Ted Smith HAS DONE IT AGAIN

Designer-developer of the Aero Commander reveals in personal interview how his latest venture, the Aerostar line, may foster new approaches in general aviation aircraft manufacturing

EDITOR'S NOTE: *Announcement of the public unveiling and details concerning the Aerostar 320 and the Ted Smith Aircraft Company were carried in The PILOT last month. This article, based on a personal interview, provides a more comprehensive look at the man responsible for the markedly different concepts embodied in the planned Aerostar aircraft line.*

When the first of a planned series of Aerostar aircraft was recently rolled out at Northridge, Calif., it was really the design philosophy in hardware of Ted R. Smith—the same Ted Smith who started the Aero Commander development at nearby Culver City in 1945 and continued this engineering design growth through the Jet Commander. Smith, in fact, flew as copilot on the first flight of the *Jet Commander*. He also intends to pilot the first flight of the new Aerostar 320/400, probably before this is in print.

There are many new concepts in the Aerostar design which may expand to as many as 43 different aircraft. And masterminding the entire project is Ted Smith.

The Aerostar concept began some 2½ years ago when Smith left the Aero Commander main plant in Oklahoma City—he still retains a desk there—to form his own company in Northridge. He surrounded himself with a group of young engineers, many of them recent graduates of the Northrop School who "were not tainted by present big-time procedures."

Smith's reason for choosing recently graduated engineers is at least twofold. "Since they haven't worked too long with big companies and big airplanes where they're forced to specialize, we can teach them our way," explained the company president. "They come to work here facing forward, not backward. A large percentage of our engineers have graduated within the past three years. "Northrop's school is filling our needs admirably. They're more practical than many colleges, yet they offer enough theoretical knowledge for a balanced background."

A high percentage of Smith's employees, particularly in engineering, are also pilots. The designer feels that he obtains better results from employees who also fly, since they are familiar with both the theory and the actual problems of flight.

"This Aerostar project was my own idea," Smith said. "I've been at it since June 1963. The concept is really quite simple. Automotive people have been using that interchangeability of components for many years. Otherwise, cars would be much more expensive."

Starting from scratch and without restrictions, Smith has developed a "building block modular system" in which some 30% of the parts are interchangeable on all of the various aircraft models. Savings in engineering, tooling, supply and manufacture are obvious. This 30% similarity goes all the way from a two-place, piston-engine sports trainer—at about $5,000—to a 400 knot, six-place pressurized twin jet at $250,000 to $300,000.

Development time and cost and production savings are anticipated because of interchangeability of airframe parts. Nose cones, nacelles, windows and forward cabin section have been developed to adapt to the basic airframe. Wings, empennage, aft cabin and fuselage, cockpit section and landing gear are common to all models. The vertical fins for all models of the Aerostar line are identical and interchangeable with horizontal stabilizers. Rudders and

by DON DOWNIE / AOPA 188441

elevators, ailerons and flaps have the same similarity.

Aerostar airframes have only about 25% the total number of parts used in current general aviation aircraft, Smith said. He designed all structures for the use of heavy skin. The entire wing, excluding bracketry, has fewer than 50 detail parts. With this same heavy-skin philosophy, there are fewer than 100 parts, including skins, in the entire fuselage.

"The 'heavy skin' philosophy will permit further savings to the operator by a drastic reduction in service problems of fatigue cracks, loose attachments, etc.," the designer explained.

Data processing programs were designed to serve the manufacturing system instead of the needs of a development program. Production templates, tools and masters were built to bypass a pure prototype stage of development. A production program has been prepared to build this specific line, starting in about six months in as many parts of the world as the market will support.

For example, the landing gear installation is the same for the entire Aerostar series except for varying sizes of main wheels and brakes because of differences in gross weights above 4,500 pounds. The main gear is attached to the wing and retracts inboard into the fuselage. Wheel well doors are sequence-cycled during retraction and extension so that the main wheel wells are closed both in flight and on the ground. This eliminates accumulation of mud, water or ice. The nose gear retracts forward and is virtually enclosed on the ground.

Aerostar uses hydraulic nose steering, actuated through flow control valves and an electrically controlled pilot valve connected to a simple left-right switch on the control panel.

A similar up-down switch at the bottom of the control pedestal controls the elevator trim tab.

All flight controls are aerodynamically balanced and mass balanced to 100% to prevent change in forces with various displacements in controls. The control systems are the solid type and once installed, according to Smith, will require no further maintenance for the life of the aircraft.

All primary structural connections are designed to minimum margins of 200% and no attachment bolts smaller than .250-inch in diameter are used at any hinge point or surface.

The fuel system of the Aerostar series is somewhat unusual, but has the simplicity of one-point filling. A 110-gallon tank is installed just aft of the main cabin in the fuselage (Smith said this has been done in many aircraft). Thirty-gallon auxiliary tanks, one in the leading edge inboard of the nacelles, are incorporated in the first airplane. The entire wing is designed for future use as a wet wing and additional fuel for turbine-powered models will be carried within the wing envelope.

This system is contrary to the design school philosophy that removes the fuel as far as possible from the cabin and may encounter a bit of resistance from some pilots. However, the wet wing design is already established and could probably replace the fuselage installation with little modification.

Fuel is fed to each engine from a common fuel sump. Electric on/off valves control flow, and electric boost pumps are installed as back-up systems for each engine-driven fuel pump and for starting. Electric liquidometers aid in precise cruise-control of fuel consumption.

Engine nacelles on the Aerostar twins are symmetrical on the wing and can handle a number of different engine combinations without change. On reciprocating power plants, augmented cooling is to provide adequate cooling at all speeds and create a minimum of drag.

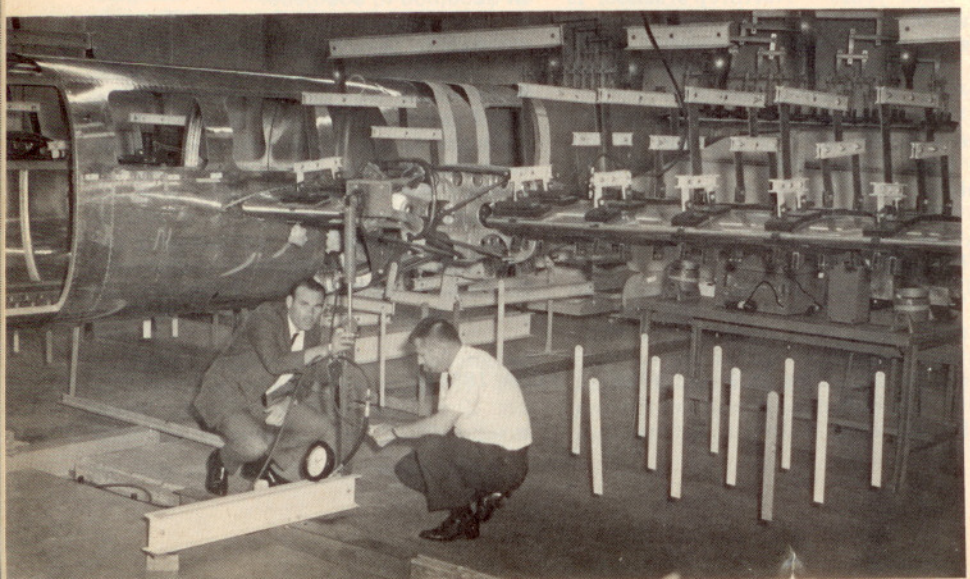
On the initial model, N540TS (for Ted Smith), some engine instruments are electric and others are mechanical. On production aircraft, all engine instruments will be electric to eliminate the necessity for fluid lines.

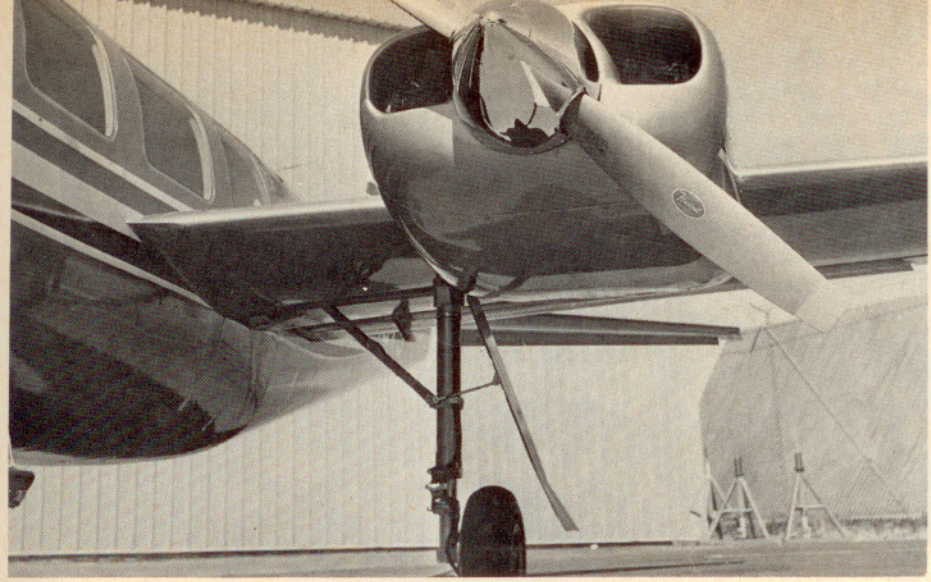
The prototype uses dual tachometers with parallel needles that swing upward as r.p.m. increases. These small needles may cause a problem in synchronizing. However, it is a simple matter to "synch" the props on any twin by ear. Merely set the desired r.p.m. and then move the prop control on one engine very slightly, either forward or back, until the "beat" vanishes.

New power control linkage has, according to the designer, eliminated the need for a friction lock on the control quadrant.

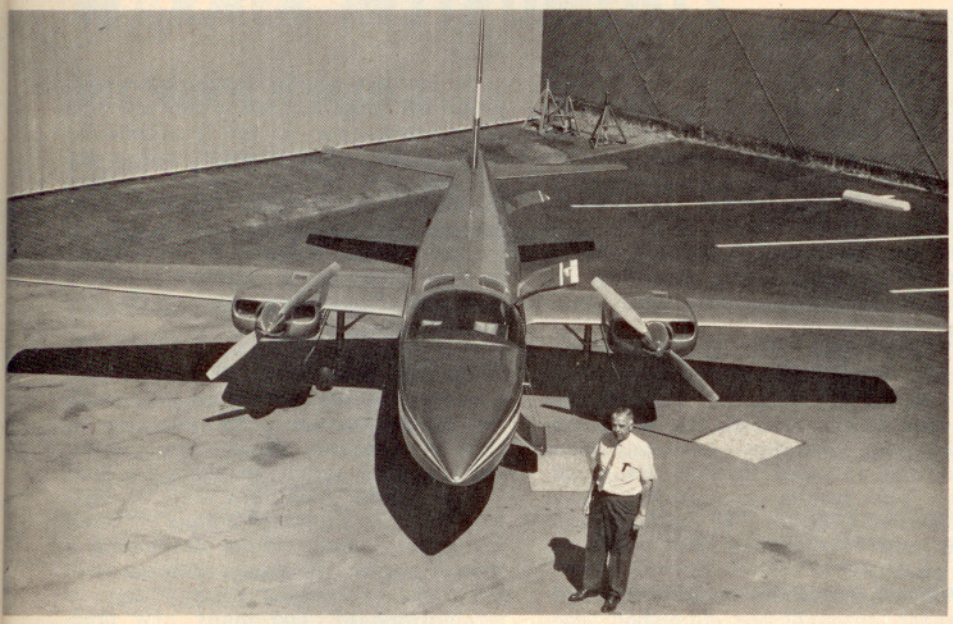
Ted Smith (right) and son, Ron, mirror pride in initial achievement of the Ted Smith Aircraft Company. It is the Aerostar 320, rolled out in September after less than three years of design and development activity. The 320 is the first of what could be as many as 43 different models, all derived from same basic design

Static testing of second Aerostar model, being conducted here by two Ted Smith Aircraft Company engineers, was well along at the time of rollout of initial Aerostar 320 in September. Company claimed FAA certification approval of the 320 was about 90% complete at time of rollout



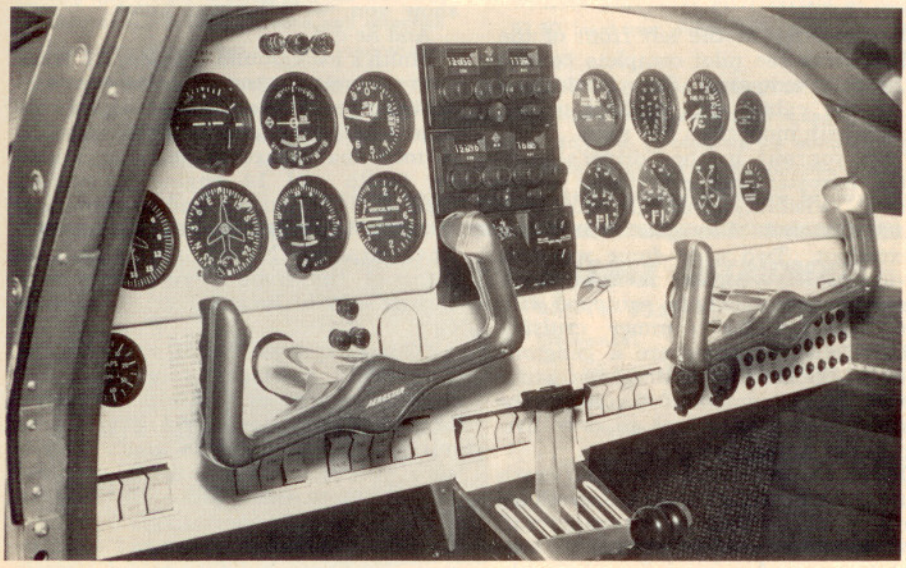


Aerostar line will feature landing gear attached to wing and retracting inboard into fuselage



Full series of Aerostar models are planned to have same sleek lines and minimum number of individual parts as the initial Model 320. In the foreground is designer-developer Ted Smith

Aerostar panel reflects new grouping of instruments for easier scanning



PHOTOS BY THE AUTHOR

Electrical power for N540TS comes from two 24-volt, 50-amp alternators feeding into two 34-amp-per-hour batteries. All circuitry exceeding five amps has trip-free circuit breakers installed on the pilot's panel.

The center of the instrument panel is designed to handle various combinations of dual avionics and the nose cone will accommodate an 18-inch weather radar within its contours.

The smaller, single-engine Aerostars will have two-blade, fixed-pitch propellers. The Model 320/400 prototype had Hartzell two-bladed, full-feathering, constant-speed propellers while three-bladed props are to be used on some models. McCauley props will be optional.

The company has a third fuselage nearing completion and four sets of complete wings. The second "flight article" will be the 500 and 500P, equipped with 250- or 260-h.p. fuel injected engines. The 500P will be the first of the pressurized units, providing an 8,000-foot cabin altitude at 25,000 feet.

The Aerostar 600P will carry 310-h.p. turbocharged engines with bleed air for pressurization. All models have been designed with a pressure bulkhead aft of the passenger cabin.

The next flight Aerostar will be a six-place pressurized twin-jet with 1,025- or 1,060-pound thrust engines with a cruising speed of 400 knots at 25,000 to 30,000 feet. Complete with dual factory-installed avionics, it can be priced to sell for $250,000 to $300,000. This is less than half the price of larger business jets. Smith expects the various versions of his six-place pure jet to satisfy a need that now exists for small, twin-jet business aircraft with extremely short-field capability.

The first parts for the present Aerostar were begun in November 1965. During the rollout, a second airframe was nearing completion of FAA static testing. Vibration and strain-gauge readouts are taken on automatic recorders and the structure is tested to loads much higher than design requirements.

"However, we don't intend to break anything," Smith said. "The fixed tail stabilizer, for example, was tested to 115% of ultimate loading. It will go much higher, but no requirement exists to do this."

At the time of rollout, the static test model had been under analysis for some four months. The company estimates that "Even before the first flight, the only data required to complete the approval are flight data—that is, certification is 85% to 95% complete." At rollout, Smith stated flatly, "we are 90% through our FAA certification program for this first model. As soon as approval is obtained, we will change engines from the Lycoming IO-320 160 h.p. to the IO-360 fuel-injected 200 h.p. engines, or the Continental IO-360 and approval process will be-

Trim in Aerostar 320 is controlled by electrical tab on throttle quadrant. Rollout model of the Ted Smith line has numerous such switches for various functions, including nosewheel steering

gin on the Aerostar 400.

"This whole program is very challenging," Smith said. "We have never been restricted in our thinking or design philosophy. We have not had to convert from existing designs or structural procedures. We've been free to work out the most functional design that modern engineering know-how can produce. We have to think twice about every decision.

"I don't like the wind-tunnel approach. It would have cost us $1,000,000 to do a complete wind tunnel analysis on the aircraft you see in the parking lot. We don't have any more than that invested in that flying version. The results we get from that airplane will certainly be more accurate than those extrapolated from wind tunnel analysis."

When you climb aboard the new Aerostar through the clamshell door you find a well-appointed interior. The top half of the door folds up to shield the cabin entry area and the lower half provides entry steps to the cabin. The steps will probably be wider in production models.

Door location at the left front of the cockpit gives the pilot complete control of the entry-exit area. Escape windows aft of the cabin are provided on all aircraft with more than five seats.

Plant yourself in the "driver's seat" of the Aerostar and everything seems normal. Visibility through the one-piece, .250-inch Plexiglas windshield is excellent. Two wide dome windows provide similar visibility in tight turns. They will undoubtedly be equipped with draw curtains for summer cruising flight. Cabin windows are a generous 16 by 21 inches. By adding one gauge heavier Plexiglas to all windows, the cabin can be pressurized to over five-pounds per square inch.

Design emphasis has gone into crash injury protection. "We have no sharp points in the cockpit, so occupants will have the best possible chance of survival in case of a crash," said Smith.

He foresees a new look in instrumentation for small aircraft within the next two to five years. In the meantime, he is equipping the Aerostar with what he considers the best available instrumentation. All avionics will be factory installed and are included in price projections. Smith doesn't like the concept of ferry pilots being required to deliver new aircraft with little or no radio and instrumentation.

Our first visit to Smith's modern development building at Northridge was perhaps four months before initial rollout of the Aerostar. After nearly an hour of courteous probing, the title for the resulting article would have been "Silent Smith, Aviation's Man Of Mystery." But he explained simply, "There's no mystery here. We're developing a line of modern airplanes with no radical new materials. Everything is straightforward. Too many new products in the aircraft industry have been overpublicized prematurely. These people have done themselves a disservice. We plan to do the job first, then publicize it. When we have something to show you, we'll let you know."

And he did.

Smith's background includes 11 years with Douglas Aircraft prior to and during World War II. Much of his time was spent on the A-20 project. It took four years of working nights for Smith and 14 engineers, pooling their skills, resources and imagination, to design the original Aero Commander. That airplane, N1944, now stands in front of the main Aero Commander factory at Will Rogers Field, Oklahoma City.

"Our design goal is to approach the problem of air frame fabrication like the 'flying Flivver,'" Smith explained several months ago. "We're designing out the human hand as much as possible. We're starting with the assumption that general aviation is going to expand in high percentages."

Ted Smith is no newcomer to aviation. He began building model aircraft

and gliders and taught himself how to fly a glider in 1928. By 1930 he had graduated to power planes and has logged over 3,500 hours since then, including "15 or 16 first flights." He has all the pilot ratings, but has never instructed professionally.

While the Aero Commander is understandably Smith's favorite airplane—until the Aerostar flies—he admits he had a great deal of just plain fun in flying Travelairs and Stearmans powered with OX-5's and J67's in the helmet and goggle era.

Ted Smith Aircraft, Inc., is a completely independent company, but it's no secret that Rockwell-Standard Corporation has set aside up to $6,500,000 with the option to purchase the full line of Smith's Aerostar designs on FAA certification.

"We're set up right here in southern California to make a 'pilot plant' and will have some production by mid-1967," explained Smith. An individualist and a designer by choice, not a production man, he hastened to add, "I will not be concerned with regular production. We have taken no deposits for any deliveries. Our job is development leading to production."

When pressed to "guesstimate" where his aircraft might be mass-produced, Smith was understandably vague. "That's up to the people at Rockwell-Standard. However, I'm sure that production facilities will have to be established in an area where there is a good labor market, where skilled workers are available. If the Aerostar were to go into large production, it could involve 4,000 to 6,000 people."

Smith emphatically stated, "No military sales are planned, not even as an 'off-the-shelf' item. As far as my own company is concerned, I'd refuse them."

Even with existing plans for up to 43 different versions of the Aerostar, Smith is looking ahead. As Aero Commander was his 'dream airplane' in 1945 and the Aerostar is his dream airplane based on today's advancements in both materials and the state-of-the-art, he's looking ahead to the 1970's to future supersonic models. His rollout press announcement also stated, "Still other singles and twins, projected for the 1970's will represent radical new departures from present-day conventional aircraft."

Smith has a singular advantage when he plans ahead into the 1970's and the supersonic general aviation aircraft. Just before the original Aerostar rollout, his son, Ron, joined the company as director of engineering. Formerly he was chief of structures at Aero Commander in Oklahoma City.

Ted Smith has one primary goal in life. He wants to be in the design end of volume aircraft production. And he'll probably never be really happy until his products are Number 1 on the production lists. □