Pipistrel Panthera

February 4, 2016

“Four seats, 200 knots and 1,000 nm.” These were the magic numbers CEO Ivo Boscarol set as a challenge for the collective minds of Pipistrel’s research department one morning in 2007. Faster, farther and−yes−cheaper: a huge challenge for an ultralight manufacturer. It was left to the brilliant Tine Tomazic, a young engineer who was just 24 at the time, and his small team of five to transform the dream into a reality. The house philosophy was to “design an aircraft that performs with the necessary power to fly at the lowest possible price,” a mantra that must have been deeply ingrained in the engineers’ thinking, because the result is sublime. With the Panthera, Pipistrel has created the first of a new generation of aircraft capable of succeeding the very best of the classic four-seaters.

Pipistrel engineers launched into the effort with a full armory of modernity at their disposal: carbon fiber, Kevlar and titanium, CAD and 3D printing on machines that work to better-than-millimeter precision, not to mention glass-cockpit instrumentation and more.

The Panthera is a true four-place cross-country aircraft. Once its engine search is completed, we'll know what its top end will be, but best guesses for it equipped with a Lycoming IO-540 are in the 185-200 knot range.

Chasing Knots

Less than two years after the official announcement of the aircraft at AERO Friedrichshafen—and 11 months to the day after its first flight at the hands of Mirko Anzel and Saso Knez—I arrived in Slovenia in the vicinity of Pipistrel's factory with my test-pilot friend Christian Briand. We have the honor of being the first journalists to be invited to fly the Panthera. The emotions are stirred at the first sight of the new aircraft. In the tradition of the greatest single-engine transportation airplanes, Bonanzas and Mooneys, the Panthera is a low-wing airplane (though carbon-fiber and not a sheet-metal) single-engine, retractable-gear model). From the spinner back, its rakish lines stir some deep predatory instinct in a pilot. The aesthetic, in all its modern form and finesse, is stunning.

The aircraft is bigger than I'd thought—but smaller than a Cirrus—and right from the start, I see that the build quality is striking: There's not a single bump or ripple in the doors, nor in the access covers. The trailing edges of the ailerons and the flaps are dead straight, immaculate—and not one bit of it looks fragile. The whole thing bears the aerodynamic signature of all Pipistrel's aircraft, and with such racy lines, the Panthera wouldn't look out of place on the start line at Reno.

The cowling—an aerodynamic jewel—has a reflex curvature unique in light aircraft, its line blending into the steeply raked curve of the racer-style screen/canopy. The cooling intakes, looking like two narrow slots, are fairly small, and optimized for reducing drag, while staying in keeping with the generally aggressive look. The ultimate refinement—a profiled strobe/navigation light assembly designed especially for Pipistrel—is integrated in the leading edge of the wingtips. Clever! The intention to wring out every last knot is apparent. Pipistrel's engineers have LoPresti blood flowing in their veins. The Panthera's tricycle gear—in this case an electrically operated retractable one—low wing and T-tail are features typical of Pipistrel aircraft. Access is via steps on each side, situated close to the trailing edges. (These will be made retractable for production aircraft.) Three large gull-wing doors provide entry to the cabin, rear-seat passengers being invited to enter or exit over the port side. Here comes the first big surprise: The volume of the cabin is very generous and certainly comparable to the Cirrus SR22. Somehow, once you're inside of it, the aircraft appears bigger inside than it does from the outside. Nor do you have to assume the laid-back position the aircraft's profile would suggest: with 1.25 meters at shoulder level —and more still at hip level—the cabin isn't only very wide, but has plenty of headroom to boot.

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It's also stylish and comfortable. The leather seats are nicely shaped and enveloping, giving a luxury limousine feel. A central screen pillar splits the horizon into two windows, offering a cinematic panorama. The geometry allows the pilot a sightline that angles down at eight degrees—just enough, in practice.

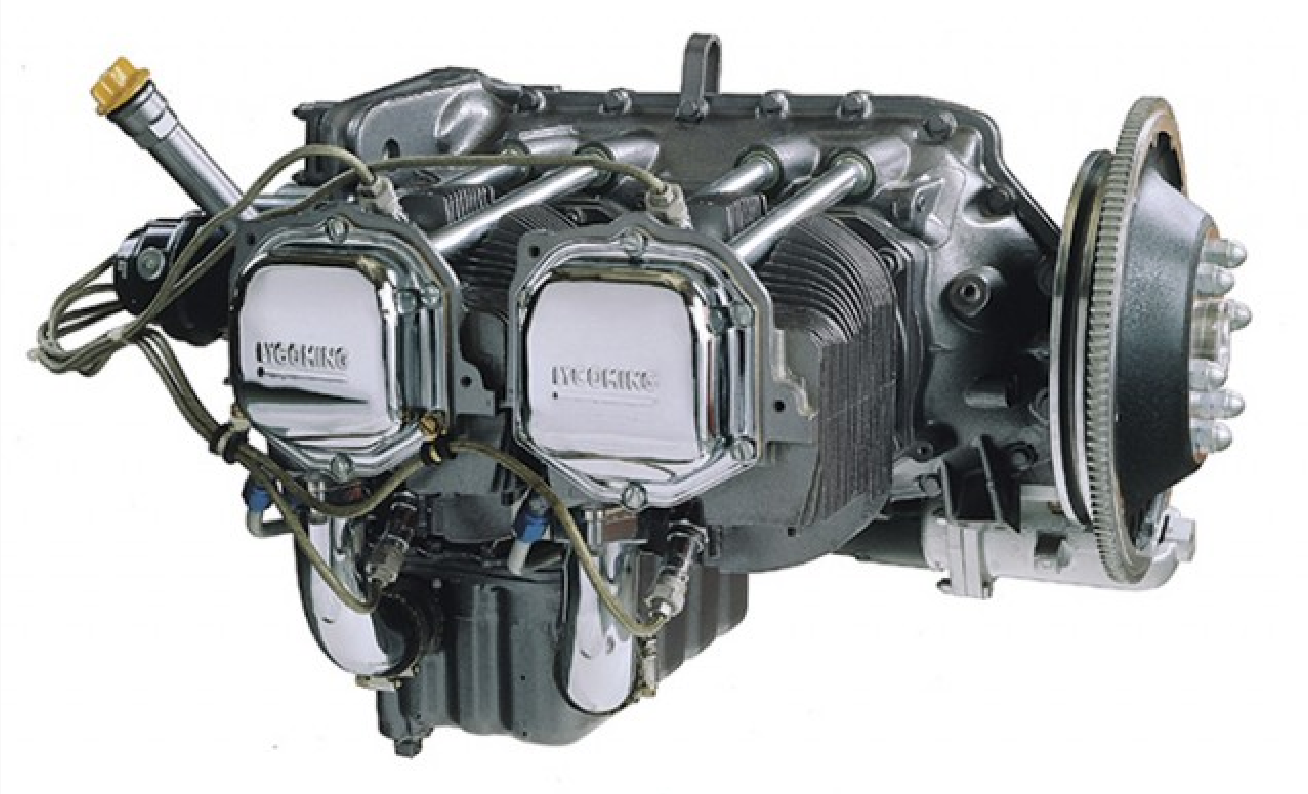
In the rear, the passenger seats are slightly raised, making it easy to communicate with the pilot. The only thing missing here is a central armrest. The structure of the egg-shaped cabin unit is crash resistant, tested to 26g and made from Kevlar—a material safer than carbon in the event of an impact. The seats are adjustable fore and aft. The flight controls fall nicely to hand: a joystick for PIC's left hand and three engine levers (throttle, pitch and mixture) perfectly arranged on the long central console.

While not the production configuration, the panel in the prototype is superb, easy on the eyes, symmetrical and functional, with two large Dynon Skyview screens and a central column consisting of a Garmin 750 multifunction navigator and a Garmin 635 for communications, both being touch-screen devices. A further addition is promised for the final version, but Pipistrel has sworn everyone to secrecy on the subject.

As on many not-yet-certificated aircraft, the panel of the Panthera is a work in progress. There's plenty of real estate for a variety of possible solutions. The trailing link gear, nose and main help soften arrivals. The seating is more sports car than sedan, but comfortable and supportive. The legacy three-lever power constellation resides in the center console. The rear seats look tight, but are surprisingly comfortable.

At the bottom of the stack, a further multi-function screen of Pipistrel's own design displays trim position, interior and exterior temperatures, and air conditioning settings. The bizjet appearance is reinforced by backlit LED switches, the sculpted shape of the panel and two sets of alarm annunciators, placed airliner-style above the Skyview screens. Mounted centrally, just under the glare shield, mechanical ASI, AI and altimeter serve as backup. The way everything has been made so simple, the purity of line and functionality suggests that Pipistrel designers also have Steve Jobs' blood in their veins.

Perhaps the biggest design consideration of any powered aircraft is the engine, and Pipistrel from the start conceived the Panthera as being somewhat engine agnostic. Tine conceived an aircraft could accommodate many types of "power eggs"—piston, electric, hybrid and turbine units—all of which would meet up with the firewall without requiring major surgery. When the project started, Pipistrel's engineers were thinking of a 2+2. Then their thoughts turned to a full four-seater built around the six- cylinder 220/330hp Rotax that was then undergoing tests. This unit promised low fuel consumption on mogas and reduced weight in comparison to the existing American aero engines. However, for financial and strategic reasons, Rotax abandoned the project, forcing the engineers at Pipistrel to rethink. In 2009, they settled on the relatively modern 210 hp Lycoming IO-390. Lycoming promised to modify and certify this engine with "iE-2" (Electronic Fuel Injected FADEC), allowing it to run on mogas. But at the start of 2014, Lycoming announced that it was abandoning the project, obliging Pipistrel to plan for certification with the 260 hp Lycoming IO-540, a dinosaur of an engine but bullet-proof—and capable of using motor fuel. Nevertheless, if there's sufficient demand from clients, Pipistrel will propose an IO-390 STC.



Lycoming IO-390

Flying The Panthera

Beanie hat-wearing, bearded, blond Saso Knez is Panthera's test pilot. Every inch the kind of laid-back dude you'd expect to encounter in a Silicon Valley start-up, his personal look reflects the dynamism of the young team at Pipistrel. In this company, they place confidence in youth—and it's working. One example of their fresh thinking: The safety pin of the airframe parachute is integral with the ignition key—a brilliant yet simple way of making sure that if you don't have the pin, you can't start the engine.

While the prototype that we're flying is equipped with a 210 hp IO-390, it has logged over 92 hours and will at least allow us to evaluate all but the top end of the flight envelope and extrapolate the performance with the production engine, which puts out 50 hp more. With the seats adjusted, we speed through the familiar Lycoming start-up procedure and release the parking brake. The ground ride is smooth, thanks mainly to a well-balanced undercarriage and the pneumatic suspension. The bottom-hinged rudder pedals are nice to use and the toe-operated Beringer brakes are effective. Running through the traditional engine checks and pre-takeoff checklist, we set the flaps to 15°. While at ground level, the windsock hangs limply, at 2,000 feet, the reported windspeed is 10-15/200. Outside, the temperature is 14º C. There are three of us on board and our weight, along with full fuel, comes to a little more than 2,400 pounds, against an MTOW of just under 2,650 pounds.

The grass runway hasn't been rolled, and recent rains have left it very slippery. Run up 2,660 rpm against the brakes, and we're off. The soft runway makes for slow acceleration, holding on right rudder to keep straight. It takes 20 seconds to reach 55 knots, the book rotation speed. The aircraft leaves the ground at around 60 knots, after we've used up less than 1,500 feet of runway. VSI indicating positive rate of climb, undercarriage up, we settle at 80 knots for the initial climb. Maintaining direction is easy. Accelerating to 105 knots with the flaps coming up, the VSI settles to 1,100f pm in a stable climb.

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From the start, good aileron feel and response are apparent. Professor Gregor Veble, the group's aerodynamicist, has clearly done some great work on the flight controls as he hasn't had to resort to spring loading or any other artificial devices: The pilot can feel the airflow directly through the yoke. What's more, the longitudinal stability is good, the aircraft settling back nicely after any disturbance to trim speed. This panther already feels like an easy beast to tame. Engine cooling appears to be fine, temperature settling to 209° C on the hottest cylinder and 165° C on the coolest. We level off at 2,500 feet for an initial look at maximum level speed, making two runs up and down the same line to minimize the effects of wind. In an OAT of 11° C, full throttle—27.5 inches of manifold pressure, 2,700 rpm—gives an average true air speed (TAS) of 183 knots, and a ground speed (GS) of 180. Reducing power to 75% (26in/2,500rpm) gives 168 knots TAS and 165 knots GS. The Panthera is fast, but doesn't yet attain the magic speed dreamed of seven years ago. With the IO-540, it'll surely get closer. With the extra 50 hp on tap, we'd estimate an improvement in performance of 8%, which should nudge the production version of the aircraft up to 195-200 knots. At normal cruising speed, the consumption of the production model will be the same as that of 210 hp prototype: 12 gph, although the pilot can use auto fuel and thus save dozens of dollars per hour in flight. However, exploiting the full 260 hp will raise consumption by between 2 and 4 gph. On the other hand, the IO-540 will raise the maximum cruise level without requiring the complexity of a turbocharger, allow a 65-pound increase in useful load and push the maximum all-up weight to nearly 2,900 pounds. Projected operating cost should only be three percent higher, according to Pipistrel. In comparison to the renowned, classic four-seaters in the same class—the Mooney M20K (210hp) and the Bonanza P35 (260hp)—the Panthera is a very light machine. In effect, the Bonanza P35 is 700 pounds heavier, the M20K 340 pounds heavier—and the contemporary Cirrus SR22 is 700 pounds heavier. In terms of cruise speed, even with the prototype's IO-390, the Panthera travels 15 knots faster than the Mooney and the Bonanza, and flies as fast as the Cirrus, which is powered by an engine producing 100 more horsepower.

While it's being tested at an airport with just a grass-strip, the Panthera is a transportation airplane. That said, the beefy trailing link gear doesn't complain about the bumps much.

Pussycat

In terms of handling, the Panthera approaches perfection. It requires five to six pounds of force on the yoke to pull 2g. Visibility is good, even in the bank. In turning right—the worst case for the left-seated PIC—the central pillar isn't obtrusive, and there's no need to bank beyond 30° to see into the turn. We climb to 7,500 feet seeking less-turbulent conditions for a further test for maximum level speed. At this altitude, full throttle gives 75% power (23.5 inches and 2,700rpm, with the mixture leaned to 12 gph) and we see 177kt TAS and 176kt GS−a very good performance, considering the available power. Ivo Boscarol's magic number may not be achieved with 210 hp, but they'll be flirting with 195 to 200 knots when the Panthera is fitted with an IO-540.

At 7,500 feet, we're comfortably placed for exploring the low-speed end of the flight envelope, flying over the mountainous landscape of Slovenia as we are. First we slow, steadily reducing power, to test the lowest trim speed (85 knots) before essaying a series of stalls. First in clean configuration: buffeting appears close to the stall break, which occurs at 58 knots. There's no tendency to pitch down or drop a wing. The ailerons give perfect control throughout. This kind of benign behavior in the stall is remarkable for an aircraft of this category.

The panel has been shaped to serve as a visual reference for the pilot: The level top of the central facet lines up with the horizon for cruising, while sloping top edges to the sides, inclined at 20°, provide a horizon reference when turning.

At 3,000 feet, we simulate a go-around: with flaps at 45º and undercarriage down, full throttle is applied. Pitching 7 degrees nose-up pegs the ASI at 75 knots, the VSI showing 350 fpm. Retracting the gear and flaps, we accelerate to 80 knots, the VSI rising quickly to 900ft/min—that's a bit more like it!

Saso, Pipistrel's test pilot, gave us one more interesting demonstration. Starting in level flight with just enough power set to maintain 100 knots, the flaps and gear were retracted. Without touching the throttle setting (20in/2,700rpm) and while maintaining altitude, the aircraft began to accelerate. After one minute and 30 seconds, the speed rose up to 135 knots. Gaining 35 knots simply by retracting flaps and gear shows slippery is the basic airframe. The Panthera really is a very pure aerodynamic design.

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After the air work, we returned to base for a series of landings. We join downwind at 110 knots. Lowering the gear, we set the flaps to 15º. Maintaining 90 knots in this configuration requires about 20 inches of manifold pressure. Descending on base leg at 90 knots drops this to 15 inches. On final, the Panthera settles into an 80-knot approach, with the flaps at 45º. The view of the runway over the nose is good, and the aircraft is generally very easy to manage. Crossing the threshold, we begin to round out. The aircraft can be positioned very precisely. Hold off neatly and the touchdown is soft, thanks in principal to the pneumatic undercarriage, which cushions our arrival very well. In fact, the Panthera carries out the mission for which it was conceived—fast travel with the advantage of being able to land on short grass runways—to perfection. Four passengers, fuel and baggage? No problem: with full tanks, there's 770 pounds of payload, (it will be around 840 pounds for the 260 hp version).

Panthera's Future
Then there's this. In the luggage compartment, a vertical tubular compartment encloses 67 pounds of airframe parachute standard equipment in the Panthera. Significantly, the Panthera will be delivered with full options and the price will include a customizable interior (seat color) and exterior paint. The final price is estimated at around $480,000 and certification is anticipated in 2017. We're a long way still from Pantheras filling the skies—the airplane has yet to be certificated or to have entered serial production. Yet despite a serendipitous engine selection phase, the Panthera has achieved to date some remarkable performance figures with promises of more to come. Stay tuned.

Pipistrel: The Most Remarkable Aircraft Manufacturer You've Never Heard Of

By Robert Goyer

It's one of the unlikeliest stories in aviation, the rise of a company called Pipistrel from Slovenia to international recognition as one of the leaders in pushing the state of the art in light GA design, but there you have it. The name Pipistrel means "bat," and the story is told that in the early days of the company (the late 1980s), founder Ivo Boscarol had to fly his ultralight designs at night to avoid detection by the then-communist regime that frowned on personal flying for so many different reasons. So Boscarol's airplanes were like bats, taking the skies only at night. Insert vampire joke here. The more instructive part of the story is that with limited resources Pipistrel focused from day one on efficiency. How could they do the most with a design at a given weight and cost and fuel consumption? As it turned out, Boscarol has answers to that eternal aviation question. His airplanes have won a number of the most prestigious awards in the world for efficiency, including twice taking home the top prize in the CAFE/NASA/Google Green Flight Challenge with the model unfortunately known as the Virus—it has a stablemate known as the Sinus. Branding, people! Regardless of nomenclature, the airplanes combine whisper-slick construction with brilliant aerodynamics to create some of the most economical platforms in the sky. The Panthera, as discussed in the main article, is that incredibly advanced and efficient airframe in search of an equally advanced powerplant. Boscarol was hoping for a hybrid solution, then an advanced ignition piston design before settling for a legacy Lycoming six-banger. It's ironic that arguably the most advanced gas-piston aircraft engine in the world—the 912is—is made by Rotax, the same company that made the primitive two-cycle engines that powered the first Pipistrels in the dark of night.

Specifications

PLANE & PILOT
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Pipistrel Panthera

Story And Photos By Jean-Marie Urlacher

The **Pipistrel Panthera** we flew for this report is a factory prototype outfitted with an Experimental Lycoming IO-390 four-cylinder engine of 210 hp. The to-be-certified Panthera will likely be equipped with a six-cylinder 260 hp Lycoming IO-540, so these specifications are only preliminary.

SPECIFICATIONS

Projected base price: $470,000
Engine: Lycoming IO-390
Seats: 4
Horsepower: 210
Empty Weight (lbs.): 1525
Useful Load (lbs.): 1120
Max Takeoff Weight (lbs.): 2645
Fuel Capacity (gals.): 58
Wingspan (ft.): 36
Length (ft.): 26
Height (ft.): 6.2
Cabin Width (in.): 43.3
Cabin Height (in.): 45 inches
Takeoff Ground Roll (ft.): 1200
Over 50-Foot Obstacle: 2200 ft
Climb Rate (fpm): 1,100 ft/min
Max Cruise Speed: 185 KIAS
Max Operating Altitude (ft.): 20,000
Stall Speed, With Flaps: 60 KIADdd
Landing 50-Ft. Obstacle (ft.): 1,870