to move (carefully) from front to rear seats in flight. Try that in a Mooney!" writes owner John Leggatt. Up front, the panel is big and broad with good visibility forward and sideways, with a smattering of instruments and switches on the canopy overhead. Sound-

cost-of-entry advantage. Here are some hotspots to pay attention to.

Landing gear: These are hydraulic systems, with the usual headaches with retrac links, hoses and pumps. Some older airplanes may still have the original single-piston hydraulic pumps, which should be replaced with new versions. Check for loose trunnions in the gear pivots and for play in the nosegear, causing shimmy.

Corrosion: Like other military airplanes, Navions built by North American were lavishly zinc chromated. But Ryan cut back on chromating and that may allow some corrosion to creep in. "Remove the seats, side upholstery panels and wing root fairings," wrote one

owner, "and check for corrosion where the fuselage mounts to the top of the wing."

Cooling: Although most examples have probably been cured of this, early Navions had inefficient updraft cooling. The B model with the 260-HP Lycoming has oil temperature problems easily cured with a larger aluminum oil cooler.

Propeller: The old Hartzell diaphragm-type props used on original Navions will leak. They must be re-

The Navion was originally intended for military duty, which explains the rugged build quality.

proofing wasn't a priority in the 1940s, so unless owners have done their own soundproofing mods, the cabins tend to be noisy—even with good headsets.

MAINTENANCE ITEMS

We highly recommend buyers new to the Navion find a shop familiar with the airplane to do a thorough prebuy evaluation. Although cheap to purchase, a poorly maintained example can easily offset any initial



That's Tanner Matheny's 1946 N-model Navion, packing an IO-550B under the cowling.

placed and adjusted regularly, if parts are available, or the prop replaced with an STC'd upgrade. (Hartzell and McCauley offer upgrades, but not for all engines.) There's also an STC for the monstrous MT composite scimitar for big-engined Navions.

Continental E-225: Later Ryan models had these engines, which have a reputation for being somewhat temperamental, tend to leak oil and are relatively expensive to overhaul. Owners and shops we talked with recommend upgrades instead.

Fuel tanks: The Navion was built a lot like the P-51 where the two wings were bolted together and then bolted to the fuselage. The wings house aluminum fuel tanks, coupled by rubber hoses. And of course those hoses get dry and ultimately crack. We're told the only real way to get the tanks out is by pulling the wings off the airplane and separating the wings from each other. Sound like a big job? You can bet it is. Navion pros suggest finding an airplane that's had this so-called wing demate in the last 25 or so years. It can be a \$10,000 job.

Damage and paperwork: We're told almost every Navion has been on its belly at one point or another, but a gear-up landing typically doesn't always do substantial damage other than taking out the flaps and the prop. And of course as with many old airplanes, paperwork might be light and missing some maintenance entries. We suggest hav-

ing the airplane weighed after major upgrades, or even if it hasn't been weighed in the past few years. You can tell a lot about the care of the airplane by its paperwork.

MODS AND HOT RODS

To learn about the current Navion market we talked with Navion Customs in Chino, California. This shop has been working with Navions for over 20 years and reports a steady flow of them coming through its doors for repair, mods and engine swaps. It's been flying a Navion in the experimental category with a Lycoming TSIO-720 eight-cylinder turbocharged engine bolted on. But for a more realistic upgrade that's FAA certified, company principal Ryan Douthitt (who grew up around the Navion) told us the 285-HP type-certified Continental IO-520 is a worthy and popular choice of engine upgrades for older models, especially ones with the E-225, although he told us the shop can generally make them run well, too. A properly tuned small engine can make a Navion do a respectable 140 knots and bigger ones, plus plenty of speed mods, make 175 knots a reality.

Navion Customs owns the STC for the big 300-HP IO-550B and is working on an STC (some have been installed with a field approval) for the 310-HP top-inducted Continental IO-55OR, an engine that's done well on the Cirrus SR22. It requires a cowling change to a two-piece cowling and you'll likely have to change the mount. The prop being used in the STC is a three-blade composite MT propeller.

Douthitt knows the Navion well

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NAVION MISHAPS: MAINTENANCE

Over many years of reviewing the 100 most recent accidents for the Used Aircraft Guide, we've only occasionally found red flag issues. After looking at the last 100 Navion accidents we came away concerned about the fuel system generally and the fuel selector valve and gascolator in particular.

We counted at least 13 power loss or engine stoppage accidents in which failure to maintain the gascolator or fuel selector valve resulted in leaks. Once the engine was started, the leak became a route for air to get into the fuel line in sufficient quantity to cause a power loss or engine stoppage.

What was scary to us was that in nearly half the cases, the owner/pilot knew of the leak and didn't have it fixed, even when there was a service bulletin that addressed the specific problem. One owner even had to run the electric boost pump to keep the engine running when operating at low power—something that he'd been doing for some time rather than have the existing leak fixed.

The fuel selector valve played a role in nine accidents in which the pilot either didn't change tanks after running a tank dry, got confused about which end of the selector handle pointed at the desired tank, pointed it between tanks or inadvertently selected the "off" position. One owner disassembled and reassembled his fuel selector valve and put the handle on backward. You guessed it—he knew it, but flew the airplane anyway and still managed to point the handle the wrong way.

We recommend that anyone looking to purchase a Navion make sure that the fuel system is inspected carefully with special attention to evidence of leaks. We also recommend a careful checkout on the fuel selector.

An owner spent 10 years restoring his Navion. He then hired a technician to perform an annual.

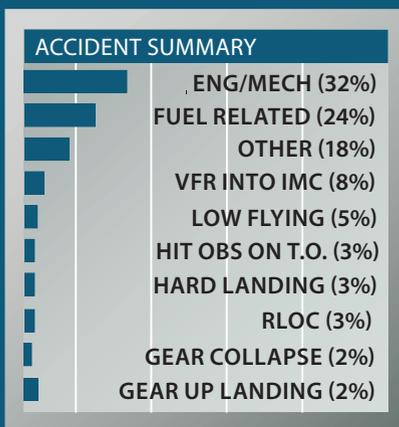
The tech refused to sign off the airplane. No problem, the owner flew it anyway. After the crash, the fuel selector and gascolator were found full of a brown liquid contamination.

On the positive side of the equation, we were impressed to see only three runway loss of control (RLOC) accidents—a stunningly low number that is evidence of excellent handling characteristics of the breed.

We've long been impressed by the Navion's landing gear. It's tough and it seems to work reliably. We found only one event in which the gear wouldn't extend and two gear collapse incidents.

The willingness to fly with known maintenance issues caused us to wonder about those who own Navions when it comes to good aeronautical judgment. Eight VFR into IMC fatal accidents as well as five low flying crashes—one involving an intoxicated pilot buzzing a family backyard barbecue, leaving part of a wing in a tree adjacent to the grill itself and then rolling into power lines and the ground—didn't improve our outlook.

We were particularly troubled by the report of a pilot and his friend drinking heavily at their favorite bar and overheard talking about "crazy aerobatics," who left to go fly the pilot's Navion. The radar track showed major speed, direction and altitude changes before the airplane broke up in flight.



enough to attest the heavy airframe really needs extra horsepower over stock to deliver the climb and cruise performance that the typical owner wants. The IO-520 is a lot of bang for the buck and has a straightforward install.

With the extra horses in place, you can tweak some more speed by cleaning up the airframe with gap seals, narrower landing gear, fairing mods and tire mods, to name a few.

But before buying any speed mods we think the first step should be to properly rig the airframe and flight controls and inspect and replace hardware. A lot of these airplanes have been patched up over time with abandoned antennas, plus we've seen some hacked-up autopilot installations that made the airplane unsafe at any speed.

Like many old airplanes, annual inspections can either be easy or labor intensive, and we think having a shop with extensive Navion experience is the absolute best way to maintain one. We're told that typical annuals (ones that are done correctly) could run \$4000, while others might be less or a lot more. It really depends on how the airplane has been maintained. Fuel tank work can require removing the wings, for example.

Navion Customs also does avionics work and panel upgrades, and has done a fair amount of ADS-B upgrades, of course. And panel replacement is part of the bigger picture of simply getting rid of the old and making an already good airplane better with modern systems, while getting rid of old and tired wiring and antennas. Some Navions have been worked over so extensively that some ramp gawkers might not even recognize them as a Navion, especially decked out in a new paint scheme and a bunch of big-screen glass on the panel.

As Douthitt put it, "You really have a blank canvas because there's so much that you can do to these airplanes."

That includes extended-range fuel tanks. J.L. Osborne (www.jlosborne.com), which is part of GAMI, has the 20-gallon wing tip tank mod for the Navion. The tank is all aluminum and has recessed LED strobe and nav lights, a flush filler neck and a concealed drain. The tanks can

Thanks to Gordon Nesbitt for the example of an original Navion (foreground) and one with lots of STC and field mods, including fuel tip tanks. Not aerobatic, but Navions are at home around airshows. That's Faron Naquin's 1951 Ryan Navion tucked behind the Jeep. He says owner-assisted annuals average around \$1000. The Navion at the bottom was worked over by Sierra Hotel Aero and looks like it came off an assembly line in 2020.



improve lift, increase gross weight (250 pounds) and some report a few knots' increase in cruise speed. Osborne suggests that typical installations could take around 25 hours.

D'Shannon (www.d-shannon-aviation.com) has a PMA'd stainless steel exhaust system, plus aileron and flap gap seals.

Another respected source for mods, refurbishment work, avionics upgrades and anything related to Navion support is type certificate holder Sierra Hotel Aero (www.navion.com) located in St. Paul, Minnesota. Its website shows off some impressive Navion modernization projects. It, like the American Navion Society, is a good source for locating service parts—from instrument panels to fuel system components—and technical data, including service letters and bulletins.

Shopping the market? Realistically you'll pay \$150,000 or more for one that's well kept, has modern avionics, nice paint and interior and has speed mods. A major engine and prop upgrade could come close to \$90,000.

FEEDBACK

As vice president of the American Navion Society I am very active in the type club, and as an A&P mechanic I also maintain several Navions. I am very fortunate to have earned my private pilot's license in my dad's Navion H Rangemaster in 1974. I have owned and flown my Navion for 18 years and have traveled all across the country in this Navion. Also, I commute an hour each way a couple of times each week

in my Navion and am now flying around 250 to 300 hours a year. My family currently owns a combined five Navions.

Each Navion is unique due to modifications made over the years so no two are identical. Horsepower can range from 185 up to 310 and there is even one modified with a turbine engine. There are numerous approved modifications that improve visibility, reduce drag and extend range. These modifications have little effect on handling. Stall characteristics remain very docile, and the Navion will not spin but will instead enter a spiral that is easily recoverable. Low-speed handling is excellent with no tendency to ever drop a wing and roll control through the stall.

I have flown a couple of dozen different Navions and my personal Navion over 4000 hours. When I bought this Navion she had a tired E-225 engine and looked sad, but



flew well and like most Navions was still a very solid airplane. During the last 18 years I have upgraded the engine three times, first from an E-225 to a 285-HP IO-520B then to a 300-HP IO-550B and finally to a 310-HP IO-550R. Each successive engine change has resulted in improved performance and efficiency.

Lightly loaded my Navion can take off in less than 200 feet and fly out

Navion

(continued from page 31)

of ground effect immediately with no headwind. Initial rate of climb is 1800 feet per minute, and it will hold 1000 feet per minute through 10,000 feet. Service ceiling is in the flight levels and it will cruise 150 knots true airspeed at 17,500 feet on 9.5 gallons per hour.

My normal cruise altitude is between 7000 and 9000 feet where my Navion will cruise 155 knots on 10.5-11.5 gallons per hour lean of peak or 165 knots on 16.5 to 17 gallons per hour.

Due to very large flaps and excellent low-speed handling an experienced Navion pilot can land in around 500 feet. Very steep descents are possible when the landing gear

Some Navions are top-of-the-food-chain show-worthy, like Phil Pinet's modded 1961 Rangemaster.



and full flaps are deployed with no tendency to build airspeed. In clean configuration glide is very respectable.

The Navion is a joy to fly. Rotate at 60 MPH indicated and fly off by 70 then pitch for 80 MPH while the gear retracts. This practice will result in a steep initial climb with a big engine and much less so with less power. Landing is simple, half flaps and 90 MPH on final is the easiest method to make a smooth landing. For short landings 70 to 75 MPH on final will work fine depending on current load and CG location.

The Navion has a large elevator that can hold the nose up through the stall resulting in the airplane settling in a flat attitude. Adding power or reducing back pressure on the yoke will immediately recover the airplane. Flaring and stalling too high on landing is a practice to be avoided as is touching down in a crab during a crosswind.

I recommend getting instruction from an experienced Navion pilot before venturing out on your own. The American Navion Society has a list of experienced Navion pilots who are willing to give demonstration rides and help prospective and new owners.

Maintenance is not a problem unless you buy

DECATHLON/ CITABRIA



It's time for a fresh look at the used Decathlon and Citabria market in an upcoming Used Aircraft Guide. We want to know what it's like to own these trusty aerobat models, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your Decathlon or Citabria 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 these planes by Oct. 10, 2020, to:

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a Navion that has been neglected for too long and use a shop that is unfamiliar with the type. An owner can spend a lot of money getting any neglected airplane into good condition. Once in good condition annual maintenance costs for your Navion should be less than the average high-performance complex airplane.

There are no expensive electric motors for the landing gear or flaps, only inexpensive O-rings and the occasional hydraulic hose, and there are no corrosion-prone magnesium control surfaces.

I'm available for demonstration rides and generally have five to seven Navions available at any one time.

Russell (Rusty) Herrington
Vice President
American Navion Society