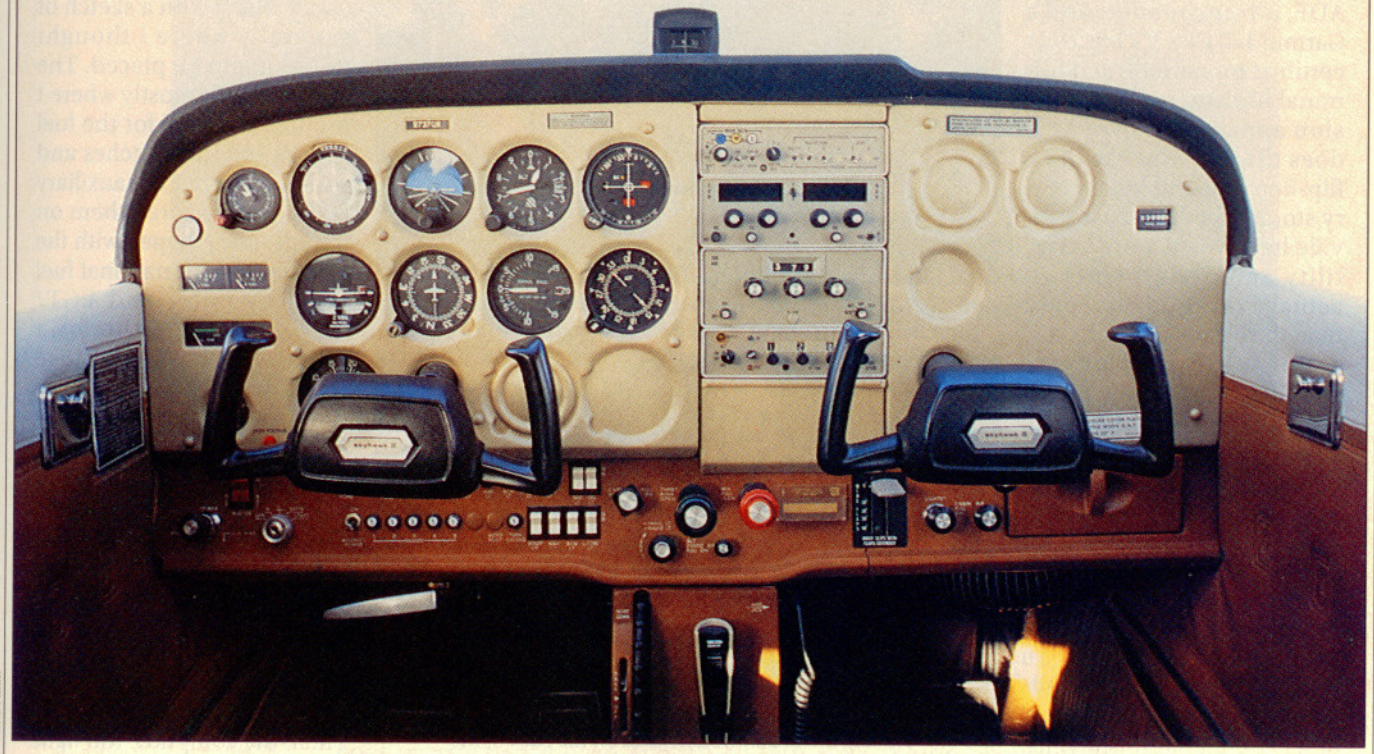
A BLANK CANVAS



MIKE FIZER

A stock starting place for creating tomorrow's panel.

BY THOMAS B. HAINES

In no part of our upgrading of N737QN, a 1978 Cessna 172N, has time and technology been more friendly than in the cockpit. A maturing aftermarket business allowed us to swap out the airplane's stock 160-horsepower engine for a 180 hp and to add a STOL kit for improving takeoff, landing, and slow-speed characteristics, but the new engine is of the same technological vintage as the original and similar STOL kits were available when this airplane was built. Today's paint and interior materials are better than in the past, but not in the order of magnitude as the improved avionics and instrumentation out now. ■ Our goals in turning N737QN into N172B, our Better Than New 172 project airplane, are to improve safety, comfort, and performance. We wrote about the enhanced safety and performance that come with the engine upgrade and STOL kit earlier in the year. Future articles will detail the paint and interior processes and, finally, tell which AOPA member wins the airplane in January as part of our Better Than New 172 Sweepstakes. ■ The upgrading of an avionics panel can take many routes, from the simple to the sublime. As you'll see in the following pages, we chose the latter. Indeed, N172B is arguably the best-equipped Skyhawk in this part

BETTER THAN NEW 172

of the galaxy, and it's without a doubt "better than new." Of course, in the case of N737QN, adding high-octane performance was easy, considering that when we bought it last December it came with just one nav/com, an audio panel, an ADF, and a transponder.

Today, the center stack consists of two Terra navs and coms, an audio panel, an ADF, a transponder, and a Garmin 155 GPS TSO receiver certified for enroute and terminal use and for nonprecision approaches. Not only does the new stack with its flip-flop frequencies, memory storage and database provide light-years more versatility and performance, it actually takes up less space than the old equipment.

But who wants to surround all those new boxes with the same old plastic panel? The only solution seemed to be a new flat metal panel. For that, we turned to Air Mod, Incorporated, at Cinncinnati Municipal-Lunken Field. Proprietor Dennis Wolter for the last 20 years has specialized in building premium avionics panels, custom interiors, and other aircraft refurbishments. His skills as a craftsman are surpassed only by his creativeness. He has solutions to panel and interior problems that most of us never knew were available. As an airframe and powerplant mechanic, he also knows how to fix things so that they either won't break again, or, if they do break, they'll be easier and less expensive to repair.

For example, the left side of the metal panel he created for N172B can be removed by twisting off four acorn nuts and spinning out five screws. Behind the panel, all of the wiring and tubing has adequate work loops to allow the panel to be pulled out and rested on the control yoke while a technician removes an instrument. To reduce the likelihood that such repairs might be needed, all of the wiring behind the panel was upgraded. The original fragile plastic tubing that plumbs the pitot/static and vacuum systems has been replaced with neoprene or AN aircraft-quality aluminum tubing with machined flanges.

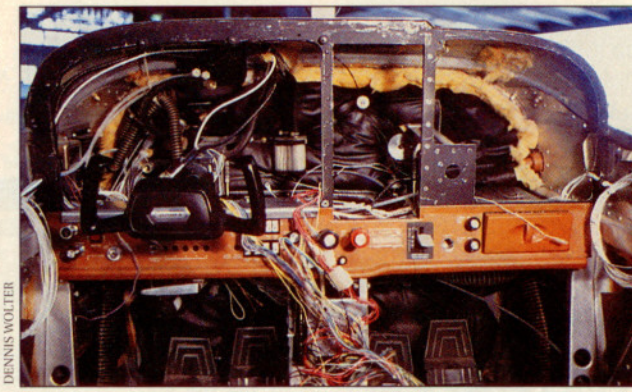
Electrical equipment is now protected by a passel of Klixon and Potter & Brumfield circuit breakers and, for the lighting, circuit-breaker toggle switches. The circuit breakers are pullable and are more durable than the originals. In all, Wolter estimates the cockpit contains about 800 feet of new wire of various sizes.

In building such a panel, Wolter starts by removing the plastic overlays and metal subpanel. After much maneuvering of thin cardboard panel blanks, he is able to determine the amount of space available for instruments. Often, the deciding factor for where some instruments go is the amount of depth available behind the panel.

I provided him with a list of what we wanted to put in the panel, along with a sketch of generally where I thought things might be placed. The equipment fit mostly where I proposed, except for the fuel gauges and the switches and annunciators for the auxiliary tanks. I had wanted them on the left side, grouped with the Electronics International fuel flow computer and EGT/CHT, but, for aesthetics, I also wanted to keep those two EI instruments together with the volt/amp meter and the oil pressure/temperature gauge. In the end, the fuel gauges and switches ended up on the extreme right side of the panel, but canted toward the pilot. A fair compromise, especially once we finish the FAA paperwork to have the EI fuel computer approved for the airplane. Then, the computer will light an annunciator at the top of the panel in the case of low fuel—at least some comfort from the "out of sight out of mind" concern.

All of the electronic engine gauges are connected to the EI annunciator panel in front of the pilot and will alert when the gauges sense a preprogrammed out-of-tolerance situation. Since the 172 has no manifold pressure gauge, we replaced the "MP" annunciator with one that detects a vacuum failure. Elsewhere on the panel, annunciators light when the pitot heat is on and when the wing-tip recognition lights are powered up, not to mention the separate annunciator panel from MSI Avionics required for the IFR GPS installation.

Once Wolter is satisfied with the placement and fit of each item, he produces a clean drawing for cus-

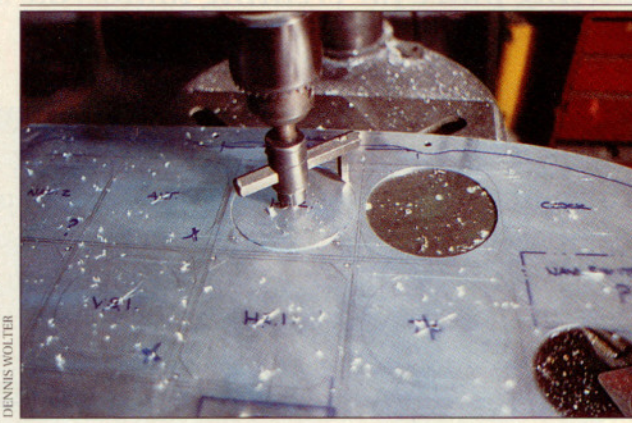


DENNIS WOLTER

Air Mod's addition of a new aluminum bar across the bottom of the left panel beefs up the original structure to accomodate the new layout.

DENNIS WOLTER

Tracing of the instrument faces on the back of the metal assures an accurately sized hole after cutting.



DENNIS WOLTER

A fly cutter on a drill press makes quick work of the actual cutting, but only after days of measuring and other preparation.

tomer approval. With all in order, he can finally cut metal—.063-inch aluminum alloy in this case. Once the blank fits properly, he traces the instrument faces on the metal. Actually cutting the instrument holes takes only about 15 minutes, somewhat anticlimactic after the many days of preparation.

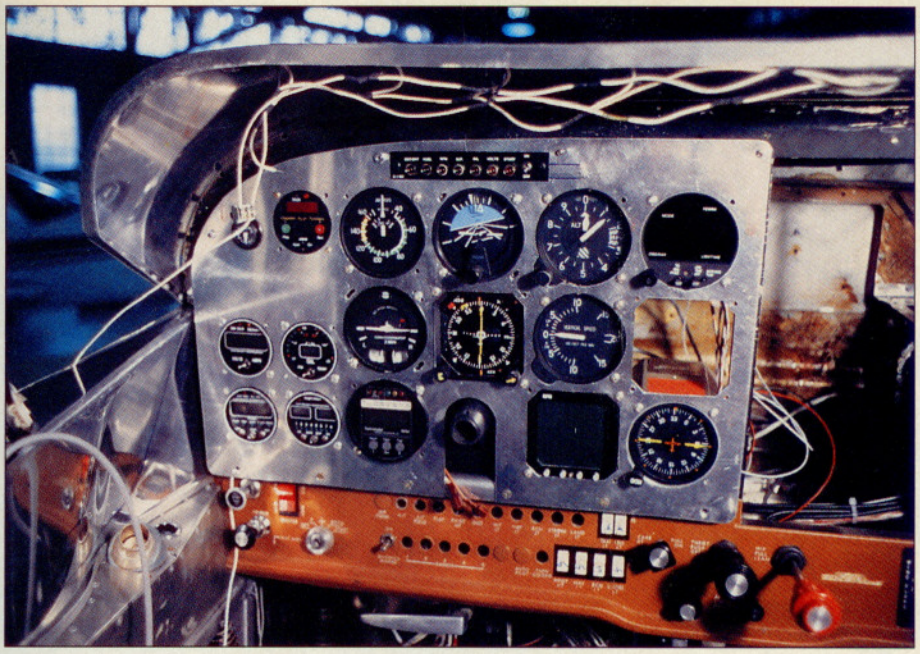
From there, it's a matter of coordinating the work with the avionics shop. We hired Avionics, Incorporated, located next door to Air Mod, to install the avionics. The panel went together relatively quickly because shop owner Joe Babis and technician Jim Kollath actually had all the equipment wired and working before it ever went into the airplane.

In the end, the only original parts in the panel are the stock fuel indicators, and then only because we could not find any others that were certified for the airplane. We overhauled the attitude indicator shortly after we purchased the airplane. The airspeed indicator was changed along with the engine. Even the vacuum gauge and Hobbs meter are now new; the originals had failed on test flights.

Night lighting of most 172 panels is just a few candlepower short of nonexistent. To fix that, Wolter added a string of alternating red and white lights under the glareshield. A toggle switch allows the pilot to choose either red or white. A rheostat on the panel controls brightness. The floodlights work well, evenly lighting the flush-mounted instruments. Instruments recessed in a plastic panel overlay would be better served by post lights. New red lights also illuminate the subpanel. Unlike when N737QN was new, many modern instruments now come with the option of internal lighting. Such is the case with the new Aerosonics altimeter and instantaneous vertical speed indicator, which emit circles of soft red light from behind their bezels.

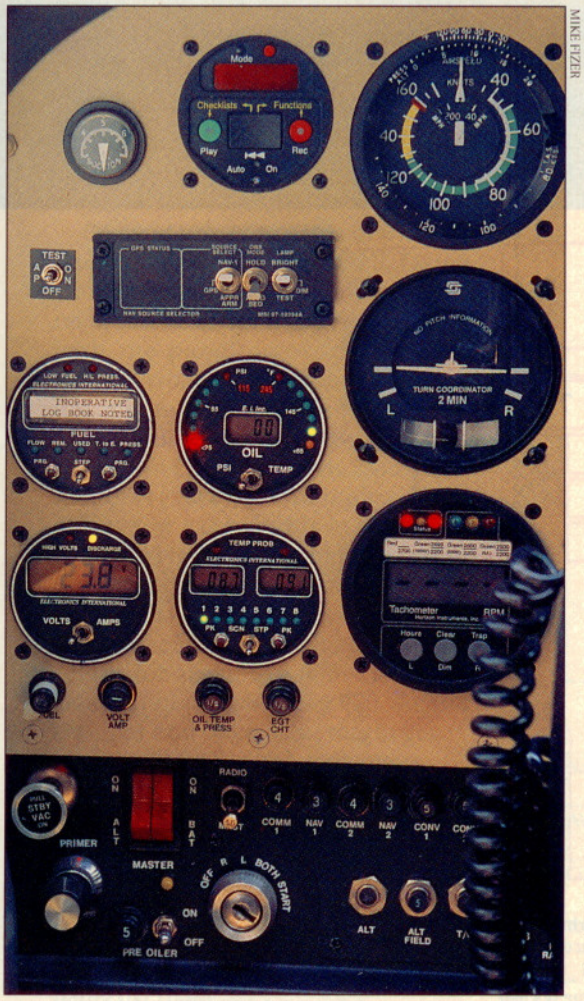
The EI instruments are backlit for easy night viewing, as is the Horizon Instruments P-1000 digital tachometer. With 1-rpm resolution and a host of diagnostic features, the new tach puts conventional mechanical tachs to shame in accuracy and reliability. The digital readouts takes some getting used to for those of us brought up in the analog generation.

The EI instruments are also far more accurate and reliable than the



DENNIS WOLTER

Before painting and placarding, the panel is checked for proper fit. The original subpanel is kept, but the old Cessna rocker switches will be tossed out in favor of new circuit-breaker switches.



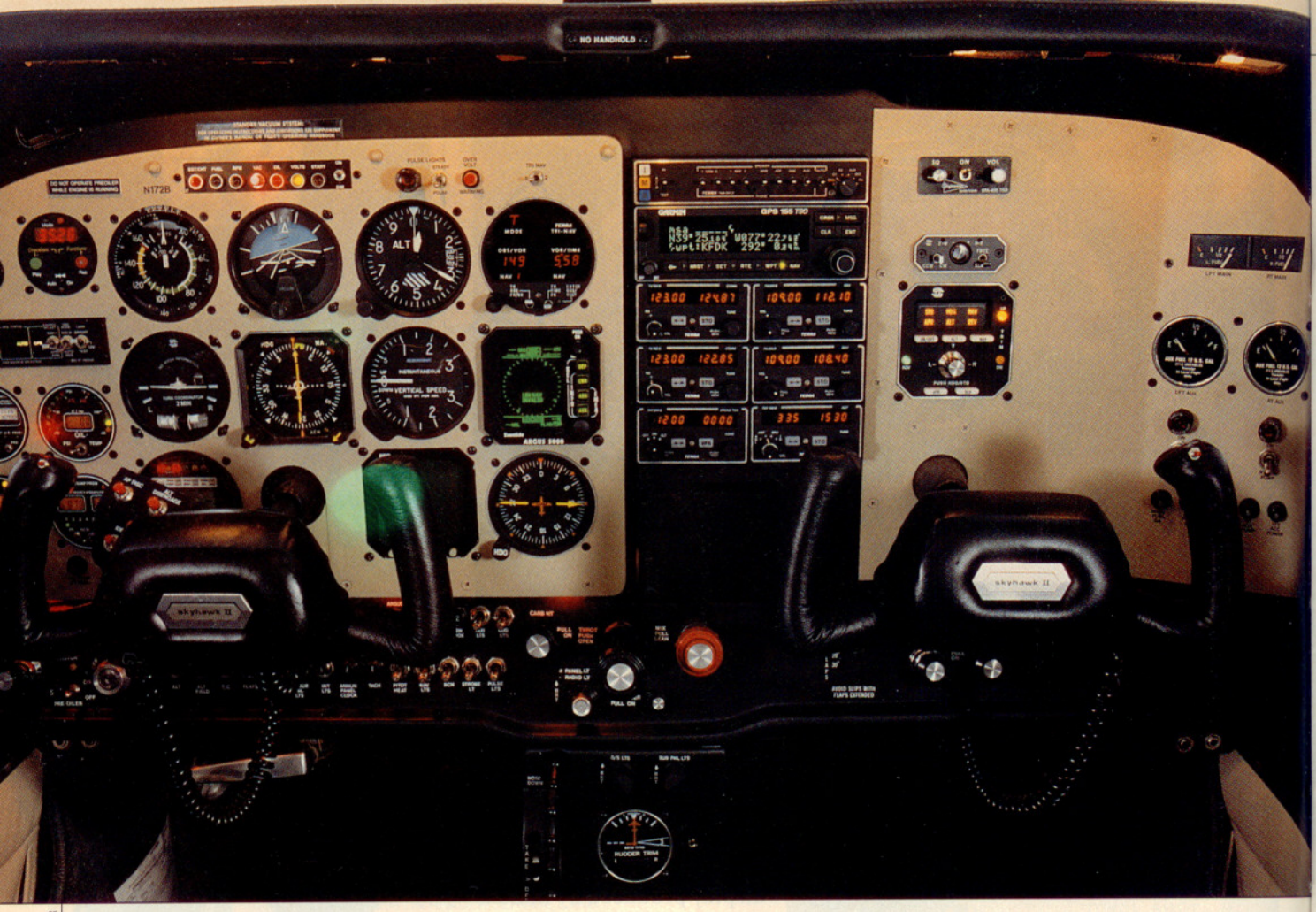
MIKE FIZER

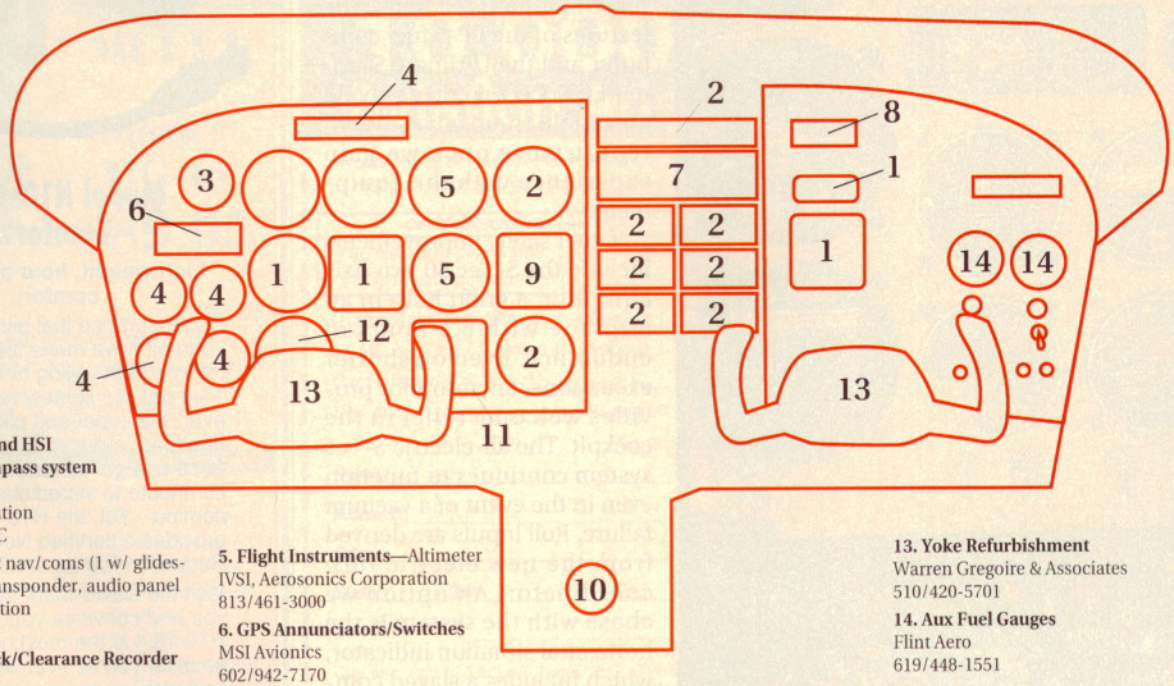
PCR Systems digital voice/clearance recorder and clock, MSI Avionics GPS annunciators, quartet of Electronics International gauges, and Horizon P-1000 electronic tach fit neatly into the left panel.

original equipment, but the same caveat applies. At the flip of a switch, either oil pressure or oil temperature is displayed digitally. Meanwhile, though, a continuous analog display produced by LEDs is shown for both readings. The features of the FP-5 fuel computer and the Ultimate Scanner EGT/CHT could easily fill an article themselves. We'll report more once we gain experience with the equipment.

Other safety improvements include the S-Tec 50 two-axis autopilot, a great help in an airplane with 6.5 hours of endurance. Even on shorter excursions, an autopilot provides welcome relief in the cockpit. The all-electric S-Tec system continues to function even in the event of a vacuum failure. Roll inputs are derived from the new electric turn coordinator. An option we chose with the system is the horizontal situation indicator, which includes a slaved compass system. A metal flange was added to the pilot's control yoke to accommodate the required autopilot disconnect buttons. Warren Gregoire and Associates wrapped the yokes in leather and provided the

MIKE FIZER





1. Autopilot and HSI w/ slaved compass system
—S-Tec 50
S-Tec Corporation
800/USA-STEC

2. Avionics—2 nav/coms (1 w/ glideslope), ADF, transponder, audio panel
Terra Corporation
505/884-2321

3. Digital Clock/Clearance Recorder
PCR Systems
Colorado Computer Associates, Incorporated
303/674-2379

4. Electronic Engine Gauges—Engine analyzer, fuel computer, oil pressure/temperature gauge, volt/amp gauge, annunciator panel
Electronics International
503/640-9797

5. Flight Instruments—Altimeter
IVSI, Aerosonics Corporation
813/461-3000

6. GPS Annunciators/Switches
MSI Avionics
602/942-7170

7. GPS Receiver—IFR 155
Garmin International
913/599-1515

8. Intercom
Sigtronics Corporation
818/915-1993

9. Moving Map—Argus 5000
Eventide, Incorporated
201/641-1200

10. Rudder Trim
Aero-Trim, Incorporated
305/864-3336

11. Stormscope WX 900
BF Goodrich FlightSystems
614/825-2001

12. Electronic Tachometer
Horizon Instruments, Incorporated
714/526-1919

13. Yoke Refurbishment
Warren Gregoire & Associates
510/420-5701

14. Aux Fuel Gauges
Flint Aero
619/448-1551

Avionics Installation
Avionics, Incorporated
513/871-6222

Metal Avionics Panel
Air Mod, Incorporated
513/321-5576

push-to-talk switches wired into the Sigtronics intercom system.

Helping out the autopilot system and relieving the pilot's right foot in the climb is an electric rudder trim system from Aero-Trim, Incorporated. The system was developed for aileron trim, but, with a field approval, can be converted to rudder trim.

Another aid is the Eventide Argus 5000 moving map. Coupled to the Garmin GPS, the Argus provides a bird's-eye view of the airplane's progress along a route, including proximity to various types of airspace, airports, navaids, and intersections.

While the Argus helps steer N172B clear of restricted airspace, the BF Goodrich WX 900 Stormscope can help keep it away from thunderstorms. The WX 900 is a lower cost variant of the more traditional WX 1000 Stormscopes. To help keep the cost down, the WX 900 uses an LCD screen instead of the brighter but more expensive cathode-ray tube found on other Stormscopes. Because of the LCD's limited viewing angle, the WX 900 should be placed as near in front of the pilot as possible, but a Stormscope is an excellent safety addition to the cockpit.

So what price does this new safety and convenience carry? Well, fasten your inertia reel harnesses. All told, the retail cost of all that's been done to and with the panel amounts to about $62,000. Wolter's retail charge for building and installing the panel is about $7,000, but several hundred dollars of that are in circuit breakers alone. The Klixon breakers, for example, sell for about $30 each. Babis at Avionics, Incorporated, would charge another $7,000 for the avionics installation. The biggest ticket item by far is the S-Tec autopilot and HSI combination, which retails for about $15,800. The Terra stack retails for about $9,900. A good shopper and negotiator might get 10 percent off retail on the equipment.

As Wolter notes, a complete panel upgrade is a commitment to the aircraft. Unlike a paint job, for example, the new panel makes each and every flight easier and more enjoyable, but new paint or an interior upgrade will return far more in a resale than a panel overhaul.

Fly N172B for a while, though, and you'll soon have to admit that it is quite unlike any other 172 you've met. How do you put a price tag on unique? □

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