ROCKET REDUX

Cessna's exit from the pressurized single market provides an entrance for Jack Riley

BY MARK R. TWOMBLY

Speed—more of it—has been the goal of each of the many airplane modification projects developed by Jack M. Riley Sr., AOPA 294058. The only way to achieve it, he believes, is more horsepower. "There is no substitute for horsepower," he declares. His latest modification, the Riley International Corporation Riley Rocket, indeed offers up more speed than the stock airplane, but, uncharacteristically, Riley achieves it not with an infusion of horsepower but with cooler air.

The raw material for the Rocket is a Cessna P210N. Riley International refines it by replacing stock components with a factory-overhauled engine and Riley-manufactured intercooler, new engine baffling, overhauled propeller, new tires, wheels and brakes, new interior with additional soundproofing, metal instrument panel, new avionics, auxiliary fuel tanks and a new exterior finish. The end product is a born-again, $225,000 pressurized single that is quieter, faster and more long-winded than in its original incarnation.

Pressurized piston singles are a relatively recent phenomenon. Mooney Aircraft Corporation manufactured the pressurized M22 Mustang from 1966 through 1970, but only 32 were built. In late 1977 Cessna introduced the P210N and quickly began to fill a void in the market. Nearly 600 were sold in the first three years of production. The P210's unchallenged reign ended in late 1983 when Piper began delivering the roomier, faster and more fuel-efficient PA46-310P pressurized Malibu. Cessna attempted to regain its foothold in 1985 with the P210R, which featured an

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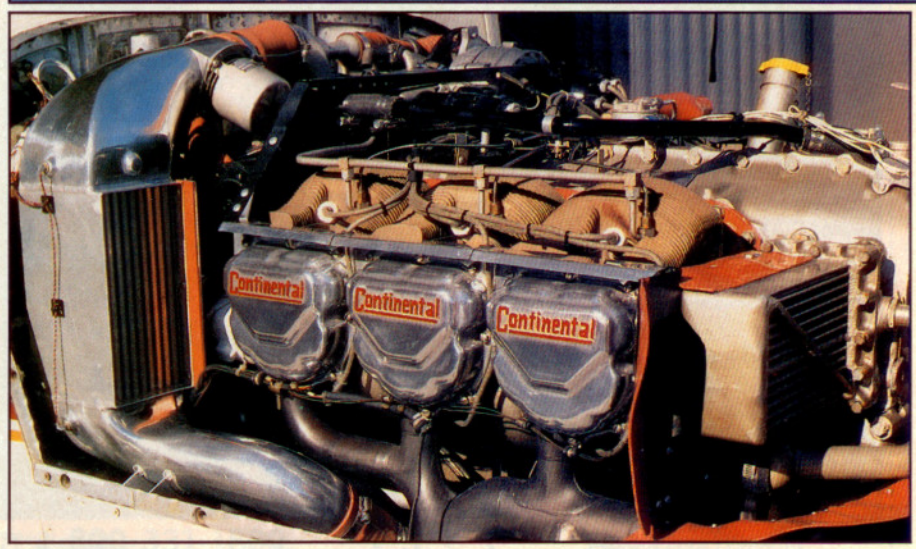
intercooled 325-hp engine and improved climb, cruise and handling, but the bid failed. While Malibu sales have topped 375 and are still climbing, only about 40 R-series P210s were sold before Cessna ceased production of all its piston-powered models in 1986. During a nine-year production run, 850 P210s were manufactured.

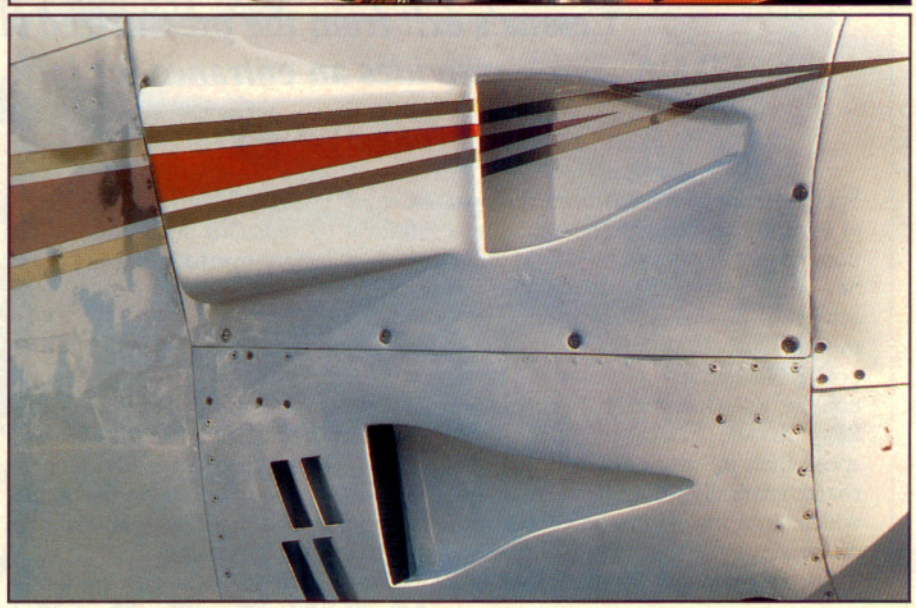
Riley International is attempting to turn Cessna's initial dominance and subsequent abdication of the pressurized piston single market into an advantage. The Rocket is being promoted as a less expensive but equally capable alternative to a new Malibu, which currently carries an IFR-equipped list price of $329,990. Though not a newly manufactured airplane, the Rocket is delivered with many new components, a fresh annual inspection and warranties on the airframe, engine and avionics.

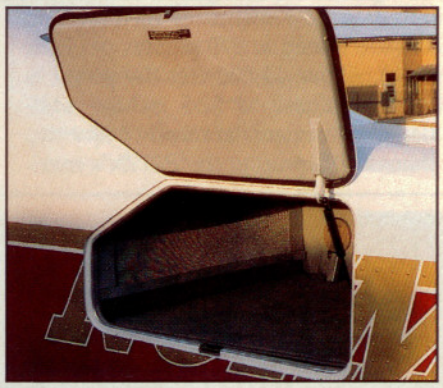
The transformation of a P210N to a Rocket begins with the purchase of a used P210 by Riley International. The interior is stripped to bare aluminum so that foil-backed dense-foam soundproofing material can be glued to the roof, fire wall, side walls and rear bulkhead. Inner window panels are installed to provide an extra measure of soundproofing. Seats are reupholstered with matching kick panels, trim and carpeting. The standard headliner is replaced with synthetic suede or fabric, and an electrically operated inflatable door seal is installed. Finally, Cessna's plastic instrument panel covers are discarded in favor of an attractive metal panel.

We adjusted power to produce an indicated airspeed of 165 knots. True airspeed? A whopping 222 knots. Rocket, indeed.

The standard avionics package consists of King Silver Crown radios, Northstar M-1A Loran C, 3M WX10A Stormscope and S-TEC System 65 flight director/autopilot. New instrumentation includes a digital-readout gauge that monitors induction air temperature drop across the intercooler, auxiliary fuel quantity gauges and switches to activate pumps that transfer fuel from the auxiliary tanks to the main tanks.







Speed is one aspect of the Rocket's appeal. Looking good is another. The Rocket's uncowled engine and intercooler (left) gleam with polished metal splendor. Intercooler intake scoop and exhaust vent (below, left) are grafted onto lower right cowl. New King Avionics suite (below) fills metal instrument panel. New instrumentation includes intercooler temperature gauge, auxiliary fuel quantity gauges and transfer switches. Rocket comes with either wing-tip auxiliary tanks or single baggage-bay auxiliary tank, shown here (right).

Exterior changes include installation of new Parker Hannifin Aircraft Wheel and Brake Division (formerly Cleveland) wheels and brakes, new tires and either Flint Aero auxiliary wing-tip fuel tanks or an O&N Aircraft Modifications fuselage fuel tank in the baggage bay. The Flint tanks add about 26 inches to the P210N's wingspan and increase fuel capacity by 33 gallons. The fuselage tank holds 30 gallons and, when full, reduces cargo capacity to just 20 pounds.

The used engine is swapped for a factory-overhauled zero-time Continental TSIO-520 with a 1,600-hour TBO. Riley then installs a backup vacuum pump and its own intercooler kit consisting of the heat exchanger, fiberglass ductwork and scoops. The right side of the engine cowl is modified to incorporate a flush-mounted intercooler intake scoop and raised exhaust vent. New engine baffles are fabricated and installed, and the three-blade McCauley propeller is overhauled and dynamically balanced.

Flash is as important to the Rocket as dash, even under the cowling. The cast-aluminum intercooler housing, engine valve covers and propeller are polished to mirror smoothness, and the raised Continental logo on each of the six valve covers is painted red, Jack Riley's signature color. Customers can choose either leather or fabric interior in a variety of colors with matching exterior paint, but Riley, who wears red socks every day, probably wishes every one would go out the door with blood-red leather seats and paint to match. At the least, Riley insists on the Rocket paint scheme to distinguish it from a mere stock P210N.

The final configuration of the Rocket depends on the equipment that came with the used airplane. If Riley buys a P210N equipped with radar, deicing equipment and air conditioning, those items will be retained on the Rocket. Some customers have opted for additional modifications, including Precise Flight speedbrakes and STOL kits.

Intercooling is the key to the Rocket's improved performance over a stock P210N. The benefits of intercooling—lower engine operating temperatures, increased critical altitudes and lower fuel consumption at similar airspeeds compared to a nonintercooled engine—are well recognized. It is a relatively simple and inexpensive way to boost engine performance and prolong engine life. Induction air that has been compressed and therefore heated by the turbocharger is routed through an intercooler,

also known as an aftercooler, which acts like a radiator. Ram air circulates through the intercooler, absorbing induction air heat. Cooling the induction air increases its density, enabling it to support more combustion and thus produce more power.

Intercooling is standard on some production turbocharged singles such as the Mooney 252 and Piper Malibu, and a small but active group of aftermarket manufacturers including Riley International have obtained supplemental type certificates to install intercoolers on just about every turbocharged model airplane flying. Riley sells its P210 intercooler as a kit for $3,950 installed. The company is developing intercoolers for the Cessna 337 and 206 and the Piper Turbo Arrow and Turbo Saratoga.

The intercooler modification on the Rocket is accompanied by a change in markings on the manifold pressure gauge and fuel flow indicator. Manifold pressure limits have been lowered compared to a stock P210N, while fuel flow limits have been raised to compensate for the increased power afforded by the intercooler, according to Riley.

A placard specifies maximum throttle settings and minimum fuel flows at various altitudes to avoid exceeding maximum continuous power. For example, above 4,000 feet msl power must be reduced to 33.5 inches of mercury and mixture leaned to 170 pounds per hour (pph). Above 11,000 feet the power is further reduced to 32.5 inches. Additional adjustments are made every two thousand feet up to the P210N's maximum operating altitude of 23,000 feet msl. The placarded power settings must be observed during a maximum performance climb, but to achieve better engine cooling, visibility and fuel economy and lower cabin noise levels, Riley recommends that power controls be set at 30 inches, 2,500 rpm and 145 pph for a 110- to 120-KIAS cruise climb.

P210 cabin is laid bare, and foil-backed foam soundproofing is glued to metal surfaces.

Red leather is Riley's favorite, but more subdued fabric upholstery is available.

Rockets are assembled in Riley International's hangar at McClellan-Palomar Airport in Carlsbad, California. A growing coastal city north of San Diego, Carlsbad suffers from nearly constant sunshine, low humidity and moderate year-round temperatures. Hangars at the airport apparently exist to shield workers from sunburn rather than to insulate airplanes from inclement weather. The spit and polish of the Rocket glows in such surroundings.

Conditions were, of course, ideal for a flight in the prototype Rocket, which Riley uses as a demonstrator. The prototype has an empty weight of 2,758 pounds. Rocket modifications add about 25 pounds to the empty weight, according to the company. The P210N's maximum ramp weight of 4,016 pounds is unchanged, leaving a useful load of 1,273 pounds. If all of the tanks are filled, 544 pounds of people and baggage could be loaded. For our demonstration flight, takeoff weight was approximately 3,450 pounds.

Robert L. Ferguson, AOPA 483114, Riley's avionics specialist and the demonstration pilot for the day, reviewed takeoff power setting procedures, which call for retarding the mixture control about an inch to 180 pph after applying full power. One aspect of the intercooler installation is an adjustment in the fuel pump to increase unmetered fuel pressure, which helps cool the engine during climb and at high cruise power settings. The higher fuel flow at full power has the potential of flooding the engine during the takeoff roll. Hence the need to lean to 180 pph.

Climbing out of the pattern to the east, we reduced power to the cruise climb settings and adjusted pitch to maintain 110 KIAS. The Rocket maintained a consistent 1,000-fpm rate of climb with cylinder head and oil temperature gauges remaining comfortably in the green. Aside from the sustained

Riley Rocket
Base price: $225,000, IFR-equipped

Specifications

Powerplant	Continental TSIO-520-P
Recommended TBO	1,600 hr
Propeller(s)	McCauley D3A34C402/90DFA-10 80-inch diameter; constant speed
Length	28 ft 2 in
Height	9 ft 8 in
Wingspan	38 ft 11 in
Wing area	185 sq ft
Wing loading	21.7 lb/sq ft
Power loading	12.95 lb/hp
Seats	6
Cabin length	8 ft 11 in
Cabin width	3 ft 6 in
Cabin height	4 ft 0 in
Empty weight, as tested	2,758 lb
Max ramp weight	4,016 lb
Useful load, as tested	1,273 lb
Payload w/full fuel, as tested	544 lb
Max takeoff weight	4,000 lb
Fuel capacity, std	90 gal (89 gal usable) 540 lb (534 lb usable)
Fuel capacity, w/opt tanks	33 gal (30 gal usable) 738 lb (714 lb usable)
Oil capacity	11 qt
Baggage capacity	200 lb

Performance

Takeoff distance, ground roll	1,300 ft
Takeoff distance over 50-ft obst	2,160 ft
Max demonstrated crosswind component	21 kt
Rate of climb, sea level	930 fpm
Max level speed, sea level	180 kt
Max level speed, 20,000 ft	217 kt
Cruise speed/Range w/45-min rsv, std fuel (fuel consumption) @ 75% power, best economy 20,000 ft	205 kt/1,129 nm (112 pph/18.6 gph)
Max operating altitude	23,000 ft
Landing distance over 50-ft obst	1,500 ft
Landing distance, ground roll	765 ft

Limiting and Recommended Airspeeds

Vx (best angle of climb)	78 KIAS
Vy (best rate of climb)	100 KIAS
Va (design maneuvering)	130 KIAS
Vfe (max flap extended)	160 KIAS
Vle (max gear extended)	200 KIAS
Vlo (max gear operating)	165 KIAS
Vno (max structural cruising)	167 KIAS
Vne (never exceed)	200 KIAS
Vs1 (stall clean)	67 KIAS
Vso (stall in landing configuration)	58 KIAS

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

rate of climb and low temperature readings, the most noticeable feature of the climb-out was the low noise level. Neither of us wore headsets, yet we were able to talk at a normal conversational level and decipher ATC communications over the cabin speaker. Riley later pointed out that the prototype is not fitted with inner windows.

Leveling at 17,500 feet msl, we adjusted engine controls to 31 inches, 2,500 rpm and a fuel flow of 120 pph for about 80-percent power, which produced an indicated airspeed of 165 knots, top of the green. True airspeed? A whopping 222 knots. Rocket, indeed. Soon, however, the pointer in the oil temperature gauge began creeping toward the redline, so we reduced power to 28 inches and opened the cowl flaps halfway. The high temperature readings came as a surprise to Riley, who speculated that the oil cooler thermostat may have been working improperly. At 75-percent power and with cowl flaps still open, indicated airspeed stabilized at 150 knots for a true airspeed of 205 knots at a fuel flow of 110 pph.

The Rocket operates in two different modes: normal and go-fast. At maximum continuous power it will live up to its name but burn about six percent more fuel than the stock airplane. Auxiliary fuel more than overcomes the additional fuel consumption by adding about 90 minutes endurance. Or, the pilot can perform the mental arithmetic common to intercooler-modified airplanes—reduce manifold pressure one inch for every 15 degrees Celsius of induction air cooling, then adjust the throttle again for variations from standard temperature—and realize stock P210N cruise speeds but with lower fuel consumption, greater endurance and cooler operating temperatures. Either way, pilot and passengers will be transported in style and comfort. □

Rocketry has been Jack Riley's preoccupation for three decades, beginning with modified 310.

THE LIFE OF RILEY

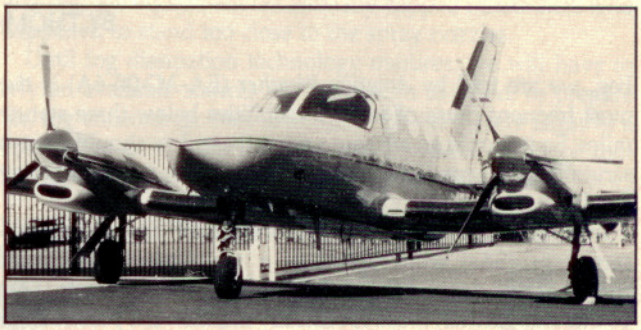
Jack Riley began 36 years of modifying airplanes in 1952 by converting the North American Aviation Navion into a twin. Riley originally installed 140-horsepower Lycoming IO-320 engines but later upgraded to 150-hp IO-320s and finally to 170-hp IO-340 engines. Cruise speeds ranged from 150 mph (129 kt) to 170 mph (146 kt). Riley produced about 100 of the twins.

The original Riley Rocket was a Cessna 310 with 290-hp Lycoming IO-540 engines. Cruise speed was 250 mph (215 kt). The Turbo Rocket, a modification of the modification, featured IO-540 engines with dual Rajay turbochargers. Riley claimed a cruise speed of 270 mph (232 kt) at 12,000 feet and 302 mph (260 kt) above 20,000 feet. About 250 Rockets and Turbo Rockets were converted.

In the 1960s Riley converted four-engine de Havilland Herons by installing turbocharged IO-540 engines. During FAA flight tests, the re-engined Heron climbed at 450 fpm through 10,000 feet with two engines feathered, according to Riley. He also converted twin-engine de Havilland Doves to eight-cylinder, dual-turbocharged 400-hp Lycoming IO-720 engines.

The Turbostream was a Cessna 310 re-engined first with 310-hp Lycoming TSIO-540 engines and later with 350-hp TSIO-540 engines.

In 1975 Riley developed a 400-hp dual-turbocharged and intercooled IO-720 engine conversion for the Cessna 414. The engines developed 100-percent power to 29,000 feet. At 33,000 feet cruise speed was 325 mph (280 kt), according to Riley. Approximately seven were sold.



The then-new Lycoming LTP-101 engine was the basis of Riley's 1977 conversion of the Cessna 421 from piston to turboprop power. About a dozen were converted before Lycoming stopped delivering the engines. Riley sued Lycoming and recently agreed to a $5.9-million settlement.

With the Lycoming turboprop unavailable, Riley switched to the 850-shp Pratt & Whitney PT6A-135 to power the Riley Turbine Eagle, which was certificated in late 1982. About a dozen were produced.

Riley's last turbine conversion was the Turbine 210, a Cessna P210 powered by a 750-shp Pratt & Whitney PT6A-135 engine flat-rated to 450 shp. Riley sold the rights to another firm, Advanced Aircraft Corporation, of Carlsbad, California. In November 1985, the FAA certificated the conversion, but the project was discontinued.