



The finished panel, lighted up and ready to go. On the left, the 10-inch SkyView display fits like it was meant to be there.

SkyView to the Rescue

An RV-9A owner details the journey from Blue Mountain orphan to SkyView family man.

BY MARC COOK

The problem is timing. During the course of building an airplane, you look at the options, take your best shot and live with the decision. Stanley Peternel, whose Van's RV-9A first flew in May 2005, knows this all too well. Back then he wanted a state-of-the-art panel including an EFIS (electronic flight information system) that contained its own GPS, moving map, terrain, synthetic vision and autopilot functions. If you were to outline those desires today, it wouldn't be difficult to name several vendors who could provide such a system. But when Peternel was building,

only one company had all of these features: Blue Mountain Avionics.

History records that now-defunct BMA's products were stuffed with leading-edge ideas not always backed by reliable hardware and gold-star customer support. "When it worked," says Peternel, "[the BMA system] was quite good, very advanced. But it didn't work often enough." Peternel's complaint is common. At one point in 2009, Blue Mountain systems were coming out of airplanes at a breathtaking pace, while those who owned working examples had to wonder what the future had in store.

Moreover, despite the \$20,000 buy-in, Peternel was forced to pay for hardware upgrades and install additional temperature-mitigation measures to keep the Blue Mountain EFIS-One happy. And still the complaint: When it worked, the BMA equipment was impressive. But it simply couldn't be counted on, and with the company's demise, the hope of ever finding a final fix for its myriad shortcomings rounded down to zero.

Enough Already

"Then Dynon introduced the SkyView system," says Peternel. "It looked good,

and Dynon had a good reputation. And then [Dynon] offered a \$1000 credit on a SkyView if you returned your old BMA system. That sealed it for me.” For Peternel, the SkyView promised to actually deliver everything the BMA promised: synthetic vision, connection to already installed radios, autopilot functions and a self-contained GPS receiver—important because Peternel didn’t want to spend for an outboard GPS like the Garmin 430.

In addition, the larger SkyView was a close physical match for the outgoing Blue Mountain EFIS-One. “I really didn’t want to tear the whole panel up,” says Peternel with a whiff of understatement. It would be disruptive enough given how many functions were crammed into the BMA system. Plus, the main pilot’s panel was already tightly packed with backup instruments surrounding the big screen; to attempt reworking the panel so that it would take two smaller displays would be a massive amount of work.

Luck with was Peternel this time. Working with friend and electronics guru Scott Millard, he says that “we figured out that the cutout for the Blue



One of the “OMG” moments, when you realize how much work is to be done.

Mountain was larger than we needed for the Dynon.” So it was a matter of having an adapter bezel created that would fill the existing BMA-size hole and pick up the mounting points for the 10-inch SkyView screen. As good fortune dictated, the difference in the dimensions allowed for a simple aluminum ring to be fabricated that looks almost like it was meant to be. “I had Pacific Coast Avionics build the adapter for me,” Peternel said. “They missed one dimension on the first try, but were really good about correcting the mistake and send-

ing me the replacement. They did well on customer service.”

In the RV-9A, the adapter plate fully surrounds the SkyView display and slots into the cutout that originally held the BMA. But that aspect of the physical portion was just the beginning. “The Blue Mountain system includes a big processor box that we’d mounted behind the display on a hinged bracket, but it wasn’t an easy piece to work around,” says Peternel. Moreover, the BMA system had multiple remote boxes along with uniquely shaped autopilot servos that had to be removed and replaced with the Dynon units.

Retrofits as comprehensive as this tend to throw surprises every so often, including the realization that things like AHRS (attitude heading reference system) modules need to be mounted, along with magnetometers, outside-air-temp probes and all the engine probes. And when you’re spanning a half decade of development, chances are slim that the new items will go right where the old ones came out. Peternel credits Millard for keeping him on the right path, backstopping him on the hundreds of small decisions that have to be made in such a project.

Building Blocks

In the SkyView system, Dynon has used the building-block principle to great effect. Essentially, the system is anchored by the displays, which carry two 9-pin



Organization helps. Keep the new hardware and documentation in order, and take copious notes.

D-Sub connectors plus a 37-pin low-density D-Sub connector for the purpose of communicating serially with external radios, handling analog inputs and outputs, and providing power to the entire system. There are also conventional USB and Ethernet jacks on the back panel of each display.

Those two 9-pin connectors are the heart of the scheme—they contain two sets of network connections plus power and ground for each of the modules used to expand the system. Dynon sells prefabricated harnesses used to connect each external module to the main system and ensure that the networking is performed properly. The system is designed to be daisy-chained with outboard splitters so that adding new modules is a matter of hooking into the main network branch.

An example of the components loaded outboard: the AHRS modules (you can use one, two or more) that include an internal magnetometer, autopilot servos, an ARINC 429 adapter and an engine-monitoring box. Other additions include one or more backup battery supplies, the remote mounted Mode-S transponder that recently began shipping and self-contained GPS engines potted into sleek antenna housings. These components do not run on the networked lines but are wired directly to one of the displays. (The way Dynon networks them allows the information from any component to be shown on any display regardless of which one it's connected to.)

"We had to think a lot about how to wire the network lines, and we decided to have the autopilot servos hooked to one of the DB-9s on the display panel, and the other components on the other," Peternel says.

Autopilot Tactics

Because Dynon provides dedicated brackets for the RV-9A, it was a matter of installing them in the proper locations and hooking up the old wires, right? No, not exactly. "It turned out that the BMA servos had the same number of wires going to them as the Dynon models, but we decided to take out all the old wiring because the Dynon uses



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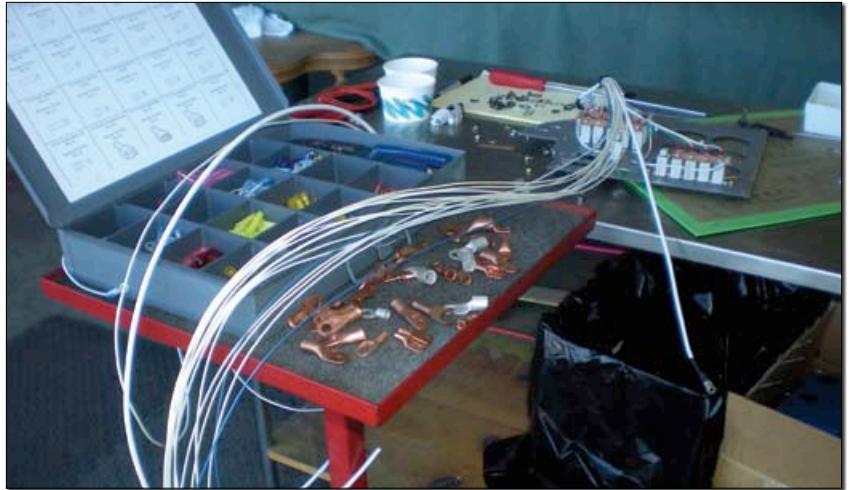
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twisted wires for the network connections. We didn't want to have a problem with noise or anything else by trying to reuse the old wires. That was a task," says Peternel, explaining that removing the wiring from the right wing and reinstalling the new harness to avoid high-voltage strobe wiring was a challenge.

What's more, the Dynon servos aren't powered by the network harness as the other items are. They require you to separate out the power lines and a disconnect line that's shared with each servo, meaning that where the servo harness meets the main network harness you'll have a few splices. This was done to ensure the servos have a dedicated power supply of sufficient capacity to drive the motors, but also so that they can be deprived of power in the event of a problem. Leaving them on the main power grid, so to speak, would require taking the whole system down to depower the servos. Finally, each servo has a "takedown" line that, when grounded, commands the servo to disconnect right at the source.

Installing the wing servo for roll was straightforward past the wiring, but not so with the pitch servo. "We got it installed according to the directions and discovered that the control arm would contact the pushrod," Peternel says. In the recommended mounting scheme, the servo is located below the longitudinal pushrod from just behind the seats leading back to the tail. The arm was shown as positioned upward from the servo, acting on a small pushrod to a link at the forward end of the main elevator pushrod. But the natural stroke of the elevator control moved the pushrod into contact with the servo arm. The solution was to turn the servo arm 180°.

"That's the cool thing," says Peternel when relating this shortcoming. "In the autopilot setup, you tell the system how it needs to work. It tells you to put the stick in a certain position, then another, and another, and it figures out which way is nose down or left wing down, or whatever. Really neat." The few days spent noodling on a fix for the elevator servo miscue was nothing compared to



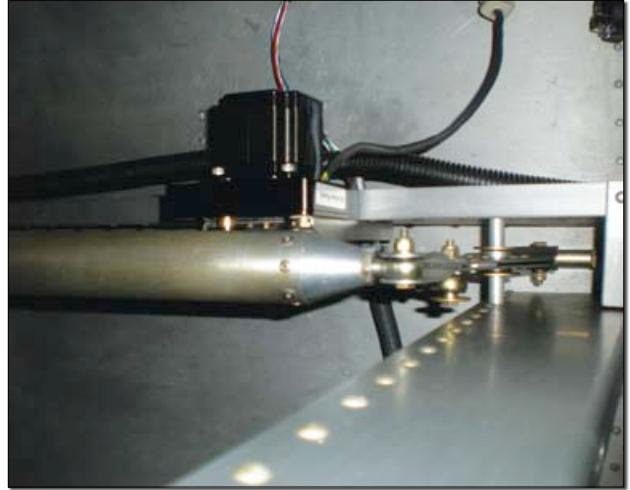
Even though Peternel was only changing the EFIS, modifications to his RV-9A's electrical system were necessary as well.



For this single-screen system, the main flight display, moving map and engine strip share space.



The Dynon servo and the install kit in the right wing. Peternel rates the install kit and the documentation as excellent.



One of the “gotchas” in Peternel’s installation. As directed, the pitch servo arm was supposed to point up from the servo, but it contacted the elevator pushrod. Reversing the arm was the solution.

the hours of fiddling trying to get the BMA system functional.

Mounting the AHRS

Dynon’s SkyView system is unique in that the magnetometer is collocated with the AHRS module, which means

you need to find a magnetically benign location and bring the pitot/static/AOA pneumatic lines to it. The AHRS module also needs to be within a defined box relative to the airplane’s center of gravity. Dynon specifies a point no more than 12 feet longitudinally and 6 feet later-

ally from the center of gravity. In the Peternel RV, the AHRS box is mounted just under the leading edge of the vertical stabilizer, beneath a fiberglass fairing. It is near the aft end of the allowable envelope, and required that the normal static lines be brought rearward from



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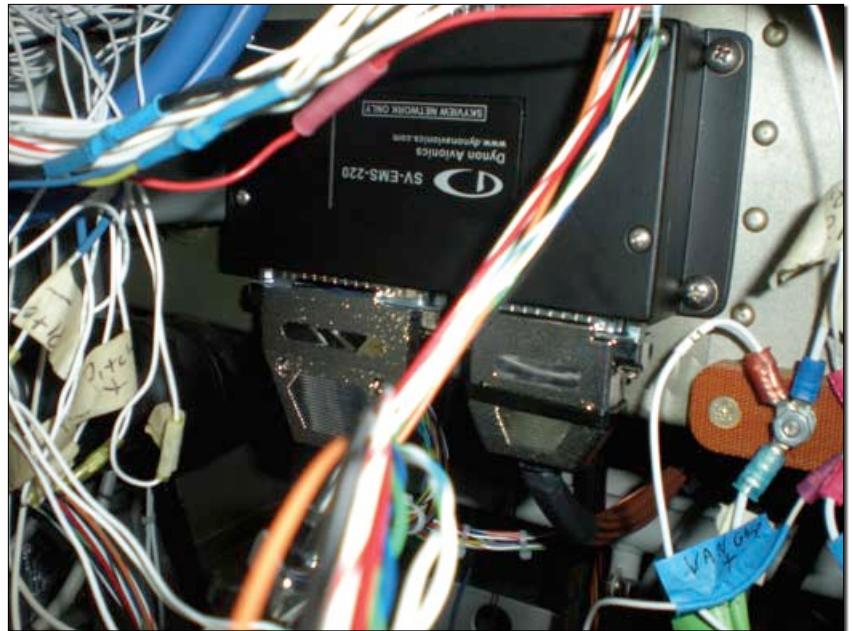
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their normal mid-fuselage points, along with a much longer pitot line brought from the left wingroot.

As it did with the EFIS-D100/D10A systems using an external magnetometer, Dynon expects the outside-air-temp probe to be ported locally. (Remember that the D100/D10A series has its AHRS modules inside the display boxes, but that meant alignment between the magnetometer and screen had to be maintained.) For Peternel's installation, the OAT probe was mounted under the right side of the horizontal stabilizer, up from the lower edge of the tail cone so that exhaust gases and engine heat would not influence the readings. There may well be installations where the AHRS module would work inside a wing, away from ferrous components, making the pitot-static lines shorter and placing the OAT probe in the ideal location away from the fuselage.

Engine Monitoring Now

A big part of the installation was converting the engine-monitoring function from the old Blue Mountain arrangement. Peternel's RV has a constant-speed prop, so he wants to read manifold



Peternel chose to mount the SkyView's engine monitoring module behind the pilot's side panel. Thin displays maximize behind-the-panel space.

pressure, rpm, fuel flow and all of the normal exhaust-gas and cylinder-head temps (EGT/CHT), which is part and parcel of the SkyView EMS module.

In fact, Dynon did retrofiters a great service by making the connectors and pinouts identical from the legacy systems—the EMS-D10/D100 and FlightDek-D180. The 37-pin main

EMS harness is the same as is the 25-pin EGT/CHT harness; had Peternel been upgrading from an older Dynon system, it would have been a matter of locating the EMS module near where the old engine monitor had come out and connecting the harnesses to the new box. But because he was changing from the BMA system, it was more complex.



A combined AHRS and magnetometer module forces the location to a magnetically benign portion of the airframe; this is just below the vertical stabilizer fairing.



Placing the OAT probe high on the tail cone under the horizontal stabilizer should keep it out of the airstream heated by the engine and exhaust.

“But it wasn’t too bad,” Peternel says. “The Dynon pressure senders are a different size, so we had to make spacers, but it was actually pretty straightforward.” He had given himself a leg up by splicing many of the engine probes on terminal blocks, so the probes themselves could remain. “We managed to keep the EGTs, but the CHT probes are different, so we had to install the new items.” Peternel also believes in full backups, so in this installation, as before, there is a cluster of Van’s-provided analog gauges on the right side; this complicates some of the wiring and hosemongery ahead of the firewall, but he does get a full, independent backup of most of the engine parameters.

The Rest of It

In Peternel’s airplane, basic avionics made the ARINC 429 module unnecessary. He has a Garmin SL30 nav/com and SL40 com mated to the display through the 37-pin main harness, and he has a Garmin GPSMAP 296, in an AirGizmo mount, also feeding the display through an RS-232 serial connection. But he relies mostly on the Dynon GPS module for navigation.

“Right now the mapping is well along and the navigation is just Point A to Point B, but that’s fine with me,” Peternel says. “It’s how I fly 99% of the



Better than yoga: Crawling under the panel is an all-too-familiar feeling during the retrofit, but the cramps pass and the memories fade with time. Trust us.

time.” He uses the outboard Garmin as a backup, and uses the SL30’s VOR/ILS/LOC display when necessary. “I was amazed. We hooked it up, set up the network according to the directions, and it all worked,” he said. The SkyView system also exports a serial altitude data stream to provide altitude encoding to the Garmin GTX 327 transponder.

Impressions, All Good

After a painless setup and calibration period—along with loading the latest software—Peternel says the SkyView system worked as promised. Actually, more than that: Marvelous. “I can’t believe how good it is,” he said. “The

synthetic vision is excellent, and the system is stable. I turn it on, and it works.”

His experience so far has been superb. “I have had no problems at all,” he says, “and the autopilot is really good. I have the latest software, and the autopilot handles the airplane very smoothly. In fact, the only problems I’ve had have been user-induced,” he says, though you suspect that more familiarity with the system will overcome that. He reiterated that when the BMA autopilot worked, it was fine, but it would sometimes command a lawn-dart maneuver without warning and once remained engaged even after he’d attempted to disengage it for landing. “That’s scary stuff,” he says. The SkyView system has done nothing he hasn’t asked it to.

Good Investment After Bad?

For a builder who has had the distinctly unpleasant experience of paying twice for a workable EFIS, Peternel is a happy man. “My investment in the SkyView has been around \$9500 as it sits, and for that the EFIS works much, much better than the Blue Mountain ever did. Factory support has been good, though it would be nice if the installation and user manuals didn’t refer to one another as often,” he says. “But my experience with SkyView from a pilot’s perspective has been nothing but great.” ±



It’s not what it seems. This beach chair was used by Peternel to be comfortable working under the RV’s wing.

For more information, visit www.dynonavionics.com or call 425/402-0433. Find a direct link at www.kitplanes.com.