AEROSTAR 700P

When time is of the essence

BY EDWARD G. TRIPP

Shortly after I picked up N6897Q, the ninth 700P built, Piper announced to its distributors that the Aerostar was being dropped from the product line. Just two years after the new model was announced and 17 months after certification, the fastest general aviation piston twin is out of production.

The company has been evaluating its product mix with the goal of further reducing the number of models manufactured. The Aerostar is a limited production airplane that is quite expensive to manufacture, even in the new facility that was designed for it and the Malibu. Piper's other pressurized piston twin, the Mojave (see *Pilot*, October 1983, page 32) is part of the Navajo/Cheyenne design family and offers more manufacturing economies. The price differential between the 700P and Mojave is quite small.

Piper executives recently confirmed that discussions have been held with several potential buyers of the Aerostar line; they express confidence that the aircraft will return to production. Any sale would include a provision for parts for all models in the line.

Speculation centers on Machen, Inc., of Spokane, Washington, because of its well-known Aerostar modifications (*Pilot* will evaluate the Superstar conversion in an upcoming issue). Whether or not the Aerostar will return is strictly speculation at this time; the famous Ted Smith design has suffered several other interruptions in the past (see *Pilot*, September 1982, page 36).

Piper production will end with the 25th 700P—the 517th Aerostar of all models.

There are a few visual clues

PHOTOGRAPHY BY ART DAVIS

continued

that distinguish the 700P from the 602P. Most noticeable are the engine nacelles and the thick-chord, highly sculptured propellers. The latter are two inches shorter in diameter than those on the 602P (76 versus 78) and were designed specifically for the 700P by Hartzell. The pitot-static system has been redesigned and the pitot tube relocated from the top of the vertical stabilizer to the left side of the nose. The static ports have been moved to the forward fuselage.

Perhaps most important to Aerostar aficionados is that Piper's fix to an airworthiness directive (AD) involving directional control—a ventral rudder extension that has been called a canoe paddle and worse—is not required on the 700P. This is because the propellers are contra-rotating; that is, the propellers rotate toward the wing tips rather than toward the fuselage. This reduces propeller vortex effect on the tail surfaces in the most adverse loading and configuration situations—namely, aft center of gravity and landing configuration—and enables sufficient rudder control to be maintained.

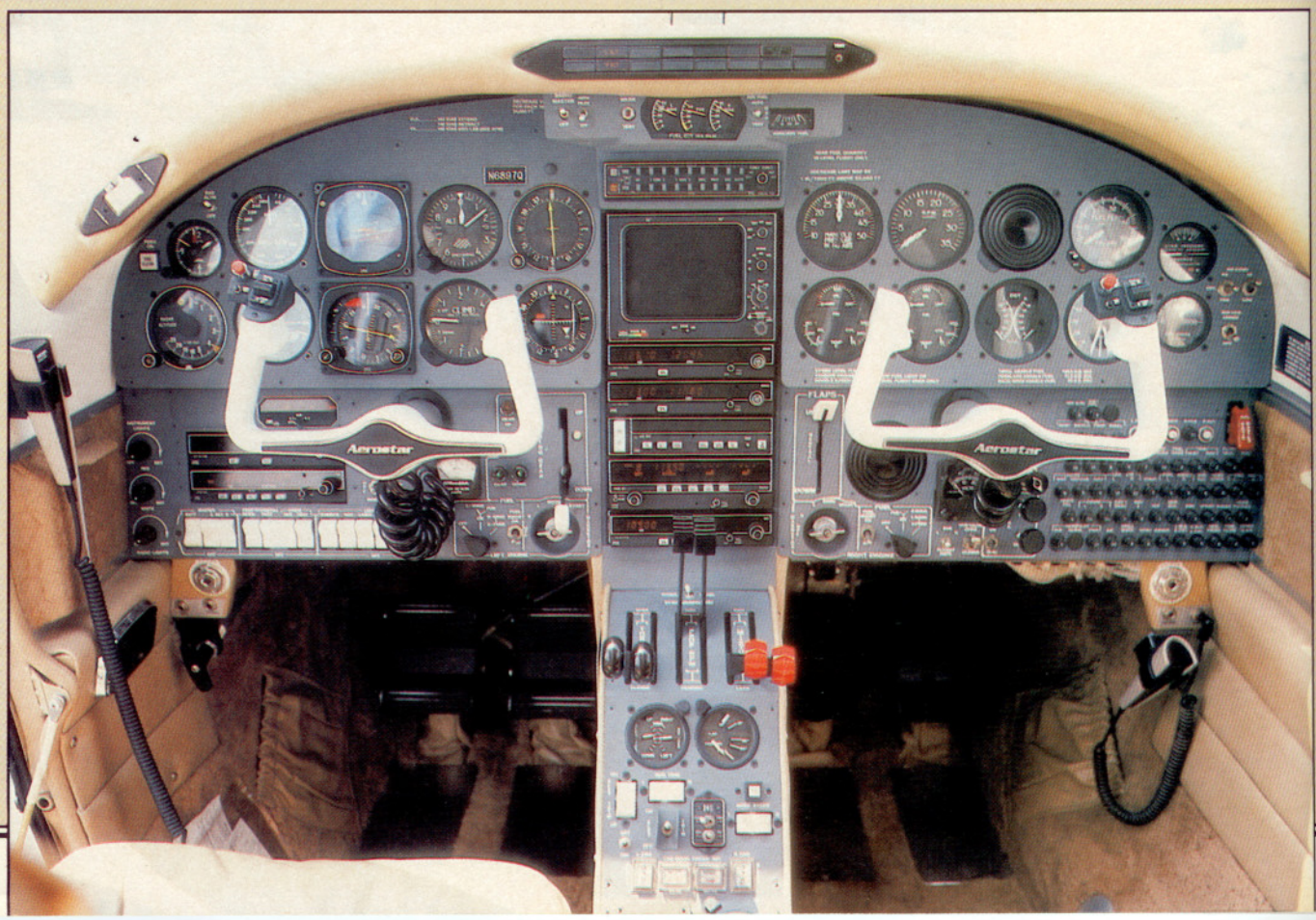
Most of the other changes are not as visible. The Lycoming TIO-540-U2A engines are rated at 350 hp, 60 hp more than the 290-hp engines in the 602P. They include intercoolers to reduce combustion air temperatures by as much as 200°F, which should improve efficiency, performance and reliability (however, the closely related V2AD version of the powerplant has just been made subject to an AD that requires replacement of the cylinder heads with an improved version because of cracking). There are two turbochargers per engine. Also, the alternate air source has been changed so that there is no need to depressurize the cabin to prevent contaminated air from entering, as is the case with the 602P.

Also new to the Aerostar are cowl flaps. The auxiliary hydraulic pump has been relocated, as has the battery, to affect center of gravity. Normal hydraulic operating pressure range has been increased from between 900 and 1,200 pounds to between 1,100 and 1,400 pounds. Among other considerations, this has permitted an increase in approach flap (20 degrees) speed from 174 knots, indicated, to 188 knots; but maximum gear operating speed has been reduced from 156 to 153 knots.

Relocation of some accessories became particularly important when Piper addressed one of the two principal criticisms of the airplane that were made as soon as it was announced—the Aerostar did not have adequate endurance for its speed. (The other criticism was that the contra-rotating propellers would increase Vmc to an unacceptable speed and would encourage accidents.) A 40-gallon auxiliary fuselage tank was added to the baggage area. Fuel is transferred from the auxiliary tank to the main fuselage tank by an electric pump. The new system also includes an automatic transfer mode.

This increases maximum usable fuel capacity from 165.5 gallons/993 pounds to 205.5 gallons/1,233 pounds and increases endurance at 25,000 feet with IFR reserves from 2.75 hours at high speed cruise (81-percent power) and 3.7 hours (at 65-percent power) to 3.45 and 4.7 hours, respectively. This change significantly adds to the utility of the 700P at the cost of restricting loading options (maximum weight of auxiliary fuel or baggage in the aft compartment is 240

AEROSTAR 700P



It's a pilot's airplane, but passenger comfort is not forgotten.

pounds). It makes careful takeoff and landing center of gravity calculations even more important. We experimented with a variety of loading problems for N6897Q and found it very easy to be out of the allowable range: As a rule of thumb, passengers meant forward center of gravity; fuel meant aft center of gravity.

Gross weight has been increased from the 6,000 pounds of the 602P to 6,315 pounds (average equipped empty weight has increased 150 pounds, so, in terms of operation, there has been an improvement).

There are quite a few operational changes, too, including the use of 20 degrees of flap for takeoff. In an article on the 602P in the September 1982 issue of *AOPA Pilot*, I mentioned that the Aerostar is different, idiosyncratic and that "[t]here are traps inherent to the design and its systems that require well-trained, conscientious pilots and maintenance people. . .[it] increases in utility, performance and reliability in direct relation to the amount of training and knowledge the pilot and the mechanic have. It is definitely not an idiot-proof design."

Ted Smith made many compromises to achieve his performance objectives for the Aerostar. Piper probably has carried those compromises to practical extremes to make the 700P even faster. That makes information, knowledge and training even more important for operators of the last Piper Aerostar than for any other model.

However, we continue to recommend that any Aerostar operator attend the Piper school, which is run by Robert D. Scott at Piper's Vero Beach, Florida, facility. The initial program includes three days of ground school and an average of 2.5 hours in your airplane; there also is a recurrent training program that includes a day of refresher ground school and an average of 2 hours flying. The fee for the initial training is $500; the refresher course price is $200. Both are bargains because the operational, systems and maintenance information pilots gain will not only enhance safety, they will save money and trouble.

The flight portion emphasizes IFR and emergency procedures. This follows Scott's approach to training, which is to let pilots know what can happen and to train to those possibilities. "If you know about what can happen, you can avoid most of it," Scott says.

Scott spent the better part of a day briefing me on the 700P and its differences and then giving me a check flight. We spent a lot of time on emergency procedures, including a simulated sudden engine failure, which, according to Scott, is the worst-case situation. Minimum control speed (Vmca) is 85 knots, indicated, only one knot higher than the 602P. Stall speed at 6,315 pounds is 71 knots in the landing configuration.

The recommended climb technique puts the 700P in the turbine operating category. Scott says it is an A-to-B airplane and should be operated that way. After takeoff, his recommended procedure is to clear the obstacles and go: While

AEROSTAR 700P

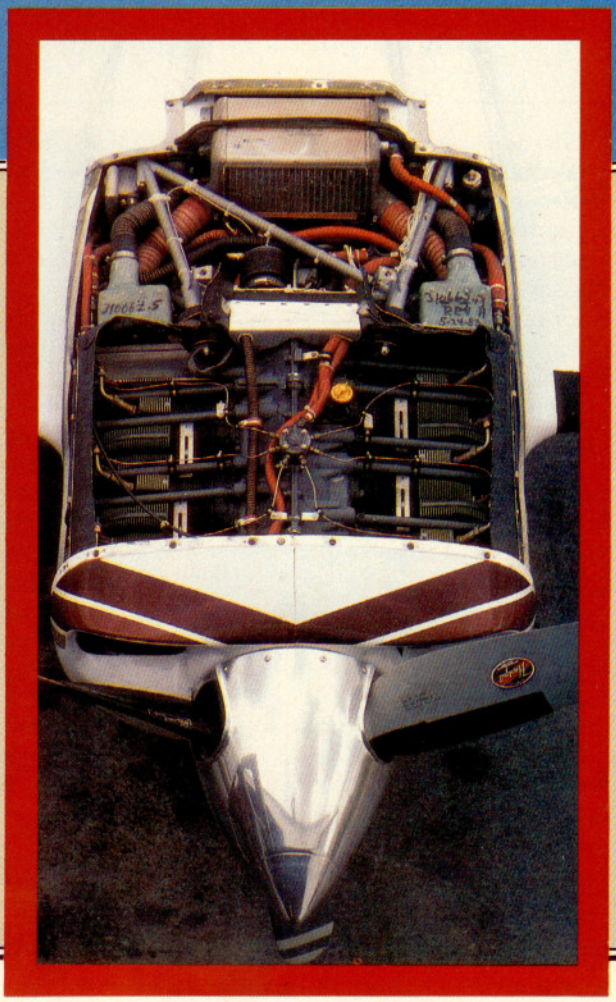
At 81-percent power and 25,000 feet, it's faster than many turboprops and can make you very popular at the fuel pump.

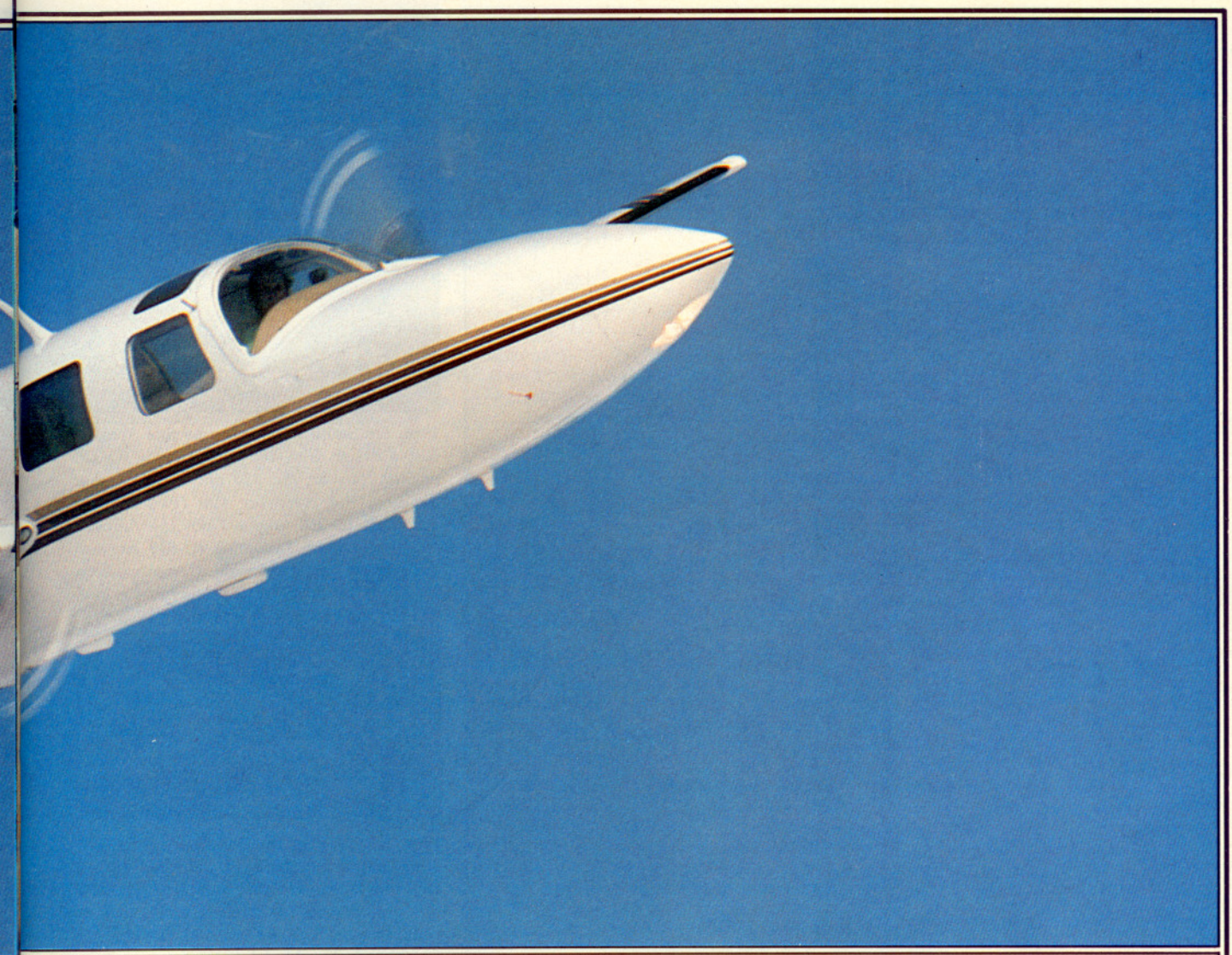
continued

accelerating to 180 knots indicated, close the cowl flaps (and remember to monitor cylinder head and oil temperatures) and maintain takeoff power (2,500 rpm and 42 inches, mixture full-rich). The rate of climb will average close to 1,000 fpm. The technique takes a bit of practice, since the aircraft is sensitive to pitch changes and any out-of-trim condition. However, once the pilot gets the procedure nailed down, it provides the Aerostar with a good ground-covering pace at a reasonable climb rate.

Descent is handled the same way: maximum performance. Scott recommends reducing manifold pressure to 30 inches and holding 200 knots; this will provide an average rate of descent of 800 to 900 fpm. This is fine if air traffic control will permit you to plan your descent far enough ahead. That rate of descent can be doubled by reducing rpm to 2,100 and manifold pressure to 28 inches and increasing indicated airspeed to Vno, or 215 knots, indicated. Approach flaps and an indicated airspeed of 188 knots will increase the rate of descent even more.

Maximum cruise power (81 percent) puts you in a speed range better than that of many turboprops. At 20,000 feet, it is 249 knots; at 25,000 feet, 258 knots. It also will make you popular at the fuel pump. Leaning at this power setting is to a fuel flow rather than a temperature value. It is 25.6 gallons per engine, or just under $100 per hour.





Except for a couple of short-range dashes, I used a more conservative, 65-percent power setting that significantly increased endurance, reduced noise and fuel cost and still provided good speed—an average of more than 215 knots at 16,000 to 23,000 feet. On one 800-mile leg, with no help or hindrance from the wind, total block-to-block time was three hours, 40 minutes. That is an average speed of 218 knots and included air traffic control-induced step climbs, vectors and routing changes.

While I did not fly N6897Q as much as I had planned—and certainly far less than I wanted—there was a good mix of day and night flying, VFR and IFR operations, in low- and high-density airspace to sample what the 700P has to offer. No significant icing was encountered that would have demonstrated the behavior of the aircraft (flaps are restricted to 20 degrees with ice on the airframe). It is a good instrument airplane—it is stable and comfortable to fly during approaches.

There were a few things that were not working quite right in the airplane. The pitot-static system had some glitches that did not get ironed out, and there was a problem setting power that could have been fuel metering, the fuel-flow gauge, the turbine inlet temperature gauge or something else that resulted in an average fuel burn that was two gph higher on the right engine than on the left.

In the airplane that I flew, there was quite a bit of static friction in the rudder system (and constant attention must be paid to rudder trim).

There are a few other elements of the systems design that I wish had been developed further. For instance, the red instrument panel floodlights glow through the glareshield and reflect on the windshield at night. It is annoying and distracting, particularly when coupled with the inability to dim the gear up light (a quality control glitch) or the fuel-transfer light. The instrument panel could be reorganized, too. Things still are scattered about too much, and the engine instruments are in a poor position for the fine tuning that proper power settings require. The alternator capacity (70 amps per engine) is marginal for an airplane with high power requirements.

Many options are available, and N6897Q is loaded with 455 pounds and more than $97,000 worth. But a counter-drum pointer altimeter still is not available. A flap preselect would be helpful.

The Aerostar always has been a special airplane that appeals to a particular kind of pilot. For those who are willing to make the investment to ensure that they operate and maintain it properly, it is a very productive, highly satisfying airplane. I hope the Aerostar line finds an appropriate buyer, and that it continues. □

SPOTTER'S GUIDE and SPECIFICATIONS, overleaf

continued

Model Aerostar PA-60-700P
Base price $499,300
Price as tested; $596,774
Operations/Equipment Category*:
IFR $514,000 to $575,000
All-weather $563,000 to $625,000

Specifications

Powerplants	Two Lycoming (L)TIO-540-U2A, 350 hp @2,500 rpm/42 in MP
Recommended TBO	1,800 hr
Propellers	Two Hartzell three-blade, constant speed, full-feathering; 76 in. dia.
Length	34 ft 9.6 in
Height	12 ft 1 in
Wingspan	36 ft 8.4 in
Wing area	178 sq ft
Wing loading	35.4 lb/sq ft
Power loading	9.02 lb/hp
Seats	6
Cabin length	119 ft 6 in
Cabin width	45 ft 6 in
Cabin height	46 ft 6 in
Empty weight	4,221 lb
Empty weight, as tested	4,624.5 lb
Max ramp weight	6,356 lb
Useful load	2,135 lb
Useful load, as tested	1,731.5 lb
Payload w/full fuel (with 40 gallon auxiliary tank)	902 lb
Payload w/full fuel, as tested	498.5 lb
Max takeoff weight	6,315 lb
Max landing weight	6,000 lb
Zero fuel weight	All weight in excess of 6,050 lb must be fuel in the wings
Fuel capacity, std	1,041 lb (993 lb usable) 173.5 gal (165.5 gal usable)
Fuel capacity, opt	1,281 lb (1,233 lb usable) 213.5 gal (205.5 gal usable)
Oil capacity, ea engine	12 qt
Baggage capacity	240 lb, 30 cu ft

Performance

Takeoff distance, ground roll	1,950 ft
Takeoff distance over 50-ft obst	3,080 ft
Accelerate/stop	4,000 ft
Accelerate/go	Not calculated by manufacturer
Max demonstrated crosswind component	15 kt
Rate of climb, sea level	1,820 fpm
Single-engine ROC, sea level	320 fpm
Max level speed, sea level	216 kt
Max level speed, 23,000 ft	266 kt
Cruise speed/Range w/45-min rsv, aux fuel (fuel consumption, ea engine)	
@ 81% power, best power	
25,000 ft	258 kt/875 nm (153.6 pph/25.6 gph)
15,000 ft	254 kt/820 nm (153.6 pph/25.6 gph)
@ 65% power, best economy	
25,000 ft	230 kt/1,080 nm (107.4 pph/17.9 gph)
15,000 ft	212 kt/1,011 nm
@ 55% power, best economy	
25,000 ft	211 kt/1,160 nm (90.6 pph/15.1 gph)
15,000 ft	195 kt/1,110 nm
Max operating altitude	25,000 ft
Single-engine service ceiling	14,000 ft
Landing distance over 50-ft obst	2,100 ft
Landing distance, ground roll	1,425 ft

Limiting and Recommended Airspeeds

Vmc (Min control w/ one engine inoperative	85 KIAS
Vsse (Min intentional one-engine inoperative)	100 KIAS
Vx (Best angle of climb)	101 KIAS
Vy (Best rate of climb)	116 KIAS
Vxse (Best single-engine angle of climb)	101 KIAS
Vyse (Best single-engine rate of climb)	116 KIAS
Va (Design maneuvering)	160 KIAS
Vfe (Max flap extended)	20 degrees: 188 KIAS 45 degrees: 148 KIAS
Vle (Max gear extended)	153 KIAS
Vlo (Max gear operating)	
Extend	153 KIAS
Retract	140 KIAS
Vno (Max structural cruising)	215 KIAS
Vne (Never exceed)	244 KIAS
Vr (Rotation)	93 KIAS
Vs1 (Stall clean)	75 KIAS
Vso (Stall in landing configuration)	71 KIAS

All specifications are based on manufacturer's calculations. All performance figures are based on standard day, standard atmosphere, at sea level and gross weight, unless otherwise noted.

**Operations/Equipment Categories are defined in June 1984 Pilot, p. 108. The prices reflect the costs for equipment recommended to operate in the listed categories.*

1966. Ted Smith poses with the first Aerostar 320, a design with 160-hp Lycoming IO-320 engines. Neither the 320 nor its companion designs, the Aerostar 400 (two 200-hp Lycoming IO-360 engines) nor the Aerostar 500 (two 260-hp Lycoming IO-540 engines) are ever put into production. Design work on the 320 began in 1964; its prototype was built in 1965 and first flew in November 1966.

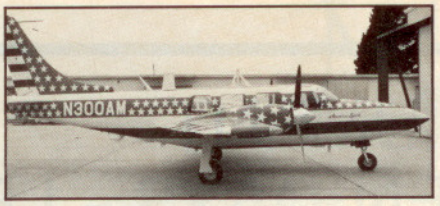
1968. On August 28, the first Model 600 Aerostar (center, above) is delivered at Ted Smith's Van Nuys, California, plant. The 600 has two 290-hp Lycoming IO-540 engines and a maximum cruise speed of 217 knots at 10,000 feet. The Model 601 (prototype is in background, above), certificated in November 1968, uses the same engines but is equipped with Rajay turbochargers, has a maximum cruise speed of 245 knots at 20,000 feet.

AEROSTAR 700P

The airplane's 18-year history includes two horsepower increases and four changes in ownership.

1970. Butler Aviation International purchases the manufacturing rights to the Aerostar and Mooney aircraft. Butler suspends production of the Aerostar and renames the Mooney singles "Aerostars."

1972. Ted R. Smith and Associates buys the Aerostar back from Butler. Production is resumed. A successor group, the Ted Smith Aerostar Corporation, continues production of the Aerostar until 1978.

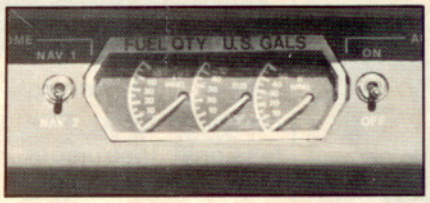


1976. In celebration of the United States' bicentennial year, a pressurized Aerostar 601P, named "American Spirit," (above) flies around the world. The pilots are Philander P. Claxton III (AOPA 424945) and Stephen E. Garfinkel (AOPA 376495). The airplane flies 19,974 nm in 104 hours, five minutes, setting a new world speed record for piston-engine aircraft. Other speed records set with Aerostars include a speed of 264.77 knots over a 500-kilometer course set in January 1975, by *Pilot*'s own Barry Schiff, and a speed record of 237.08 knots over a 2,000-kilometer course was set in August 1975, by Jack F. Chrysler. Both these records were set with Aerostar 601s.

1977. The Model 601B is introduced. This features a wingspan 30 inches wider than the basic 601 and a higher gross weight (6,000 pounds vs. 5,700 pounds) and useful load (2,125 pounds vs. 1,863 pounds) than its predecessor. At 75-percent power and 25,000 feet, the 601B will cruise at 253 KTAS.

1978. On March 27, the Piper Aircraft Corporation buys out Ted Smith and continues production of the Aerostars 600A, 601B and 601P. Piper renames the 1981 line of Aerostars, calling them Sequoias. The name is changed back to Aerostar after Piper learns the name is already being used by another manufacturer.

1979. In response to a series of fuel-starvation accidents attributed in part to the Aerostar's fuel system, Piper installs a new fuel-quantity



indicator system. Three gauges (above) show the fuel levels in the Aerostar's single fuselage tank and two wing tanks. Earlier systems used a single gauge with a selector switch to read each tank's fuel quantity.

1981. The 600A, -B, and -P are awarded certification for flight into known icing conditions. The approved de-icing package includes a choice of either alcohol windshield de-icing or an electrically-heated windshield panel. Production of the Aerostar is moved from Santa Maria, California, to Piper's Vero Beach, Florida, facility.

1982. On November 30, Piper introduces the Aerostar 700P, an improved version of the 601P with turbocharged, intercooled 350-hp Lycoming TIO-540-U2A engines.

1983. In July, the FAA issues an AD on 600-series Aerostars, prohibiting the use of flaps and moving the aft CG limit forward, stating that, "With flaps extended. . .and the CG approaching the aft limit, directional control cannot be maintained during power-on stalls." Piper responds with an "all-flying" ventral fin mounted on an extension of the rudder post and the installation of elevator gap seals. Maachen Conversions, Spokane, Washington, provides a different solution, adding vortex generators to the vertical fin and the undersides of the wing and stabilizer.

—Thomas A. Horne

AT A GLANCE:

Year	Model	Engines	TBO	Avg new price	Curr mkt value	Number built
1969	600	Lyc 290 hp IO-540-Gib5	1,400 hr	$93,500	$60,000	45
	601	Lyc 290 hp IO-540-P1A5/ Rajay turbo	1,400 hr	$112,500	$72,500	32
1970	600	-P1A5	1,400 hr	$99,950	$61,500	14
	601	-P1A5	1,400 hr	$117,500	$74,000	36
1971-72		Not in production.				
1973	600A	-G1B5	1,400 hr	$128,695	$72,500	8
	601A	-P1A5	1,400 hr	$150,145	$80,000	10
1974	600A	-K1F5	2,000 hr	$134,695	$77,000	21
	601A	-S1A5	1,800 hr	$158,145	$84,000	12
	601P	-S1A5	1,800 hr	$216,645	$105,000	14
1975	600A	-K1F5	2,000 hr	$160,000	$82,500	20
	601A	-S1A5	1,800 hr	$175,000	$87,500	16
	601P	-S1A5	1,800 hr	$242,000	$110,000	47
1976	600A	-K1F5	2,000 hr	$166,567	$87,500	28
	601A	-S1A5	1,800 hr	$185,050	$92,500	10
	601P	-S1A5	1,800 hr	$253,480	$120,000	62
1977	600A	-K1F5	2,000 hr	$171,170	$92,500	22
	601B	-S1A5	1,800 hr	$189,170	$105,000	11
	601P	-S1A5	1,800 hr	$255,440	$128,500	68
1978	600A	-K1F5	2,000 hr	$177,451	$107,500	32
	601B	-S1A5	1,800 hr	$195,751	$117,500	8
	601P	-S1A5	1,800 hr	$274,961	$142,500	68
1979	600A	-K1J5	2,000 hr	$203,725	$125,000	29
	601B	-S1A5	1,800 hr	$226,825	$137,500	10
	601P	-S1A5	1,800 hr	$306,600	$157,500	101
1980	600A	-K1J5	2,000 hr	$227,675	$142,500	29
	601B	-S1A5	1,800 hr	$252,810	$155,000	8
	601P	-S1A5	1,800 hr	$341,280	$172,500	84
1981	600A	-K1J5	2,000 hr	$268,385	$162,500	17
	601B	-S1A5	1,800 hr	$303,270	$177,500	4
	602P	Lyc IO-540-AA1A5 290 hp	1,800 hr	$432,020	$230,000	63
1982	602p	Lyc IO-540-AA1A5 290 hp	1,800 hr	$484,078	$310,000	35
1983	602P	Lyc IO-540-AA1A5 290 hp	1,800 hr	$527,710	$527,710	21
1984	700P	Lyc 350hp C/R TIO-540-U2A	1,800 hr	$610,435	$610,435	8
					Total	993