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FIRST WORD

THE TYRANNY OF ONE MORE THING

I wouldn't be the slightest bit surprised if an archeologist rooting around the middens of some ancient society unearthed, along with pottery shards and crude tools, a Bendix 1200 magneto, with the part number intact. Magnetos are what industrial historians sometimes call "persistent technology." Gee, ya think?

In this issue, we're reporting on the demise of the Bendix dual mag, a cursed thing which represents one of evolutionary blind alleys that often dog industrial development. It's not that it was really that awful, it's just that the idea of two mags in the same housing struck some people as like putting a screen door in a submarine.

But there's also an opportunity here and a little company called E-Mag Ignitions is trying to seize it. E-Mag has developed a successful line of electronic magnetos for the experimental trade and they'd now like to leverage that into the certified market which, it seems to me, is now ripe for replacing these relics.

Of course, Unison thought the same thing when it developed the LASAR mag in 1995. This was a small baby step toward solid-state ignition which sought to provide some of the benefits without representing an impossible certification challenge. And it succeeded at both. However, the benefits were, should I say, subtle. The things didn't exactly fly off the shelves because they just didn't do that much. Fuel savings were elusive and quicker starting just wasn't that big a deal.

The E-Mag could potentially take electronic ignitions beyond the baby step and into something that actually has a real advantage for owners. They produce a sharper, hotter spark so they'll fire extreme lean mixtures more smoothly and this should also improve starting with richer mixtures. Better yet, they can be mapped to advance settings as much as 39 degrees BTDC. That has implications for fuel economy, too.

Sounds like a great idea, right? Except the FAA will do everything it can to keep it from happening. No, there's no grand conspiracy at 800 Independence Ave. to thwart electronic ignition or advances of any kind, it's just that the FAA's lower and middle bureaucracy is now staffed with people gripped by the "one-more-thing" syndrome. I'm told that this is now worse than it's ever been.

One more thing means that if you've collected 200 spin data points, some well-meaning FAA engineer will want 300. Or the FAA will concede a 150-hour test run is standard, but some well-meaning FAA staffer will propose 250 hours instead. This sort of thing nibbles away at the limited capital of a small outfit like E-Mag and all but stymies what should be real progress in the industry.

Interestingly, one of the proposals floating around the FAA is to remove certification work for airplanes under 6000 pounds from the FAA and place it under the ASTM process used for LSAs. I wrote about this in the May issue. But even some of the regulated don't like that idea. Cirrus founder Alan Klapmeier told me his problem with this is that with no uniform oversight, the first crash would result in the entire process being called into question during litigation, something he thinks could tank the entire industry. (Hard to imagine it being deeper in the tank than it already is.)

So what's the solution? One might be to move some of the cert projects into ASTM—say appliances like magnetos, alternators, fuel pumps and so on. Run that for a few years and see how it works. Whatever happens, these smaller companies need to get FAA mid-level apparatchiks off their backs or, sure as hell, we'll still be flying with magnetos at the turn of the next century.

—Paul Bertorelli



Retract Retorts

As always, I enjoyed reading *Aviation Consumer's* airplane review of bargain retractables in your April 2010 issue. But having owned both an Arrow and Cardinal RG, you represent the especially efficient Cessna 177RG unfairly.

In range, for example, you chart the RG range at 500 miles, which must be the original 1972 50-gallon model. The 1973 RG manuals call for 682 miles, while 1974-1975 models with standard 60-gallon tanks show 821 miles range at 75 percent cruise power.

This places the 177RG just behind the Bonanza and Debonair in range capability. Your chart should have at least shown this model variation, if not the maximum, since it purported to include optional fuel.

In real life, my 60-gallon 1975RG cruises comfortably at 140 to 145 knots at 10 GPH depending on load, for 6 hours without reserve. My 1977 Arrow III (which back in the day sold for a premium over the T-tail IV, due to its more polite runway manners) cruised no better than 135 knots on 12GPH, also for 6 hours thanks to its larger 72-gallon tanks.

Even the Piper manual claimed only 143 knots at 11.6 GPH, with a no-reserve range of 810 miles.

Ken Towl
Via e-mail

I just read your article on bargain retracts and have two nits to pick. There is no way that a Cardinal RG has less range than a more draggy Cutlass RG as indicated in your second bar graph. I suspect that the two were somehow switched.

The second logic error that I

noticed has to do with the Cardinal RG's engine dash number in the chart on page 31. It should be -A1B6D not -A1B60. Other than that, keep up the good work. I look forward to the *Aviation Consumer* appearing in my mail box each month.

Name withheld

To the 363 Cardinal owners who wrote expressing some version of the sentiment, "no #@!\$%& way is my Cardinal that*

all ChartBook systems feature solid state (SSD) hard drives.

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Definition display is not offered by any other company. We want to be sure readers recognize that the similar 2Go PC platforms offered by two companies in the review are not identical in terms of components or options.

Please also note a pricing correction: ChartBook with Flight Definition Display is priced at \$1995.99

continued on page 32



Bargain Retractable:

Now's a great time to buy a retractable single. Piper's Arrow is the best bang for the buck.

By Joseph E. (Ed) Bernadek

Now's a good time to buy a retractable. Why? Because I can snag up pretty much whatever they want, paying as little as 50 percent of what the same plane might have gone for only three or four years ago. (I've owned a Piper Arrow always has been the right airplane for you is the right airplane for your mission. For many of us, that one was a four-seater capable of cruising at around 130 knots for four hours—plus 80 reserves—and enough payload to reasonably hand four adults and bags, even if we need to offload some fuel. So, we're basically talking a retractable single. The good news is there are a lot of

them from which to choose. The bad news? Even in this market, finding the right bargain will still take some work. To be making the process easy as for you, we set an arbitrary price of \$60,000 and, with a fresh copy of the *Aviation Consumer's* Piper Arrow in hand, looked at what's available and what you can expect. We found that best bargain is the Piper Arrow IV, but many other models may merit your attention, especially if you have some special needs or desires.

CAVEATS
With the economy in the tank and some desperate sales strategies, prices will be lower average, it's definitely a



Straight-tail Bonanzas like the 1967 B-13 above are good performers for the money and are still supportable. The 1959 Cessna 250, upper right, retails in the mid-60s and appears rare above them. Although J-model Mooneys aren't cheap, the pre-2010 J-1 like the one at quite affordable at under \$60,000 for a good example.

As retractables go, Piper's Arrow offers a high-value combination of good price, supportability, ease of operation and middling performance.

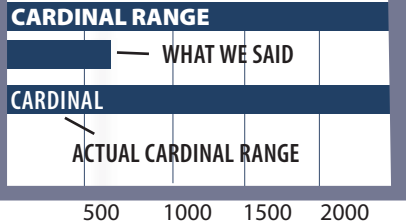
buyer's market. Which means it's probably not a good idea to jump on the first "deal" you come across. Instead, spend some time watching Trade-A-Plane and other resources for those airplanes that seem reasonably priced but which haven't sold. There, since there's usually a good reason an airplane hasn't sold if it's priced right, ignore them.

At the same time, think carefully about what you might be getting into. For example, some of the models averaging \$60,000 these days are 50 or more years old. While age alone wouldn't deter us from a well-maintained airplane, buying an airplane that's essentially a vintage airplane isn't for the faint of heart. It could be a real money-maker, or it might require a couple of years and several trips to the shop to get it sorted out the way you want. And if you find some serious issues on your pre-purchase inspection, your \$60k bargain easily could turn into an \$80,000 albatross.

Also, the very idea of having a retract may not be the best one for you. That same \$60,000 can get you into a mid-1970s Skyline or slightly older Cherokee 235, which will meet all of our basic criteria without the maintenance or clearance expense of retractable landing gear.

Finally, in another area where you may find "average" isn't what you had in mind. The flight prices we used in evaluating this market, for example, may not include a moving map GPS or autopilot, something you consider standard equipment in an airplane used for traveling. We generally were able to find an airplane with all the goodies they want already in the past, since adding them yourself costs more than having them already installed. When looking for one of these bargain retractables already equipped with all the goodies you want, expect the price to

Ed Bernadek is Editor-in-Chief of *Aviation Consumer*. Write to him at ed@aviationconsumer.com.



short on range," we hereby post a groveling and mortifyingly sincere pledge to never again fail to more carefully examine all the fuel tank options. Here is a corrected range chart carefully distilled from actual reader reports.

EFB Follow-Up

We know articles are space limited, but we would like to stress two critical areas in your well-written article "Tablet-Based EFBs: Chart-Case Wins by a Nose." (See the May 2010 issue.) Please consider the following response offered as a clarification.

Stenbock & Everson, Inc. is proud of earning the top pick award twice in a row. In our experience as a leading EFB provider, we rate a solid state disk (SSD) and the best possible display as make-or-break EFB features.

If you fly with a standard spinning drive, it isn't a matter of if you'll have a failure, but when your failure will occur. To avoid the issues that plague standard drives,

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CHECKLIST

-  Real increase in likelihood of rapid response after crash.
-  Several new models could make installation cheaper but ...
-  ... installation often costs more than the new 406 Mhz ELT

406 MHz ELTs: ACK and Kannad Lead

Prices on 406-MHz ELT beacons are dropping but the surprise cost is running new wires. We like the designs that make installation simpler.

by Larry Anglisano

From our perch, we see high-priced 406-MHz ELT interest bottoming out. Maybe it's because Transport Canada has backed off on an initial threat of mandating 406 MHz beacons for any aircraft operating in Canadian airspace—at least for now. This mandate was a driving, if shallow, motivation for U.S. operators to drop a couple of grand on new ELT technology.

But even without the Canadian mandate, going 406 is something we all should plan for at some point. Many owners are in denial that distress signals from old 121.50 MHz beacons aren't satellite-monitored anymore, can't be tied with on-board GPS for transmitting wreck coordinates

or even that the device in the tail might be over 40 years old. There are a handful of good reasons to invest in a 406 ELT and some

AIRCRAFT UPGRADES

well-worn excuses not to. Maybe you always fly IFR, or never in the sticks, or always in earshot of a listening control tower. But given the improvements in 406 technology, we think the investment is worthy.

DISASSEMBLY REQUIRED

The good news is that beacon prices are falling and there are more offerings. The bad news is that ELT installs are pricey projects. Owners are shocked to see lopsided quotes where shop labor far exceeds the

cost of the system. We're not talking complicated avionics work here. Instead, it's the grunt-work that tags along with many ELT installations that kills the deal on more than a few proposals.

The issue is that 406 beacons require an ELT remote activation control switch (to be located within easy reach of the pilot). Aside from the instrument panel work that's required for mounting the switch, there's often new wiring that needs to be connected between the beacon and that switch even in ELT upgrades.

Unfortunately, the wiring effort to connect that remote control switch with the transmitter that's all the way in the back of the aircraft often requires removal and

then reinstallation of the aircraft interior. Owners underestimate this challenge. Some interiors are old, brittle and cracking. Others are tightly-sewn custom designs not intended for easy removal. In some panels packed with gear, there might not be room for the switch. And even if there's an existing switch on the panel, it might not be the same size as the new 406 switch. The wiring is seldom compatible.

Some manufacturers like KANNAD and ACK are attempting to tame this dragon with universal remote switches. More on that later. Our advice is to coordinate an ELT upgrade with maintenance intervals and other avionics projects that might require interior disassembly. And even if you decide to hold off on a full installation, your shop can always route ELT wiring through the interior while it's opened up. New interior upgrades are perfect timing for this easy task.

As with any other system, the antenna effort shouldn't be underestimated. Pressurized aircraft could need additional approval and definite expertise. Faster airframes might require high-speed antennas that will cost more than the standard whip that come with most GA ELTs.

Since many beacons offer an optional GPS interface for more precise transmit data (as tight as 100-foot accuracy with a response time of approximately 10 minutes according to manufacturers) avionics shops and not maintenance shops need to be involved in the project.

This means the radio stack will need to be disassembled to access the connectors on the GPS. For models like Garmin's GNS 430, for example, this could mean several hours' worth of additional labor to wire into a serial output port. Hopefully the previous installer pre-wired spare outputs for future connection. Don't assume the install will include a GPS interface. You'll need to ask for it.

ACK E04

The long awaited ACK Avionics model E04-406 still waits for final

406 MHZ ELTS COMPARED

MODEL	PRICE	GPS INTERFACE	CERTIFICATION	COMMENTS
ACK E04	\$599 (\$530 R-model)	SERIAL INPUT	PENDING IN U.S.	E04R drop-in for E01 121.5 model; years delayed to market
AMERI-KING AK451	\$1158	SERIAL INPUT	YES	Serves double duty as fixed mount or portable model
KANNAD COMPACT	\$945	OPTIONAL	YES	Two- or three-wire, remote-switch compatible; small and lightweight
POINTER SKYHUNTER	TBD	INTERNAL	PENDING	USB update port and internal GPS
ELT ELT406	\$1360	INTERNAL	YES	Internal GPS and battery monitoring
ARTEX ME406	\$1150	OPTIONAL MODULE	YES	Commercial quality; ACE model easy retrofit

certification. With rumors flying, we recently had a long talk with ACK President Mike Akatiff for the real story surrounding the much-delayed E04. Frankly, we walked away feeling sorry for him and his product stuck in the testing process.

The 406 MHz E04 and direct-replacement E04R system has been approved for use in Canada as well as in Europe so it's clearly a sound product. And as we go to press, ACK expects U.S. approval in a matter of weeks although we've heard that before and ACK is tired of saying it. The system already has TSO-approval, but the waiting game is for final COSPAS/SARSAT approval, pending years of testing accomplished by the U.S. Army. Apparently there have been more than a few snags in the approval/testing process. The company web site reveals stacks of

E04 beacons ready to ship once the final approval is issued. ACK makes it clear that the unit has never failed any of the testing. The wait is the result of Army/COSPAS coordination.

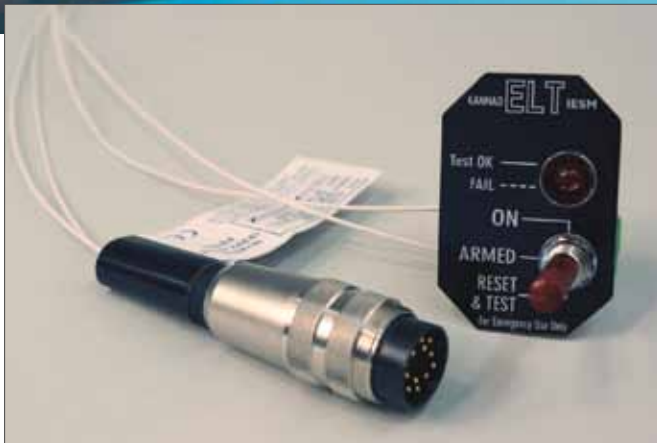
And for consumers the wait will be worth it. Foremost is the price: A new E04 system with everything you'll need for a new installation is \$599 while

Tied up in the final steps of certification for some time, the ACK E04 represents a great value (once you can actually buy one that is). The E04R version is a drop-in replacement for the popular E01.





Kannad's Compact can be strapped onto any existing mounting and their RC102 remote is designed to work with existing wiring.



reworked 121.5 MHz E01. Instead, the circuit board includes newly designed ICs to efficiently fit into the tight chassis. The beacon outputs 13.7 watts of EIRP power on transmit. Contrast this to a measly 200mW of a 121.5 MHz model.

There's a built-in GPS interface without the need

the E04R drop-in replacement for an existing E01 ELT is \$560. In our view, this is an excellent value, and it's made even better through liberal mail-order discounting. Second is the level of modern technology built into the E04. The unit is more than a

for external converter modules. You simply wire the RS232 outputs from common GPS units to include Bendix/King, Garmin and generic NMEA format.

The unit has a five-year, TSO'd lithium battery that currently sells

for \$99. And when the battery is installed, the unit including mounting tray weighs less than two pounds. The standard whip antenna is rated for 260 knots and is the same footprint of the antenna used on the old E01 model so antenna installation should be easy.

So will this seemingly perfect modern ELT ever make it out of the testing process? We hope so and here's our prediction: We think the 406 MHz upgrade market will come alive once this beacon hits the market. There were over 63,000 old 121.5 MHz E01 units sold and many beg for a drop-in E04 replacement. At \$560 we think the pending E04 is a solid value.

KANNAD COMPACT

The French-made Kannad Compact model is growing legs in the U.S. market given its reasonable cost and small footprint. With mounting tray it measures 6.8 x 3.9 x 3.4 inches and weighs 1.8 pounds, including the two-element battery. It's perhaps the smallest and lightest 406 ELT.

Kannad is no stranger to the beacon world manufacturing maritime EPIRBs, PLBs and aircraft ELTs for over 20 years. The Compact uses a single battery to power beacon and the remote control switch without the need to connect aircraft power. Kannad told us the six-year battery in its unit exceeds the certification requirements by 300 percent. As a result, the beacon can operate up to 120 hours after activation (the requirement for 406 operation is 24 hours). The Compact has five watts of transmit power output on the 406 MHz band and the usual 100mW on the 121.5 MHz band.

KANNAD also attempts to tame the overall installation effort. For instance, there's a universal mount-



Just looking at this Artex ME406 makes the install look trivial. The hidden cost is in wiring to the remote switch and optional GPS connection.

ing tray that can be configured to bolt onto existing ELT mounting holes so techs can leave the drill in the toolbox. If the existing 121.50 beacon uses a remote switch that has two-wire interconnect (many do) KANNAD offers the RC102 remote control unit that can saddle up with the existing switch wiring. The RC200 remote control is standard and uses a three-wire interconnect.

The self-testing procedure which is accomplished monthly consists of pressing the self-test button on the remote switch (or on the beacon) and status is indicated by a flashing light and buzzer. A dedicated self-test button ensures there's no inadvertent beacon activation. Further, this remote switch is powered by the battery in the beacon, so no ship's power interface is required.

ARTEX ME406

The Artex ME406 has been a brisk seller with a street price just under \$1000. It was one of the first 406 models intended for light GA aircraft and there are many flavors available for varied applications. But don't expect any shortcuts in a ME406 installation. You'll need the provided remote control switch and new wiring from beacon to the switch as well as an antenna change. The issue is Artex requires shielded wiring between the beacon and the switch, a standard that doesn't exist in many 121.5 installs. There's no internal GPS interface module, so that functionality requires a pricey remote carried over from the transport-category market.

The ME406 ACE model is targeted for replacing ACK E01 units, using the existing remote switch and wiring. There's an ACE version targeted at Cirrus applications complete with a 1.25-foot coaxial cable specific for a Cirrus install. Also worth mentioning is that the ME406 can drop into an existing Artex 121.5 beacon mounting tray. There's also a helicopter flavor (HM) unit with a multi-axis G switch that can activate any



SPOT'S LATEST: AN ELT STAND-IN?

Having a 406 MHz ELT or beacon is one way of getting found, but as good as this technology is, it won't do something that costs a fraction as much will do: Track your progress on a trip.

For that, the Spot GPS Satellite Messenger is the technology of choice at a typical retail price of \$149, plus the yearly charge for the service, which is either \$99 a year or \$148 a year, depending on level of service. At Sun 'n Fun 2010, the company announced a new version of the Spot. It's phasing out the older unit. The new version is about two-thirds the size of the original, making it close to a shirt-pocket profile.

We first covered the Spot in the June 2008 issue of *Aviation Consumer*. The Spot isn't an ELT or a beacon, but an interactive GPS-assisted satellite messenger that uses low earth-orbit satellites to communicate position to a network that then passes this on to whoever you'd like to designate—family member, coworkers and so on.

It's capable of transmitting a short, pre-prepared text message, an "I'm OK" message and full-up SOS that goes through the GEOS Rescue Coordination Center. Spot claims more than 500 rescues.

The unit itself has a simple interface—just six single-purpose buttons. The "ok" button reports position to designated e-mail accounts or cell text messages, with a Google map plot. The help button allows a pre-prepared assist message to be sent or, you can use the breadcrumb feature.

Every 10 minutes, the unit puts out a tracking message and lays down a bread crumb trail with a link to a Google map. It stamps the location with date and time. Anyone you share the link with can follow your trip in real time.

Whether the Spot is an alternative to a 406 ELT is a matter of personal philosophy. Two things must be considered: Will the Spot survive the crash and will you be conscious to activate it? Those are two big ifs.

With that in mind, we think the Spot is a natural complement to a 406 ELT. But if you're flying with an old 121.5 MHz ELT, you essentially have no ELT at all and the Spot can fill in the gap, with the aforementioned shortcoming of requiring activation.

For more, see www.findmespot.com and for a complete video on the unit, see <http://snipurl.com/w03kq>.

which way an out-of-control helicopter smacks the ground.

All Artex units use a five-year lithium battery, that's come down in price, but is still \$130.

AMERI-KING AK451

The Ameri-King model AK451 is partly marketed as both an AF (automatic fixed) and AP (automatic portable beacon) since it can be removed from a Velcro strap and

connected with a portable antenna that's included. So if you auger, survive and need to hike away from the crash you can take the beacon with you. Smart.

The AK451 transmits five watts of power on the 406 band and has a transmit battery life of 78 hours. The battery has a five-year replacement interval and there's internal self test monitoring. The AK451 weighs one pound 14 ounces and measures 4.27

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714-842-8555

KANNAD North America
www.kannad.com
509-468-1738

Artex (Cobham Avionics)
www.artex.net
503-678-7929

Pointer Avionics
www.skyhunter406.com
519-648-3778

x 2.95 x 5.64 inches. It comes standard with a whip antenna rated for 300 knots and there are optional blade and rod antennas for jets.

The AK451 will be easily compatible with the company's AK450 121.5 beacon and comes complete with fixed and portable antenna, remote control switch,

prefabricated wiring harness including coaxial cable and mounting tray. A GPS interface is standard and requires connection to a compatible GPS (Garmin, Bendix/King, Trimble or Apollo).

CONCLUSION

If you've made the decision to make the jump to a 406 MHz ELT, which one do you buy? Our simple advice is to buy the one with the least amount of install cost rather than looking at beacon cost alone. You'll need to work with your shop on the decision. We're confident that any of the models we cover here will offer quicker rescue than any 121.5 model simply by nature of 406 technology. It's questionable whether one will perform better than another based on specs alone since the bulk of transmitter specifications need to be identical for certification purposes.

Is the remote GPS interface worth the extra wiring effort? We're on the fence. Consider, though that crash coordinates are transmitted on the first beacon burst and you won't need to wait for an orbiting satellite (which could take up to four hours). Hit accuracy is improved from approximately three kilometers to 21 meters.

If you routinely fly in the deep sticks—by which we mean rugged mountains, uncivilized desert and the Alaskan landscape, we think it's worth the extra wiring effort. Keep in mind that 406 beacons also transmit on 121.5 and 243 military bands so if someone in the vicinity is listening, they might hear the transmission.

We might hang on to our wallets and wait for the ACK E04 as it promises to represent an excellent value. If you have to buy now, we have no problem recommending the KANNAD Compact for its installation simplicity and small footprint. Perhaps most important is the timing of the installation. There's no mandate that says you have to have a 406 AF beacon, so the project can wait until the aircraft guts are accessed for other work. You'll benefit from the cost savings.

While Larry Anglisano really dislikes crashing, he hates even more waiting several days to get found.

BRIGHT IDEA: GPS INSIDE THE ELT

Aside from the efficiency of the 406 MHz frequency, even the most modern ELT retains much of the crude technology that's left over from 1970. What's really needed is a self-contained beacon that keeps tabs on your movement through internal GPS positioning – a source that's independent from the onboard avionics and transmits this position when you hit the dirt. Such technology is emerging.

Pointer Avionics in Canada is close to certification with their Skyhunter 406, a unit that has the smart idea of a built-in GPS receiver and a combination GPS/ELT antenna. This eliminates expensive GPS interface modules and the hassle of tearing into the avionics stack for wiring into a remote GPS. The Skyhunter is designed with a mini-USB port in the case of the beacon for in-the-field data programming and diagnostics—a welcomed and modern level of functionality, in our view. Pointer Avionics is in no way related to Pointer, Inc., who also makes 121.5 beacons.

Another such design is the Emerging Lifesaving Technologies (ELT) model ELT406. It's an AF beacon that has an integrated GPS receiver that updates aircraft position every 15 seconds. It also has a built-in clock that monitors battery use and can alert the pilot when there is less than the minimum battery life required. The unit is completely self-contained except for remote switch and combination GPS/ELT antenna and requires bus voltage for the GPS system. Software allows the system to update position every second and is stored in cache for trend monitoring to ensure an accurate fix. The ELT406 is available exclusively through Aircraft Spruce and sells for \$1360.

The double-edged sword here is that there's an additional GPS antenna to be mounted atop of an already crowded cabin. They'll need an unobstructed view of the sky and need to be a certain distance from transmitting antennas that can affect their reception.

Still, such smart ELT systems are what we would expect in a modern avionics world. These units, both priced south of \$1500, are a good start.





To show the chart full width, the FX8 must cut off either the top or bottom. But this works fine in practice as only the briefing strip is missing during the approach. The visual contrast is poorer than paper.

Jeppesen Plate Reader: The FX8 Gets it Right

Smaller and lighter than its predecessor, the FX8 plate reader from SOLIDFX for Jeppesen plates is the best digital chart solution we've tried to date.

by Jeff Van West

When we reviewed the first Jeppesen plate reader from SOLIDFX in September of 2009, we saw a lot of promise in the innovative software but we found the hardware too big and slow.

SOLIDFX said they were working on improvements to the software and on the prowl for better hardware platforms. Nine months later, they have delivered on both promises with the FX8.

THE RIGHT SIZE

We're picky when it comes to these plate readers. They have to hit the Goldilocks zone of comfortable enough to hold in your hand as you could a piece of paper but big enough to view everything you might need to see between the final approach fix and the missed ap-

proach without panning or zooming.

The FX8 is all that. It's running on the iRex 800, which measures 7.6 by 5.9 inches and, perhaps more importantly, it's almost all screen (8.1 inches diagonal). It's also only 0.4 inches thick and weighs 12.6 ounces. The battery charges off a USB connection, which is also how you update the charts and load any other documents you might want.

We left the device running for 12 hours and drew the battery down

about 60 percent from a full charge, so SOLIDFX's claims of 24-hour battery life are reasonable.



The screen is not touch sensitive. To tap on-screen buttons you must use a special stylus. This is an overall downside, in our opinion, as you have to keep the stylus on a lanyard around your neck or hanging from the panel to prevent dropping it somewhere out of reach in the cockpit. You can control the FX8 via the button and switch on the left side of the unit, but it's cumbersome for anything other than paging through a list of preselected charts.

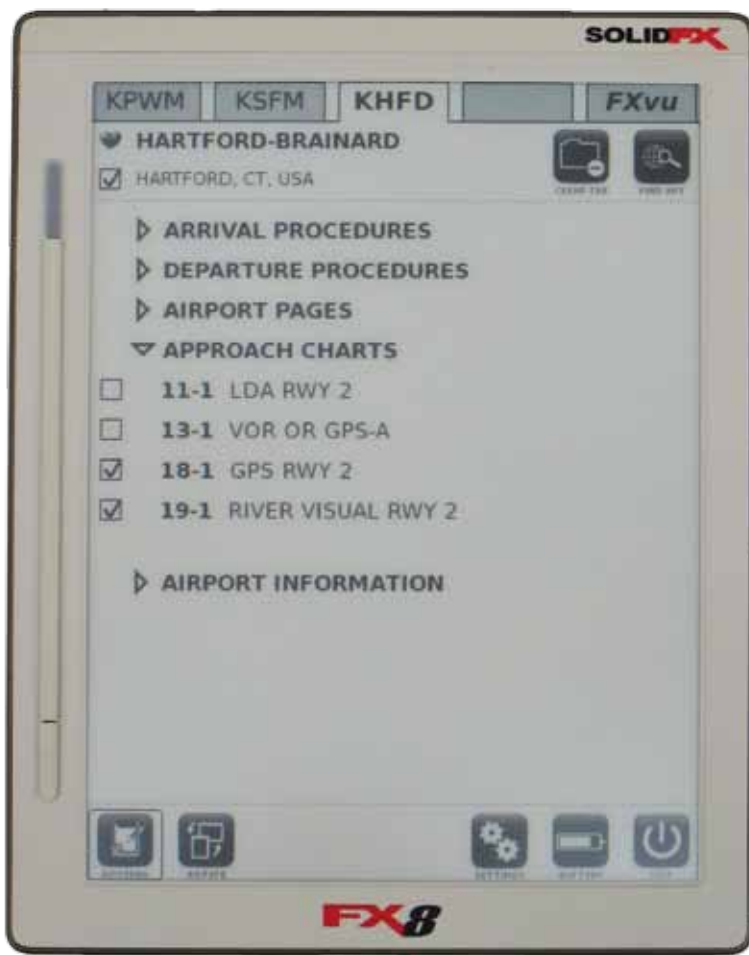
One plus of the pen, however, is a built-in writing pad. You can call up blank pages to copy clearances or even mark up approach plates. SOLIDFX plans to have an option to import custom documents to mark up with the pen, such as loading manifests. The iRex reader is designed for eBooks and can read PDF documents. This is handy as you can toss your maintenance manual on the device when you travel, as well as those romance novels you secretly read on long, en route stretches.

MASTER OF ORGANIZATION

The real innovation of this reader is how it organizes charts. There are four blank tabs across the top (there are six on the bigger-screened FX10). Tap a tab and you'll be prompted to load an airport. You can enter the ICAO identifier or start tapping the name of the airport or city. The search is progressive, so options get fewer as you tap. The screen update is not speedy, but you can tap out several letters and then let the screen catch up. Any airport can be saved as a favorite for faster retrieval later.

CHECKLIST

-  Simple, effective system to find, organize and view plates.
-  Big enough to show all critical data at once, but not too big or heavy.
-  Hardware may be eclipsed by iPad and copycat devices.



Once you select an airport, it loads into that tab and you can see all the documents in a list. They are grouped by arrival, departure, airport diagrams and approach. Chart NOTAMs and basic airport information also appear on the page for each airport.

Tap any chart and it appears, fit to the screen top to bottom. That's about 80 percent the paper chart size, but we found it readable. Buttons also appear down the right and left sides for taking notes, flipping to the next chart for that airport, hiding the buttons and some other basic functions.

With a tap of the "fill" button or a gesture of the pen, you can make the chart full width on the screen. This makes it as big as a full-size Jeppesen plate and completely readable. That said, all of these eReaders have black type on a gray screen that's just a bit harder to read than the stark black-on-white of real paper. Also, none have a backlight, so you'll need cabin lights or a flashlight to read them at night.

The pen does two neat tricks when it comes to viewing the chart. If you flick the pen across the screen, the chart will slide the same distance. This makes it easy to read the briefing strip for the approach and then flick the chart to see the plan view, profile view and minimums for the rest of the approach. You can also circle any area of the chart to zoom in on it. This is particularly

We wish other plate reader designers would take the hint from SOLIDFX. You can load an airport into the tabs at the top of the screen for easy retrieval. Checked approaches and documents collect on the rightmost tab for even easier access. The buttons on the side of the chart appear or hide with a pen tap.

handy on complex airport diagrams. There is no GPS in the FX8, so don't expect to see a little airplane icon on any of the charts. There's also no current option to display en route or area charts on the FX8.

There is one more tab on the top of the main viewing screen. This is a clipboard. Tap a checkbox by any chart on the other four tabs and it appears on this fifth. You can drag and drop these clipboard charts into any order. The result is a little chart book where you can flip from chart to chart in the order you'll need them for the flight. Getting the FX8 to correctly register taps in these checkboxes was the only function we had trouble with on the device. Sometimes it checked the box. Sometimes it displayed the chart. We ended up using the hardware buttons to get reliable results. Along those lines, we often found flipping from

AC TV



For a video demonstration of the FX8, log on to www.avweb.com and select the video index and search for

the FX9. Or you can go directly to <http://snipurl.com/w4o9z>.

chart to chart in a sequence was better done with the long switch on the left side of the device.

When you're done with data on any tab, a tap of the clear button (and a confirmation tap) wipes the slate clean for the next flight. While we're talking about things disappearing, the FX8 has a lock function to prevent any changes on screen during critical phases of the approach.

PAY TO PLAY

Jeppesen charts have always occupied the premium service niche when it comes to approach charts. The FX8 is no different, with chart subscriptions running a comparable amount to paper chart service. Expect to pay about \$710/year for U.S. coverage. If you already have a JeppView subscription, you can add the FX8 option for \$55/year.

The FX8 itself costs \$1195 for the reader and the SOLIDFX software. That's the price with or without 3G service. The 3G service is strictly for use as an eBook reader. Update to the FX8 charts are via an internet download and the familiar JSum software from Jeppesen. The larger FX10 is still available for \$1595.

While we've always questioned the cost-benefit equation of Jeppesen charts, for those who want them we think this reader is—finally—a practical replacement for paper. We would feel perfectly comfortable leaving the paper charts at home. The tradeoff in visual contrast or seeing most, but not all, of the chart at full size is more than outweighed by the benefit: Approach plates for as much of the world as you want on something that weighs less than a pound and can stay on all day. The device is even more of a boon for international fliers who must use Jeppesen to get the multi-country coverage they need.

The iPad and similar devices may eclipse the FX8 in usefulness, but, even if it does, SOLIDFX's terrific software should find a home on that device as well.

CONTACTS

SOLIDFX
508-316-8078
www.solidfx.com

YET ANOTHER NACO PLATE READER

Digital plate readers for government approach plates are more plentiful, but they are just as hamstrung by hardware limitations. ReaderPlates is now offering their software on the Sony PRS-900 Reader.

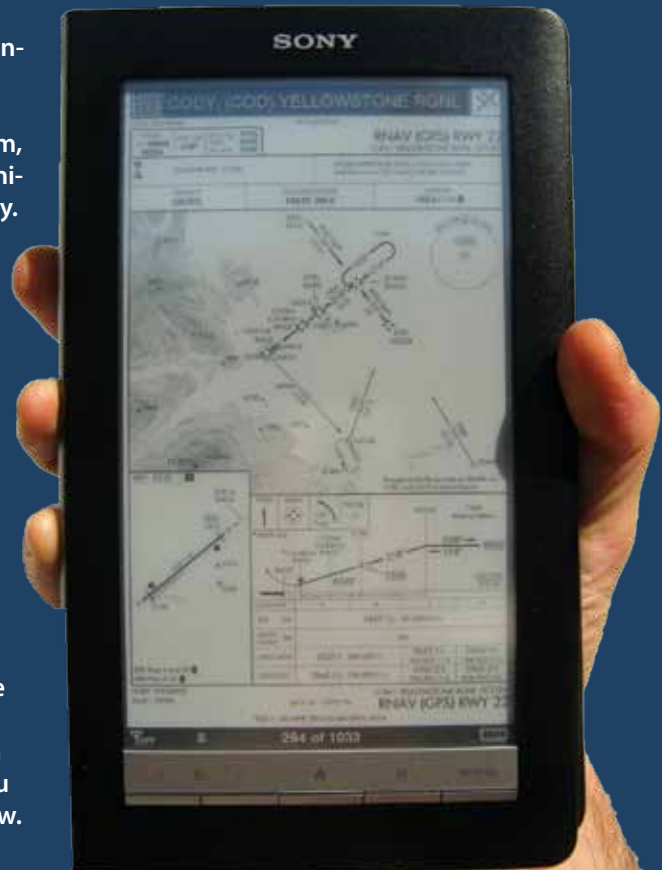
The PRS-900 has a screen one inch taller than the Sony PRS-505 and the Amazon Kindle DX, which we have reviewed in the past and found too small and slightly too large respectively. The PRS-900 also has a touch sensitive screen—a big plus, in our opinion. It also has a stylus and you can use it for jotting down notes or writing on the approach plates.

But we think the pluses end there. While the reader fits nicely in your hand, we found viewing an entire chart was at a scale that's difficult to read for anyone with substandard vision. It's even small for good eyes. There is a zoom function, but it was slow and cumbersome enough to be frustrating. It's easy to rotate the view so a slice of the chart fills the screen in a portrait orientation, but scrolling is by full screen sections so you might not be able to get just the view you want at once. The final result is functional—we could shoot an approach with either view—but it's not ideal and we wouldn't want it as our primary system for approach plates.

ReaderPlates does a good job leveraging the eBook structure and features of the PRS-900 to make using the plates easier. The plates are organized by state into books. Some states span several books. You can search within a book, but there's no comprehensive list of hits. You must page through airports to find the one you want. It's better to just know the name of the town you want and navigate to that page. In that way, ReaderPlates is just like a book of government charts. You can bookmark any plate you want with a double-tap in the upper right corner. These bookmarks are collected on a single page from which you can jump directly to those plates. A little prep on the ground really pays off in the air.

Once you get to the contents for the airport you want, you see all the approaches, airport diagram, takeoff and alternate minimums and the A/FD entry. A cool feature of the ReaderPlates system is that even if the airport doesn't have approach procedures, it still appears in the master list for that state with its A/FD entry.

ReaderPlates doesn't supply the PRS-900 and the required 4GB SD card. That combo can be found online for about \$400. The ReaderPlate subscription for the data is a right bargain, however, at \$9.95/month for full U.S. coverage. You can find out more at www.readerplates.com.





The piston-type Billet fuel pump is a bolt-on replacement for the stock diaphragm-type pump. These factory pumps have been problematic in the past. The kit also includes the pressure regulator.

Rotax Engine Mods: Some Good Options

Engine heaters are a welcome arrival for those running Rotax in colder climates. Better starts, fuel flow and electrical power hold appeal as well.

by Jeff Van West

With more and more Rotax engines out in the field, it makes sense that there is a growing market of aftermarket parts and accessories. However, this is purely good news for owners of Rotax engines on experimental aircraft, including E-LSAs.

For owners of S-LSAs—factory complete LSAs not registered as experimental—the usefulness of these parts depends on what it is and which aircraft they own. S-LSAs don't use the STC process many aircraft owners know and love (or not). Instead, almost any modifica-

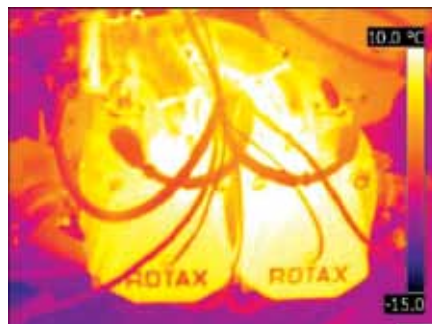
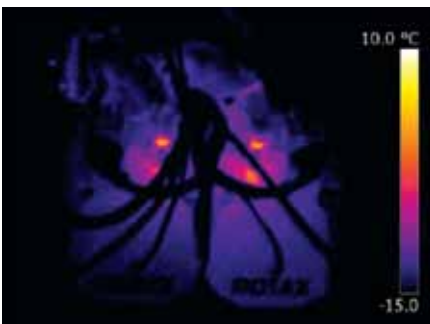
tion can be made with a letter of authorization (LOA) from the aircraft manufacturer. These LOAs are supposed to be issued on an aircraft-by-aircraft basis. So, just because your hangar neighbor with the same LSA has an LOA for a particular change, that doesn't give you the right to do it. That said, the more organized LSA manufacturers keep common LOAs ready to go for customers who request them.

The take home from this is that a minor or common change, such as adding a pre-heat system, is likely to be approved. Getting approval to install a turbocharger that boosts engine output by over 40 percent ... not so likely. The LOA must come from the airframe manufacturer, not Rotax.

HOT METAL AND OIL

While it's arguable that a Rotax isn't as susceptible to cold-start damage, pre-heating is still a good idea for both ease of start and reaching the required oil temperature before flight. In fact, we've heard that some flight

The photos below are from a Rotax 912ULS cold soaked to -20 degrees C and then preheated for 30 minutes (left) and five hours (middle). The Tanis kit (right) heats both the cylinders and the oil sump.



schools are leaving their Tanis heating systems for Rotax plugged in all the time just to avoid burning Hobbs time in the runup area waiting for the oil to get up to minimum takeoff temperature.

The Tanis system weighs in at less than a pound, draws two amps and targets both the cylinders and oil sump. We spoke with Jamie Shimer, who installed the system on AOPA's sweepstakes Remos. He reports a kit complete with all parts, including proper-length harnesses, tiewraps and silicone sealer. Some LSAs have less than ideal access inside the cowl, so positioning the 110-volt plug may be a concern. Shimer says Tanis was also helpful in getting the LOA from Remos.

The Tanis system can be put on 912 or 914 engines and runs \$649 from Tanis or distributors such as Lockwood Aviation in the U.S. or Bully Hawk Aero Performance in Canada.

Oil heat is an issue in the air as well, and northern operators must put foil tape over part of their oil coolers during the cold season. As an alternative to this, an oil thermostat can bypass the oil cooler when the oil is cold. This also helps cut down the ground heat-up time.

Reports on the effectiveness of these devices are mixed. With some installs not seeing the temperatures still colder than they were hoping for. Some manufacturers, such as Tecnam Aircraft, won't approve the installation due to concerns about failures disabling the oil system.

Two systems in use on the Rotax are the \$90 Perma-Cool (www.rotaxservice.com/rotax_engines/rotax_912UL.htm) and the \$119 ThermoStasis (www.thermostasis.com/aircraft).

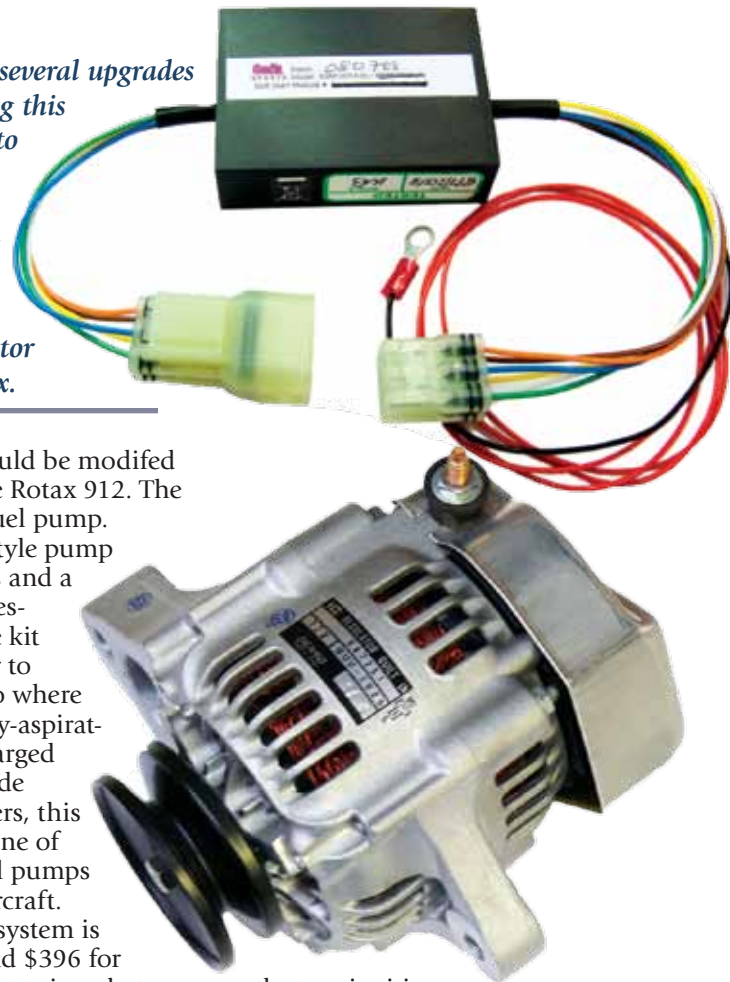
RACE-CAR FUEL PUMP

The engine-driven Pierburg fuel pumps on Rotax engines had a terrible failure record early on—we heard several stories of pumps leaking fuel or oil internally after as little as 10 hours in service.

This seems to have been largely resolved, but consensus is even the current pump isn't as robust as it could be.

During the dark days, Michael Coffey was searching for a better fuel pump and hit upon one designed

Bully Hawk offers several upgrades for Rotax, including this Soft Start module to ease starting and prevent engine kickbacks, and this 40 amp alternator to supplement the 18-amp AC generator built into the Rotax.



for race cars that could be modified to mate up with the Rotax 912. The result is the Billet fuel pump.

This is a piston-style pump with few wear parts and a potential output pressure of 170 PSI. The kit includes a regulator to drop the pressure to where needed for normally-aspirated 912 or turbo-charged 914 engines. As a side benefit to 914 owners, this pump can replace one of the two electric fuel pumps needed on those aircraft.

The Billet pump system is \$368 for the 912 and \$396 for the 914. That's about twice what a factory pump from Rotax will cost, but it's unlikely to ever fail. Billet stopped its failure testing after the pump was still performing well at 2500 hours. They will also refurbish any customer's pump for \$60 for the life of the pump. The pump is distributed through CorbiAir.

BETTER SPARKS

Most Rotax installations use the 18-amp AC generator built into the Rotax 912/914. This is adequate for most LSA use, but can max out when several digital displays are installed—especially at low RPM.

The engine can easily spin a belt-driven alternator and this is an option from several manufacturers. Bully Hawk of Canada offers a belt-driven, internally-regulated, 40-amp alternator for those who don't have one installed.

The kit is complete with all mounting hardware and weighs 8.5 pounds. It has a 50-hour, six-month warranty. The standard price is \$1035, but, as of this writing, it was marked down to \$699.

Bully Hawk also offers the Soft Start Module that retards one of

the two ignition systems for the Rotax during start up. The high-compression 912 and 914 engines have a bad habit of kickback if the cranking speed is too slow (due to a weak battery or long starting cables). The unit plugs into the existing wiring and is tiewrapped on top of existing engine modules. It sells for \$1035.

Bully Hawk sells several other products, including a kit to turbo-charge existing 912s and several tools for Rotax maintenance. They are distributed in the U.S. through Lockwood Aviation.

CONTACTS

Billet Pump
www.billetpump.com
877-267-2424 (c/o CorbiAir)

Bully Hawk Aero Performance
www.bullyhawk.com
863-655-5100 (c/o Lockwood Aviation)

Tanis Aircraft Products
www.tanisaircraft.com
800-443-2136

Anywhere Map Quadra: A Shirt-Pocket MFD

It offers surprisingly useable approach plates and many powerful GPS features. We'd like to see a brighter screen and a bit more software stability.

by Jeff Van West

Our first reaction when pulling the Quadra from its box was, "That thing's tiny. I'm gonna be able to read an approach plate or sectional chart on that? No way."

Well, actually, yes way. The Quadra's 4.3-inch screen has an 800 x 480 resolution. (For reference, a Garmin aera is the same screen size but has 480 x 272 resolution and Avidyne's 5.8-inch EX600 panel-mount MFD has a 640 x 480 resolution.) As long as your eyeglass prescription is up to date all map elements, scanned charts and approach plates set to match the width of the screen were readable at the distance to the yoke or nearby window mount.

POWERHOUSE MAP

The heart of the Quadra are six, user-configurable moving map layouts. These come preconfigured for sectional charts—actual, scanned sectionals with the aircraft plotted

on top of them—terrain, airways, night, weather and emergency. You use the layout that works best when you need it, similar to switching between different screens on a panel-mount MFD.

All the layouts can be rejiggered to display most anything you want. This is both power and pitfall for the

Quadra: It takes some time to get the screens configured just the way you like and it's easy to overload both the screen with information and the Quadra's processing power trying to display it all. The unit is noticeably slow when rendering a lot of data (although it's much faster than its predecessor, the Anywhere Map ATC).

Once you pick and choose the features you want, it works well. Some options we particularly liked were the ability to overlay weather and TAWS-like warnings on IFR en route charts, Approach and Navaid





frequencies on the moving map and the ability to save map range settings along with each view.

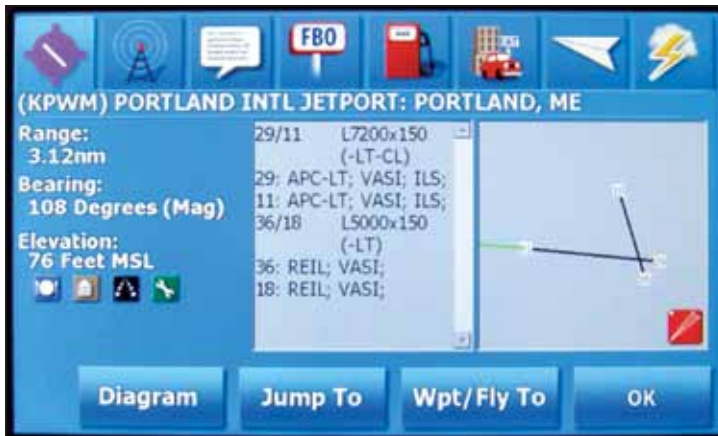
The Quadra uses a pressure-type touch screen (so it will work with gloves on) and hits a sweet spot in sensitivity. One of our tests is how well the screen can distinguish a tap to select versus a drag to pan. The Quadra works well. It also offers a cool feature in that one tap pops up an information box about the tapped item. This is great for quickly double-checking a frequency or field elevation. Two taps opens a well-organized, detailed screen with airport info and weather (if equipped).

Anywhere Map has long offered special emergency features. You can display "cones of safety" showing which airports might be in your no-wind gliding distance. More interesting to us was the dedicated emergency function. Tapping this launches the emergency map layout and prompts you to select an airport. Tapping the airport immediately changes your flight plan for the diversion and shows with a green arc where your current angle of descent will reach ground level—and whether the airport is in range or not.

That green arc is used in normal ops for vertical navigation (VNAV), which is simple and effective on the

CHECKLIST

-  Compact, yet sharp display makes even approach plates readable.
-  Three versions with broad price span to meet varied pilot needs.
-  Powerful software offers many options, but it's more demanding of the computer and the user.
-  We'd like a brighter screen and longer battery life



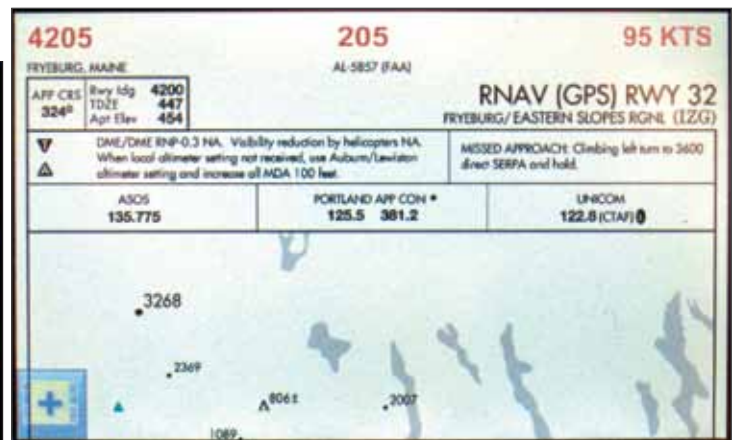
Quadra. It has a “virtual ILS” feature that creates a generic three-degree glideslope to specific runways at most any airport. You can also load the instrument approach waypoints for about 4000 approaches. It seems a bit hit-and-miss which approaches are available at which airports, so we wouldn’t count on this feature being available all the time.

Additional Quadra features we appreciated were optional reminders for things like switching fuel tanks or lowering gear, georeferenced airport diagrams for major airports and integrated fuel prices. Obstacle and terrain warnings were adequate, although not so brute-force obvious as on competing units.

SHIRT-POCKET PLATES

The moving map program is called Anywhere Map. Approach plates are shown through a companion program called Pocket Plates. We think

The Quadra’s small screen has excellent resolution (all four screens on this page are actual size) but it’s dim in direct sunlight, however. Battery life is about two hours.



Dragging pans the map, tapping items brings up quick info (upper left) and double-tapping brings up detailed info on its own screen (lower left). The green arc shows where the aircraft will reach the ground with the current speed and descent rate. Approach plates show the aircraft position and GPS altitude, heading and speed, as well as terrain warnings. The buttons running down both sides can be hidden and the display can be landscape or portrait.

the integration between these two programs

has room for improvement. You can toggle between them, but you must select the destination airport manually in both places.

Approach and departure procedures for the selected airport are available, but the file is the entire list of airports from the NACO chart book. Other solutions at least jump directly to the page for the selected airport and we’d like to see the same from the Quadra.

The approach plates are georeferenced, so the airplane position appears as you fly. GPS-derived airspeed, heading and altitude also appear on the plate, which is great in the last stages of the approach. Another cool trick is that terrain awareness can be displayed in the plan view so you don’t have to give that up when you view the plate during the approach.

Both Pocket Plates and Anywhere Map use a common system of buttons down the sides (or top and bottom in portrait mode), so if you understand one program, you under



WANT IT BIGGER? TRY A DUO

Back when we did our EFB roundup, several readers asked what we thought of the Anywhere Map Duo. We weren't able to get one for that review, but we got one to look at along with the Quadra.

The Duo runs similar software to the Quadra but does so on a viliv-brand touchscreen PC running Windows. It shares many of the same features as the Quadra, and betters the Quadra in some areas (such as integration between Anywhere Map and Pocket Plates). It's not quite as sophisticated as ChartCase or nearly as robust as Voyager, two other leading EFBs. But it has all the critical items—moving maps, charts, plates, weather—that you need and it's generally easy to use.

The seven-inch screen makes reading charts easier, but it lacks the real keyboard of other EFBs. The Duo is \$1795. Add \$195 for TAWS and \$700 for XM weather.



stand the other. The buttons can be toggled on and off to better use the small screen. Navigation through the software is easy with the buttons and menus that are rarely more than one level deep. It's not always intuitive, however. Anywhere Map uses some non-standard icon, such as a magnifying glass for zoom rather than find or using the term "hold" rather than "suspend" to temporarily stop the sequencing of a flight plan.

Speaking of zoom, we think this is a miss on the Quadra. You can jump to common ranges such as 10 or 50 miles, or autozoom, but there are no

familiar plus/minus buttons to zoom in and out.

HARDWARE HITS AND MISSES

A feature we think is unique to the Quadra is built-in WiFi. This not only makes updating the data and approach plates a snap, it can also be used to download METARs, TAFs and NEXRAD to the device from your internet connection. Since this data only stays on the device for one hour, it's not a replacement for XM weather, but it can be handy to check weather for your route at the FBO or hotel and for checking what that

AC TV



To see more of the Quadra's features—and see them in action—log on to www.avweb.com and select the video index. Or go directly to www.avweb.com/allvideo/.

TAF said before you took off. It's also perfect for updating TFRs just before you walk out to the aircraft.

If you want XM, you'll need the external XM receiver that communicates with the Quadra via Bluetooth. We found the system worked fine, but it requires finding a place for the receiver box and antenna, as well as having a second power supply. You'll definitely want to keep the Quadra plugged in. Battery life is two hours on the outside, less if you did some WiFi downloads before you took off. But that's a trade off common to these small GPSs.

We were disappointed with the sunlight-readability of the Quadra screen. It's barely adequate, in our opinion. There were times we had to shield it to see the screen at all. In any shadow or in the clouds it would be just fine.

We were also disappointed with the automotive mode for the Quadra. Side-by-side with a Garmin Nuvi, both units plotted the same route, but the Garmin predicted our arrival

	TERRAIN AND OBSTACLES	ROAD NAV	FUEL PRICES	XM WEATHER	TAXI DIAGRAMS	AIRWAYS	TRAFFIC OPTION	SCANNED CHARTS/ APPROACHES	YEARLY DATA	PRICE
Honeywell AV8OR	yes	yes	yes	add \$522	no	Flight plan only	yes	no*	\$229	\$799
Garmin aera 500	yes	yes	no	no	no	On screen only	yes	no	\$495	\$875
Garmin aera 560	yes	yes	no	yes	yes	On screen only	yes	no	\$495	\$2199
AWM Quadra	yes	yes	yes	no	yes	On screen only	planned	no	\$115	\$595
AWM Quadra EFB+XM	yes	yes	yes	yes	yes	On screen only	planned	yes	\$260	\$1689

1 AV8OR Ace has scanned charts and plates, but it's a larger device for \$1999

Diamond HK36: Gliding and Flying

Diamond is making another run at selling motorgliders in North America. Since flying one doesn't require a medical, will older pilots nibble?

by Paul Bertorelli

with about one minute accuracy. The Quadra's ETA was off by 45 minutes at the trip's start. There were also differences like "Turn left in 600 feet on Newbury Street," for the Garmin versus just "Turn left in 600 feet," for the Quadra. Not that this matters to aviation use, but dual capacity is important to many users. The Quadra never got us lost, though.

Lastly, Anywhere Map still has some kinks to work out in their software. In addition to the system slow-downs when displaying complex data, we saw some screen lockups and errors that required restarting the unit. To the Quadra's credit, it restarts quickly and the kind of messing about that caused the lockups were not things you'd likely be doing during critical phases of flight. But there's still some bug squashing to do.

In our GPS survey earlier this year, Anywhere Map got top marks for customer service, so we expect the company will actively correct these. There's also a 30-day, money-back policy on the Quadra and a one-year warranty.

BIG BARGAIN

We can't argue at all with the Quadra's price. The basic unit is \$595, plus \$10 for the mount of your choice. Sectionals are an extra \$199 and en route charts and approach plates are another \$200 on top of that. The Bluetooth XM receiver is an additional \$695. That still makes the Quadra one of the least expensive solutions for what it offers. Anywhere Map also has the least expensive data updates of the leading GPS manufacturers, at \$115/year for basic data and \$260 for everything. Lifetime subscriptions are available.

Our takeaway from the Quadra is that makes an ambitious reach to fit all that capability into such a small package and it largely succeeds. If you're in the market for a super-portable GPS, the Quadra is well worth a look.

CONTACT

Anywhere Map
800-292-1160
www.anywheremap.com



Shortly before the outbreak of World War II in Europe, Germany stunned the world by fielding the most advanced and competent air force on the planet. And it did that despite Draconian post-war treaty restrictions that all but prohibited combat aircraft development. But the pilots came from a different tradition—a passion for gliding and soaring.

That continues yet today with most of the world's glider production centered in Europe, including the re-introduced HK36 Super Dimona motorglider from Diamond Aircraft. "New" doesn't exactly ap-

ply to this airplane because it has been in and out of production for 20 years. In fact, the design is really responsible for much of the way Diamond airplanes look, feel and fly for before it was a powered airplane company, Diamond's predecessor, HOAC, was a motorglider company, with antecedents extending to 1980.

Although motorgliders are a rarified taste in the U.S., Diamond is making another run at selling the HK36 to the North American market. It pitched them in the early 2000s with mixed results, but when the DA40 and DA42 projects took off, Diamond had no room in the





an aircraft tow can be a pain if the gliderport is busy. Winch tows are more common in Europe than in the U.S., but they require a higher degree of skill and good soaring conditions to make much of the flight, since the release altitude is typically lower.

Motorgliders address this by allowing a self-launch with the engine, meaning there's no delay waiting for a winch or towplane and you can fly some distance to find decent green air for soaring. Cross country flights are also doable, if not entirely practical due to speed and range limitations.

Of course, being a compromise, a motorglider needs to do something with the prop when and it's in soaring mode. In the HK36, it's simply feathered, while in one other type, the engine is actually retracted and stowed.

MODEL HISTORY

It's no overstatement to say that Diamond owes its lineage to the HK36. It evolved from HOAC-Austria Flugzeugwerk's H36 motorglider which first flew in 1980. The follow-on model, considerably reworked, appeared in 1989 and was brought into production as the HK36 Super Dimona in 1990. The original airplane had a 90-HP Limbach L 2400 engine, but this was soon displaced by the Rotax 912, which Diamond retained when it went forward with the Katana project.

A year later, the current owners of the company acquired HOAC and eventually renamed the company Diamond Aircraft. Their first product after the HK36? The DV20, which is essentially the motorglider



As in most sailplanes, the HK36's panel is spare, top photo. But it can be equipped with options such as an SL30 navcom or a GNS430. A pair of pins, left, lock the load bearing leaves for foldable wings. The airplane has two-position spoilers, above, to control descent rate. With the engine secured for soaring flight, the electrical master remains on but a soaring mode kills electrical power to the engine accessories.



Wiener Neustadt factory in Austria to produce them, so the project was shelved.




About a year ago, Diamond restarted the line to produce a limited number of HK36s and the sales effort is being handled not directly by the factory, but by Great Lakes Aircraft Sales, a major Diamond dealer in the Chicago area. Diamond may find an emerging oppor-

tunity in "full-circle" pilots who are affluent enough to buy new airplanes but don't want to support aircraft that require them to maintain a medical. Light sport fits that design brief and so does a motorglider, which can be flown by a pilot without a medical and even a driver's license, for that matter. (See the sidebar on page 19 for more detail.)

A COMPROMISE

Motorgliders of all types represent a compromise of sorts and the HK36 is no different. The design motivation is that for glider pilots, arranging

CHECKLIST

-  Anyone who has flown a Katana can manage an HK36.
-  As a glider, the airplane is a credible performer with better numbers than a trainer.
-  Long wings require care when taxiing and there's no just backing it into a T-hangar. The wings need to be folded.

with the long wings sawed off, flaps added and new tricycle gear.

That model eventually morphed into the two-place DA20 Katana trainer, thence the follow-on Eclipse C-1 variant, which is powered by a Continental IO-240. If Diamond airplanes have always look like wasp-waisted sailplanes, you now know why.

When Diamond first marketed this model in the U.S., it was still available as a taildragger, but the current version—still called the HK36 Super Dimona—is available only in tricycle gear. Since the DA20 line sprang from the HK36, the two airplanes have much in common, including all-composite construction with a beefy spar, a 21-gallon fuel tank behind the cabin, a high T-tail and a wrap-around rear-hinged canopy. While the DA20 has flaps, the HK36 does not, but it does have a pair of massive manual spoilers deployed by handles on the cabin wall. This is typical of all gliders.

While the wings are similar, they aren't identical. That's because at 53.5 feet, the high-aspect wingspan is enormous and too large to fit into the typical T-hangar.

Therefore, the wings are designed to be folded for storage in a typical hangar or a glider box. The airplane is not considered towable, since the wings don't detach in any way in the folded position. But it can tow other gliders and Diamond offers a tow package for that purpose.

One option for stowage is a dolly system that allows two people to split the wings and roll them along the side of the fuselage. The control circuitry—rods for the ailerons and cables for the rudder—remain attached, but the nav light wire has to be disconnected.

When detached, a spar carry-through splits and the wings rotate 90 degrees. In the locked position, they're held in place by beefy leaves secured with a pair of heavy pins accessible behind the pilot seats. Working quickly, two people can do the wing trick in about a half hour, in both directions.

GLIDER RATINGS: AS EASY AS IT GETS

After a fashion, motorgliders sneak through the backdoor as far as pilot certification is concerned. The HK36 is too heavy to be LSA compliant, but nonetheless, it can be flown as though it is an LSA.

Here's the basic rundown. For a zero-time student, 10 hours of flight time is required in a glider or a motorglider—the FAA doesn't make a distinction between the two for the basic rating. In addition, 20 total flights are required, including two hours of solo flight time in a glider with at least 10



launches and landings. "Launches" in a glider means either aerotow or winch launch, but in the motorglider, it's a powered takeoff just like in a regular airplane.

The reality is that just as with powered ratings, the student will require more than the basic requirement, but it's still a lot less than either the LSA requirement of the basic single-engine land certification.

So if it sounds like a motorglider is a cheap way to learn to fly an airplane with an engine, it can be. Further, since no medical is required—and not even the driver's license that LSA requires—earning the rating in a motorglider

is about as painless as it gets. What about a pilot who already has a power rating and wants to earn a glider rating? If the pilot has at least 40 hours of airplane time, he or she must log at least three hours of glider time, including 10 solo flights in a glider and at least three flights—flights, not hours—with an instructor. That's it. Again, most applicants will require more, but the training is hardly onerous.

The commercial and instructor ratings obviously require more. If the pilot already has the glider rating, he or she needs 25 hours of flight time and at least 100 flights as a glider PIC. Three hours of instructional time are required and 10 training flights with an instructor, plus two hours of solo and 10 solo flights. Last, how about a glider pilot who wants to step into the motorglider? Here, it's laughably easy. Merely demonstrate competence in the motorglider and get an endorsement for motor launching and you're good to go.

Given the relative ease of all this, it seems to us there's an opportunity for someone to short circuit the extra hours often required on a power pilot rating by first obtaining the glider rating, then the motor launch endorsement. By then, you can do the basic flying—and probably well. The rest is just grinding through the navigation, radio, regs and practical test standards drills. There are worse ways to learn to fly. Or to keep flying if your medical is iffy or you just don't want to maintain the Bonanza anymore.

ROTAX

In the early days of its foray into the North American market, Diamond favored the Rotax series engines—the 81-HP 912 F3. In the Katana, these delivered acceptable performance, but owners complained about poor climb rate and overheating, which Diamond had a difficult time sorting out.

The current iteration of the HK36 has the Rotax 912 S3 at 100-HP or the turbocharged 914 F3 at 115 HP. Either way, with all that wing, the

airplane doesn't lack for climb rate. Its max weight is 1694 pounds against an empty weight of 1210 pounds. That yields a power loading of 16 pounds per horsepower compared to the original Katana's 20 pounds. With the additional wing, the HK36 has climb rate to burn, even with two aboard and full fuel. The useful load is about 480 pounds so with full fuel, two 200-pounders will be over the top. If Diamond finds many buyers, we suspect most will opt for



When Diamond first brought the HK36 into the North American market, Sporty's Academy bought one and put it on the line in 2002, where it rents for \$109/hour. Chief instructor Paul Jurgens told us the airplane has flown as much as 200 hours a year and attracts both power pilots wanting to transition to gliders and a smattering of zero-time students wishing to start out in gliders. "Most of the operations within the aircraft will be familiar to an airplane pilot," Jurgens told us. "Starting, taxiing, before takeoff checks and the takeoff are like the same operations in an airplane. This allows the transition pilot to concentrate on and master the 'glider' aspects first while saving the formation flight-on-a-rope challenges for a later date."

the turbocharged version. The price Delta is about \$13,000 on a \$177,937 base-price airplane. (Actual invoice prices, allowing for options and delivery costs, are closer to \$218,000 for the non-turbo and \$231,695 for the turbo.) The turbocharged's versions extra 15 HP would kick up the climb a little but would be most noticeable in a high density altitude environment where sailplanes often find themselves. The HK36 tilts toward

the sailplane world so it is minimally equipped. The version we flew in Florida in April didn't even have a radio, but basic instrumentation including a digital variometer, an airspeed indicator and an altimeter, plus the engine gauges. Options range from the basic SL30 navcom to a GNS430. There's also a high-capacity generator option for airplanes tarted up with equipment requiring more electrical demand.

As in the DA20, the cockpit is bisected by a fiberglass structural piece that serves as a console to support the throttle and prop controls. Electricals are along the base of the panel. Unlike the older DA20s, the panel is flat metal from end to end, without the breakfront design for a radio stack. Getting into the airplane is...well, it requires practice.

You mount from the front, ahead of the wing, and grab a handhold carved into the glareshield and use that purchase to lower yourself onto the seat. To exit, reverse it. Older pilots can do this, but they'll need to apply a certain method.

FLYING IT

We're basically talking about a DA20 here...sort of. Ground handling is via braked main wheels and is easy enough, except for those long wings. You have to pay attention lest you clip another airplane, a fuel pump or some other obstruction. The long wings affect handling, too. Although the control inputs are on the light side, especially in pitch, those long wings impart plenty of inertia so the roll rate is on the sluggish side.

And with ailerons on the end of a giant lever arm, adverse yaw is magnified enough to make deft rudder use an absolute must. It's not necessarily easy to keep it coordinated, either. We tried some rudder coordination exercises and never did achieve that rotation-on-an-axle feeling.

Climb rate feels spectacular—we say "feels" because we had no VSI to measure it. The claimed max climb rate is 1063 FPM. Once at altitude, we tried some steep turns and stalls, all of which are Katana like, with the aforementioned exception of roll rate and the need for rudder. Like the DA20, the HK36 does a nice parachute mode when the nose is parked high after it slows to the 42-knot stall speed. No surprises there.

As a glider, the HK36 is no slouch. Its L/D max is 27, which puts it in the middle of the pack for sailplane performance. It's not a world-class competition sailplane, but it's no slug, either. Shutting down the engine involves pulling it to idle and shutting off the ignition while simultaneously pulling the prop into feather.

The engine chugs a turn or two and everything goes silent. The airplane has an optional large capacity battery so you can leave the master on with radios and instruments fully powered up. There's an electrical sub-switch which you need to set to the soaring position to kill the electric fuel pump. Otherwise, the engine may flood and refuse to start. (This actually happened to our sister publication, *avweb.com*. Demo pilot Andy James demonstrated his glider prowess by landing deadstick at Plant City, Florida.)

On our flight, we had no so such problems and the engine fired up nicely three times, so we could climb back up and search for thermals on a weak lift day. Doing this—or at least staying in the thermal col-

AC TV



For two video reports on the HK36 motor glider, log onto our sister publication, www.avweb.com, and click the video button in the upper right hand corner. Scroll down to the HK36 videos.

The D-Mag's Demise: Not a Crisis—Yet

Even as some shops say good riddance, they're worried about keeping these mags serviceable now that TCM has dumped the line. A digital solution looms.

by Paul Bertorelli

umn—proves to be surprisingly physical work. From the ground, sailplanes look graceful and fingertip light. In the air, you have to honk the stick hard over to get a tight turn and you'd better not be late with the rudder. The turn rate has to be high and the roll-in quick, so max control inputs are required.

A modern variometer aids this process immensely, but you still have to muscle the turns. Landing is equally physical. Pilots of powered aircraft are used to high sink rates, which they arrest with power. Confronted with a sailplane, the problem is just the reverse—how to judge the glide angle to get the damn thing down?

For this, the HK36 has a two-position spoiler system. The first notch locks the spoiler up and delivers about 500 FPM of drag. The second position requires a strong pull against a spring and it doesn't lock there. So that means your left hand has the spoiler engaged while your right handles the stick. That spring is strong enough that you won't want to hold full spoilers too long.

One thing we noticed is that with the long wings, it's very easy to get into a PIO while trying to finesse the runway lineup. Getting behind on the rudder input will aggravate this so until you figure it out, don't expect pretty touchdowns.

CONCLUSION

At perhaps \$90,000 more than a typical LSA, the HK36 is definitely not a cheap toy. If we were serious about one, we would find three partners to share the purchase. Although it's not LSA compliant, you don't need a medical to fly it, so given the graying demographic of the pilot population, Diamond might find traction with this airplane.

In our view, the fun part is that unlike an LSA, in a motorglider, you can engage in the intellectually challenging pursuit of lift and if you don't find any, well, the engine can take you home. That's altogether not a bad way to spend an afternoon.

Some inventions seem to be naturally bad ideas but work anyway, while others are bad ideas that don't actually work that well. In-tank electric fuel pumps are an example of the first, the Bendix dual mag as a poster child for the second. But not for much longer.

Earlier this year, in a terse two-line press release, Teledyne Continental announced that it's discontinuing manufacture of the D2000 and D3000

Bendix mag-

netos. No details were offered nor provided by follow-up query, but we can connect the dots. D-mags aren't used on any Continental engines, just Lycomings. Litigationally speaking, they've lived a rough life so Continental must have figured why have the legal exposure just to supply a competitor with a few mags. Even a Goldman Sachs executive could figure that one out.

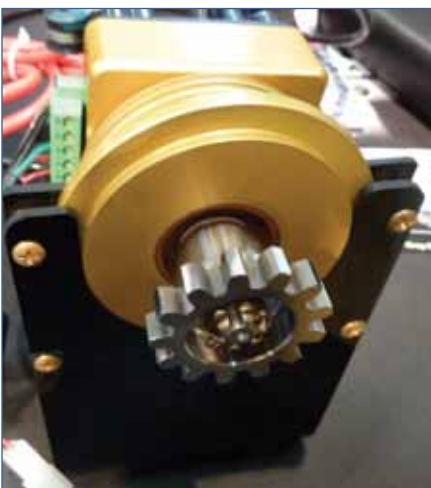
TCM's bail from the market has left shops scrambling to find replacements, but we're not sensing any

The Bendix D-mag, below, is unloved and now abandoned by Teledyne Continental. The single-unit mags, left, remain in production.



CONTACTS

Great Lakes Diamond Aircraft Sales
www.greatlakesdiamond.com
312-315-7146



E-mag's new 200 series, above, is a clever hybrid with its own internal alternator to make low voltage. Electronic circuitry turns that into high tension for the plugs. There's a single moving part, left, a shaft with a gear.

panic. Yet. No one seems to know exactly how many engines have D-mags, but 20,000 is a realistic estimate. Any Lycoming engine with D as the last letter of its suffix—IO-360A3B6D, IO-540-K1G5D, for instance—have the D-mag.

The good news is that even though the D-mag is exiting, a company in Texas is feverishly developing what could be its replacement—a fully electronic mag that would be a bolt-up replacement.

WHY?

The basic idea of having two mags is that if one tanks, the other will still run the engine, since each mag fires only one plug in each cylinder. Why

Bendix thought it would be a good idea to combine both mags into a single housing driven by a common shaft is lost to the sands of time. We don't think Lycoming requested it.

Either way, mechanics tend to hate the things. "Who needs it anyway?" said John Schwaner of Sacramento Air Ranch, when we asked him about how the shop will service D-mags. Although the idea of two mags on a single shaft seems awful, the actual field history of the mags could best be described as "not as bad as you might think."

Our sweeps of accident reports occasionally unearth accidents in which a D-mag is involved or implicated, but we're not aware of any credible statistical evidence that shows they have a higher failure rate than discrete magnetos.

There have been reports of the D-mag loosening or actually falling off the engine, with obvious results. As a result, the FAA issued a special

airworthiness information bulletin noting that most of the problems have occurred in the Mooney J-model and Cessna Cardinal 177RG, both of which have the D-mag on the 200-HP Lycoming IO-360.

The SAIB warns mechanics to check the torque of the single nut holding the mag in place and to also use new nuts and washers during maintenance. It also cautions to check for the correct oil gasket replacement, because the gasket can compress and cause the mag to loosen in flight.

SCRAMBLING

With the D-mag out of manufacture, shops are scrambling to acquire a supply until someone either picks up the line or PMAs enough parts to build entire mags. The mag housing remains problematic—no one has a PMA for that, yet.

"We bought as many as we could get our hands on until they pulled the plug. We've got enough parts to get through until somebody steps up to build the parts," says Penn Yan Aero's Bill Middlebrook. For now, any D-mag-equipped engines that come in for overhaul can go out with new or overhauled mags. Further, says Middlebrook, there's an STC to convert the O-320-H2AD in the Cessna 172 to a dual-mag engine.

Lycoming still manufactures new engines requiring D-mags, but the volume is low. "We're talking maybe under a dozen engines a year," says Lycoming's Scott Miller. For the time being, Lycoming has sufficient supplies. But at some point, it will need to PMA the mags inhouse—unlikely, we think—or find a supplier who will.

That's likely to be Kelly Aerospace or Aero Accessories. Kelly has picked up many defunct or limited produc-

CONTACTS

Aero Accessories
www.aeroaccessories.com
 800-822-3200

E-Mag Ignitions
www.emagair.com
 817-444-5310

tion lines and Aero Accessories is already the leading supplier of parts for D-mag overhauls. But it doesn't make all the parts, such as the distributor block, the housing and the coils. Aero Accessories' Kim Claar told us the company had a surge in business just after TCM's announcement and is considering expanding its line of overhaul parts.

NEXT GEN

Meanwhile, a modest little company in Texas is busy building what could become the ultimate replacement for the D-mag. E-Mag Ignitions has had great success selling an electronic magneto to the experimental market and has now turned its efforts to four- and six-cylinder versions that will be bolt-up replacements for the D-mag.

E-Mag's previous models—the 113 and 114—are clever hybrids using a tiny internal alternator to provide voltage to coils whose fields are broken by electronic means rather than mechanical points. Unlike

other electronic ignitions, they don't require electrical back-up, although they can use external power in tandem with the internal alternator to provide the low voltage.

The follow-on version—the 200 series—uses the next generation of this technology, according to E-Mag's Brad Dement. While the earlier version had coils on the back of the mag, the 200 series houses everything inside a cylindrical case that's smaller and 6 pounds lighter than the D-mag. The 200 has a single moving part: a shaft with a gear on it that drives the alternator and gives the mag information about crank position for timing. And it doesn't use coils for the high voltage.

The mags use look-up tables—combinations of manifold pressure and RPM—to vary timing anywhere between 20 and 39 degrees BTDC. This can be customized to each engine via either a simple wire shunt or with a computer through a serial port. E-mag expects to have the dual

mags available later this year for the experimental market, but it plans an ambitious cert program, too, for Dement says the company sees a significant opportunity. Timing?

"I stand on my record that whatever I tell you can't be trusted," Dement jokes, but E-Mag is hoping for a two-year time frame to certification.

In the experimental market, E-Mags have been impressively competitive pricewise with conventional magnetos. Although a certified mag would probably have to cost more to offset the considerable certification costs, we have no reason to believe it won't be competitive.

That said, attempts at electronic ignition for aircraft haven't exactly been slam dunks thus far. Unison's LASAR received a chilly market response as did TCM's full-blown FADEC.

Meanwhile, if you have a D-mag engine, you shouldn't encounter any overhaul hang-ups for now. But a year from now? No promises.

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Adam A700 Twin Jet
Adam's A500 Twin
Aeronca Champion
Aerospatiale TB-10 Tobago
Aerospatiale TB-20
Aerospatiale TB-20,
21TC Trinidad
Aerospatiale TB-9
Tampico Club
Aerospatiale TB10 Tampico
Aerostar 600, 700 series
Airvan
Alarus Trainer
American Champion
8GCBC Scout
American Champion
Citabria/Decathlon
Aviat Husky
Beech 19, 23 series
Beech 24 Sierra
Beech 33 Debonair
Beech 33 Debonair/Bonanza
Beech 35 Bonanza
Beech 36, A36 Bonanza

Beech 36TC Bonanza
Beech 55 Baron
Beech 58 Baron
Beech 60 Duke
Beech 95 Travel Air
Beechcraft 36 Series
Beechcraft 55 Baron
Beechcraft Duchess
Beechcraft Sport,
Sundowner and
Musketeer
Bellanca Viking
Cabin Class Cessnas
Cessna 140
Cessna 150/152
Cessna 170
Cessna 172 Hawk XP
Cessna 172 Skyhawk
Cessna 172RG Cutlass RG
Cessna 172XP Hawk XP
Cessna 177 Cardinal
Cessna 177 Fixed-Gear
Cardinal
Cessna 177RG Cardinal RG
Cessna 180 Skywagon
Cessna 182 RG Skylane

Cessna 182 Skylane
Cessna 185
Cessna 185 Skywagon
Cessna 195
Cessna 206
Cessna 206 Stationair
Cessna 206 Turbo Stationair
Cessna 208 Caravan
Cessna 210 Centurion
Cessna 310
Cessna 320 Skyknight
Cessna 337 Skymaster
Cessna 340
Cessna 340
Cessna 402 Businessliner
Cessna 414 Chancellor
Cessna 421 Golden Eagle
Cessna 425 Conquest I
Cessna 441 Conquest
Cessna P210
Cessna P210 Centurion
Cessna T303 Crusader
Cirrus SR20
Cirrus's SR22
Columbia 300
Commander 112/114

Commander 114TC
Diamond Katana
Diamond's DA40 Star
Diamond's New Twin
Diamond's Star
Eagle 150: A Different
Breed of Eagle
Eclipse and Safire
Gippsland Airvan
Grumman Tiger
Katana C1
Liberty XL-2
Maule MXT-7-180
Maule Taildraggers
Meyers 200
Micco's SP20
Mitsubishi MU-2
Mooney 201
Mooney M20 Series
Mooney M20J 201/MSE
Mooney M20K
231/252TSE/Encore
Mooney M20M TLS/Bravo
Mooney M20R Ovation,
Mods
Mooney M20S Eagle

Mooney Predator
Mooney TLS
OMF Symphony
PA-22 Tri-Pacer
PA-28 Warrior
PAC 750XL
Piper Cherokee 140
Piper Arrow
Piper Aztec
Piper Comanche
Piper Cub
Piper J-3 Cub
Piper Lance/ Saratoga
Piper Malibu and Mirage
Piper Meridian
Piper Navajo
Piper PA-12 Cruiser
Piper PA-18 Super Cub
Piper PA-22 Tri-Pacer
Piper PA-23 Apache/Aztec
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Piper PA-28R Arrow
Piper PA-28RT Turbo Arrow
Piper PA-30/39 Twin
Comanche
Piper PA-31 Navajo
Piper PA-31T Cheyenne
Piper PA-32 Cherokee
Six/Saratoga
Piper PA-32R Lance/
Saratoga SP
Piper PA-34 Seneca
Piper PA-38 Tomahawk
Piper PA-44 Seminole
Piper PA-46 Malibu/Mirage
Piper Tomahawk
Piper/Ted Smith Aerostar
Piper's PA-34 Seneca
Piper's PA-44 Seminole
Robinson R22
T3A Firefly
Taylorcraft
The Tiger
Twin Commander 500 Series
Twin Commander 500 Strike



Cessna 182: Still a Load-Hauling Standard

No one would mistake you for being a jet setter for owning one, but the venerable Skylane hauls a big load at an acceptable speed and even a caveman can fix it. Better learn how to land it right, however.

By all measure of logic, the Cessna 182 should have passed out of production years ago. Given its horsepower, it's slow and in an age of \$5 avgas, it's hardly economical. It handles like a truck. But it's that truck part that explains why, in 2008, Cessna sold 223 new Skylanes, making it essentially tied with the Cessna 172 in sales popularity. Sales tanked in 2009, but that was true for the entire market. Still, in the teeth of a vicious recession, the airplane retains relatively good values on the used market, although not many are selling.

The reason for this, we surmise, is that the 182 will haul about anything you can throw at it, it has good dispatch reliability and hardly any handling, except for nose-first landings. All that adds up to one thing: Buyers are comfortable with Skylanes and for many, it's as far up the pecking order as they'll go in their flying careers.

These days, you can buy a 182 with a full G1000 glass panel and a luxe interior for a price in the low

\$400s. A big investment, to be sure, but less money than a new SR22 from Cirrus.

MODEL HISTORY

Wind the clock back to 1956 to reach the beginning of the 182 evolutionary history. The fact that it looks like a giant Skyhawk which

The 182 will haul about anything you can throw at it with excellent performance. And it will do this without complaint.

itself looks like an inflated 150 shows that Cessna just did what it does best: It built on its experience with previous designs and scaled them up.

The 182 evolved from the 180 taildragger, so Cessna added the tri-gear, redesigned and relocated the exhaust and reworked the fuel vent system. Wet wings were used to hold fuel.

With the new gear, the 182 developed a nose heavy tendency and Cessna never did sort this out.

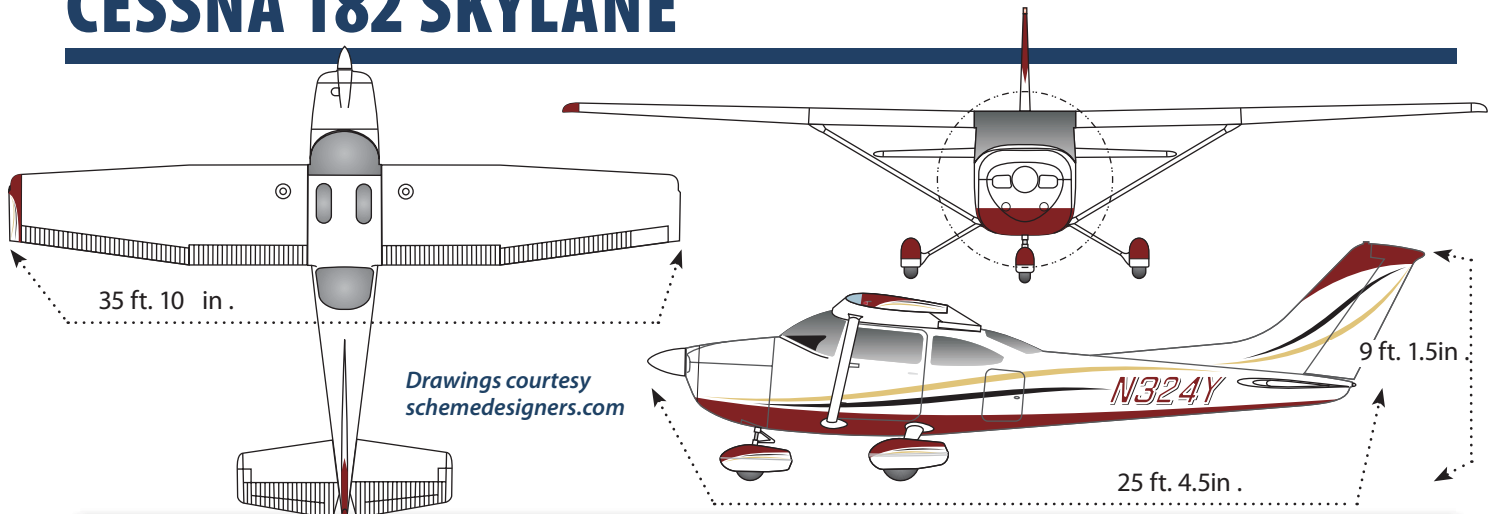
Even new ones require deft trimming or the lazy pilot risks smashing the nosegear into the runway and crow hopping down the strip. It's not unusual to see an older 182 with repaired gear and firewall due to a nose prang.

When the airplane appeared in 1956, the average price was just under \$17,000. That's equivalent to about \$132,000 in 2010 dollars. Obviously, given the price of the 182T, aircraft prices have far outstripped inflation.

In the first 182s, power was provided by a 230-HP Continental O-470-L engine that proved to be such a worthy choice that some variant of it was retained until the airplane went out of production in 1986. The engine remains easily overhaulable, for prices under \$30,000.

With its straight tail and windowless back, the original 182 looks like an antique, but Cessna soon sleeked it up with a rakish tailfin and the classic rear window everyone loves. Gross weight was 2550 pounds, compared to the modern Skylane

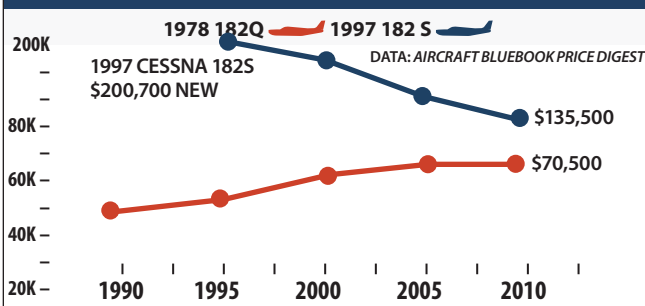
CESSNA 182 SKYLANE



CESSNA 182 SELECT MODEL HISTORY

MODEL YEAR	ENGINE	TBO	OVERHAUL	FUEL	USEFUL LOAD	CRUISE	TYPICAL RETAIL
1956-1959 182 A,B	CONT 230-HP O-470-L	1500	\$25,000	55	1010 LBS	117-120 KTS	±\$31,000
1960-1965 182 C-H	CONT 230-HP O-470-L	1500	\$25,000	65-84	1090-1190	123 KTS	±\$34,000
1966-69 182 J-M	CONT 230-HP O-470-R	1500	\$25,000	65-84	1175	123 KTS	±\$41,000
1970-1971 182 N	CONT 230-HP O-470-R	1500	\$25,000	65-84	1310	121 KTS	±\$44,000
1972-1974 182 P	CONT 230-HP O-470-R	1500	\$25,000	61-80	1169	123 KTS	±\$46,000
1975-1976 182 PII	CONT 230-HP O-470-S	1500	\$25,000	61-80	1169	125 KTS	±\$57,000
1977-1980 182 QII	CONT 230-HP O-470-U	2000	\$25,000	61-80	1169-1390	121 KTS	±\$70,000
1981-1982 182 RII	CONT 230-HP O-470-U	2000	\$25,000	92	1373	124 KTS	±\$82,000
1983-1986 182 RII	CONT 230-HP O-470-U	2000	\$25,000	92	1373	124 KTS	±\$85,000
1981-1985 T-182 RII	LYC 235-HP O-540-L3C5D	2000	\$30,000	92	1319	157 KTS	±\$100,000
1997-2000 182 S	LYC 230-HP IO-540AB1A5	2000	\$35,000	88	1210	140 KTS	±\$140,000
2001-2005 182 T	LYC 230-HP IO-540AB1A5	2000	\$35,000	92	1025	140 KTS	±\$160,000
2001-2005 T182 T	LYC 235-HP TIO-540-AK1A	2000	\$40,000	92	1025	159 KTS	±\$190,000
2006-2009 182 T	LYC 230-HP IO-540AB1A5	2000	\$35,000	92	1130	145 KTS	±\$280,000
2006-2009 T182 T	LYC 235-HP TIO-540-AK1A	2000	\$40,000	92	1025	159 KTS	±\$375,000

RESALE VALUES



SELECT RECENT ADS (S-MODEL)

AD 08-26-10	ALTERNATE AIR SELECTOR VALVE
AD 07-05-10	SEAT BACK LOCK ASSEMBLIES
AD 04-15-10	BENDIX/KING KAP140 AUTOPILOT
AD 98-16-04	SPAR CAP ANGLE STIFFENER INSPECTION

SELECT MODEL COMPARISONS

PAYLOAD/FULL FUEL

CESSNA 182	600	700	800	900
CESSNA 177				
PIPER ARCHER				
PIPER DAKOTA				
CIRRUS SR22				

CRUISE SPEEDS

CESSNA 182	130	140	150	160
CESSNA 177				
PIPER ARCHER				
PIPER DAKOTA				
CIRRUS SR22				

PRICE COMPARISONS

1986 CESSNA 182R	(\$100,000)
1977 CESSNA 177B	(\$40,000)
1986 PIPER ARCHER	(\$60,000)
1986 PIPER DAKOTA	(\$109,000)
2001 CIRRUS SR22	(\$145,000)



If you like Royalite, the old Skylane panel is a delirious celebration of 1970s materials technology, top. Newer Skylanes, besides having the G1000 EFIS suite, also have rather more elegant flat metal panels



max takeoff weight of 3110 pounds. (More on that later.)

Cessna embarked upon a continuing improvement program, introducing new model designations every couple of years. The 182A saw redesigned gear with a wider track and a lower stance, with the mains 4 inches shorter and the nose gear 2 inches shorter. The 182A got an external baggage door and a 100-pound higher gross weight.

In 1958, the Skylane name was applied—prior to this, the airplane was simply called the 182—and a deluxe version with wheel pants, standard radios and full paint instead of the trim-over-bare aluminum of the basic 182.

The 182B, with cowl flaps, came

out in 1959. A swept tail was added in 1960 to make the 182C; it was basically a styling move, since the swept tail degraded spin recovery and reduced rudder power. The gear continued to be a bit of a problem, so in 1961, it was lowered again, by another 4 inches, on the 182D.

As it did with other models, Cessna put a rear window (Omni-Vision) on the airplane in 1962, with the 182E. This airplane was a significant upgrade over the earlier 182s and these are often thought of as “modern” Skylanes. The fuselage was widened 4 inches and the cabin floor lowered by 3/4 inch to make more interior room.

Electric flaps became standard, the panel layout was updated and

the adjustable stabilizer of the original gave way to a trim tab. The gear was beefed up (again) and the gross weight was boosted to 2800 pounds. A different engine variant, the O-470-R, was fitted. The 182E also had a redesigned fuel system, with bladders and the availability of auxiliary fuel which raised capacity to 84 gallons.

Cessna also made changes that weren't as obvious. To save weight, it used thinner aluminum for the skins and converted from sheet aluminum to roll aluminum, which was cheaper. That also yielded an airplane with more surface imperfections, which ended the days of polished metal airplanes. Full paint jobs became standard, to hide the dimples. The new airplanes were only 10 pounds heavier than the old ones but performance actually suffered, with reduced climb, takeoff performance and service ceiling.

The 1963 182F sported a thicker, one-piece windshield and back window, a standard T-panel and an increase in horizontal stabilizer span of 10 inches. Flap pre-select also became standard. From the F model forward, until the S arrived in 1997, changes were less dramatic. The G model had an available kiddie seat for the baggage bay while the 182H got an alternator to replace the generator.

TURBOCHARGING

The next significant upgrade was with the 1970 182N model. Gross weight was increased to 2950 pounds and the spring-steel gear was swapped for tapered tubular steel legs that allowed more fore-and-aft movement.

Track was widened again, to 13-1/2 feet, improving ground handling somewhat. In 1972, a leading-edge cuff was added to the wing to improve low-speed handling, resulting in the 182P, a variant that stayed in production through 1976.

The dorsal fin was extended and the cowling was shock mounted.

In 1981, the 182R got another gross weight boost to 3100 pounds, and an increase in standard fuel capacity, to 88 gallons, stored in wet wings. The bladders, which had been a problem, were dropped in 1978. Cessna also switched over to a 28-volt electrical system. A turbocharged version was added to the line in 1981, the T-182RII, powered by a Lycoming O-540 producing 235 HP. Production ended in 1986 with the 182R.

NEW ERA

In 1997, when Cessna re-entered the market, it introduced a newly retooled Skylane for the next century. The changes were substantial, some cosmetic, some not. The biggest change was dropping the reliable O-470 for a 230-HP Lycoming IO-540-AB1A5; no surprise there, since Cessna and Lycoming share the same parent company, Textron.

But the change improved one thing. The O-470s were quite susceptible to carb icing and the injected Lycoming solved that. But like the O-470, the Lycoming is a bit of a fuel hog. Further, the Lycs are known for lurching cams at the mid-time point, which the TCM engines don't typically do. Also, the Continental is a smoother-running engine, in our view.

Cosmetically, Cessna did away with the old Royalite instrument panels, replacing them with painted metal. The interior—seats and cabin panels—is much improved, as is the instrumentation. Interior surfaces are now treated with epoxy-based anti-corrosion materials.

The latest 182 also has sealed wet wings, not bladders, making us wonder if owners will encounter leaks as the sealants age, as happens to Mooney owners. To get water out of the system, the airplane has no fewer than 12 separate drains, five on each wing tank and two at the bottom of the cowling. Although gross weight of the airplane is 3100 pounds, its typical empty weight is substantially higher than earlier models so it carries less than, say, an early 1980s RII. Speedwise, the normally aspirated model is respectable, cruising at just under 140 knots on 16 to 17 GPH. One reader



Skylanes are valued for their cavernous interior, above. Some older models carry more than later models. This mid-70s Cessna marketing photo shows the available kiddie seat in the baggage compartment. Although not Continental's most efficient engine, the O-470, right, is one of its most durable. Owners say you should plan on some mid-time cylinder work. (Lower photo by Andrew Hunt/Airteam.)



told us the turbocharged 182 is capable of the mid-160 knots in the teens.

Maintenance wise, the 182S has proven the target of a number of Cessna service bulletins, with most of the work being covered under warranty. Thus far, we've heard no significant beefs related to unusual maintenance problems.

MARKET SURVEY

The market may have been more well delineated when the 182 appeared but it's a jumble now. There are so many used and new airplanes available, it's hard to know what to compare the 182 to. The Skylane still offers lots of interior space and an unusually flexible payload/range combination that explains its enduring appeal. Late-model Skylanes have depreciated to the point that a 1997 S model can be had for \$135,000 or less. That's a good value when you consider that one 10 years older—a lesser airplane, in our view—sells for half that.

For equivalent capability, buyers may or may not favor Cessnas over Pipers. An average-equipped 1979 Skylane will fetch about \$71,000 while a 1979 Piper Dakota has held its value, bringing as much as \$109,000, despite the fact the Cessna cost less when new. Since our last Used Aircraft Guide on the Skylane, that price Delta has opened up a little.

Which Skylane model? That depends on budget. As noted, the latest models have started their depreciation slide and are looking to be better values than ever. These are well-equipped airplanes and are quieter and more comfortable than the earlier Skylanes. For a real steal, look for 2005 models with G1000 suites for prices in the mid-170s or less.

If you're going older, most buyers

ACCIDENT SCAN : HOLY COW!

We don't use exclamations around here much, but this one deserves it. The Cessna 182 has, as far as we can tell, the worst record in general aviation for incidence of landing and runway mishaps.

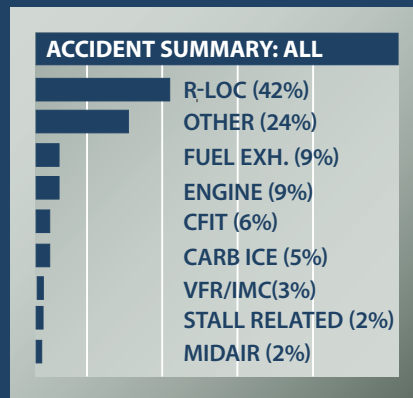
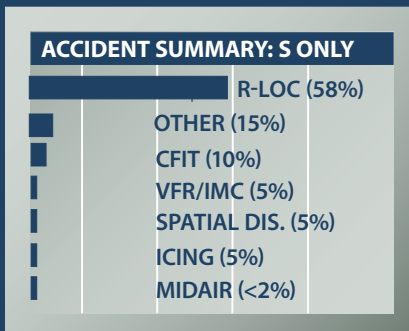
The charts below compare the post-1997 Cessna 182 S models with all others models before that period. We found that a whopping 58 percent of all Skylane accidents involved runway loss of control—mostly on landing, but a few on takeoff, too.

For most models we review, the R-LOC percentage is between 20 and 40 percent. For the 182 S model, nearly two-thirds of all reported accidents are R-LOCs. Previous models of the airplane fared a little better, but 42 percent is still quite

high. What's going on? In our view, it's exactly what owners complain about. The airplane has a tendency to land nosewheel first and is simply intolerant of too little nose-up trim.

Not all of the accident reports we reviewed described nose-first touch-downs, but many did. And frankly, we suspect that many of the unexplained loss-of-control incidents actually were nose-first landings.

Frankly, this is a poor showing for both the airplane and the pilots, reflecting badly on training. We're not sure why the S model is so much worse, but a 16 percent Delta isn't trivial. We'll be examining this further in a future issue.



seeking a practical, use-it-often airplane won't want a museum piece, so that argues for a 182E or later. If your budget allows up to \$90,000, the 1981 T-182 strikes us as a better combination of speed, value and hauling ability than any other airplane we can think of.

PERFORMANCE, HANDLING

If fast is your mantra, the Skylane won't be your airplane. Flogged to the limit, these are 135-knot airplanes but more like 130 knots burning about 12 GPH. Range varies with year and tankage, of course, but typically, you can easily fly 900 still-air miles in the 88-gallon versions. That's more endurance than most owners can muster.

Skylanes are prized for short and rough field ops and deservedly so. Long time reader David T. Chuljian flogs his L-Model 'Lane into the Idaho outback with good results.

The prop is well clear of the ground and the gear is high enough to keep antennas out of the muck. If need be, the wheelpants can be removed. But still, it ain't no traildragger. The nosegear will take some hits on rough strips.

A late-model 182 will get over a 50-foot obstacle in only 1115 feet; add a third more for safety margin and you're still comfortably under 2000 feet. Initial rate of climb is good, thanks to the high horsepower but it was better in the early models than the later ones, thanks to significantly higher gross weights.

But later models—the 182P and forward—have greater fuel capacity and higher gross weights and thus offer more loading/range flexibility. This, more than any other factor, makes the Skylane a first choice as a family airplane. It's not much good to blaze along at 160 knots if you can only carry three people.

Although the CG range in the 182 series is adequate, the airplanes tend toward forward CG; ballast or bags in the baggage compartment help. Speaking of which, the baggage compartment is large and easily accessible through an exterior door. (The seals, when old, may leak and should be replaced.)

Handling? We're not talking a Miata here. The 182 is a big, stable airplane and it takes some effort to break it loose from anything other than straight and level. And even if you do, its draggy profile means that speed builds slowly enough that only a somnambulant pilot could lose it in a dive. The Skylane is heavy in pitch, so timely trimming is a must, especially prior to or during the landing flare. Get lazy in the flare and the Skylane can slam the nosegear onto the pavement, buckling the firewall and leading to a huge repair bill. Roll forces in the 182 are nothing unusual; think of a Skyhawk with stiff cables. In a turn, the Skylane will want to overbank if left alone but so slowly that you should never get behind it.

As far as roll trim goes, fuel load and balance are important in the 182, particularly in airplanes with long-range tanks. The fuel system will self-siphon between tanks if the airplane is not parked on a level surface, so it's possible to have an imbalance that won't improve in flight. Even Cessna's excellent L-R-Both fuel selector won't prevent the tanks from draining at different rates unless a single tank is selected.

Transitioning from a Piper or smaller Cessna to a Skylane is a Ralph Kramden experience: You'll definitely feel like a bus driver, albeit a regal one. The seats are high and upright and relatively comfortable. Although visibility is good forward and out the windows, the panel and glareshield are tall, requiring short pilots to use a booster seat. Heating is good for the front-seat passengers, less so for the rear. Wing root vents provide plenty of ventilation but also leak air during the winter, leading some pilots to tape the inlets. Cessna fixed this in the newest Skylanes, which are tight, quiet and warm.

ENGINE, MAINTENANCE

In all of general aviation, there are



perhaps a handful of engine-airframe combinations that are nearly perfect. The 182/O-470 pairing is one of them. Four variants of the engine were used, the L, R, S and U. The S (1975-76) has been the most troublesome because of its revised piston ring configuration, intended to cope with the introduction of low-lead fuel. The U variant (1977-on) is desirable because of a 2000-hour TBO, though earlier engines are upgradeable from their 1500-hour TBO. It's a rare Continental that makes it to TBO without some form of top overhaul but as big displacement engines go, the O-470 is more likely than most to get by without a top.

Because of its high population and simplicity, the O-470-series is relatively inexpensive to overhaul. One persistent weakness of the design, however, is the tendency of the carburetor to ice up. In carb ice conditions, you have to be on your toes in using carb heat—the accident history shows this.

In its singles, Cessna wisely adhered to the KISS theory for the fuel system. But early models still had their problems. The bladder fuel systems found on 1962 to 1977 Skylanes didn't fit well in the wing bays, resulting in the possible formation of a diagonal wrinkle across the bottom of the bladder. Combine that with water leaks due to deteriorated O-rings in the flush fuel caps and you can see the problem;

Skylanes are inherently stable for instrument training and flight. The G1000, along with Garmin's GFC700 in newer models, make the Skylane a good glass trainer. In the photo above, the 182's high glareshield is obvious. Short pilots might have to crank the seat to max height or use a booster. (Photo by Stefano Capuzzo.)

the wrinkle acts as a dam to trap water that the pilot couldn't remove during pre-flight sumping. On rotation, the water would spill over the wrinkle, reach the fuel pick-up and choke the engine on climbout.

The FAA's response (AD 84-10-01) was to mandate the installation of additional drains and the inspection of the bladders for wrinkles. This is better known as the "rock-and-roll" AD, for it also directed pilots of airplanes not so modified to go out to the wingtip and shake it up and down to get the water to slosh over the wrinkles. This Marx Brothers-like procedure is certain to cause serious doubt in the minds of nervous passengers.

Otherwise, the Skylane is relatively free of serious ADs. A few have cropped up recently, but they're one-time directives. 98-1-14 calls for replacement of mufflers; 98-1-1 mandates inspection and possible

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Longtime reader David Chuljian uses his 1968 Skylane as a bush aircraft for trips into the Idaho outback. The airplane easily carries all the gear necessary for a two-week camping trip. The blue tape on the door seams keeps dust out. Ray Hamel's 2007 model, left, includes the G1000 and Garmin GFC700 autopilot.

replacement of the alternate static air valve. Also of note are 97-21-2, inspection of certain cylinder installations, 97-15-1, replacement of specified cylinders and 96-12-22, recurrent inspection of the oil filter adapter.

More recently, Continental had issues with valve lifters coming apart and these impacted some O-470s. On page 25, we've published a summary of ADs against the S-model Skylane. Although the number is seemingly large, none are especially onerous.

MODS, CLUBS

The Skylane may hold the record for having the most modifications available and many of them are good. The big ticket items are engines, replacing the stock O-470 with a Continental

O-520 or IO-550, another TCM product with a good reputation. P.Ponk does the 520, contact pponk.com or 360-629-4812. Peterson Performance Plus (316-320-1080) offers an impressive STOL package and O-470 engine upgrades.

Air Plains (airplains.com, 800-752-8481) does O-520 and O-550 conversions for the Skylane. For another STOL package, see Sierra Industries at sijet.com or 830-278-4481. Texas Skyways offers the O-550 upgrade; check them out at txskyways.com or 830-755-8989.

In the June 2001 issue of *Aviation Consumer*, we reviewed the Horton Flight Bonus speed package; contact 800-835-2051 or stolcraft.com. More speed mods are available from Knots2U at knots2u.com or 262-763-5100 and Maple Leaf Aviation at 204-728-7618 aircraftspeedmods.ca. Met-Co-Aire has drag reducing wingtips; see metcoaire.com and phone 800-814-2697.

If you want to slow down instead of speed up, contact Precise Flight (preciseflight.com or 800-547-2558) for a speed brake kit. Vortex generators are available from Micro

Aerodynamics at 800-677-2370 or microaero.com.

If six hours of endurance isn't enough, see Monarch Air and Development for aux tanks and improved fuel systems. For more aux tanks, see Flint Aero (flintaero.com and 619-448-1551) and O&N at onaircraft.com or 570-945-3769. Last, don't forget props from Hartzell; three-blade conversions are available. See www.hartzellprop.com or 937-778-4200.

There are a couple of Cessna groups. We highly recommend the Cessna Pilots Association, 805-922-2580 and on the Web at www.cessna.org as the first stop in obtaining information before purchasing a Skylane. These guys have been at it for years and know the brand well. Find more support at the Cessna Owner Organization at 888-692-3776 or www.cessnaowner.org.

OWNER FEEDBACK

I have owned my 1968 L model Skylane since October, 2000. I had been flying a Cardinal RG into the Idaho back country and I was getting tired of repairing the landing gear all the time. The engine was a zero-time field overhaul, with chrome cylinders and has generally behaved well; I figure replacing a cylinder every 600 hours is par for the course for the O-470-R.

I've had many and varied problems with the mags, including left/right failures within two hours of each other. I replaced the nose fork with the 206 style with the 6.00-inch tire and put 8.50s on the mains for better back country durability. Eventually went with 26-inch tundra tires. In spite of this, I spent several thousand dollars repairing extensive firewall and nose floor damage a few years ago—it's still not a tail dragger.

The tundra tires were disappointing, as they cost \$4000 and wore out after just a few years—my flying is mostly on pavement nine months of the year. The 206 fork/wheel cost about 7 knots and the tundra tire conversion (which put an 8-inch tire on the nose) took another 12 off that, so my 182 was flying at 115 knots at low altitudes, although the speed penalty was not too bad above 8000 feet. I removed the back seat and put in one F. Atlee Dodge

jump seat, spiffed out with Oregon Aero foam, so now I have a three-place 182. I have never ridden back there, but passengers tell me it's not bad.

One thing my 1968 lacks is decent baggage space; the very early models have an extension by STC, and later models came with an aft cut-out. I installed a Garmin audio panel and GNS530W and an engine analyzer. I have two glideslopes for IFR flying.

About the time I bought the airplane, gas prices went up enough to make flying to Idaho and Montana for weekend camping trips fairly expensive, so now I mostly use it to commute to Seattle on weekends and around the state. Once a year I take it up into the Canadian sub-arctic, laden with inflatable kayak and gear for a two-week solo trip. The Canadian trip is the reason I keep it rather than opting for a 172, which wouldn't quite carry everything. Total expenditure over nine years was \$184,000 for 1200 hours—includes hangar, insurance, avionics upgrades, everything but engine and prop reserve—and both are pretty much run out. This year I quit keeping track of the costs. It's too depressing.

I've attached photos, one showing how much you can fit into a 182, another showing the tundra tires (sealed up with tape to keep three weeks' worth of dust out, plus some creative tiedowns).

David T. Chuljian
Port Townsend, Washington

I purchased my 2007 Skylane shortly after finishing my pilot training. I had about 100 hours in a G1000-equipped Skyhawk and I wanted to purchase an airplane that would last me for a few years, but provide for an easy transition.

The Skylane's cockpit layout is virtually identical to the 172 Skyhawk, with the addition of the constant speed prop control and cowl flaps. The 2007 production year marked the first time that Cessna included the GFC700 autopilot in the Skylane G1000 suite and so this also provided the opportunity to learn a new piloting tool, albeit one that was far more intuitive and useful than the Skyhawk's KAP 140.

In almost every respect, the Skylane is easier to fly than the Skyhawk. Its 235-HP Lycoming engine provides more than enough power for short field and fully loaded take-offs. An exception is the degradation to performance on hot, humid, high density altitude days. As I fly exclusively on the East Coast, I opted for the normally aspirated engine, but I can see how valuable the T182T would be in the high country and desert Southwest.

The Skylane is extremely stable in cruise. Steep turns, climbs and descents are very predictable. It is difficult to stall this airplane and it would take a desperation yank on the yoke (if boxed in a canyon, for instance) to provoke a stall. The stall break is gentle and responds immediately to aileron, rudder and throttle inputs.

Where the Skylane diverges in flyability for the new pilot is the landing phase of flight. The big six cylinder has oodles of power, but also makes this airframe quite nose heavy, particularly with 20 or 30 degrees of flaps and speeds under 70 knots.

My Skyhawk training never really included the use of the yoke mounted electric trim, as the usual landing sequence involved cutting power a hundred yards short of the runway and coasting in with minor hand adjustments to the elevator trim.

The Skylane requires deft and regular use of the power trim and a wee bit of power all the way into the flare. Premature throttle cut off causes the Skylane to nose dive and can lead to three-point bounced landings.

Speed bleed-off on short final is far more pronounced than on the Skyhawk, so keeping the speed at 70 knots over the numbers will provide a flare speed of 60+ knots—just enough to keep the nosewheel up, but also allow for full command authority. Flap settings of 10 or 20 degrees al-

low for very short roll outs, but the 30-degree setting sets up a more challenging power management scenario.

The Skylane is very rugged and forgiving, with stout main landing gear and gas-filled strut for the nose gear. Because the big Lycoming can be thirsty, I usually cruise at 21 to 22 inches MAP and 2200 to 2300 RPM. This produces a burn rate of 11 to 11.5 GPH with TAS of 125 knots. Max cruise speed at 24 inches and 2400 RPM burns 14 GPH and 135 to 145 knots, depending on altitude.

A big plus for the Skylane is its 87-gallon capacity. I have flown from Boston to Sarasota, Florida with only one stop and with plenty of reserve in the tanks. With full fuel, it leaves 600 pounds for pilot, crew and belongings.

Annuals run between \$2000 and \$2500 and insurance with a hull value of \$250,000 and \$1 million liability is \$2016. I fly about 220 hours per year (VFR) and have had no maintenance issues or squawks. The Skylane is a rugged and dependable aircraft and is well suited to a novice flyer.

Ray Hamel
Wellesley, Massachusetts



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LETTERS

(continued from page 3)

(article states \$1795). ChartBook comes equipped with SSD in 32GB (standard) or an optional \$100 for a 64GB add on.

John Bouyea
President/ CEO
FlightPrep.com

Century Defense

After reading Ken Sutton's Autopilot Odyssey article and his rather blanket indictment of Century Flight Systems, I would like to offer another viewpoint concerning their equipment and service.

Century installed a 2000 in my G-33 Bonanza in 1995. It is a full three-axis and I also have their altitude pre-select. The autopilot is coupled to an Apollo GX60 GPS, an Apollo SL30 navcomm and an elderly KX170B.

The 2000 has been incredibly reliable over the entire 15 years it has been in my airplane and flies the airplane as close to perfect as one could expect. The computer has been out of the airplane two times. One time the airplane wasn't tracking correctly—in this case, the trouble turned out to be the Bendix/King HSI. The second time was just recently when the autopilot was flying in a 2- to 3-degree left bank—the computer was the problem and it was fixed the same day.

Century troubleshoot and repaired the autopilot both times. The only time there was a delay was when the HSI had to be sent in for overhaul.

In both cases, I called, made an appointment, flew the airplane to Mineral Wells and the repairs were accomplished the same day. Century technicians were courteous, responsive and knowledgeable.

Although I can certainly sympathize with Sutton's experience with the Triden, my experience with Century equipment, service and support has been completely the opposite. The Triden may very well not be a good fit for a 310, or the installation may have uncovered something that caused the problem. However, I know personally that Century does manufacture some good equipment and I have seen how excellent their service can be.

Gary L. Glisan
Wimberley, Texas

Ken Sutton certainly picked a bad time to shop for a new autopilot, as reported in your April issue. I wasn't aware of the recent history of Chelton and S-TEC either. For readers who have an older autopilot, there is another option that I can recommend as a lower cost solution that has given us a good half a loaf in the autopilot department.

Like Ken had, we have a Century IIB (Piper Autocontrol III) autopilot whose wing leveler and heading bug circuitry still work up to spec. The rest of the functionality is marginal and rarely used. After upgrading our Garmin GNS430 to the 430W, we installed a DAC GDC-31 roll steering converter which interfaces the Garmin to the Century's heading bug.

A new annunciator lets you choose either roll steering or head-

FEEDBACK WANTED

GRUMMAN TIGER



For the September 2010 issue of *Aviation Consumer*, our Used Aircraft Guide will be on the Grumman Tiger. We want to know what it's like to own these sporty singles, how much they cost to operate, maintain and insure and what they're like to fly. If you'd like your airplane to appear in the magazine, send us any photographs you'd care to share. We accept digital photos e-mailed to the address below. We welcome information on mods, support organizations or other pertinent comments. Please send correspondence by July 1, 2010, to:

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ing bug modes. The GDC-31 takes full advantage of the 430W approach functionality and will steer the airplane around a procedure turn or RNAV approach with aplomb.

It will also fly a LOC or ILS approach to the FAF and then disconnect—push the annunciator to continue on the heading bug (or the Century's ancient analog steering) or disconnect the autopilot and hand fly the rest of the way in.

Yes, it's a single-axis solution, but for our needs, it's plenty good enough. We even have a nearby shop that services the Century IIB. Gives us a little more assistance so we can wrestle with our Voyager EFB, too. Installed it only set us back about \$2000.

Jim Grant
via e-mail