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FLIGHT TEST

HIT SINGLE

Why Daher-Socata's high-speed TBM 900 is top of the props

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FAST MOVER

Daher-Socata's TBM 900 follows where its 850 predecessor left off, delivering speed, superb handling and economy advantages over comparable small jets

PETER COLLINS TARBES

Daher-Socata secured US certification for the third and latest version of its single-engine turboprop, the TBM 900 in March this year. The aircraft builds on the very successful previous TBM 700 (324 delivered) and TBM 850 (338 delivered) models, with an accumulated fleet total of 1.2 million flight hours.

However, with a certification programme lasting three years and involving over 160,000 man hours of research and development effort plus over 200h of flight testing, together with a significant number of major airframe, systems and avionic improvements, the TBM 900 now represents a new aircraft in its own right, rather than being designated simply as an "upgrade" model of the TBM 850. The TBM 900 retains the same internal cabin dimensions as the TBM 850, with up to six seats (for pilot and five passengers).

To date, 30 TBM 900s have already been delivered and Daher-Socata is presently planning on a production rate of 50 aircraft per year at its production facility, in Tarbes, southwestern France. Daher bought the business from EADS in February 2009 to form Daher-Socata.

I evaluated the TBM 850 in mid-2006 for *Flight International* and it had greatly impressed me then with its speed, economy, flexibility of operation and superb handling qualities. I coined the term "very fast turboprop (VFT)" in the 2006 article in response to the almost unprecedented wave of very light jet (VLJ) models being proposed at that time. Tellingly, since then, most VLJ projects have now either stalled or been cancelled, including Cessna's Mustang, which ceased volume production earlier this year.

The TBM 900's quoted price is $3.7 million. Most customers remain owner-operators, with North America, Latin America and Europe as the dominant markets, but TBM is expanding sales and dedicated sales support into Africa, the Middle East, China, and Australia.

A standardised agreement between the European Aviation Safety Agency and Federal Aviation Administration over the use of single turboprop aircraft in commercial operations, is presently at Notice of Proposed Amendment (NPA) stage and TBM is contributing to those detailed discussions.

UPDATES

The major improvements to the TBM 900 are extensive. Carbonfibre composite (for which Daher-Socata has extensive »

(*Above*) The cockpit has been completely redesigned with new control yokes and a true, single power lever configuration

(*Main*) Registration N900XH was used for the mid-September flight from Tarbes

» in-house expertise) now accounts for nearly 25% of the aircraft's structure. Possibly the most obvious external difference is the new, highly swept, carbonfibre, five-bladed Hartzell propeller, which still features full reverse capability. The wings now have 0.6m (2ft) carbonfibre composite winglet extensions (to TBM's own design).

The engine remains the Pratt & Whitney Canada PT6A-66D, flat rated at 850shp (634kW) but the entire engine inlet air system, including the inertial separator, has been redesigned from the forward inlet to the firewall, resulting in an effective power gain of 80shp without increasing fuel consumption.

A new automatic torque limiter allows full power of 850shp to be used as standard from the start of the take-off roll, reducing take-off distances by more than 20% compared with the TBM 850, which could only use 700shp for its take-off roll.

The cockpit has been completely redesigned and remodelled ergonomically, including new control yokes and a true, single, power lever configuration controlling all engine power, propeller and fuel conditions from just one lever. Avionics now feature the Garmin G1000 system, with three screens. The outer pilot flying displays (PFDs) both have a 10.4" screens, while the central multifunction display (MFD) features a 15" screen.

The G1000 supports a wealth of advanced avionics options, including an advanced autopilot with automatic yaw trim, controller pilot data link control (CPDLC), synthetic vision technology (SVT), GPS/WAAS for the satellite-based approach system (SBAS) for approaches at austere airfields and satellite-based weather reports. A new 28V/300A starter-generator system now supports the avionics.

The cabin has also been extensively redesigned with new seats, a new automatic pressurisation system (including a maximum differential control for medevac conditions) and the cargo compartment can be extended by the quickly removable rear two seats.

The cockpit immediately gave the impression of being wonderfully uncluttered and well laid out

The TBM 900's maximum ceiling remains 31,000ft, while the maximum cruising speed is now 330ktas (knots true airspeed – 611km/h) at 28,000ft, or 326kt at 31,000ft. This equates to a range of 1,440nm (2,670km) with 45min of reserves. At the long-range cruising speed of 252ktas at 31,000ft, the maximum range is 1,730nm, also with 45min of reserves.

EVALUATION

My short test flight took place from Tarbes in mid-September. The aircraft was a standard production TBM 900, registration N900XH. My safety pilot was Stéphane Jacques, chief test pilot for Daher-Socata, a former French air force fighter pilot and former chief test pilot tutor at the French Flight Test School (EPNER). Weather CAVOK (ceiling and visibility okay), very light wind, +15C, QNH (barometric pressure adjusted to sea level) 1,023hp. Mark Diaz, the TBM 900 demonstrator pilot, acted as photographer in the cabin.

Zero fuel weight (ZFW) including three crew was 2,430kg; fuel weight was 725kg (1,600lb, or 120 USgal per side) giving a ramp weight of 3,160kg (max ramp weight is 3,370kg) and a CG of 25% (mid range).

I would fly the complete evaluation from the left hand seat with Stéphane handling the navigation and the radio, including communication with our own dedicated flight test controller (since Airbus uses the same test area over Tarbes).

External checks were simple to conduct and included a check of the 50ft³ oxygen bottle, plus engine oil level and fuel filter, both helped by clever small mirrors mounted on the inside of the inspection panels.

Entry to the pilot seat is via the dedicated forward pilot door and small drop-down ladder. This is such an enhancing feature that it is now fitted as standard.

The cockpit immediately gave the impression of being wonderfully uncluttered and well laid out, with system switches now grouped, automated and rationalised. I especially liked the environmental control system (ECS) panel and the Garmin G1000 alphanumeric data entry panel set centrally underneath the multifunction display. The three G1000 screens now dominate and the digital information provided was immense but easy to manipulate, especially when being able to use the data entry panel, rather than an on-screen data insertion method.

This sense of an advanced cockpit design was further heightened by the layout of the single power lever. Looking a little like the top of an automatic gear lever in some cars, the power lever operates in a small, gated "H" arrangement. The right hand leg of the "H" acts as a condition and propeller lever to control fuel shut-off for start-up and shutdown, manual in-flight feather, low (LO) idle and high (HI) idle fuel flow.

The power lever handle must be lifted to allow it to move backwards or forwards to change mode within the legs of the "H". In the middle of the "H", the power lever handle is lifted and rocked into the left hand leg of the "H" to act as an engine throttle controlling flight,

Taking in the view: the aircraft has a maximum ceiling of 31,000ft and a range of 1,440nm with 45min of reserves

BillyPix

The TBM 900's handling qualities were "beautiful"

BillyPix

taxi and reverse power modes (primarily % torque – TQ). To utilise the reverse power range, a separate trigger underneath the power lever handle must be lifted to access the beta range. I thought the single power lever design was extremely neat, simple but very clever and was a real enhancing feature of the new aircraft.

After start, the only check was to ensure the standby generator would come on line with the main generator turned off. With a flight plan preloaded before start and held in memory, we were ready to taxi within 2min of engine start, the limiting factor being not engine stabilisation but the alignment of the attitude, heading and reference system (AHARS).

Take-off was runway 02. The power lever was advanced with the aircraft stationary to check propeller governing and I then slammed it open as the brakes were released to check the operation of the torque limiter, which limited at 106% TQ. I then adjusted manually to set 100% TQ. The operation of the power lever throughout the sortie was wonderfully precise, linear and accurate when setting target TQ values. The power lever had no free play or breakout, so very small TQ adjustments could be done with ease.

Rotate speed was 85kias (knots indicated airspeed), coming about 7-8s and approximately 500m (1,640ft) after brake release. I noticed no directional swing during take-off roll. Gear-up and then flap up at 110kt was accompanied by minimal trim change. Max rate climb speed of 124kias was held and gave an initial climb rate of 2,200ft/min (11.2m/s). To reach 20,000ft took 10min 30s, 30,000ft 17min 15s and 31,000ft 18min 00s. At 31,000ft, the cabin altitude (normal mode) was 9,700ft. Max cruise torque (as indicated by a bug on the TQ gauge) stabilised the aircraft at 188kias at 31,000ft. Cruise consumption was 53/53 USgal/hour.

A 60˚/+2.0G banked turn was completed at 31,000ft at 180kias without any buffet. An emergency descent was then initiated with throttle idle, holding a 70˚ banked spiral turn at +2.5G and just below the VMO of 266kias with about 15-20˚ of nose down. At VMO and +2.5G in the descent, there was only the very slightest hint of wing buffet. The descent from 31,000ft to 15,000ft took just 2min 12s from the start of the manoeuvre.

Most customers remain owner-operators, with North America, Latin America and Europe the dominant markets

At 15,000ft, wind up turns at +3.8G were completed at 180kias in both directions, with absolutely no buffet or any other aerodynamic effects. Dutch roll with the yaw damper off was lively when initiated and only slightly convergent but damped instantly when the yaw damper was re-engaged.

The automatic yaw trim function of the YD was another enhancing new feature of the aircraft and the pilot requirement to monitor directional trim with the YD engaged was negligible. Max yoke deflection aileron rolls indicated a roll rate in excess of 60-70˚/sec. The TBM 900 retains beautiful handling qualities and flew like a fighter throughout the sortie and the handling envelope I evaluated.

Two stalls were completed at 15,000ft. The first clean, gear up, gave a spoken "airspeed low" warning at 90kias, a continuous stall tone at 87kias and a defined G break at 80kias. With flap LDG (= full flap and limit 126kias) and gear down, the figures were 75/70/65kias. Wing drop was minimal.

The recovery was to an auto transition from lateral navigation into an ILS approach at Tarbes. The approach type and runway were simple to select. The synthetic vision technology on the primary flight display gave excellent situational awareness of terrain. The multifunction flight display, acting as an electronic flightbag or navigational map, was so large that it gave the impression of looking at a wide-screen HD TV at home.

On the ILS approach the aircraft was flown at 45% TQ/170kias. At one dot "above the glideslope", the flap was taken to TO (= mid flap with limit 178kias). At half a dot above, gear was selected down (178kias limit). On the glideslope, power was reduced to 20-25% TQ and the speed allowed to decay towards 120kias. At 120kias, LDG flap was selected to then arrive at decision altitude (DA) at the landing reference speed of 85kias. It was just so simple to fly.

The final event was a practice forced landing, flown initially to glide at 120kias with TO flap from 2,500ft above field. The chosen touchdown point, again at a V ref of 85kias, was achieved with accuracy and with ease. On shutdown, after a 1hour 10min flight, our fuel state was 83/83 USgal.

CONCLUSION

The new TBM 900 richly deserves its new designation as a new TBM type because it is far beyond that of a TBM 850 upgrade, impressive as that aircraft is in itself. The new digital displays and redesigned cockpit of the TBM 900 will inspire owner-operators (many of whom may have low hours experience) with confidence while underwriting that confidence with the safety and survivability that comes from supporting the latest avionic systems and future required navigation performance.

The aircraft's undoubted classification as a VFT and its combination of climb rate/cruise altitude/cruise airspeed/range/payload/landing and take-off performance, gives it usability and economy advantages that a VLJ will never be able to match.

The aircraft has exquisite handling for its pilots but will continue to delight its passengers. When an aircraft is so outstanding as this, Daher-Socata may have to double the planned production rate in the very near future. ■