The Panther shows its claws

With handling and performance to match its stunning looks, the Pipistrel Panthera combines sailplane-like aerodynamic purity with luxury car comfort and bizjet-level avionics

Words & photos *Christian Briand & Jean-Marie Urlacher*

Four seats, 200 knots and 1,000nm: 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. Go faster and further, and – yes – *do it for less money too:* 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 'design an aircraft that performs with the minimum necessary power' – a mantra that must have been deeply ingrained in the engineers' thinking, because the result is sublime: the creation of a new generation of aircraft capable of succeeding the very best of the classic four-seaters.

To replace the Mooney M20J/M20K or Beech Bonanza would have been ambitious enough, but to outperform these iconic aircraft, Tine and his team have used the full armoury of modernity at their disposal: carbon fibre, Kevlar and titanium, CAD and 3D printing on machines that work to better than millimetre precison, glass-cockpit instrumentation… and complete freedo of the imagination.

But has Pipistrel gone one step further and succeeded in producing a 'Cirrus killer'? It is hard to think they haven't...

Main image: quite literally finger-tip control, as Christian holds a turn – and makes notes

Top right: Pipistrel has set the stand-by flight instruments in prime position for easy reference, between banks of airliner-style annunciator lights. The rudder pedals are split horizontally, their upper sections operating the wheel brakes

Clockwise from right: rear-seat passengers gain access to the cabin by a single gull-wing door on the port side (those in the pilot seats enjoy a door each); the quality of the seats and general level of interior trim – including the stitched leather stick grip on the starboard side – is to luxury sports car standards; we rate the ergonomics as well – to avoid confusion, the throttle, propeller and mixture levers are very differently shaped; and the whole cabin is protected by a Kevlar-reinforced safety cell (orange sections in CG the perspective)

Chasing knots

Adjvocina, 4 March 2014. Less than two years after the official announcement of the aircraft at AERO Friedrichshafen – and eleven months to the day after its maiden flight at the hands of Mirko Anzel and Saso Knez – we arrive in Slovenia in the vicinity of Pipistrel's factory. We have the honour of being the first journalists to be invited to fly the Panthera.

One's emotions are stirred on first sight of the new aircraft. 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 imposing – but less so than a Cirrus – and 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 less than robust. The whole thing bears the aerodynamic signature of all Pipistrel's aircraft and, with such racy lines, the Panthera would not look out of place on the start line at Reno.

These remarkable elements drew our attention in particular. The cowling – an aerodynamic jewel – has a reflex top profile 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 optimised for reducing drag, while staying in keeping with the generally aggressive look. The ram air intake is positioned in the area of maximum propeller wash in order to benefit from the dynamic pressure. It is divided into three sections: engine air in the centre and supplies of hot and cold air for the cabin on either side. The cooling outlets are just as ingenious. Moulded as hollows on either side of the forward fuselage, they are set in the right position to generate an aerodynamic depression that extracts the cooling air. They are very efficient, as we discover when flying.

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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 undercarriage – 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. And here's the first big surprise: the volume of the cabin is very generous, and certainly comparable to the Cirrus.

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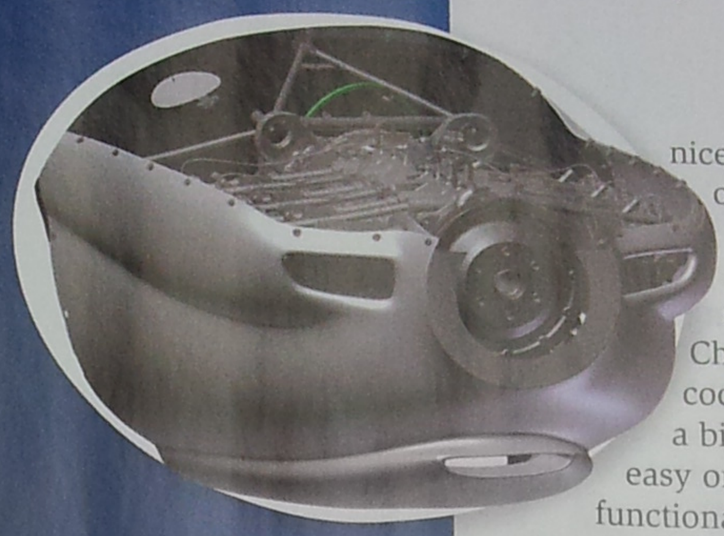

nicely laid out, in the manner of a luxury car.

With the master and avionics on, numerous screens light up like a Christmas tree. Now the cockpit feels more like that of a bizjet. The 'glass' is superb – easy on the eye, symmetrical and functional, it comprises two large Dynon Skyview screens and a central column consisting of a Garmin 750 for navigation 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. Anybody want to put their money on the G3X?

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 glareshield, mechanical ASI, AI and altimeter serve as back-up. The way everything his been made so simple, the purity of line and functionality, suggests that Pipistrel designers also have Steve Job's blood in their veins.

The 'wow' effect!

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 Pipistrel's youthful engineering team. In this company they place confidence in youth – and it is working. One example of their fresh thinking: the safety pin of the airframe parachute is integral with the ignition key. This is a brilliant yet simple way of making sure that if you've left the pin behind, you cannot start the engine.

The choice of this engine goes to the heart of the Panthera story. Tine conceived an aircraft that could accommodate many types of 'power egg' – piston, electric, hybrid and turbine units – all of which would mate 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

Top, inset: more power! Planned installation for the six-cylinder IO-540, which offers another fifty horsepower

Above & right: exquisite aerodynamic design detail extends all the way out to the wingtips

Somehow, the aircraft appears bigger inside than on the outside. Nor do you have to assume the laid-back position the aircraft's profile would suggest: with 1.25m at shoulder level – and more still at hip level – the cabin is not only very wide, but very well lit. The leather seats are nicely shaped and enveloping, giving a luxury limousine feel. A rather wide 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 those in front. 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, the joystick in PIC's left hand and the three engine levers (throttle, pitch and mixture) perfectly arranged on the long central console. It is only towards the back of this, at wrist level, that the trim control and fuel selector are not ideally placed: they will be moved in the production aircraft, the fuel selector perhaps being sunk into the central armrest. In all other respects everything is

Complex gear is a snug fit in the wing. Trailing-link geometry makes for smooth ground handling

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 210hp 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 260hp Lycoming IO-540, a heavy dinosaur of an engine but bullet-proof – and capable of using motor fuel. Nevertheless, if there is sufficient demand from clients, Pipistrel will propose an IO-390 STC.

A testing grass runway!

While the prototype we're flying is equipped with a 210hp IO-390 rather than the designated IO-540, 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 50hp 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°. Whilst at ground-level the windsock hangs limply, at 2,000ft the reported windspeed is 200/10-15. Outside temperature is 14°C. There are three of us on board and – along with full fuel – our weight comes to 1,092kg, against a MTOW of 1,200. The grass runway has not been rolled, and recent rains have left it very greasy.

Run up 2,660rpm against the brakes and we're off. The soft runway makes for slow acceleration, holding on right rudder to keep straight. It takes twenty seconds to reach 55kt, the book rotation speed. The aircraft leaves the ground at around 60, after we have used up 400m of runway. VSI indicating positive rate of climb, undercarriage up, we settle at 80kt for the initial climb. Maintaining direction is easy. Accelerating to 105kt with the flaps coming up, the VSI settles to 1,100fpm in a stable climb.

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 has not had to resort to spring loading or any other artificial devices: the pilot can feel the airflow directly through the stick. 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 minimise the effects of wind. In an OAT of 11°C, full throttle – 27.5 inches of manifold pressure, 2,700rpm – gives an average true air speed (TAS) of 183kt against an average GPS ground speed (GS) of 180. Reducing power to 75% (26in/2,500rpm) gives 168kt TAS/165kt GS: the Panthera is fast, but does not attain the magic speed dreamed of seven years ago.

In terms of handling, it does approach perfection, requiring two to three kilograms force on the yoke to pull 2g. In turning right – the worst case for the left-seated PIC – the wide central pillar is not obtrusive and there is no need to bank beyond 30° to see into the turn.

We'll be flirting with 195 to 200 knots when the Panthera is fitted with the 260hp IO-540

A further speed test

We climb to FL75, seeking less turbulent conditions for a further test for maximum level speed. At the top of the climb, the hottest/coolest cylinder temperatures are 198°C/150°C, confirming that there is nothing wrong with the cooling – if anything, it's now looking like it might be a bit *too* efficient. At this altitude full throttle gives 75% power (23.5in and 2,700rpm, with the mixture leaned to 43 lit/h fuel flow) and we see 177kt TAS/176kt GS – a very good performance, considering the available power. Ivo Boscarol's magic number may not be achieved with 210hp, but there's no doubt that we'll be flirting with 195 to 200 knots when the Panthera is fitted with the 260hp IO-540.

At 7,500ft we are 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 (85kt) before essaying a series of stalls. First in clean configuration: buffeting appears close to the stall break, which occurs at 58kt. There is no tendency to pitch down or drop a wing. As the ailerons remain effective, one can afford to hold the stick back for a few seconds. The aircraft stays nose high and settles into a mushing descent, wallowing mildly. Recovery is quick as soon as the nose is lowered.

With flaps at 15° and gear down, the stall speed is the same, and the aircraft again mushes downwards, with effective aileron control throughout. With the gear down and flaps at 45°, the minimum trim speed drops to 80kt and the stall occurs at 55, again leading to a controlled, mushing descent in which the speed oscillates between 51 and 65 knots. The ailerons give perfect control throughout. This kind of benign behaviour in the stall is remarkable for an aircraft of this category.

Experimenting with side-slipping during the descent at 90kt clean and 75kt in landing configuration demonstrates that the aircraft is sound. We note one interesting aerodynamic phenomenon: when out-of-balance rudder equivalent to two ball widths to the left or right on the slip indicator is applied, a light vibration can be felt through the yoke and around the aircraft. This comes from the T-tail, which enters the prop stream in the side-slip. This phenomenon is useful, because it provides the pilot with a natural, tactile warning that the aircraft is out of balance: a useful feature, especially for flight in IFR conditions.

As it is, the Panthera would make an excellent IFR platform because its stability is so good, minimising pilot workload. For long flights, there is a two-axis autopilot integrated with Skyview, which has been shown to be very flexible to use. This unit automatically self-tests on the ground.

Descending at 200kt, the aircraft rides the turbulence in comfort. At 3,500ft, we investigate adverse yaw at 100kt, then at 85kt with flaps at 15°, and finally at 80kt with flaps 45°. With either full right or left aileron, the effect is very small.

Much of the wing is given over to the flaps. The ailerons, by contrast, are very small but they are very effective. Responsive around the neutral position, thanks to their laminar profile, they give a very precise response to rapid roll input: at ➔

PUTTING IT INTO PRODUCTION

With the extra 50hp on tap, we would estimate an improvement in performance of eight per cent, which should nudge the production version of the aircraft up to 195-200kt. At normal cruising speed, the consumption of the production model will be the same as that of 210hp prototype: 43 lit/hr, although the pilot can use mogas and thus save dozens of euros per hour in flight. However, exploiting the full 260hp will raise consumption by 10 to 15 lit/hr. On the other hand, the IO-540 will raise the maximum cruise level without requiring the complexity of a turbocharger, allow a 30kg increase in useful load and push the maximum all-up weight to 1,300kg. Projected operating cost should only be three per cent 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 319kg heavier, the M20K 154kg heavier – and the contemporary Cirrus SR22 is 319kg heavier. In terms of cruise speed, even with the prototype's IO-390, the Panthera travels fifteen knots faster than the Mooney and the Bonanza, and flies as fast as the Cirrus, which has 100hp more. These gaps in performance will be more significant still – and the overall advantage tip further in the Panthera's favour – once it is equipped with the IO-540.

However, while Pipistrel is close to achieving its objectives, the route to certification is long. The company will still need to fork out between seven and ten million euros, and it will take Pipistrel's twenty-strong engineering team three years to complete all the necessary paperwork, dedicating three airframes for flight tests, fatigue tests and crash testing – all to meet the standards of EASA's CS-23...

The other major problem that will face Pipistrel is that of manufacturing. It takes 5,500 man hours to construct a Panthera from A to Z, and this involves very skilled labour. Effective solutions will need to be found if delays in production are not to become problematic.

What about those alternative engines? The first flight of the hybrid version was heralded as coming by the end of 2015! It's not far off – and Ivo Boscarol is betting, moreover, that this version will be the best seller. As to the fully electric version; we'll have to wait a little longer.

135kt it takes less than two seconds to roll from 45° of bank in one direction to 45° in the other. 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 3,000ft we simulate a go-around: with flaps at 45° and undercarriage down, full throttle is applied. Pitching 7° nose-up pegs the ASI at 75kt, the VSI showing 350fpm. Pulling up the gear and flaps, we accelerate to 80kt, the VSI indicating 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 100kt, 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 thirty seconds, the speed rose up to 135kt. Gaining 35kt simply by retracting flaps and gear shows how slippery is the basic airframe. The Panthera really is a very pure aerodynamic design.

Built to millimetre precision

After the upper air work we returned to base for a series of landings. Downwind, the cylinder temperatures are indicating 168°C/139 °C despite flying for more than an hour. To bring those temperatures up a bit, the size of the air outlets will be reduced in future versions.

We join downwind at 110kt. Lowering the undercarriage, we set the flaps to 15°. Maintaining 90kt in this configuration requires about 20in of manifold pressure. Descending on base leg at 90kt drops this to fifteen inches. On final, the Panthera settles into an eighty knot approach with the flaps at 45°. The view of the runway over the nose is perfectly 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 mainly to the pneumatic trailing-link undercarriage, which cushions our arrival very well.

The landing gear is a notable feature. The engineers spent a lot of time on its geometry and it is one of the most complex parts of the aircraft. To give you an idea of the tight packaging and precision involved, they had to work with wheel wells that allowed clearance of less than 4mm. Thank goodness for CAD!

Second circuit; this time a chance to evaluate the short-field approach – not something most pilots would expect be at ease with in a high performance aircraft like this. In the event, there's no problem: the Panthera is biddable – it is speed-stable and the controls are precise. There's no feeling that you are fighting the aircraft. Flying 500ft circuits and coming in with the throttle closed poses absolutely no problem, and the go-around and touchdown remain easy to manage.

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 350kg of load capacity to spare (380kg for the 260hp version). In the luggage compartment, a vertical tubular compartment encloses 28kg of airframe parachute, mounted on the aircraft as standard. The weight capacity of the hold is 62kg – plenty enough for four people.

Significantly, the Panthera will be delivered with full options and the price will include 'customisation' of the interior (essentially seat colour) and exterior paint. Currently, the final price is estimated at around €450,000 and certification is anticipated in 2017. ■

SPECIFICATION

PIPISTREL PANTHERA*

■ DIMENSIONS

Wingspan	10.86m
Length	8.07m
Height	1.90m

■ WEIGHTS AND LOADINGS

Empty weight	692kg
Max takeoff weight	1,200kg
Useful load	508kg
Fuel capacity	220 litres
Luggage capacity	62kg

■ PERFORMANCE

Vne	220 kt
Cruise	75% 7,500ft, 176kt
Stall (clean)	58kt
Climb	1,100fpm
Take off (to 50ft)	466m
Landing (from 50ft)	400m
Range	860nm

■ ENGINE AND PROPELLER

Air-cooled, flat four Lycoming IO-390 producing 210hp driving a three-blade MTV-12-B/188-302 propeller

■ FACTORY

PIPISTREL
Goriska Cesta 50a - SI-5270
Ajdovscina - Slovénie
www.pipistrel.si

■ BRITISH DEALER

Sergey Grachev
Fly About Aviation Ltd.
0844 556 1279
Email: contact@flyabout.co.uk
Website: www.flyabout.co.uk

■ SMALL PRINT

**These data were recorded during flight tests of the prototype and are for information only. They may differ from manufacturer's published data as well as figures for the series production version of the aircraft.*