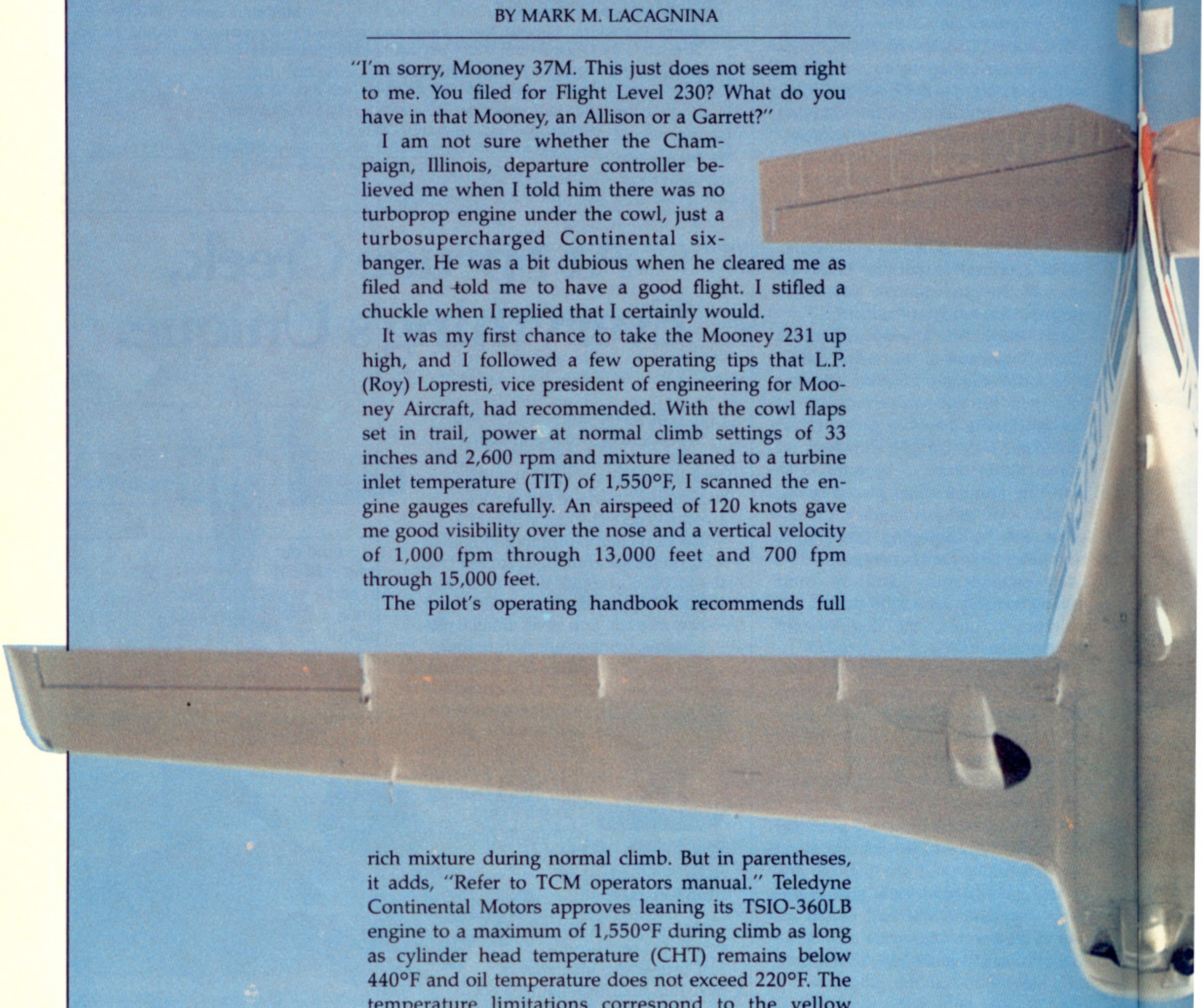
# MOONEY 231

*The businessman's express, from Kerrville with pride*

BY MARK M. LACAGNINA



"I'm sorry, Mooney 37M. This just does not seem right to me. You filed for Flight Level 230? What do you have in that Mooney, an Allison or a Garrett?"

I am not sure whether the Champaign, Illinois, departure controller believed me when I told him there was no turboprop engine under the cowl, just a turbosupercharged Continental six-banger. He was a bit dubious when he cleared me as filed and told me to have a good flight. I stifled a chuckle when I replied that I certainly would.

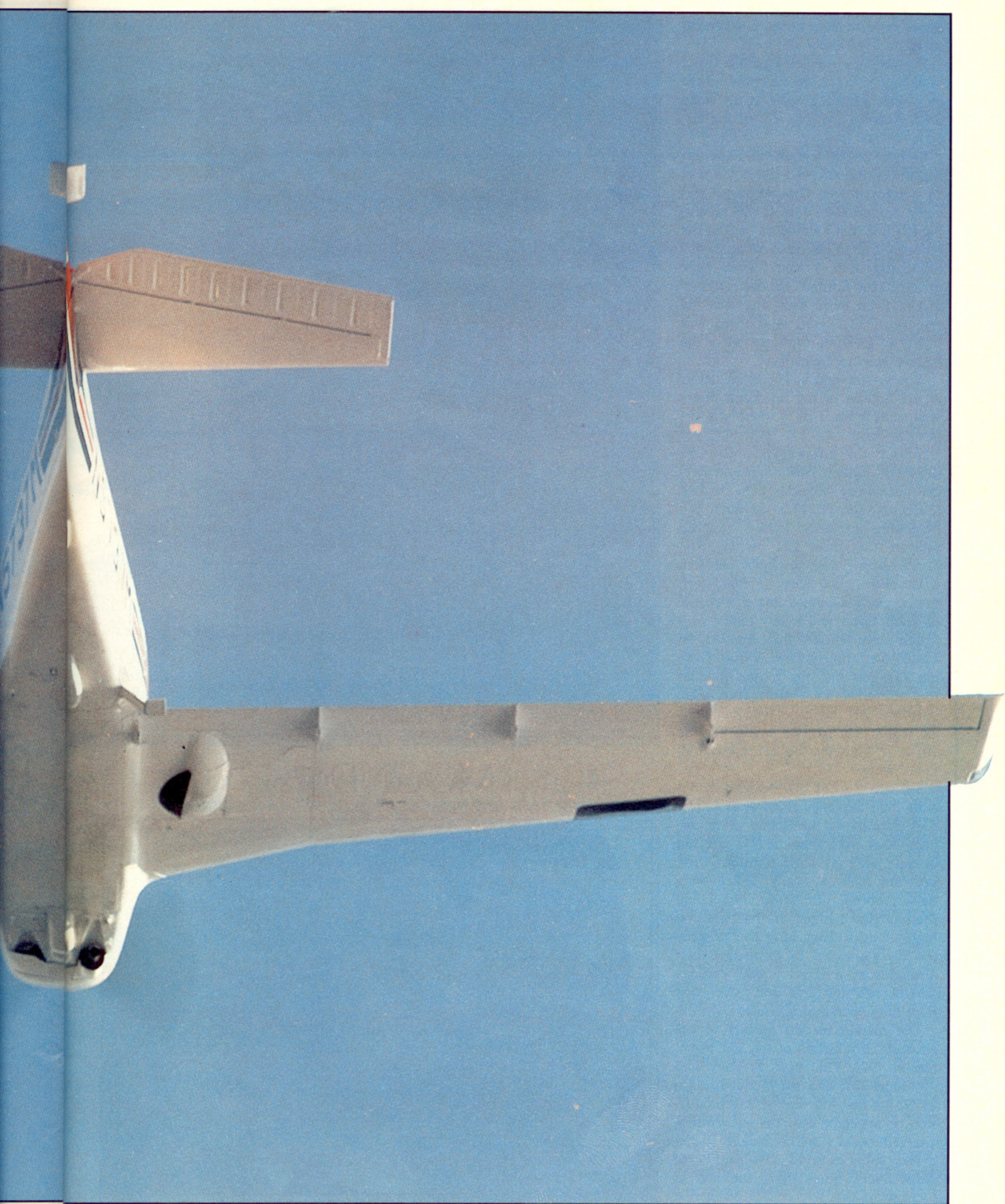
It was my first chance to take the Mooney 231 up high, and I followed a few operating tips that L.P. (Roy) Lopresti, vice president of engineering for Mooney Aircraft, had recommended. With the cowl flaps set in trail, power at normal climb settings of 33 inches and 2,600 rpm and mixture leaned to a turbine inlet temperature (TIT) of 1,550°F, I scanned the engine gauges carefully. An airspeed of 120 knots gave me good visibility over the nose and a vertical velocity of 1,000 fpm through 13,000 feet and 700 fpm through 15,000 feet.

The pilot's operating handbook recommends full rich mixture during normal climb. But in parentheses, it adds, "Refer to TCM operators manual." Teledyne Continental Motors approves leaning its TSIO-360LB engine to a maximum of 1,550°F during climb as long as cylinder head temperature (CHT) remains below 440°F and oil temperature does not exceed 220°F. The temperature limitations correspond to the yellow bands in the respective gauges.

According to the Alcor fuel totalizer in N3757M, leaning from full rich to 1,550 TIT reduced fuel flow from about 22 gph to 16.5 gph. But the procedure requires vigilance and nearly constant tweaking of the mixture control.

Climbing through 15,000 feet, the CHT and oil temperature indicators began to edge toward their yellow arcs. After the cowl flaps were opened fully, the indi-

PHOTOGRAPHY BY ART DAVIS



cators froze in their spots, but vertical speed decayed about 200 fpm.

The Mooney reached FL230 and the Indianapolis Vortac, 89 nm from where its wheels left the ground, at the same time. Average climb speed for the aircraft was 600 fpm.

Level at 23,000 feet, the airplane settled into a true airspeed of 195 knots at 75 percent power. Ground speed wavered around 250 knots. It was satisfying to think that I would be back in the office in time to get rid of some paperwork. (By then, I would even have grown accustomed to the oxygen mask.) Even more satisfying was the fuel flow: 11.2 gph. And there was plenty of green surrounding all of the engine temperature gauges.

A note scrawled in big block letters at the bottom of my notebook pretty well sums it up: *This is where this airplane belongs!*

Indeed, the turbosupercharged 231 delivers optimum performance at oxygen-mandatory altitudes. The higher, the better; and FL240 is the limit. Yet, marketing studies by Mooney Aircraft indicate that most 231 owners routinely operate their airplanes between 8,000 and 12,000 feet. At 8,000 feet, the normally aspirated 201 is a couple of knots faster and a few tenths of a gallon more efficient than the 231. At 12,000 feet, the converse is true. Once the 231 gets into the oxygen-mandatory altitudes, its performance edge over the 201 increases exponentially. At 18,000 feet (service ceiling for the 201 is 18,800 feet), the 231 is about 20 knots faster.

So, why do 231 owners tend to operate their airplanes at lower altitudes? The answer—up until this year, perhaps—has been that the 231 did not operate well at high altitudes. The problem is heat. Many 231 owners have reported difficulties in keeping their engine gauges in the green at high altitudes. They have had to settle for lower altitudes or to operate their airplanes at reduced power settings and/or rich mixtures and with cowl flaps fully open during cruise.

The market reacted quickly to the situation. Production of the 231 began late in 1978. That year, Mooney sold 18 Model 231s and 361 Model 201s. In 1979, the first full year of 231 production, it appeared that the new turbocharged model would eclipse its stablemate; sales totaled 264 and 175, respectively. Since then, the market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Baggage space normally totals 17 cubic feet but can be nearly doubled by folding the rear seats.

balance has tipped in the 201's favor. In the past three years, Mooney sold 305 Model 231s and 367 Model 201s.

Mooney Aircraft and Teledyne Continental Motors had to make a decision: Make the TSIO-360 engine run cooler, or settle for increasingly cooler 231 sales. They chose the former, of course.

The best solution to the heat problem, an intercooler, was rejected by Mooney. An intercooler basically is a radiator that reduces the temperature of induction air as it passes from the turbocharger compressor into the intake manifold. Mooney felt that the benefits of an intercooler would be compromised by its cost and increased complexity.

(An intercooler kit for the Mooney 231 is available from Turboplus. The kit includes an intercooler, intake ducts and an outflow plenum and costs $4,495. According to the company, 24 hours of labor are required for installation. More information on the Turboplus intercooler kit can be obtained from Turboplus, Incorporated, 1437 West Valley Highway, Auburn, Washington 98001; 206/735-2700 or 800/742-4202).

Mooney chose, instead, to work with Continental on improving the flow of air and fuel through the engine. The diameter of the throttle body was increased from 2.06 to 2.50 inches to provide a larger passageway for induction air and wider fuel-injection lines were incorporated to facilitate fuel flow. Back pressure on the turbocharger was reduced by reducing the overboost (poppet) valve setting from 44 to 41.5 inches. Back pressure also was reduced by eliminating a resonator in the exhaust system. "The resonator was supposed to silence exhaust noise," a Continental engineer said, "but it was not worth the back pressure it produced."

The transformation of the TSIO-360GB engine into the TSIO-360LB engine included several other refinements worthy of mention. The cylinder walls are now coated with zinc phosphate, which protects them from corrosion during the time the engine is shipped from Continental, installed in an airplane and delivered by Mooney. The coating is burned off within 25 hours of engine operation.

The cylinder walls also are impregnated with nitrite, a hardening agent; and a cast steel compression ring guide

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has been incorporated in each piston. The guide prevents the ring from fluttering when the engine is operated at low power settings. Nitriding and the new ring guides are intended to improve engine wear characteristics. In addition, the alternate induction air system now operates automatically as well as manually.

The recommended time between major overhaul (TBO) of the TSIO-360 engine remains 1,800 hours, but Mooney and Continental, have increased their warranty on the new LB engine from six months to one year.

Only time, and service difficulty reports submitted by 231 owners, will tell if Mooney and Continental have improved the heat-management problem. Our experience with N5737M indicates that the 231 now can be flown at the altitudes for which it originally was designed.

In addition to the new engine for the 231, Mooney has introduced a number of new features for both airplanes. Six access panels on the bellies of both models have been eliminated. Access to fuel lines, control systems, fuel selector and landing gear actuator now is achieved by removing an eight- × three-foot fiberglass panel that is held in place by 38, quarter-turn fasteners. The unit also houses a marker beacon antenna.

Cockpit instrumentation now is internally lit rather than post-lighted and includes more accurate oil-pressure and fuel-pressure transducers. The manifold pressure gauge has been reduced in size from three inches to two inches to correspond with the compressor-discharge and turbine inlet temperature gauge and the tachometer. The smaller manifold pressure gauge also has freed more room for the circuit breaker panel.

Drag has been reduced slightly with a Teflon seal for the nose gear doors, a tailcone fairing, redesigned engine-access hatches, elimination of both an air-induction port and a cabin vent on the left fuselage and replacement of a "towel-bar" antenna with a blade antenna on the vertical stabilizer.

A standby vacuum system is available as an option for both the 231 and the 201. The system weighs 12 pounds and includes an electric motor in the tail. Cost of the option is $1,850.

Our evaluation airplane was intended to be a factory demonstrator (but was sold shortly after it was produced) and is very well equipped. King Silver Crown avionics equipment, including a KFC 200 flight control system, a Sperry WeatherScout color weather radar, 3M Stormscope, Texas Instruments 9100 Loran receiver, 76-cubic-foot oxygen system and propeller deicing system were among the options that brought the net price of N5737M to $177,370 from the base price of $86,950 for a 1984 Model 231.

The airplane also has a standby generator system, an option introduced for the 231, only, in 1982. A 14-volt direct-current generator is mounted on an engine accessory drive and is connected to its own voltage regulator. Should the alternator fail, the pilot can connect the generator to the standby bus by pulling the circuit breakers for both the alternator and the battery. The standby bus powers the following equipment: the number one communications transceiver and navigation receiver; transponder; altitude encoder; headphone jack; fuel totalizer; gear and stall warning systems; annunciator panel; engine guages; turn coordinator; horizontal situation indicator; tachometer; and outside air temperature gauge. The circuit breakers for these systems are grouped together on the panel. Other systems—such as the landing gear, flaps and radio speaker—are not included in the standby generator system. To activate these systems, the main bus must be connected to the battery by pushing the battery circuit breaker.

The Mooney 231 is, indeed, an electric airplane. (See "The Electric Airplane," by Edward G. Tripp, June 1981 *Pilot*, p. 107.) Operating a 231 equipped as N5737M is (and as most M20Ks are) requires judicious selection of what you need to use and what can be left on standby. A pilot just cannot turn everything on and expect the alternator to carry the load. It won't. When operating in instrument weather conditions, the standby generator system (5.8 pounds and $2,700) is a good option to have, just in case.

Although the airplane generally performed well during our two-week lease, it did exhibit a few teething problems. One *Pilot* editor reported that the weather radar system and the Stormscope failed to provide any useful information during one flight in some heavy weather. At high power settings, the 231's throttle and propeller controls required nearly constant adjustment. The Loran receiver did not function properly; a malfunctioning amplifier was the culprit. (*Pilot* will have a full report on the TI 9100 Loran receiver in an upcoming issue.)

*From fuel gauges to color weather radar, almost everything in the Mooney 231's panel runs on electricity. An optional stand-by generator can provide a hedge against an alternator failure.*

The fuel filler caps were a constant headache. They tend to stick if not lubricated regularly (every week, at least).

When the cowl flaps are closed, the cabin heater is more than adequate to keep the cabin toasty on a cold day but discharges onto the fuel selector, making it very hot to the touch. I learned to protect my fingers with a handkerchief while switching tanks.

The biggest complaint, however, was lodged by a passenger. The rear seats are uncomfortable on a long flight. The seat pads are small and do not provide much latitude for adjusting your position. The elbow rests are narrow and practically useless, and the wing spar carry-through structure chafes your calves, if you happen to be short in stature. (The front seats are quite comfortable, though.)

In my opinion, these shortcomings do not stack up very well against the 231's speed, mission capability and economy. True airspeeds of 180 to 190 knots on a little more than 11 gallons of fuel per hour are quite satisfying. The airplane is capable of climbing


# STEEL DEALS

Mooney Aircraft faces an uncertain future. Republic Steel, Mooney's owner for 11 years, seeks to merge with the Jones & Laughlin Steel Corporation, a subsidiary of the giant LTV Corporation. But in mid-February, the U.S. Justice Department blocked the merger on antitrust grounds, saying it would result in the creation of the nation's second largest steel company, which would own a commanding market in certain steel products. At press time, Republic and LTV were considering revising the merger plan to make it acceptable to the Justice Department.

The proposed merger has spawned a host of rumors regarding Mooney's fate. Some say that Republic, which has lost $600 million in the last two years, is ready to sell its lone aircraft subsidiary. Others claim LTV, which had a net loss in 1983 of about $181 million on sales of $4.6 billion, won't be bothered with little Mooney if the merger goes through and simply will shed the company. One final bit of speculation: A competing aircraft manufacturer wants to buy Mooney and put it out to pasture.

Thomas J. Smith, president of Mooney, discounts the speculation. Smith said he has seen no indication that Mooney would be sold by either Republic or LTV, and that it's "business as usual" in Kerrville, Texas. However, Smith seems worried that LTV won't find any value in hanging onto a small general aviation aircraft manufacturer; he is promoting the company as having the space and ability to produce parts for LTV products.

Mooney has increased its market share of single-engine retractables from 15.9 percent in 1981, to 19.5 percent in 1982, to 23.9 percent in 1983, when it sold 154 aircraft. Last year would have been acceptable financially, Smith said, except the company spent heavily on development of the 301. With little help from Republic, which must contend with its own losses and concentrate on the LTV merger, Mooney has had to slow down work on the 301. Certification had been targeted for early 1986; the revised plan calls for late 1986 or early 1987.

Mooney still is marketing a military trainer version of the 201/231, but no orders have been placed.

One group that has an emotional, if not vested interest in Mooney's fate is the 2,500-member Mooney Aircraft Pilots Association (MAPA). An editorial in a recent issue of the MAPA's official publication raised the possibility of Mooney owners buying the factory. "We've had unofficial commitments from a number of owners to participate in a purchase," MAPA President Mark Harris said. Harris said he was told by Republic that Mooney is not for sale, but, just in case, he asked that MAPA be placed at the top of the list of interested parties.

"If that's what it takes to keep the company going, we'd sure like to give it the college try," Harris said. "Who wouldn't like to own the company that manufactures your aircraft?"

*—Mark Twombly*

# MOONEY 231

**Mooney M20K 231**
Base price $86,950
Price as tested $177,370
*AOPA Pilot* Operations/Equipment Category*:
Cross country $110,740 to $119,870
IFR $137,110 to $177,150

**Specifications**

| | |
|---|---|
| Powerplant | Teledyne Continental TSIO-360LB1B 210 hp @ 2,700 rpm |
| Recommended TBO | 1,800 hr |
| Propeller | McCauley, 2-blade constant-speed, 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 | 2,051 lb |
| Max weight (takeoff, landing) | 2,900 lb |
| Max useful load | 1,100 lb |
| Useful load, as tested | 849 lb |
| Payload w/full fuel | 646 lb |
| Payload w/full fuel, as tested | 395 lb |
| Fuel capacity, std | 471.6 lb (453.6 lb usable) 78.6 gal (75.6 gal usable) |
| Oil capacity, ea engine | 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 |
| Takeoff distance over 50-ft obst | 2,060 ft |
| Max demonstrated crosswind component | 12 kt |
| Rate of climb, sea level | 1,080 fpm |
| Max level speed, sea level | 201 kt |

very quickly through weather. Only one mission was canceled due to reports of moderate to severe icing conditions. And with the fuel tanks full, the 231 can cover long distances in a single leg. At 65 percent power and 24,000 feet, the airplane has a maximum endurance of six hours.

Probably the biggest concern facing any potential Mooney customer is deciding whether to buy a 201 or a 231. Mooney suggests that, if your mission requirements usually involve trip lengths of less than 300 miles, the 201 is your airplane. But, if you need to travel longer distances, the 231 is the better choice.

And if Mooney and Continental have done their heat-management homework well—and our experience with N5737M indicates that they may have—you need not be concerned about taking the 231 up high, where it belongs. □

| | |
|---|---|
| Cruise speed/Endurance (fuel consumption) | |
| @75% power, best economy | |
| 8,000 ft | 167 kt/5.9 hr (66 pph/11 gph) |
| 22,000 ft | 188 kt/5.5 hr (66.6 pph/11.1 gph) |
| @65% power, best economy | |
| 12,000 ft | 161 kt/6.4 hr (59.4 pph/9.9 gph) |
| 24,000 ft | 179 kt/5.9 hr (60 pph/10 gph) |
| @55% power, best economy | |
| 12,000 ft | 150 kt/7.3 hr (49.8 pph/8.3 gph) |
| 24,000 ft | 163 kt/6.7 hr (52.8 pph/8.8 gph) |
| Max operating altitude | 24,000 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) | 132 KIAS |
| Vlo (Max gear operating) | |
| Extend | 132 KIAS |
| Retract | 107 KIAS |
| Vno (Max structural cruising) | 174 KIAS |
| Vne (Never exceed) | 196 KIAS |
| Vr (Rotation) | 67 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 1983 Pilot, p. 96. The prices reflect the costs for equipment recommended to operate in the listed categories.*