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A Union of Style and Speed

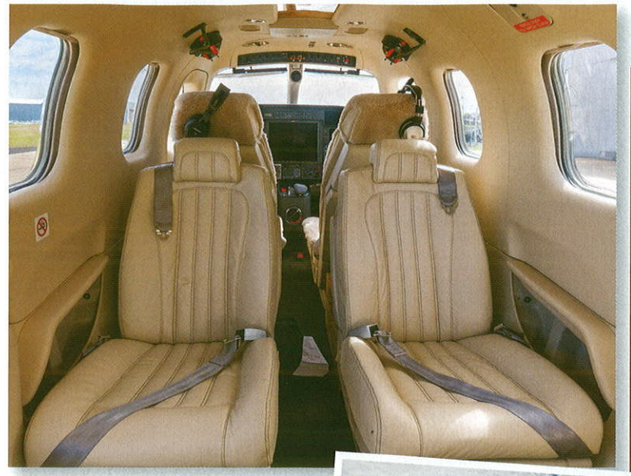
John Absolon *grabbed the opportunity to take the new TBM 900 for a fly just after Avalon 2015. His task was to find out how DAHER-SOCATA took a market speed leader and made it even better.*

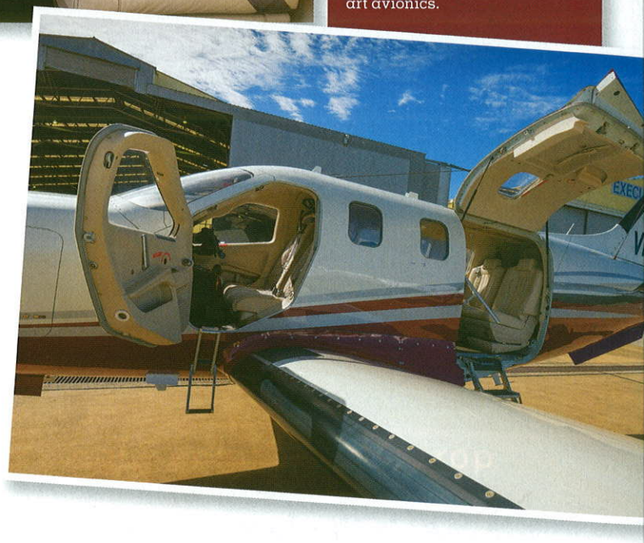
The TBM 900 single-engined turbo-prop (SETP) is the latest development of the venerable DAHER-SOCATA design dating back to the early 1980s. At *Australian Flying*, we have previously reviewed the TBM 850 but this new version is a whole new aircraft with many improvements. Many thought that the original TBM 700 and then TBM 850 design couldn't be improved on much, but DAHER-SOCATA have proven the observers wrong again. The original design inherits its aerodynamic design from its Mooney ancestry when–back in the early 80s–Mooney designed a six-place, pressurized turbo-prop aircraft that first flew in 1983. With the purchase of Mooney by new French owners in 1985, a joint venture was set-up that included SOCATA. Development continued even after Mooney dropped out, and the TBM 700 was born. The TBM 700 was powered by a Pratt and Whitney PT6A-64 power plant of 700 shp and made its first flight in 1988. In 2008, DAHER-SOCATA improved the TBM 700 after a collaboration of ideas from prospective TBM owners around the world when they were asked about the type of developments they would like to have in the their TBM to stay faithful to the brand rather than be enticed away by the increasing number of small jets like the Eclipse, Mustang, and Phenom 100 that were entering the market.

As a result, the TBM 850 was born with an emphasis on performance, especially cruise speed, that came from the addition of the more powerful PT6A-66D 850 shp flat-rated power plant and then progressively with the inclusion of the standard Garmin G1000 avionics suite.

The use of the PT6A-66D engine enabled the TBM 850 to use the 850 shp for climb and cruise only, but not without a number of limitations, which sacrificed the ease of handling.

As a result, a number of pilots used only the 700 shp that was available without any limitations. These limitations were described in our review on the TBM 850 in *Australian Flying* Mar-Apr 2011. The TBM 850 in both the old avionics fit and the new Garmin G1000 suite, continued in production through until the end of 2013 when DAHER-SOCATA, not being satisfied with their efforts, began work on how they could improve even the TBM 850 design and as a consequence released the TBM 900. The TBM 850's PT6A-66D power plant was delivering 700 shp for take off and only the 850 shp in the climb for a flat-rated climb performance. In the TBM 900, the PT6A-66D produces 850 shp on take-off through a single-lever control as opposed to the "850" position on the TBM 850, which was an extra position on the flap lever after the aircraft was cleaned up. This extra horsepower shortens the average take-off roll from 700 m down to 550 m at maximum take-off weight. This not-so-simple feature from the design and industrial process significantly reduces the workload of the pilot while delivering the improved takeoff performance. As a result of the excellent acceleration from the 850 shp, DAHER-SOCATA had to increase the maximum Landing Gear Retraction speed as they were concerned that some pilots might even exceed the old speed with the startling acceleration, especially at light weights. The new max retraction speed is 150 KIAS. This ease of engine handling allows the pilot to devote more attention to managing the TBM 900's improved climb performance instead of manually monitoring engine parameters to keep them within limits when the TBM 850 was climbed in "850" mode. The TBM 900 can climb to around FL310 in a little under 20 minutes.





LEFT: The cabin is set-up in a four-seat club configuration with leather upholstered seats.

BELOW: The single piece CNC machined pilot entry door is now standard fitment giving more access along with the rear entry door.

OPPOSITE PAGE
TOP: The futuristic five-blade Hartzell propeller and redesigned air inlet show that this is the new TBM 900.

BOTTOM: Highlighted by the three Gamin G1000 screens, the TBM 900 has state-of-the-art avionics.

Enter the 900

When you first walk up to the TBM 900, the first and most obvious feature is the five-bladed Hartzell composite propeller. With its swept-back curved blades, it is very futuristic looking, and blended in well amongst a line-up of up-market business jets at the recent 2015 Australian International Airshow, where it didn't look out of place next to a Gulfstream G650ER long range jet.

It is not only looks that this propeller delivers, but also an improvement in lower noise levels, improved climb and cruise performance and a is lot smoother than the old four-bladed version. Some TBM 850s have also been modified with this new generation prop.

The improvements are not just limited to engine handling and the propeller but to a number of other aerodynamic enhancements.

The next most prominent feature is the addition of winglets. Not just a fibreglass or carbon fibre add-on, but also a full flow, dynamics-designed integrated wing tip and winglet design that also incorporates the LED landing, navigation and strobe lights.

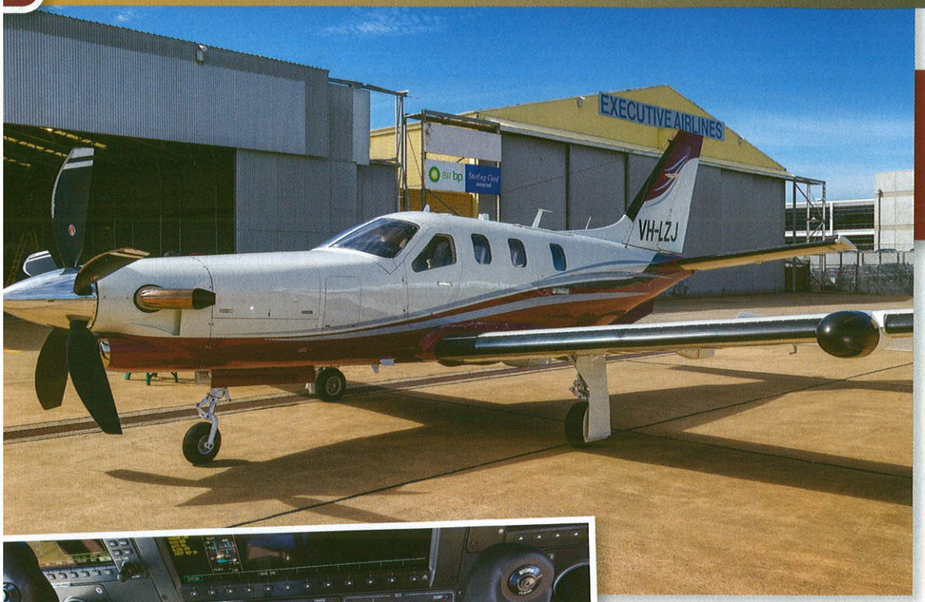
These winglets not only reduce the induced drag associated with the wingtip vortices, but have also improved the roll response of the ailerons. The other effective improvement is that they also increased the wing span, which reduces induced drag through a higher aspect ratio.

Other minor aerodynamic improvements also include an extra wheel fairing door that almost completely covers the main wheel tyres in the retracted position, leaving only about the width of the bottom of the tyre exposed. This also attributes to overall drag reduction. The TBM 850's gear door covered only the strut after retraction.

Improvements have also been made to the engine air inlet. The inlet is now wider, but not as deep as previous and includes a heated intake lip and improved inertial separator that goes towards reducing more drag.

The engine cowling has been redesigned with an improved shape to reduce drag and is now constructed from carbon fibre to reduce weight while being easier to mold into the complex shapes required.

The exhaust pipes have also been



TOP TO BOTTOM:

Looking right at home on an executive aircraft ramp

The new H-shaped throttle lever quadrant with the throttle in the cut-off position prior to start.

"It was obvious why the TBM 900 is the fastest civilian SETP in the world"

redesigned to limit the impact of exhaust residue on the fuselage and make the extraction of exhaust gases more efficient.

Less obvious airframe improvements include a redesigned dorsal fin and tail cone that increases the overall length slightly.

Inside job

Improvements are not only limited to the exterior design, but also have reached into the cabin with a new reclined instrument panel and standard pilot entry door with a fold-up ladder. No longer does the pilot have to scramble past the cabin passengers after closing the large aft entry door. Now they can easily enter the cockpit from the outside after climbing up the small ladder, raising it up to be neatly folded into a recess on the inside. This new door is now milled out of a single piece of aluminum instead of being built up from separate components, as previously was the case when the door was optional extra.

Behind-the-scenes improvements extend to an improved electrical system that aids in faster starts of the avionics after the engine is started, which helps reduce the amount of fuel consumed whilst waiting for avionic systems to initialize. The TBM 900 also includes an automated pressurisation control that, again, reduces pilot workload so that the main focus is on flying the aircraft and managing the operation instead of using resources to manage systems.

However, the most obvious change in the cockpit is the new single-lever engine control that replaces the traditional throttle and condition lever in normal PT6A installations. With the combined throttle and condition lever operating through an H-shaped gate with the bottom right position being the cut-off position. Moving the lever forward on the right side of the gate moves the throttle into IDLE LO FEATHER position and then across to the left in the centre of the H to HI IDLE TAXI Power.

Movement of the throttle is now just advance and retard like any other turbine-powered aircraft with the aft-most position of the throttle lever being REV (reverse) which with the slow approach speeds and excellent brakes is seldom required. This simplified throttle movement makes starting the PT6A even easier than before and, when coupled with the automatic starter cut-out, there is even less chance of exceeding starter limits.

Now, with the new updated electrical system and new software in the Garmin G1000, minimal time is spent idling on the ramp while waiting for the avionics to initialize. In fact, after the attitude indicator is erect and the heading reference system is aligned, the aircraft can be taxied to the runway while the other data is initialized. Even the pressurisation system has been automated through a control panel just forward and to the right of the central throttle quadrant so that it is in easy reach of the pilot.

The only manual controls for the pressurisation are for the selection of the engine bleed supply (AUTO or OFF/RST), the PRESS MODE of AUTO or MAX DIFF (Differential Pressure) and a guarded DUMP switch to override and open the cabin pressurisation dump valve to release all cabin pressurisation. This panel also has a master temperature control, fan speed control and control over where hot air can be directed either towards the windscreen or the occupants.

In front of the eyes

The remainder of the instrument panel is very similar to the previous TBM 850 model with the three large Garmin G1000 displays providing EFIS flight data to each front seat occupant with the central 14-inch Multi-Function Display (MFD) providing the engine's vital signs indicators and the moving map. The MFD can also be used to display a large variety of other information from maintenance data, navigation and flight planning data, weather radar information that can be overlaid on the map or can even be used as a back-up EFIS should any of the other two EFIS displays fail.

Above the central MFD, there are the various controls for the flight director and autopilot. These closely

The new winglets improve both handling and improve overall climb and cruise performance.

Specifications

Dimensions	
Wing span	12.7 m
Length	10.4 m
Height	4.4 m
Weights	
Max. Ramp Weight	3370 kgs
Max. Take-off Weight	3353 kgs
Max. Landing	3186 kgs
Avg. Empty Weight	2099 kgs
Performance	
Vmo	270 KCAS
Va	158 KCAS
Vle	178 KCAS
Max. Crosswind	20 KnotsTakeoff Dist (50' obstacle) 2380 ft (725 m)
Vso	65 KIAS
Max. Ceiling	31,000 ft
Long Range Cruise	252 KTAS @ FL310
Max. Cruise	330 KTAS @ FL280
Range @ Max Cruise	1440 nm

resemble those of a modern jet airliner with them being conveniently located just below the pilot's eye line so that minimal time is spent looking down into the cockpit. To the left of this control panel is the Integrated Standby Instrument display that combines on a single colour LCD attitude, airspeed, altitude and an electronic skid ball.

As a sign of the times with today's modern flight planning software systems that are available, there is a convenient stowage for an iPad to the right of the central flight control panel. This stowage will hold a full size iPad and a sunglasses case with ease. Likewise, on the front of the left yoke, this aircraft was fitted with a cradle that neatly held an iPad Mini in such a way that it could be rotated to be in either portrait or landscape format.

USB power outlets are also located on either side of the instrument panel. Each control yoke is festooned with a multitude of buttons and controls for pitch trim, transponder IDENT, Autopilot Disconnect, Autopilot Command Wheel Steering (CWS), timer start/stop, radio transmit and lighting. Like the TBM 850, the main cabin is entered through a large overhead hinged door that is closed by an electric motor after the stairs have been raised.

The cabin has four leather-upholstered seats facing each other in a club layout. All seats have individual reading lights and air outlets. Individual emergency oxygen masks like those of a modern airliner can be lowered automatically over each seat. A baggage stowage area is located behind the rear seats and equipped with a cargo restraint barrier harness. The two front seat occupants have the luxury of EROS quick-donning pull down oxygen masks, again similar to those that flight deck crew in a modern jet would be familiar with.

Flying the 900

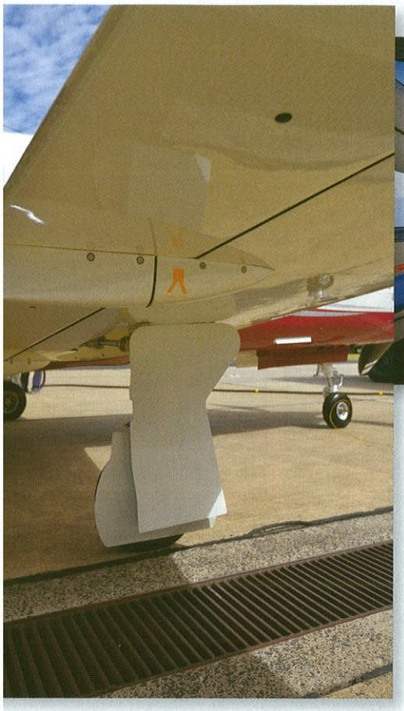
On my evaluation flight with Mark Diaz–the International Sales Director for DAHER SOCATA who had been in Australia for Avalon–we flew on a short flight out of Essendon over Bass Strait and back.

Our flight took us from Essendon south out over Cowes and then via H439 to waypoint BENZO on the air route towards Launceston and then across to FLIKI and back via air route H215 overhead Wonthaggi, WAREN and via a STAR arrival back to Essendon at a cruising level of FL280 and FL270.

This route was loaded into the G1000 as we taxied out to depart from Essendon's runway 35. With the flaps set to the T/O position, the extra horsepower available on take-off was immediately noticeable as the TBM 900 accelerated down runway 35 before lifting off in well under 700 metres.

With a clearance of an immediate right turn once airborne, we set heading for Cowes. The few climb restrictions that we experienced enroute from ATC delayed part of the impressive climb performance, which–if it hadn't been for these–the TBM 900 would have easily achieved the planned cruising level in under 15 minutes from brake release.

The climb to cruising level gave me time to check out the impressive



ABOVE: In the cruise at FL270 approaching top-of-descent via Wonthaggi to Essendon.

LEFT: Re-designed main gear doors now mean most of the undercart is faired when retracted.

OPPOSITE PAGE: An all-new tail cone has provided some aerodynamic gains.

view from the front of the TBM. Even with the long nose cowling, the view over the nose was more than adequate for the IFR flight planned. The visibility through the side windows below and forward was excellent with the ability to easily acquire the "slowly" overtaking SAAB 340 below us that the Traffic Awareness System had highlighted.

Once at cruising level, it was obvious why the TBM 900 is the fastest civilian SETP in the world. Descent back into Essendon was straightforward and fast with a speed of 250 KIAS for most of the descent into a close left base for runway 35 to avoid traffic and overflying jets on the LIZZI 2V arrival to Melbourne's runway 34.

The ability of the TBM 900 to quickly decelerate as we approached the base turn by reducing the throttle back to idle was excellent with the Hartzell propeller acting like a large speed brake. Coupled with the higher gear extension speeds, speed control in the circuit wasn't a problem. With the flaps lowered to the LDG position, there was no need to use reverse after touchdown as we rolled through to the exit taxiway.

Nothing compares?

When it comes to comparing the TBM 900 to its six-seat competitors, only the single-pilot jets come close, but they lose out through higher fuel usage.

When compared to, say, the Cessna Mustang, the TBM takes off in 230 metres less. It can't climb as high, but the TBM 900 will cruise 10 knots faster at maximum ceiling compared to the jet anyway? And when it comes to going places, the TBM 900 with four people on board can travel over 1200 nm, while the Mustang would be stopping for fuel after 1000 nm.

Roughly speaking, the TBM 900 can travel 30% further carrying up to 18% more payload. As Mark Diaz said, with full fuel of 1100 litres, you can carry four people. Take 110 litres out and you can carry five, or another 110 litres and you have all six seats filled.

If you were to limit your fuel uplift to 750 litres, you could carry all six and travel 700 nm flying at an average of 295 knots.

Cruising slower at say 250 KIAS, Mark says he could go even further with all that payload. Mark also indicated that when he flies the TBM 900 around Europe, he averages around 60 US Gallons (227 l) an hour, whereas here in Australia with our reduced airspace restrictions he has averaged only 55 US Gallons per hour (208 l).

Couple these figures with DAHER-SOCATA's recommended maintenance program, these costs along with fuel and oil work out to be around US$352/hour for flying close to 200-400 hours per year.

So, there seems to be little left to improve on ... but then that's what they thought when the TBM 700 came out!

My thanks to Mark Diaz from DAHER SOCATA in preparing this review.