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The Rocket Launcher: Riley 65

TWIN & TURBINE

EDITOR
Lance Phillips
lance@twinandturbine.com

EDITORIAL OFFICE
2779 Aero Park Drive
Traverse City, MI 49686
Phone: (231) 946-7770

PUBLISHER
Dave Moore

PRESIDENT
Matt Kenny

PRODUCTION MANAGER
Mike Revard

PUBLICATIONS DIRECTOR
Jake Smith

GRAPHIC DESIGNER
Marci Moon

TWIN & TURBINE WEBSITE
www.twinandturbine.com

ADVERTISING
Jenna Reid
816-699-8634
Jenna.Reid@VPDCS.com

ADVERTISING COORDINATOR
Betsy Beaudoin
1-800-773-7798
betsybeaudoin@villagepress.com

GENERAL AVIATION ADVERTISING INFORMATION
Aviation.Publications@VPDCS.com

SUBSCRIBER SERVICES
Rhonda Kelly
Jessica Meek
Leah Backus
P.O. Box 968
Traverse City, MI 49685
1-800-447-7367

To change mailing address, email *rhonda.kelly@vpdcs.com*

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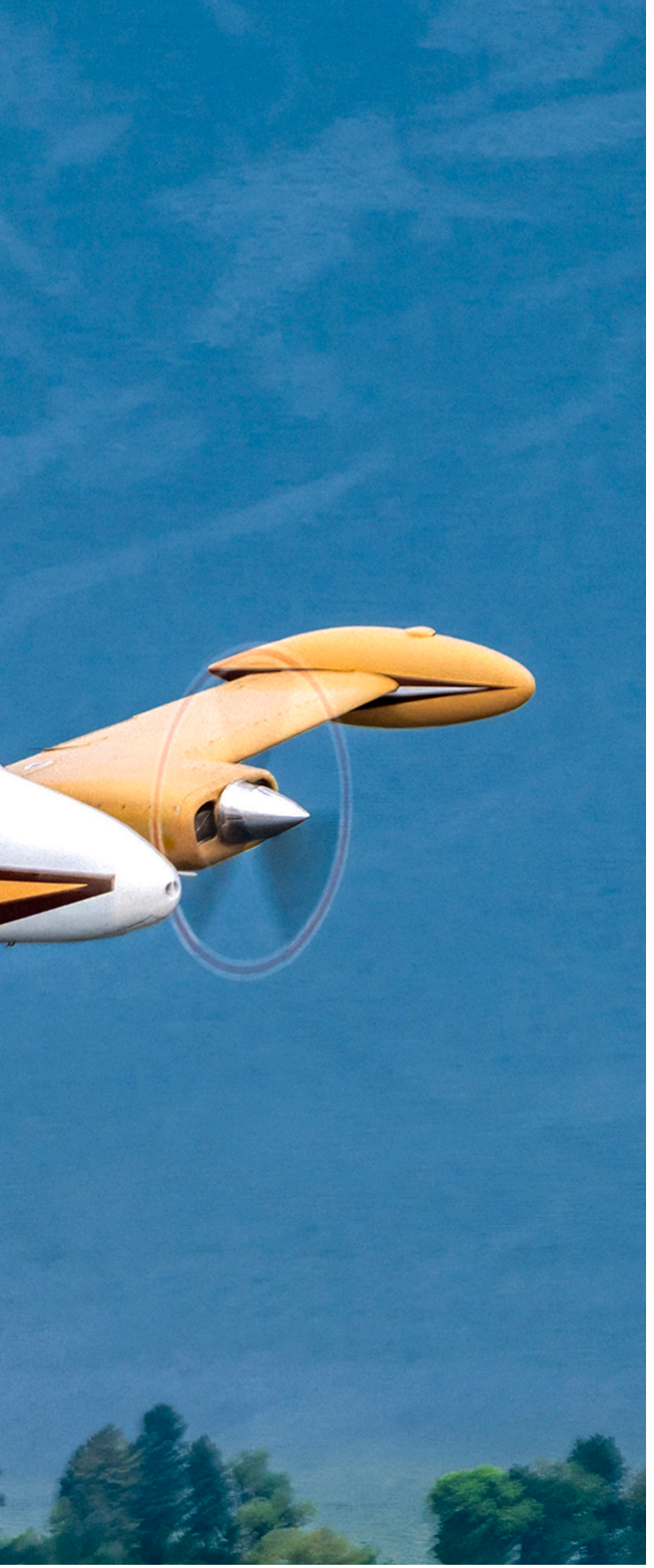


The Rocket Launcher:

A Predecessor to Riley's Rockets Flies Again

by Matthew McDaniel

No predetermined effort had been made. I hadn't planned to mark my 150th aircraft type flown by consciously choosing a fascinating type. Nor had I considered whether it would be a hopped-up twin versus a mild-mannered single. Between my crazy schedule and trying to seize opportunities as they are presented, it just worked out to be something noteworthy. Something rare in its heyday six decades ago and on the verge of extinction today. A fitting machine to mark a personal milestone, but also a machine worthy of much more recognition than a simple association with my meager accomplishment.

Ushering in the Next Generation

In the early 1950s, Cessna was not new to the twin-engine game. Its Model 50 Bobcat first flew before WWII began in 1939. By war's end, over 5,400 had been produced. They served in a variety of roles: multi-engine trainer, utility, cargo, VIP transport, etc. Post-war, many were snatched up via surplus sales and converted to corporate aircraft or family haulers. Their wood, tube, and fabric construction and thirsty radial engines made them relatively high-maintenance and inefficient, limiting their longevity. All-metal construction, horizontally-opposed engines, and sleeker airframes were the future, and Cessna knew it. They needed a next-generation twin that would replace the old "Bamboo Bombers," serve as the foundation for a new family of twins, and help them compete with Piper, Beechcraft, and Aero Commander (all of which had new light-twins in development or early production, as well).

In 1953, those aspirations became reality when the prototype Cessna 310 took to the air. Production 310s began rolling off the assembly line in Kansas in late 1954. These were "Straight 310s," meaning they incorporated no sub-model designation, as no sub-model yet existed. Their straight vertical tail and rotund wingtip fuel tanks (commonly called "Tuna Tanks" for their resemblance in shape and size to that prized fish) soon become the visual markers of these now-classic light twins.

The straight-310 was basic. Two pilot seats with a three-person bench seat behind (assuming the three in back were all quite small). An aft baggage area was accessible via a right-side baggage door. Inside, a hat-rack shelf topped the baggage area and allowed interior access to the lightweight items stowed there. The 50-gallon tuna tanks carried all the fuel for the carbureted, normally aspirated, 240hp engines (which turned 2-bladed constant speed props). The panel was a hodgepodge arrangement of instruments and radios that passed for "IFR equipped" at the time.

The C-310 seemed light years beyond the technology and aerodynamics of Cessna's T-50. It also significantly surpassed the performance of its only truly in-class competitors, the Riley Twin Navion and Piper's Apache (both 4-to-5-seat, light twins).

Polishing the Diamond

With sales steadily rising, Cessna soon began refining the 310. The 310A was built for the military only. Thus, the 310B was the first upgraded version offered to the civilian market (starting in 1958). The D-model (introduced in 1959, for the 1960 model year) did away with the decidedly uncool-looking straight tail, replacing it with a swept fin and rudder (which were all the rage on both cars and small aircraft of the era, drawing from the steeply raked fins of the futuristic jet-powered military aircraft then in service). By 1962, the 310 was up to the G-model and offered many design and performance enhancements over its earlier siblings (especially the pre-D, straight-tailed 310s). This disparity did not escape the watchful eye of Jack Riley.

Based in Florida, Riley was an entrepreneur and one of the most successful aircraft salesmen in the country in the post-WWII years. In 1953, he took delivery of the second D-16 Twin Navion conversion from Acme Aircraft Co. in California. Soon after, he purchased the original prototype too, along with rights to the design, and founded Riley Aircraft Conversions. He initially built D-16 Twin Navions via approved modifications to any Navion airframe. By late 1954, Riley and TEMCO (who he'd outsourced production rights to) incorporated so many improvements into the D-16A version that it was certified as a separate aircraft type (the Riley 55). Throughout the mid-1950s, Riley stayed busy marketing and selling slightly over 100 Twin Navions. When sales began to dry up, he converted many of the original D-16s to D-16As. But by decade's end, Riley was eyeing new projects. The Twin Navion could not compete with the clean-sheet light twin designs in steady production by then.

Riley noticed the performance gains of the current 310 models over their predecessors. Even though the oldest straight-tailed model was barely over five years old at that point, Jack saw an opportunity. Take pre-D-model 310s and subject them to an array of modifications that would transform their aesthetics, performance, interior appointments, and overall capabilities to such a degree that they would match or exceed those of a brand-new C-310D. He'd sell them as conversion-completed aircraft, or existing owners could have their early 310 converted.

As with his previous projects, Riley was an all-in sort of guy. His team's list of design modifications grew long and complex. Just as they had with the A-model Twin Navion, the FAA grew uncomfortable with such extensive modifications being approved solely via the STC process. Again, Riley agreed to subject his work to independent certification standards and have the resulting aircraft certified as a separate type. That type would be the Riley 65. He was placing full-page ads in aviation magazines as early as 1960 to market the new twin.

Riley's Pre-Rockets

The Riley 65 is a type few remember today, and hard data is difficult to scrounge up on it. It seems only around 60 were manufactured. Because each was highly customized, no two were exactly alike, making each one unique in its own right. Today, many aircraft continue to fly with the Riley name on them. "Riley Rocket" is a fairly well-known moniker Riley

applied to many types for which he eventually certified performance enhancement packages. The Riley 65 is not, however, a Riley Rocket. Rather, it was the launching pad that supported all of Riley's future Rocket programs.

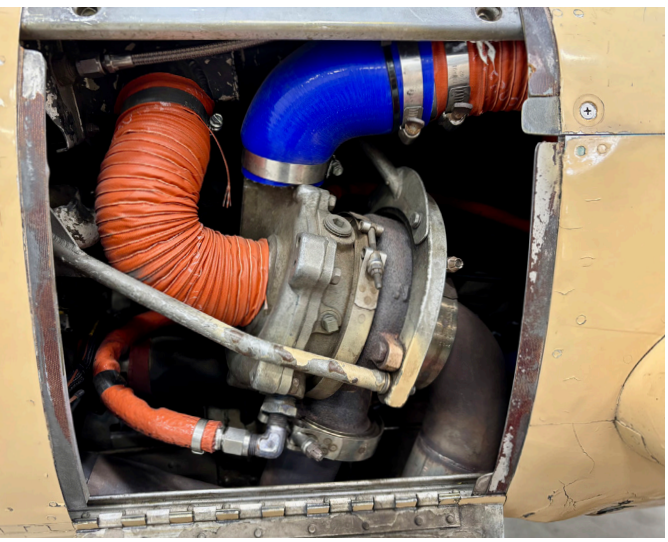
Any Straight-310, 310B, or 310C could be transformed into a Riley 65. The buyer could specify one of two engine choices: the original O-470-M (240hp) or the fuel-injected IO-470-D (260hp). Sticking with the original engine, along with Riley's speed mods, would make these older 310s perform like a D-model. Choosing the 260hp engine (same as on the factory D-models) bought performance that not only exceeded the D, but also exceeded the future E and F-models. By 1962, adding a manual wastegate Rajay turbocharging system became an option, as well. Later, a "Super 65" was offered with the 290hp IO-540s. That would be the aircraft that led directly to the development of the first Riley Rocket. Semantics aside, the engines were only the tip of the iceberg.

Outside, the 65 received a one-piece windshield (void of the center post). Additionally, third side windows were added to the fuselage. The windshield and all windows were double the thickness of the originals. The over-wing, augmenter-tube exhaust systems were converted to faired, under-wing exhaust stacks. These changes, along with significant improvements to the noise insulation, lowered cabin noise levels

to a more tolerable roar. Later in the program, the vertical tail could also be exchanged for the swept version introduced on the 310D. Although, before that option was introduced, many Riley 65s were built retaining their straight tail.

The under-wing exhaust also allowed the upper nacelle to be reshaped into a more aerodynamic design. This was done via the addition of a perfectly streamlined, 20-gallon fiberglass nacelle fuel tank (bringing total capacity up to 140 gallons, to feed the thirstier engines). Finally, a resin and epoxy coating was applied to the wings, the cowlings, nacelles, and fuselage. The coating covered rivets, screw heads, and panel joints, dramatically lowering parasite drag (resembling the smooth composite construction commonly used in aircraft today). Riley called it "Bond-Tite Aerodynamic Surface Smoothing."

Internal structures were strengthened throughout to support the higher performance and boosted gross weight (from 4,600 to 4,830 lbs.) allowed by the increased horsepower. Up front, the 65 was upgraded to a one-piece shock-mounted panel with the flight instruments arranged in an "Airline-T" configuration for IFR operations. The best avionics the early-1960s had to offer were installed, too. The yokes were modified to remove the upper crossbar for better visibility of the panel's new goodies. The rear seat bench was exchanged for two bucket seats. The hatrack was removed, the cabin was extended aft, and an additional bulkhead was added, where an additional bucket seat was added in a third row (adjacent to the new third side windows). A later option was a side-facing couch that could be converted to a rear bench seat in minutes. Finally, a built-in oxygen system was added.



Saving a "Barn" Find

In 1956, Cessna completed its second full year of Model 310 production. Serial #35281 was one of 228 Straight-310s manufactured that year. Registered as N310S, it was initially purchased by Florida Power & Light Co. It was re-certified as a Riley 65 in August 1964, using the 260hp IO-470-D engine option. Since Riley re-used Cessna's serial numbers, it's not known exactly where in the list of 65s this airframe falls, but it is clear that it was a later one, based on the dates of the paperwork filed and the fact that it incorporated both the swept vertical tail and turbocharging options. For the next 35 years, it changed hands many times, but remained active. It was exported to Canada in 1968, where it flew through the mid-'80s. Upon returning to the U.S. in 1987, it remained active (as N310LB).

Then, there was a belly landing in the late 1990s (whether that was purely accidental or the result of a gear malfunction is unknown). Thereafter, the engines and belly skins were repaired, and the 2-bladed props were replaced with new 3-bladed units.

While the plane flew again, it never really returned to an "active" status and slowly got surrounded and buried by other vehicles and equipment sharing its hangar space.

Ken Schmick entered the picture in 2022. As owner of Sierra Aviation, he focuses on buying, improving, and reselling all vintages of Cessna's 182 Skylane. His recently constructed hangar at the Fond du Lac, WI airport (KFLD) is bristling with Skylane airframes, wings, and parts. A twin Cessna was not really on his radar, nor was a multi-engine rating on his pilot certificate. Nonetheless, an online ad from the nearby East Troy, WI airport (57C) caught his eye. An attractive deal was struck for a Riley 65, having languished in a hangar there for almost a quarter-century. Ken had the mechanical abilities to tackle the technical challenges, and the seller just wanted it to be saved before it was too late.

As is so often the case, the project was not one for the faint of heart. Once it was freed from its tin prison and inspected more closely, the punch list of necessary projects grew quite long. The good news, however, was that no serious corrosion was found. The obvious priorities were to put the long-dormant major mechanical systems back into good working order. Many instruments were missing or in need of overhaul. Most of the avionics had aged into their paperweight stage. Thus, Ken soon decided a total panel makeover was also in order. Of course, this allowed him to install equipment that would have been the stuff of science fiction when Riley remanufactured the plane in 1964. This, in turn, stripped significant weight, as heavy analog equipment and gyros were replaced by digital units.

In the meantime, Schmick was pursuing his multi-engine rating in a rented 310 so he would be both safe and legal to fly the Riley when the time came. The plane's registration had expired during its inactive years, and its N-number had been reassigned to another aircraft. So, it was re-christened N115CK. Finally, the interior (which had been stripped from the plane years before) was reinstalled. Slowly but surely, Schmick crossed items off his list, and in 2024, nearly two decades since her props had last spun, #35281 flew again.

Giddy Up!

When an airframe is 71 years old and displays plenty of cosmetic signs of its age, one doesn't necessarily expect stellar performance from it. Yet, the aircraft leapt into the air before I'd even pushed the throttles fully open. The climb from 1,000' to 8,500' MSL (while operating normally aspirated only) might not have qualified as exhilarating, but it was impressive nonetheless. In climb, the throttles were adjusted to maintain 25-squared until they'd returned to their wide-open takeoff position. By level-off, wide open throttle was generating a predictable 22.0" of Manifold Pressure (MAP). While accelerating, I rolled in nose-down trim and soon found near hands-off equilibrium. Then, I reached down to the bottom of the throttle

quadrant, where the wastegate controls for the Riley-added Rajay turbochargers are located. Pushing each control full forward, the wastegates closed fully, MAP jumped back to sea-level values, and the septuagenarian Cessna was off to the races.

The Rajays are the most significant change incorporated into the 65, systems-wise. While their manual wastegates are antiquated by today's standards, they were game-changing technology for general aviation pilots of the 1960s. Today, we would be more likely to refer to the Rajays as "turbo-normalizers," because they were not designed to push MAP beyond what could be achieved at sea level. Instead, they are meant to boost MAP back towards (but not above) sea-level pressure while at cruise altitude and/or in the higher stages of climb. But they have limitations. First, they should not be used below 5,000-6,000 feet, where the risk of over-boosting the engine is too high. Second, they should not be used unless the throttles are wide-open, allowing the engines to accept the extra intake air they supply without over-boosting. They are running whenever the engine is running. However, all their air supply is dumped overboard through the normally open wastegates. Great care must be taken by the pilot when modulating the turbo air supply between zero and full, as there is no accurate way of knowing what percentage of opened/closed the wastegates are. Balancing one with the other can be challenging, too. For those reasons, many pilots choose to use them as an all-or-nothing system, waiting until it is safe to close the wastegates fully in one motion and re-opening them fully again when their MAP boost is no longer required.

Using that methodology, the Rajays are simple to use. Climb at normal climb power (25-squared for most operations in the Riley 65) until the throttles have been pushed to wide-open to maintain 25" MAP. From there, allow MAP to drop naturally in the climb (roughly 1" per additional thousand feet of climb), until they've fallen several more inches. At that point, the wastegates can begin to be closed, which will provide an immediate MAP boost. In climb, this will allow an increased climb rate at the same airspeed, or a greater forward speed at the same climb rate. In cruise, it will translate into increased cruise speed. But that cruise speed will be slightly better than if the plane were simply cruising at a lower altitude where such power is naturally available, because it will be cruising in higher/thinner air, which will provide a slight true airspeed (TAS) advantage too.

In descent, the wastegates can remain closed only if the descent rate is

The author and Ken next to the Riley

shallow enough to allow the throttles to remain wide open. Once indicated airspeed (IAS) and/or turbulence necessitate a power reduction, the simplest way to avoid accidentally over-boosting the engines is to open the wastegates first (which will reduce MAP 8 to 10 inches, as the engines return to a normally-aspirated state). Thereafter, the throttles can be safely reduced, on whatever schedule the pilot chooses, to control IAS, rate of descent, and manage engine cooling rates.

During our cruise speed tests, we consistently achieved at or slightly above 200 KTAS (230 MPH) with density altitudes in the 13,000-foot range. This was while running approximately 27" MAP/2400 RPM and burning around 19 GPH per engine. Those speeds are right at Riley's advertised cruise speed for the 260hp version of the 65. Those performance numbers put the Riley 65 on par with D, E, & F-model 310s. Rajay literature says to expect about 240 MPH at that altitude using their current turbos (in new condition, of course).

There is definitely more speed to be had from N115CK. First, Schmick knows his gear doors are not yet perfectly rigged in their closed position. Second, there is much more tweaking to be done to ensure the turbos are functioning perfectly and providing maximum and equal boost to the IO-470s. Finally, the drag-reducing coating applied by Riley is showing its age in many areas. Chunks have broken away on the nacelles and upper fuselage, leaving areas of the aircraft skin exposed around jagged edges of the remaining coating. In other areas, the coating had to be chipped away intentionally to expose screw heads for maintenance work (such as around the windshield, which Schmick replaced during his early restoration work). Schmick's long-term plan is to repair all the missing, chipped, and cracked speed coating before fully repainting the aircraft. In doing so, appreciable speed gains seem almost certain, which will likely have him easily exceeding the 230 MPH TAS that Riley claimed (at optimum altitude and best-power settings), and matching or exceeding what Rajay claims 260hp 310s with their turbos are capable of.

Single-engine work in the Riley 65 proved quite anticlimactic. Even while operating at 7,500 feet MSL, the 65 was able to maintain level flight above Vyse with the critical engine at zero-thrust and the operating engine slightly below normally aspirated full power. The boost in single-engine performance (both in speed and single-engine service ceiling) was a big selling point to Riley, who claimed a single-engine service ceiling of 10,000 feet (normally aspirated) and 20,000' (with max turbo boost). In many ads and sales brochures of the era, Riley boasted, "The Riley 65 can fly faster on one engine than Piper's Apache can on two."

The Future of Ole #35281

Schmick's unique twin is very much an ongoing labor of love. Future

projects include the restoration of the Riley speed coating and the exterior aesthetics. Though he hasn't decided on final colors, he does plan to retain the current paint scheme, as it is the standard scheme Riley applied to all the 65s. A new interior is on the wish list too, but is prioritized fairly low for the time being (as the current interior -installed by Riley- is functional, even though it might be a little dated and worse for wear in areas). However, Schmick is content to complete those projects in good time, while keeping the aircraft flyable as much as feasible throughout the process. There is little doubt that the Riley will need a steady stream of ongoing maintenance to keep it reliably airworthy. Such is the case with any aging aircraft.

The best part is that this rare machine is a hangar queen no more. It has become a working airplane again and is being used on missions to support Schmick's C-182 business and the occasional family junket, too. For example, as this article was being prepared, Schmick flew N115CK from his home just south of aviation's Mecca in Oshkosh, WI, to the L.A. basin and back. Not too bad for a twice-manufactured twin, almost twice the age of the new owner who brought it back to life. Somewhere in the universe, Jack Riley, Sr., is smiling...and probably disappointed he didn't change just one more thing to make it even faster. T&T

Matthew McDaniel *is a Master & Gold Seal CFII, ATP, MEI, AGI, & IGI, and Platinum CSIP. In 36 years of flying, he has logged nearly 23,000 hours total and over 6,000 hours of instruction given. As owner of Progressive Aviation Services, LLC (www.progaviation.com), he has specialized in Technically Advanced Aircraft and Glass Cockpit instruction since 2001. Currently, he is a Boeing 737-series Captain for an international airline, holds 8 turbine aircraft type ratings, and has flown over 150 aircraft types. Matt is one of fewer than 15 instructors in the world to have earned the Master CFI designation for 11 consecutive two-year terms. He can be reached at: matt@progaviation.com or 414-339-4990.*