



AOPA'S 2001
BONANZA
SWEEPSTAKES

Firewall forward to the future

Think of what happened to Clark Kent when he entered a phone booth

BY STEVEN W. ELLS

To appreciate the change that came over the AOPA Bonanza Sweepstakes airplane in late February, think of what happened to Clark Kent when he entered a phone booth. Complete firewall-forward upgrades have trans-

formed our perfectly competent 1966 Beech V35 Bonanza into a super sky screamer—an airplane that can readily leap halfway across the country in the time it takes an AOPA member to get through his monthly dose of *AOPA Pilot*

magazine. The sweepstakes Bonanza is now easily capable of true airspeeds in excess of 200 knots.

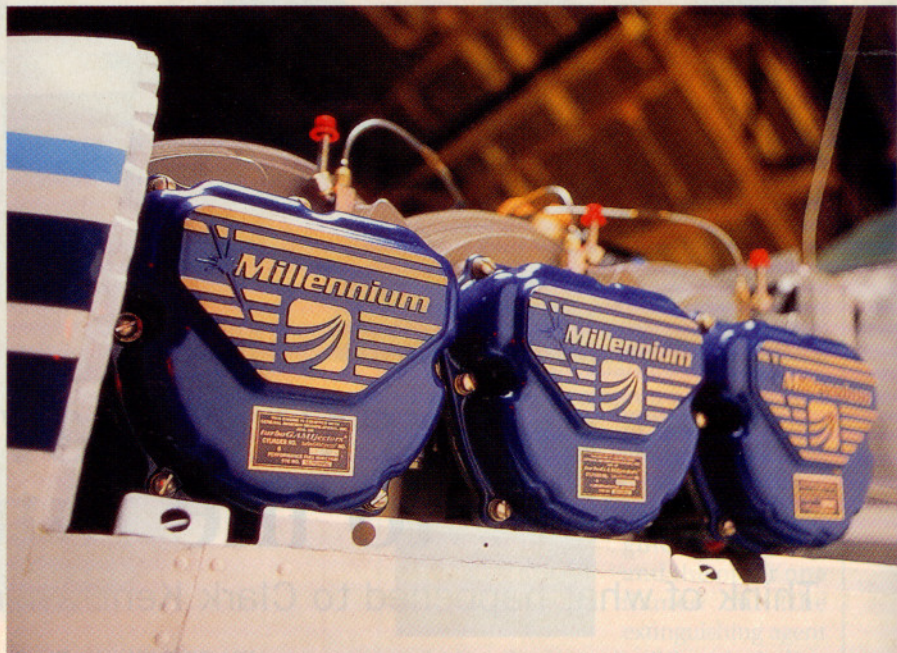
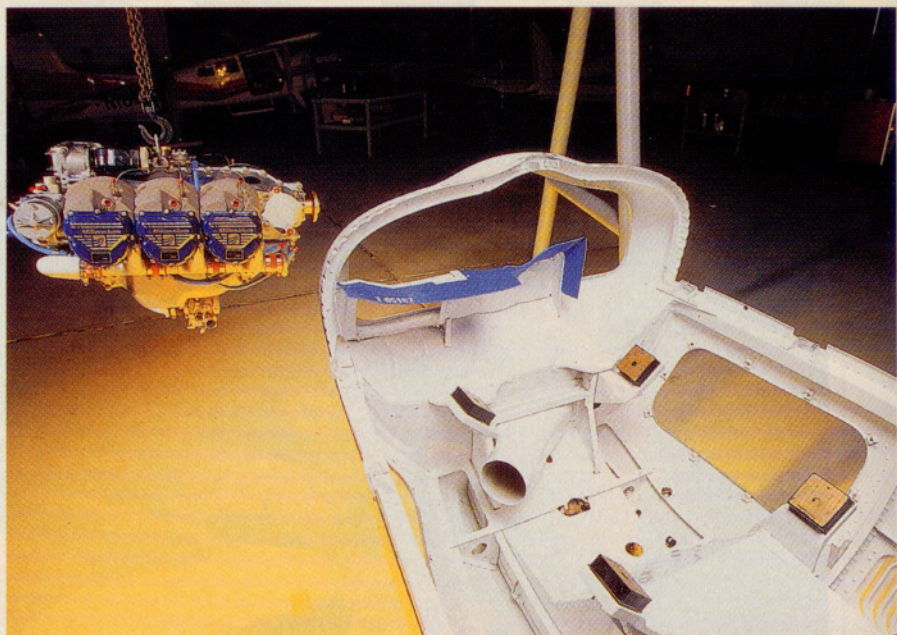
Superior Air Parts

Superior Air Parts, of Dallas, Texas, sup-

plied one of its Certified Millennium preowned engines for the sweepstakes Bonanza.

To achieve the remarkable cruise speeds, we married the new, upgraded Superior engine to a turbonormalizing system and intercooler from Tornado Alley Turbo, in Ada, Oklahoma. We'll report in detail on the turbo system in an upcoming issue.

In 1991, Superior introduced its drawing-board-new Millennium cylinders. The cylinder heads are an advanced aluminum alloy that is cast using investment rather than sand-casting techniques. No other aircraft cylin-



With the engine compartment freshly painted (top), the Tornado Alley Turbo staff prepares to lower the Superior Air Parts Certified Millennium engine into place.

der manufacturer uses this process, even though it results in a superior casting with tighter grain structure. Cylinder barrels are machined out of a high-quality 4140 steel forging that meets AMS 6382 standards.

Superior chose to through-harden its Millennium cylinder barrels instead of the more common practice of nitriding. Nitriding, a nitrogen infusion process, produces a surface-hardened layer approximately .025 inches thick. Superior's departure from established manufacturing techniques hasn't affected the success of the Millennium cylinders, as the majority of reports from

overhaul shops and users have been positive. These cylinders, with their new approach to design and method, have proven to be very popular, with more than 75,000 Millennium cylinders currently in use worldwide.

In 1999, at AOPA Expo in Atlantic City, New Jersey, Superior announced its Certified Millennium preowned engine program. The idea was to compete with Continental and Lycoming in the engine-rebuilding market by building engines to very high standards using Superior's Millennium cylinders and parts. Superior's motive, according to President and CEO Bernie Coleman,

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“was a competitive move” and was planned so that “the customer will have the best possible engine that’s available with today’s technology.”

Western Skyways— starting point for the world

To test its Certified Millennium pre-owned engine concept Superior contracted with five existing engine-overhaul facilities in the United States and one in Canada to build engines to its standards. Each facility is an FAA-approved repair station. Western Skyways, of Montrose, Colorado, built up the IO-550 engine that is installed in the Sweepstakes Bonanza. This company, which has a thriving engine-overhaul business and outstanding reputation in its own right, was the first facility picked by Superior to implement its Certified pre-owned engine concept. Three members of the four-person leadership team—David Leis, Perry Nicholson, and John Robinson—have been building aircraft engines together for more than 30 years. Al Head joined the team in 1993.

According to initial reports during flight testing after the installation of the turbonormalizer system, the IO-550 engine that the Western Skyways team built for the Bonanza is a very smooth, strong engine. For more information on Western Skyways, visit the Web site (www.westernskyways.com).

After testing the Millennium concept in the United States and Canada, Superior is currently expanding its Millennium engine-building capabilities by designating new manufacturing facilities in Europe, Africa, and Australia.

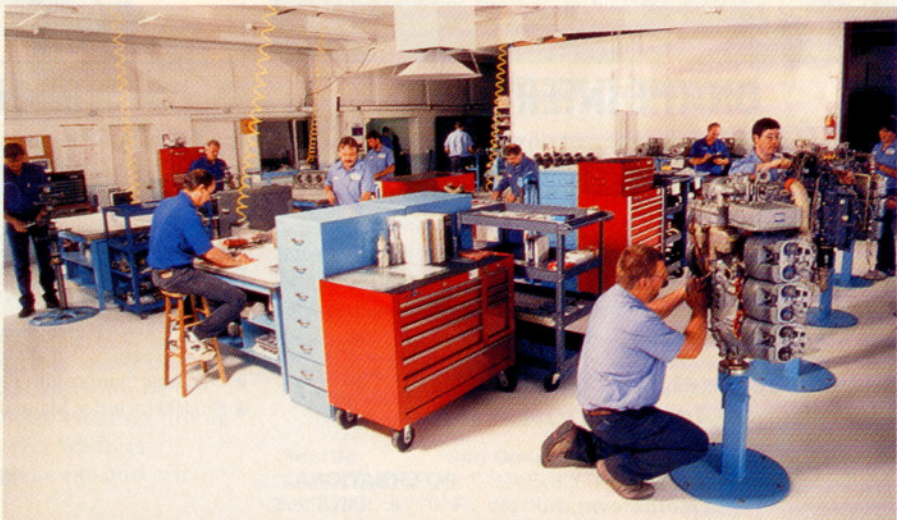
The ‘Certified’ treatment

The Millennium cylinders and Certified pre-owned engine program fit into the AOPA goal of installing twenty-first century technology in the sweepstakes Bonanza. Hand in hand with the new technology is an outstanding engine warranty. Every Millennium engine comes with a five-year security assurance plan that covers parts and labor for five years or to TBO, whichever comes first. Each engine is built using a “one engine-one man” philosophy. In other words, the buck stops at the toolbox of the airframe and powerplant mechanic who assembles the engine. Engine cases are rigorously inspected—any that don’t meet new standards for critical measurements such as deck height, main bearing journal alignment, and parting surface tolerances are rejected.

To create a smooth engine, the crankshaft and reciprocating parts are statically and dynamically balanced to exacting standards (less than 0.25 inches-ounces of imbalance). Another component of engine smoothness is equal power impulses out of all six cylinders. Superior’s Certified engine specifications require that only hydraulic lifters with similar bleed-down rates be installed in the same engine.

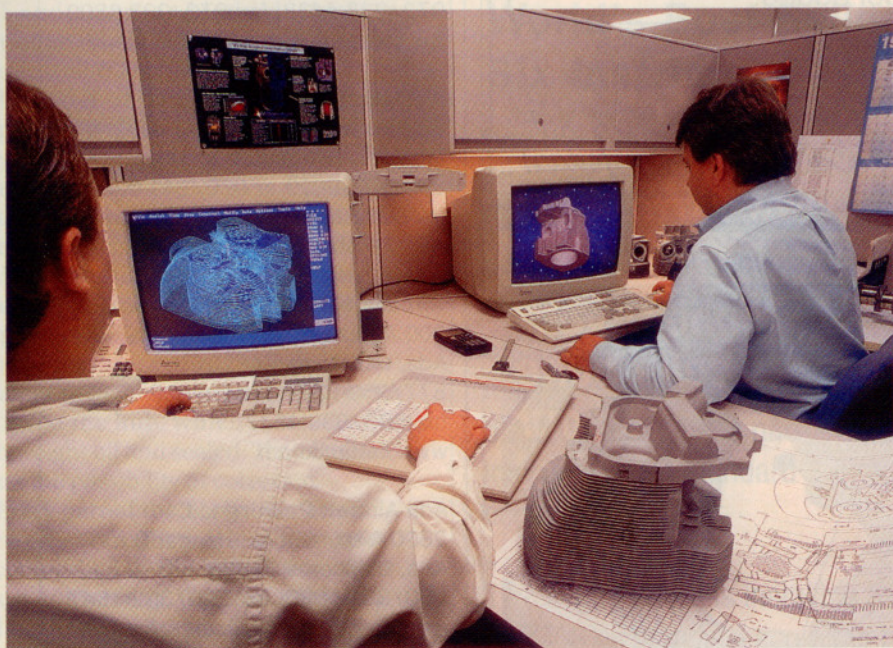
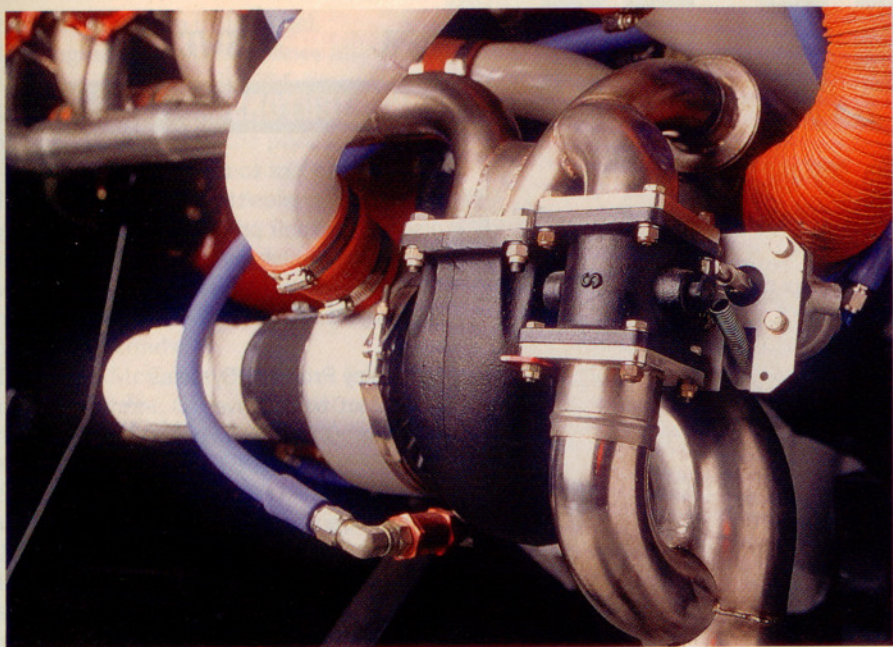
Hydraulic lifters automatically adjust the valve clearance as engines expand and contract during operations. Hydraulic lifters are used in almost every modern airplane engine (one exception is the Lycoming O-235, most commonly used on the Cessna 152).

Hydraulic lifter assemblies are made up of the tappet body (the part that contacts the camshaft) and a hydraulic



PHOTOGRAPHY COURTESY WESTERN SKYWAYS INC.

Western Skyways uses the “one-engine-one-man” approach to building engines. It apparently works, because late-February test flights showed the engine to be fast and smooth.



The turbnormalizer (top) allows the engine to make rated horsepower into the flight levels. Superior Air Parts uses computer-aided design to improve its cylinders (above).

unit that fits inside the body. The bleed-down rate describes the rate at which oil (at a prescribed temperature or viscosity) in the tappet body escapes past the hydraulic unit when a prescribed force is applied to the unit. Matched lifter sets lessen the variations in intake and exhaust valve lift, and duration of valve opening. The result is more evenly matched power impulses from all six cylinders. A smooth-running engine lessens downtime because of reduced vibration-induced damage to expensive avionics and instruments, increases customer satisfaction, and makes flying safer by

reducing pilot fatigue.


The critical initial start and cylinder break-in, along with a thrust load test, is carefully controlled during a test-cell run. Each engine has to pass a 67-checkpoint engine inspection before it's released for service. Even though each engine is built to the highest standards, there is an options list. GAMjectors or turbo GAMjectors, a choice of magnetos, and appearance packages are among the selections.

When a long list of new parts, a set of new Millennium cylinders, painstaking attention to detail, and an outstanding warranty are combined under the

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CONTRIBUTORS

AOPA would like to thank the following companies that donated or discounted their products and services to refurbish the Sweepstakes Bonanza or otherwise assisted in the project.

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Ada Aircraft Painting LLC
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watchful eye of a top-notch engine shop, the result is a twenty-first century definition of the word *engine*—and a perfect fit for the AOPA Sweepstakes Bonanza. For more information on Superior Air Parts and its Certified Millennium preowned engine program, visit the Web site (www.superiorairparts.com).

More power, bigger prop

The McCauley three-blade propeller that came with the Bonanza had been overhauled fewer than 15 flight hours before we bought it, so it was certainly serviceable, but it was only approved for the Bonanza's stock 285-hp installations. A new propeller was needed for

our upgraded 300-hp installation.

The engine upgrade STC does allow for the installation of the 285-hp propeller on the 300-hp engine, and it would bolt right on. But the pilot would be required to fly the airplane at reduced power settings. A big placard saying, "Do not exceed 27.7 inches manifold pressure at sea level" would have to be installed on the instrument panel. We thought about that option for about three seconds.

Thanks to McCauley Propeller Systems, of Vandalia, Ohio, a brand-new, three-blade McCauley is installed on the sweepstakes Bonanza. Since 1989, with the introduction of its Blackmac line of STCed high-performance propellers, McCauley propellers for GA airplanes have included several new design features. A forged-aluminum, single-piece hub; new-generation airfoil and scimitar blade designs; a threadless-blade retention system; and a sealed, oil-filled hub lead the list.

The goal of this redesign was to improve the utility and performance of the props. For instance, the threadless-blade retainer replaces a threaded retainer design. Although the threaded-retainer system was strong and worked well, propeller overhaul costs were often high because of corrosion, which required either expensive rework or replacement of either the hub or the retainer nuts. The new retainer system is inside the hub, which is filled with lightweight oil and sealed. The oil eliminates the possibility of corrosion.

Every part of the Bonanza's firewall-forward transformation has been accomplished by the installation of the latest equipment. The McCauley propeller that was designed to deliver all

i Links to additional information about the engine and propeller on the Sweepstakes Bonanza may be found on AOPA Online (www.aopa.org/pilot/links.shtml). Also check the Web site for weekly updates on the project.

300 horsepower completes the process. The next step in our twenty-first century project is the installation of the Meggitt MAGIC display system, Garmin avionics, and S-Tec autopilot. The Bonanza was flown to JA Air Center near Chicago at press time

for the next phase of the transformation.

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