



A glass-cockpit Bonanza

A modern instrument panel full of sophisticated avionics equipment

BY STEVEN W. ELLS

New engine? Check. New turbonormalizer system? Check. New propeller? Check. New avionics? Check. What's left? It would be nice if we were half done. But we still have lots to do on AOPA's 2001 Sweepstakes Bonanza project

airplane. A TKS weeping-wing ice protection system will be installed in Salina, Kansas. Then the Bonanza will be flown to Murmer Aircraft Services in Arcola, Texas, so Doug and Teresa Kelly can install Beryl D'Shannon aileron and flap gap seals and solar gray-tinted side windows. The Kellys specialize in installing Beryl D'Shannon (BDS) modifications. After the BDS modifications

are installed, the Bonanza paint experts at Murmer will apply the unique sweepstakes Bonanza paint design by Craig Barnett of Scheme Designers. According to our carefully organized schedule, this should take most of June and July.

The sweepstakes Bonanza will be at the AOPA exhibit site at EAA AirVenture 2001 (aka Oshkosh). Stop by to see a beautifully equipped airplane. The

upgrade and refurbishment chores should be completed by that time, except for the installation of Dennis Wolter's interior. That task awaits late summer. Wolter, owner of Air Mod in Batavia, Ohio, is well known for his innovative and high-quality interiors.

An incredible amount of planning, very generous support in the form of equipment and labor from a long list of contributors, and a lot of very talented and hardworking people have pitched in to make the sweepstakes Bonanza a dream airplane. It's a shame that every AOPA member can't take it home for a week—it really is quite an airplane.

As in any project this size—more than 30 different companies have contributed to the sweepstakes Bonanza airplane—there have been a few sur-

AOPABONANZASWEEPS

prises, but that can be expected during a total airplane refurbishment.

In a project that stretches over a year, schedules are often wishful thinking, especially when there's a deadline to meet. Last month you read that the projected completion of the avionics installation would be the first week in May. As I write this it's Monday, May 21, and the airplane is scheduled to be finished on Wednesday, May 23. If there's fault to be assigned for this delay, it probably lies with me, Associate Editor Steve Ells, because I kept calling the staff at J.A. Air Center and adding another page to the project board.

The dreaded phone call

Ringggg: Excuse me, do you think it would slow things down if your team could install a set of Aero Tech Services fuel bladders? *Ringggg:* It wouldn't be too much trouble to have your mechanics install a complete Whelen Aero Flash three-light strobe system, would it? *Ringggg:* I was hoping you could remove the J.L. Osborne tip tanks and ship them to California so Osborne can refurbish them; that isn't a problem, is it? *Ringggg:* Oh yeah, I forgot to tell you that the old yokes and wheels are going to be removed and we're going to install a new yoke and two new control wheels from Cygnet Aerospace. *Ringggg:* Guess what! We're going to put a SIRS Products compass on the glareshield in place of the old Airpath unit. Yada, yada, yada.

The well-mannered and competent staff at J.A. never came right out and pointed the finger at me, but it was soon obvious whom the avionics installers thought caused the slowdown. On the side of the airplane was a bright-red handcrafted universal warning sign. In the red circle was a picture of a wrench—with a red diagonal slash across the face. Were they joking? Perhaps—after all, this was the same crew that had pasted an official-looking sign saying, "Caution HOT AIR BLAST" on the door of J.A.'s maintenance office.

To J.A. Air Center's credit, it had been able to keep very close to the schedule in spite of my unending stream of amendments to the project outline.

The panel

Last month the layout of the panel was described. The slightly right-of-center

The Garmin audio panel/intercom tops the stack, just above the S-Tec autopilot controller. For communication and navigation, the winner will have the choice of the Garmin GNS 530 or the smaller 430. Rounding out the stack is the Garmin solid-state transponder. Below, the Meggitt primary flight display incorporates attitude, airspeed, altimeter, vertical speed, and heading. The nav display can be set up as an HSI or in an arc mode.



radio stack is topped by the programmer/controller for the S-Tec System Fifty Five X two-axis flight control system, followed by a Garmin avionics suite including their GMA 340 (audio panel, marker beacon receiver, intercom), a GNS 530 (moving map GPS, nav/com), a GNS 430 (slightly smaller moving map, GPS, nav/com), and their solid-state GTX 327

transponder. The 530 and the 430 have capabilities that had never been seen before in general aviation avionics. When a single unit contains a WAAS-compatible, approach-certified GPS with a moving-map display, combined with nav and com radios, that's impressive. Add a logical menu-driven operating system that puts the power of a Jeppesen database readily at hand, and it's no wonder that these units are selling like snow cones in August.

Because of clever sheet-metal work by the J.A. installers, the Garmin and S-Tec boxes mounted in the radio stack are all canted toward the pilot for better viewing.

On the far right side of the panel is the Avionics Innovations CD player with AM/FM radio. Above the CD player is a small glove- or chart box.

Other panel-mounted components of the S-Tec System Fifty Five X system are a turn coordinator, and, in the upper left of the panel, an altitude selector/alerter, and mode annunciator.

Directly in front of the pilot are the

AOPABONANZASWEEPS

two LCDs of the Meggitt EFIS system—the primary flight display (PFD) and the navigation display (ND).

Other systems that have been woven into the available panel space are the J.P. Instruments EDM-800 engine monitor display; the J.L. Osborne wingtip fuel tank quantity gauge and transfer pump control switches; a remote ELT on/off switch; and a vacuum gauge. The only hole in the panel as the sweepstakes Bonanza left DuPage Airport was a cutout for the TKS Ice Protection System control unit.

In addition to these obvious touches, there's an overload warning light for the B&C Specialty Products standby alternator, an alternator overvoltage warning light, and the P2 landing gear and overspeed audio muting switch.

The P2 audio gear and overspeed warning unit was being adjusted during my visit. If the airspeed drops below the approach airspeed and the landing gear is not fully down and locked, the pilot hears a voice repeatedly saying, "Check gear...check gear." When the gear is down and locked, a very calm and reassuring voice announces, "Gear is down for landing." If the airspeed approaches V_{NE} , another voice repeatedly announces, "Overspeed...overspeed." A lighted panel-mounted button can be pushed to mute the audio warnings.

The only post light on the panel is above the original flap position gauges—all other instruments and avionics are internally lit. The panel has been painted a light tan.

J.A. Air Center technicians crafted a unique switch panel located below the ND screen. Bonanza owners generally rave about the handling and speed of their airplanes, but they also tend to mutter a little about the position of some switches—they're mounted low and are often hard to see. The J.A. switch panel, which is internally lighted, relocates the following controls to the lower pilot's instrument panel: magneto switch, battery master, alternator, standby alternator, EFIS master, avionics master, EFIS dimmer, and EFIS power #1 and #2.

The redundant EFIS power supplies were necessary for certification since we needed to install power converters to boost the aircraft voltage (14 VDC) up to 28 volts. To ensure that a power con-

CONTRIBUTORS

AOPA would like to thank the following companies that are donating or discounting their products and services to refurbish AOPA's 2001 Bonanza Sweepstakes project or are otherwise assisting with the project.

AM/FM radio with CD player

Avionics Innovations Inc.
2450 Montecito Road
Ramona, California 92065
760/788-2602
fax 760/789-7098
www.avionicsinnovations.com

Standby alternator system

B&C Specialty Products Inc.
123 East 4th
Newton, Kansas 67114
316/283-8000
www.bandcspecialty.com

Sloped windshield, windows, vortex generators, aileron, and flap gap seals

Beryl D'Shannon Aviation Specialties Inc.
Post Office Box 27966
Golden Valley, Minnesota 55427
800/328-4629 or 763/535-0505
fax 763/535-3759
www.berylshannon.com

Dual control yoke and control wheels

Cygnit Aerospace Corporation
Post Office Box 6603
Los Osos, California 93412
805/528-2376
fax 805/528-2377
www.cygnit-aero.com

Avionics suite (including audio panel/marker beacon/intercom, transponder, and dual nav/com/GPS units)

Garmin International
1200 East 151st Street
Olathe, Kansas 66062
913/397-8200
fax 913/397-8282
www.garmin.com

Avionics and instrument panel installation

J.A. Air Center
DuPage Airport
3N060 Powis Road
West Chicago, Illinois 60185
800/323-5966 or 630/584-3200
fax 630/584-7883
www.jaair.com

Wingtip fuel tank system

J.L. Osborne Inc.
18173 Osborne Road
Victorville, California 92392
800/963-8477 or 760/245-8477
fax 760/245-5735
www.jlosborne.com

Engine monitor

J.P. Instruments Inc.
3185-B Airway Avenue
Costa Mesa, California 92626
800/345-4574 or 714/557-3805
fax 714/557-9840
www.jpinstrument.com

MAGIC EFIS display system

Meggitt Avionics Inc.
10 Ammon Drive
Manchester, New Hampshire 03103
603/669-0940
fax 603/669-0931
www.meggittavi.com

Audio landing gear and overspeed (V_{NE}) warning system

P2 Inc.
Post Office Box 26
Mound, Minnesota 55364-0026
888/921-8359 or 952/472-2577
fax 952/472-7071
www.p2inc.com

Paint design

Scheme Designers
277 Tom Hunter Road
Fort Lee, New Jersey 07024
201/947-5889
www.schemedesigners.com

Magnetic compass

SIRS Product Services
25422 Trabuco Road #105, PMB 436
Lake Forest, California 92630
310/325-3422
fax 949/951-0778
www.sirsproducts.com

Autopilot and EFIS certification

S-Tec Corporation
One S-Tec Way
Municipal Airport
Mineral Wells, Texas 76067
940/325-9406
fax 940/325-3904
www.s-tec.com

Airframe anti-ice system

TKS Ice Protection Systems
3213 Arnold Avenue
Salina, Kansas 67401
888/865-5511 or 785/493-0946
fax 785/493-0959
www.weepingwings.com

Strobe lights

Whelen Engineering Co.
Route 145, Winthrop Road
Chester, Connecticut 06412-0684
860/526-9504
fax 860/526-4078
www.whelen.com

AOPABONANZASWEEPS

verter failure wouldn't take out the EFIS system, we installed two.

Avionics interplay

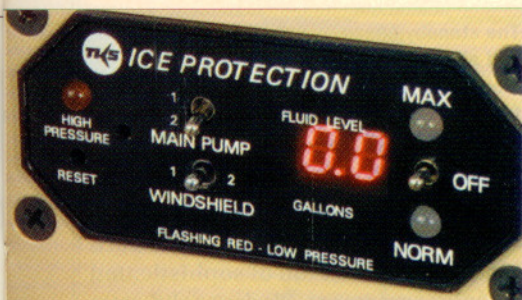
Not too long ago, avionics interconnection was nonexistent. When pilots dialed in a VOR frequency, the airplane's position on a radial could be determined only after spinning the OBS knob until From was in the window and the needle was centered. It took at least two frequency changes (or two nav radios) and some knob turning to plot an airplane's position. At best, this system was time consuming and inexact. By the time a fix was determined by using two VORs, the airplane had moved. Today all the avionics are interconnected and are constantly trading data. This eases the pilot's workload by continuously providing position information and other data that only a few years ago had to be laboriously ciphered from an E-6B (remember the wind triangle) or accumulated, often by rattling a sectional chart from one side of the cabin to the other.

The avionics suite in the sweepstakes Bonanza is a modern panel so there is a constant interplay of data between different avionics and instrument panel units. Fuel flow data is fed from the J.P. Instruments EDM-800 to the Garmin GPS units, with all pertinent fuel information (such as range at present consumption and wind conditions, current fuel flow, and fuel remaining) being instantly available when the pilot needs it. Any lightning detected by the Goodrich Stormscope WX-500 is automatically fed to one of the pages on both of the Garmin GNS units.

The PFD continuously displays airspeed, vertical speed, and horizontal position from the air data attitude heading reference system unit, and the ND displays data from the Garmin GPS units. Four different LCDs express the meaning of "glass cockpit."

Skin mapping

When I arrived at J.A. Air Center in West Chicago, Illinois, the avionics crew was skin mapping the airplane. The Goodrich Stormscope WX-500 is engineered to detect lightning discharges. The intensity, range, and bearing of all lightning discharges is displayed on the Garmin GNS units, and is instantly available to the pilot. This information is critical for safety because thunderstorms



The refurbishment brings new levels of safety and entertainment to the cockpit. Top to bottom: TKS ice protection controls, J.P. Instruments EDM-800 engine analyzer/fuel computer, and the Avionics Innovations CD player/AM/FM radio.

always generate lightning, and fully developed thunderstorms are easily capable of dashing airplanes to the ground, without any respect for the company that labored hard to produce the airplane, the FAA-mandated structural limits, or the pilot's total hours. Staying at least 25 miles away from lightning discharges prevents encounters with mature thunderstorms.

Since electrical components such as autopilot servos and strobe light systems radiate small amounts of radio frequency interference during operation, and the WX-500 is designed to pick up electrical signals (generated by far-off lightning), it's critical to place the antenna in a position where there's very little airplane-generated interference. That's where the skin mapping comes in. By using a special receiver and antenna that measures the amount of interference at different airframe locations, a low-noise position can be determined. On the sweepstakes



Bonanza, this low-noise position turned out to be just forward of the tail cone on the belly.

Circuit breakers

Safety is the determining factor in many of the equipment decisions arrived at during our project planning. Some of the safety decisions are so obvious that there was no discussion at all. Others are less obvious. Shoulder harnesses are obvious. No airplane should take off

unless the occupants are restrained by a set of shoulder harnesses.

Circuit breakers are a little less obvious. The original circuit breakers in the sweepstakes Bonanza, with the exception of the alternator breaker, could not be pulled (opened) by the pilot. Since few, if any, circuit breakers are ever tested, and since pullable circuit breakers give the pilot one more level of control if there's ever an electrical problem, we removed all the original breakers and replaced

The standby airspeed and attitude indicators and altimeter provide redundancy to the electronic versions. The gauges and controls for the J.L. Osborne tip tanks reside just below the tachometer.

them with new circuit breakers that could be pulled in case of an emergency.

J.A. Air Center created a modern instrument panel full of sophisticated avionics equipment. Modern solid-state aviation electronics have progressed to the point where safety is enhanced because of the increased navigation, communication, positioning, and auto-flight capabilities of this equipment; yet the total electrical current draw for the panel, with lighting turned up bright, is only

i Links to additional information about avionics installations and weekly updates may be found on AOPA Online (www.aopa.org/pilot/links.shtml).

20 amps. Today's avionics do much more, using less power, and provide more information than was thought possible even five years ago.

Next month, the sweepstakes Bonanza update will feature the installation of a TKS Ice Protection System.

AOPA

E-mail the author at steve.ells@aopa.org