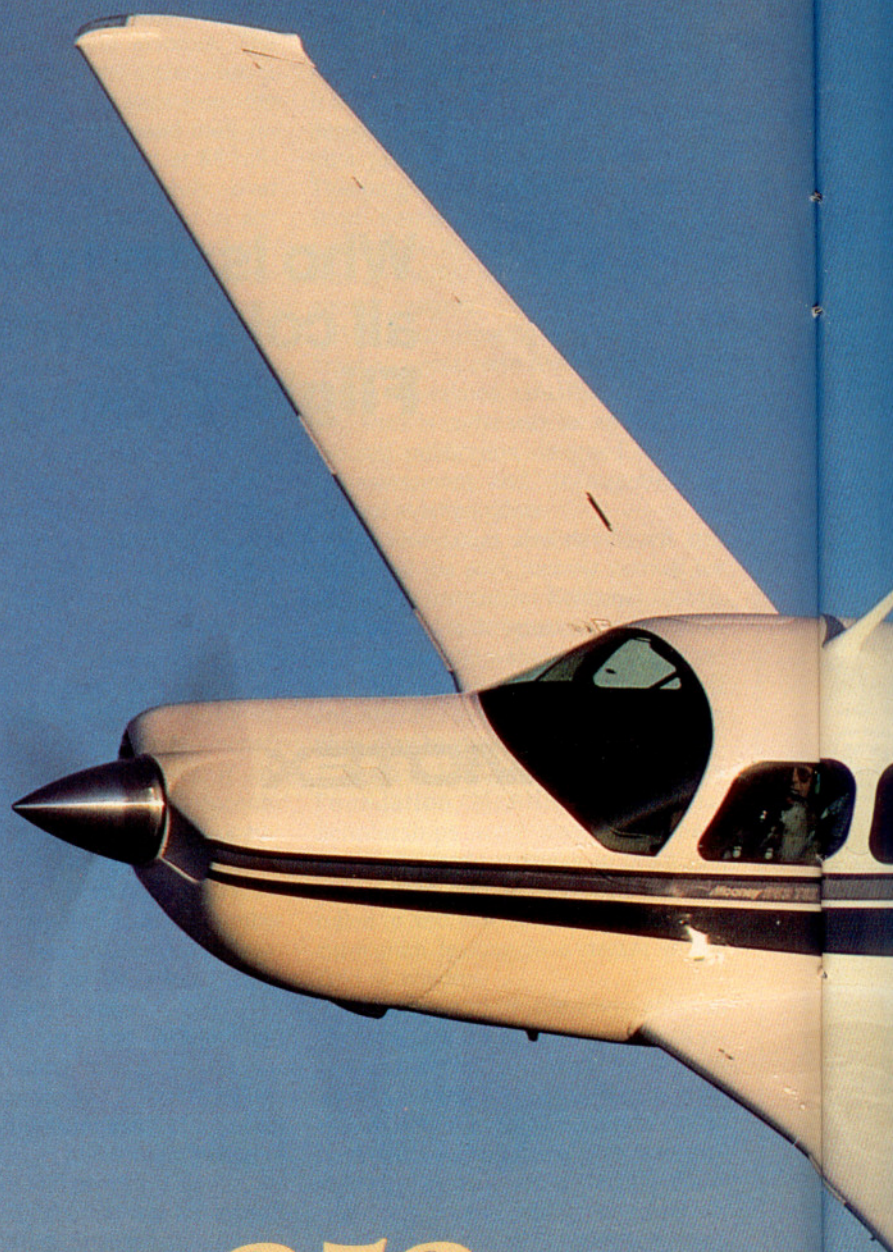




MOONEY 252

*The new M20K flies high
and fast, but keeps its cool.*

BY MARK M. LACAGNINA

Two years ago, Mooney Aircraft Corporation established four major goals in a broad development program for its turbocharged single, the M20K. Priority was given to improvement of the airplane's electrical system, which needed more capacity to accommodate the needs of panel-cramming customers.

Next, the company wanted better performance without increasing engine displacement or horsepower. The engine would be modified to run cooler and to

make the new airplane's cruise speed at altitude match the top speed of its predecessor.

Drag-reduction, a hallmark of Mooney engineers, also was part of the program; this time, the slight protrusion of the main landing gear when retracted was the prime target of the drafting-board commandos.

Last but not least was the cabin. The goal was to make it more attractive and comfortable.

All the goals were achieved. The result of the program is the new M20K, the 252. To a casual observer, the most noticeable change is the windows, which



have been rounded. The new window shape softens the visually aggressive angularity of the airplane.

But, windows aside, the 252 looks very much like its predecessor, the 231. A close inspection turns up some clues to the most important changes. But until you fly the airplane—actually live with it for awhile—the full impact of the program cannot be appreciated.

Pilot editors operated a 252, N252JS, for a few weeks around Easter. We found the the improvements in performance and in occupant comfort give the new/old airplane a character all its own. The M20K has taken a big step from being a strong competitor in its class to becoming a near-dominator.

N252JS was the first 252 to roll off the production line. For an M20K, it was

equipped conservatively. There was room left in the panel. But the airplane's equipment exceeded the recommendations for *Pilot's* IFR Operations/Equipment Category. A package of King Radio equipment, including a KFC 150 autopilot/flight director system and a KAS 297B vertical speed and altitude selector, added more than \$43,000 to the base price, \$118,750. Other options—such as a polished metal propeller with deice boots, speed brakes and a 77-cubic-foot oxygen system—brought the price of the aircraft to \$176,585.

These prices were established last October. According to Mooney, all prices on the M20K equipment list will be increased by 3.9 percent in May.

A standby vacuum system, formerly a \$1,850 option, now is standard equipment for the M20K. Installed in the tailcone, the system comprises a dry-air pump and an electric motor, which draws between six and eight amps of electrical power. The standby pump provides enough pressure to drive the attitude and direction gyros. If the primary (Sigma Tek) pump fails, however, a weather radar system could not be operated; the standby pump is not capable of evacuating the system's antenna housing.

Changes to the electrical system become evident upon starting the engine. The new 24-volt/22-ampere-hour battery provides impressive cranking power and should be more effective for cold starts than the former 14-volt/35-amp-hour battery. A true 70-amp alternator is part of the new 28-volt electrical system. The 231's 14-volt alternator was rated at 70 amps but could provide only 60 amps, a limitation imposed by its gearing mechanism.

A loadmeter enables the pilot to thoroughly monitor the electrical system. This is a new feature; the 231 simply has an annunciator light to warn of an alternator failure or a low-voltage condition. The 252's loadmeter, installed in the upper left side of the panel, supplements the annunciator with read-outs of alternator and bus loads and battery voltage.

A second 70-amp alternator is available for \$3,900. It is a belt-driven unit that increases system capacity to 140 amps and replaces a 10-amp standby generator on the options list.

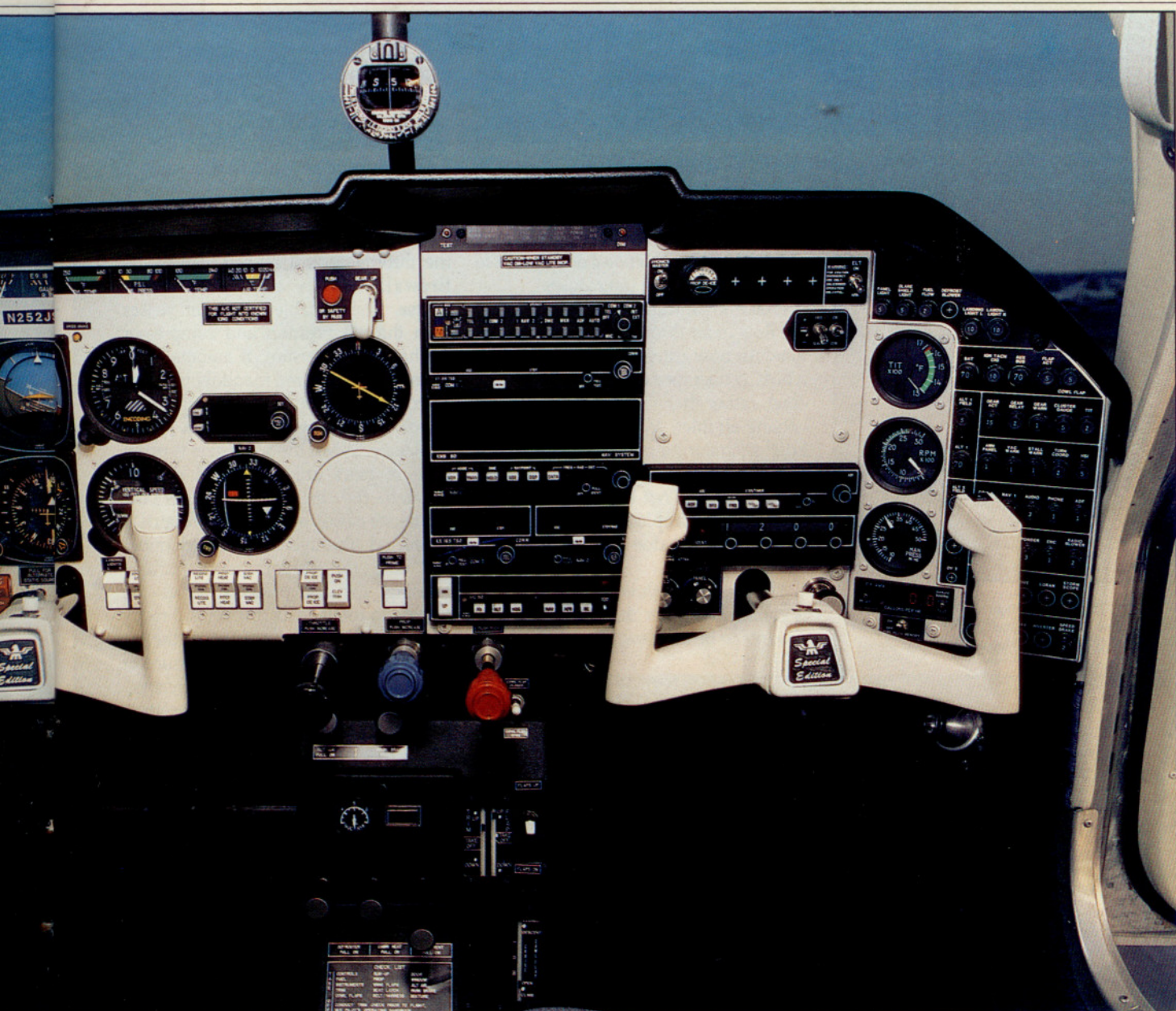
The option was made available shortly after N252JS was built. Although the airplane had only one alternator, it appeared to be more than ade-



quate to meet the demands of the equipment that was installed. With everything turned on in flight, the loadmeter showed the alternator to be producing 70 percent of its maximum output; gear-retraction caused a momentary spike to about 80 percent.

However, if the alternator should fail, the only remaining source of power would be the battery. The optional dual installation provides redundancy as well as more than enough capacity to meet the needs of customers who select liberally from the M20K's options list.

The engine has been modified substantially. The 252's Teledyne Continental TSIO-360-MB1 produces 210 horsepower at 36 inches manifold pressure and 2,700 rpm from sea level to its critical altitude (the maximum density



MOONEY 252



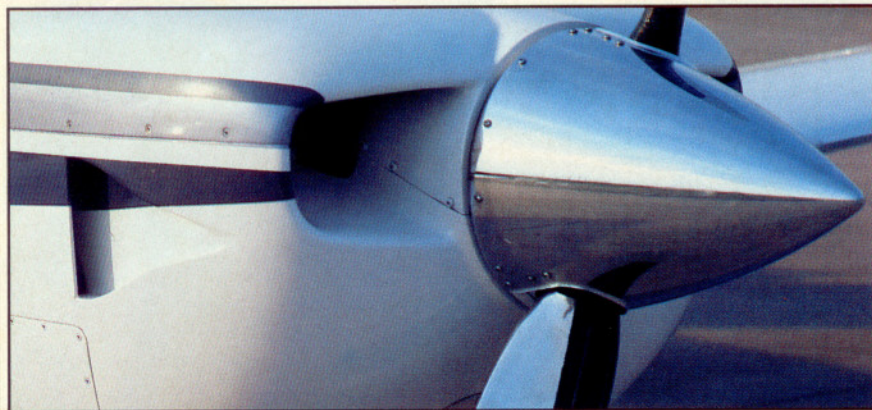
altitude at which sufficient manifold pressure can be produced to maintain rated power) between 23,000 and 24,000 feet. The 231's -LB1 engine requires 40 inches of manifold pressure to produce 210 hp, and its critical altitude is 14,500 feet.

Engineers at Mooney and Teledyne Continental Motors took the core of the injected, 360-cubic-inch, six-cylinder engine and added a Garrett AiResearch TE04 variable-wastegate turbosupercharger system, which includes a 42-square-inch intercooler installed behind the number 1 cylinder.

According to Mooney, the intercooler reduces the temperature of the air passing from the turbocharger compressor to the intake manifold by 60°F at low altitudes and by 120°F at high altitudes. In



Electrically actuated single-cowl flap (above) is adjustable to any position. NACA duct (below) keeps ice, snow away from intake air.



Wing-tip navigation and strobe lights (above), together with rear-facing recognition lights, give maximum visibility.



other words, the compressed air loses about half of its heat before reaching the combustion cylinders. Temperature limit for induction air is 280°F. Mooney said that during tests of the new engine, the temperature of the induction air never exceeded 160°F.

The new engine can produce rated power at a lower manifold pressure and to a higher critical altitude because the induction air is cooler and denser due to the efficiency of the intercooler.

Other modifications have improved the flow of air through and over the engine. Air now enters the engine through a NACA duct located on the side of the cowl, rather than through a duct in the cooling-air inlet. A NACA duct is an *inertial separator*, so-called because air can flow (i.e., make a sharp turn) into the recessed orifice, but heavier substances, such as water droplets and ice and snow crystals, cannot, due to their mass and inertia.

The air filter is three times larger and is cylindrical rather than flat. The chief advantage of the new filter is a smaller

best economy.

A variable wastegate controller replaces the fixed-wastegate system used in the 231's engine. The latter required the pilot to use only partial throttle during takeoff to avoid overboosting the engine and to make periodic adjustments during climb to maintain the desired manifold pressure.

On takeoff in a 252, the pilot advances the throttle control all the way to the firewall—slowly and carefully, of course. The variable controller senses both throttle position and compressor discharge air pressure. It automatically maintains the desired manifold pressure by controlling oil pressure within an actuator that adjusts the position of the wastegate. When the wastegate is open, exhaust gases are discharged directly through the exhaust pipe. As the wastegate closes, some of the exhaust is redirected through another chamber and into the turbocharger's turbine housing. Exhaust pressure forces the turbine to rotate. The turbine is directly connected to the compressor; as the rotation of the unit increases, pressure of the induction air (boost) also increases.

The inlets behind the propeller spinner have been enlarged from 62 square inches to 90 square inches. According to Mooney, the inlets provide sufficient flow of cooling air to keep the engine well within its maximum temperature limits during a maximum performance climb from sea level to 24,000 feet on a 38°C (100°F) day.

The two large cowl flaps on the bottom of the 231's engine cowl have been replaced with a single cowl flap in front of the 252's nose-gear doors. The 231's cowl flaps are set with a mechanical linkage to only two positions: trail or full-open. An electrical actuator positions the 252's cowl flap to any position desired by the pilot.

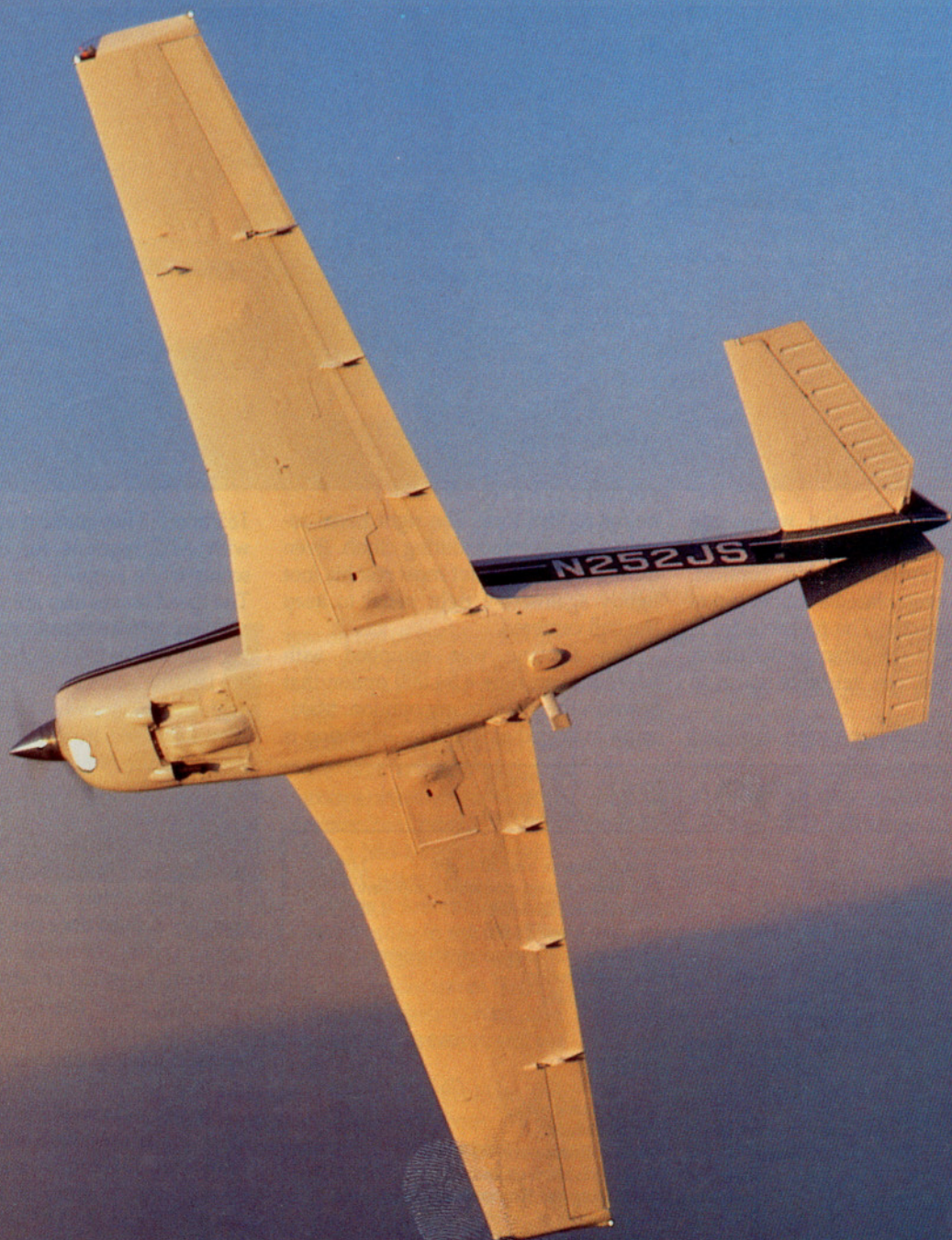
The attention paid by engineers at both Mooney and Continental to improving the flow of air through and over the 252's engine was quite noticeable when I flew N252JS from San Antonio to AOPA headquarters in Frederick, Maryland.

Ambient temperatures were about 10°C above standard for the trip. I followed recommended procedures for a maximum performance climb from San Antonio International Airport to my requested cruise altitude, Flight Level 250. (The 252's maximum operating altitude is 28,000 feet, where time of useful consciousness without oxygen is about one

pressure differential between the air entering and leaving the filter can.

The induction system also has been *tuned*. Simply speaking, this means that the diameters and lengths of the individual induction tubes have been designed precisely to deliver identical air charges into each of the six cylinders. A result is that the exhaust gas temperatures from each cylinder are nearly the same.

Mooney Aircraft recommends that the pilot use 78.6 percent power for cruise (maximum recommended cruise power for the 231 is 75 percent). The M20K manual no longer contains separate performance information for best economy and best power. The 252's engine should be leaned to peak turbine inlet temperature or 1,650°F, whichever comes first, to obtain best power and



MOONEY 252

minute. Since N252JS did not have a standby oxygen system, I decided on the lower altitude, where I would have about 2.5 minutes to recognize and respond to the onset of hypoxia.)

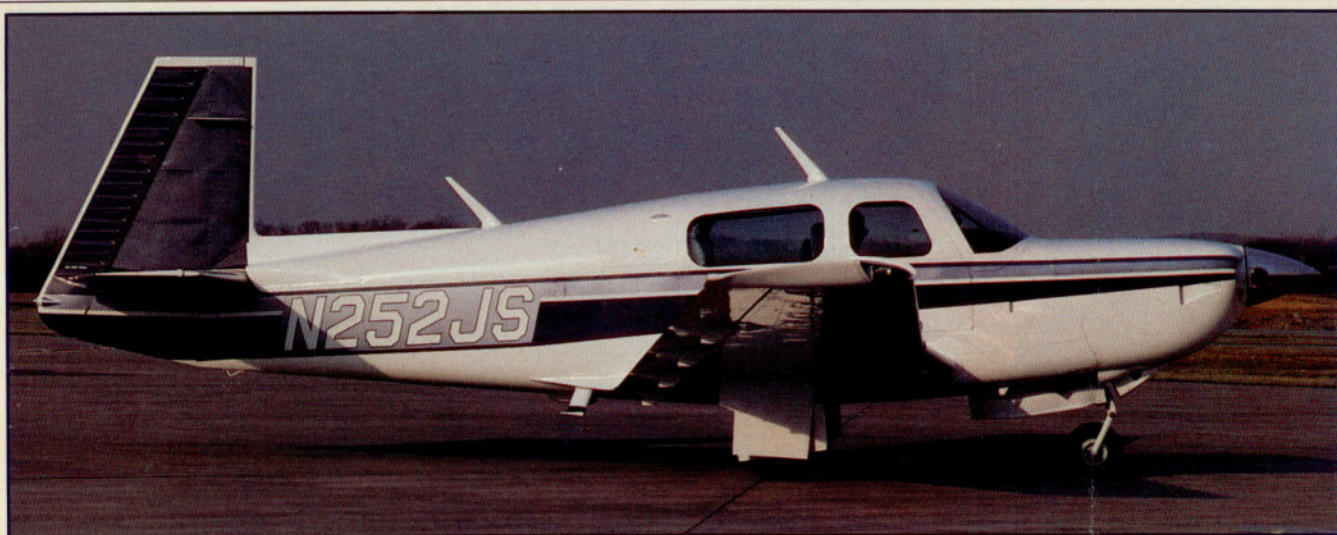
At 96 knots—the airspeed for best rate of climb—36 inches of manifold pressure and 2,700 rpm, with cowl flaps open and mixture full-rich, the airplane initially climbed at 1,400 fpm. Before reaching 13,000 feet, where I was held

momentarily by ATC, the rate of climb was about 1,200 fpm. The climb rate decreased gradually from 1,200 fpm at 15,000 feet to 900 feet at FL230, where I was held again for awhile. Throughout the climb, the cylinder head and oil temperature indicators never crept past the middle of their green arcs. Fuel flow averaged slightly less than 22 gph, according to the indicator. Mooney claims that the 252 uses about 1.5 gallons less than

a 231 in a max-performance climb because the new engine does not need as much fuel for cooling purposes.

At FL230, true airspeed worked out to 205 knots on 12.8 gph at 78.6-percent power. After leveling at FL250, I recorded 207 knots true airspeed.

The 252 has some interior refinements that make life at altitude, with your face buried in an oxygen mask, a bit more comfortable. The new fully



articulating headrests, the wider side armrests and, especially, the new center armrest also enhance cabin comfort. Mooney has even placed a rubber jacket on the fuel selector. The fuel selector is right in front of the cabin heater outlet and, uncovered, can get quite warm to the touch.

If I were to make one wish, it would

be for rudder trim. The right pedal requires a heavy foot during climb. Even during cruise the pilot must rest his foot lightly against the right pedal to keep the ball centered.

The airplane was equipped with speed brakes, now a \$4,000 option that is worth the price, in my opinion. Maximum indicated airspeed for extension is

185 knots. They make it easy to comply with ATC requests for expedited descents while keeping the engine warm. The speed brakes also are very useful for airspeed and descent management during approaches and to dump lift during the landing roll.

Maximum gear-extension speed has been increased from 132 to 140 knots, which makes mingling the slippery Mooney with pattern traffic a bit easier.

The geometry of the main landing gear has been altered so that when the gear are retracted, the wheels fit into their wells (they used to protrude slightly). A third door has been incorporated to cover the wells when the gear either are extended or retracted.

N252JS made the 870-mile first leg from San Antonio to Knoxville in 4 hours 15 minutes and burned 55 gallons of avgas.

Departing Knoxville, I tried the procedures for cruise climb—32 inches and 2,500 rpm, 105 knots—and obtained an average rate of climb of 1,000 fpm on about 15.7 gph. At 11,500 feet, true airspeed was 180 knots on 12.7 gph at 78.6 percent power.

Performance of the new airplane is impressive. Pilots who have flown a 231 will find the 252 familiar, yet strikingly different. It is like encountering an old friend who has taken to lifting weights.

Mooney appears to be holding to the build-a-better-mousetrap theory for success. Currently, success means survival in the general aviation industry.

Continued refinement of the M20K does appear to be quite a successful undertaking for Mooney. In addition to impressive new performance figures, the 252 is racking up significant numbers where it counts: in sales. At press time, Mooney had sold 40 of the airplanes. □

MOONEY 252

Mooney M20K 252

Base price \$123,380

Price as tested \$176,585

AOPA Pilot Operations/Equipment
Category*:

Cross-country \$145,700 to \$146,900

IFR \$175,650 to \$199,220

Specifications

Powerplant	Teledyne Continental Motors
	TSIO-360-MB1
	210 bhp @ 36 in Hg./2,700 rpm
Recommended TBO	1,800 hr
Propeller	McCaughey, constant-speed
	two-blade, 74-in dia
Length	25 ft 5 in
Height	8 ft 4 in
Wingspan	36 ft 1 in
Wing area	174.7 sq ft
Wing loading	16.6 lb/sq ft
Power loading	13.8 lb/hp
Seats	4
Cabin length	9 ft 6 in
Cabin width	3 ft 7.5 in
Cabin height	3 ft 8.5 in
Empty weight	1,800 lb
Empty weight, as tested	2,034 lb
Maximum weight	2,900 lb
Useful load	1,100 lb
Useful load, as tested	866 lb
Payload w/full fuel	646.4 lb
Payload w/full fuel, as tested	412.4 lb
Fuel capacity	471.6 lb (453.6 lb usable)
	78.6 gal (75.6 gal usable)
Oil capacity	8 qt
Baggage capacity	120 lb, 17 cu ft
Hat rack	10 lb, 2.6 cu ft

Performance

Takeoff distance, ground roll	1,200 ft
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Takeoff distance over 50-ft obst	2,000 ft
Max demonstrated crosswind component	12 kt
Rate of climb, sea level	1,080 fpm
Max level speed, 24,000 ft	219 kt
Cruise speed/endurance w/45-min rsv	
(fuel consumption)	
@ 78.6% power	
28,000 ft	202 kt/4.9 hr
	(76.2 pph/12.7 gph)
12,000 ft	176 kt/5.9 hr
	(76.2 pph/12.7 gph)
Max operating altitude	28,000 ft
Critical altitude	23,000 ft
Landing distance over 50-ft obst	2,280 ft
Landing distance, ground roll	1,080 ft

Limiting and Recommended Airspeeds

Vx (best angle of climb)	71 KIAS
Vy (best rate of climb)	96 KIAS
Va (design maneuvering)	118 KIAS
Vfe (max flap extended)	112 KIAS
Vle (max gear extended)	140 KIAS
Vlo (max gear operating)	
Extend	140 KIAS
Retract	107 KIAS
Vno (max structural cruising)	174 KIAS
Vne (never exceed)	196 KIAS
Vs1 (stall, clean)	61 KIAS
Vso (stall in landing configuration)	56 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 1985 Pilot, p. 94. The prices reflect the costs for equipment recommended to operate in the listed categories.