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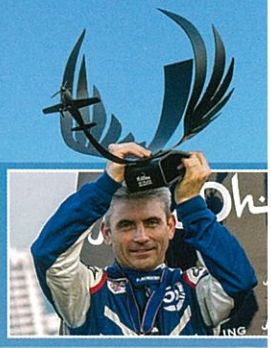

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FLIGHT TEST
Daher-Socata TBM 900

Jacques Callies reports on the Tarbes-based manufacturer's secret project: a complete aerodynamic makeover of the already successful TBM 850. The new TBM 900 is set to become the company's sole model

Three years ago, in the utmost secrecy, Daher-Socata gave its design office a challenge: look at how to improve on the TBM 850. No need to start from scratch when you already have a high-performance aeroplane which is loved by its pilots and owners, and which continues to enjoy healthy sales. The result is the new TBM 900. And while the name doesn't mean that the engine develops 900hp, its performance in comparison with the TBM 850 might make you think otherwise, as we shall see.

Despite regular visits to the factory in Tarbes, in the foothills of the Pyrenees, the secret was well kept. Everyone thought that Daher-Socata was working on a completely different aircraft. It was evaluating the prototype Grob SPn composite business jet, and had recruited Christophe Robin, the founder of DynAero, known for his creative talent and mastery of composite materials, which he had demonstrated when manufacturing lighter aircraft.

We knew that the jet evaluation had served only to confirm that it was not the path to go down, but that was about it. So on 6 March we were quite taken aback to discover that a team of 125 people had worked on a very different project: improving the TBM 850 to make it a more efficient and spectacular aircraft on several levels, namely performance, handling, noise and carbon footprint.

It's tempting to make a comparison with the Airbus A320neo (New Engine Option), which burns less fuel, pollutes less and flies further than its predecessor. The same is true in spades for the ▸

Better seats and a quieter cabin than the 850 mean happier passengers!

Single lever power and automatic pressurisation make operating the new TBM simpler

FLIGHT TEST
Daher-Socata TBM 900

Two-part gear doors are one result of the comprehensive drag-reduction programme

TBM 900, but where Airbus used new engines, Daher-Socata kept the same 850hp PT6A-66D and concentrated on the aerodynamics.

The TBM design dates back more than 30 years and could certainly be improved. Today, 3D CAD modelling and computational fluid dynamics programs have largely taken the guesswork out of aircraft design. The computers were let loose on the TBM to check the aerodynamic choices of the past. New parts were created from composite materials, with complex and precise shapes, and finally the results were checked by extensive flight testing, using five synchronised GoPro cameras to film tufts of wool, which make the aerodynamic flows visible.

To sum up over three years work in a few lines, the changes have focused on anything that could be improved aerodynamically. The result is an aeroplane that even non-experts can see is different from the 850. There's a modern Hartzell five-blade propeller, and everything from the propeller back to the firewall has been redesigned to optimise the efficiency of the air intake and cooling. There's a new inertial separator, straighter exhaust outlets, double main-gear doors, winglets whose profile is copied in the filet that blends the fuselage to the tail, and a new tail cone. With the exception of the exhausts, all of the new parts are made from carbon fibre.

At the same time, Daher has reviewed the ergonomics of the aeroplane, interviewing owners to find out what they would like corrected, starting from the principle that the simpler the aircraft , engine and avionics are to use, the better it will be for everyone. This is particularly true for the TBM, which is generally flown by its instrument-rated private pilot owner rather than a hired professional. The work focused on all aircraft systems and some improvements are truly spectacular. Pressurisation is now totally automatic, there is auto-start for the PT6 and a torque limiter to prevent inadvertent damage from a moment's inattention. A 300 amp generator replaces its 200 amp predecessor, and if it fails there's a 100 amp standby alternator that keeps all the aircraft systems running – including de-icing.

Winglets add dihedral and allow full power to be used on take-off, unlike the TBM 850 which was physically limited to 700shp

The cockpit has also been improved. The bottom of the panel has been redesigned giving more knee room for larger pilots, there are new controls on the yokes and the centre console now has just one engine control. The Garmin G1000 software has been reprogrammed in order to simplify engine management, and all controls , buttons and switches have been redesigned and modernised, from the landing-gear selector to the LED landing-light switch and the circuit breaker panel. And as the devil is in the detail, two USB ports have been added to connect the indispensable iPads. Note to all aircraft designers from microlights up: it's time to include USB charging ports!

Speed and simplicity

When I learnt of the tremendous work done, I was very interested even before seeing the new machine… and a little ashamed at having missed so many clues. With hindsight, this change was so predictable, especially when you know that Nicolas Chabbert, Director of Daher's Aircraft Division, worked at Mooney when the small Texan manufacturer developed its Ovation2 from the M20. As I am known by the factory to be a long-standing admirer of the TBM, I was privileged to be invited to a confidential presentation of the new aircraft a week before its official unveiling. How can I not be an admirer when I have engraved in my mind the ▸

memory of a take-off at 7am from Le Bourget in a TBM 700, and an arrival in Dallas the same night! Without any particular preparation, without ferry tanks and with the inevitable delays for Customs clearance in America. What other single-engine aircraft could fly 4,616nm with four stops in less than 24 hours?

Now, Nicolas Chabbert had arranged for me to take the controls of the 900. He placed me in the hands of Chief Test Pilot, Stéphane Jacques, a friendly and modest man who gives no clue to his impressive background as a fighter pilot and military test pilot. We began by walking around the 900, and as the aeroplane was parked next to an 850, the drag-reducing modifications stood out. The aircraft has always looked superb, but now even more so with its new winglets. According to Stéphane, the winglets, which reduce the induced drag without increasing the wingspan, have no measurable effect on stall speed but improve climb and cruise performance. In addition they improve handling.

On a turboprop (or any powerful single) in a crosswind the propwash affects one wing more than the other when you are slipping. With flaps down, this ▸

You can see more photos from this feature on the iPad and Android edition of *FLYER* and on the Editorial Extras section of the *FLYER* forum at *forums.flyer.co.uk*

Clever aerodynamics mean that you can fly further and faster

gives a fairly strong rolling effect. This can be countered by increased dihedral, but regular dihedral has various other drawbacks, notably, Dutch roll at altitude. The winglets increase the dihedral effect, allowing greater power to be used with the flaps down and taming the behaviour in a slipping approach. The limitation to 700hp in the 850 was because of this effect. The winglets allow the increase to 850 with flaps down.

Another important novelty is the disappearance of power limiter. The TBM 850 could only use 700hp for take-off. In the 900, full power can be used, with a torque limiter active throughout the flight envelope, and once settled in the owner's seat I notice that the power-limiting control has gone. Even better, there is now just one engine control in place of the previous three. It's pretty clever, with an H-shaped grill enabling it to act as both the fuel condition lever and a combined power and propeller pitch control. According to Stéphane Jacques, on the first flight you'll be sceptical: on the second, you know you'll know to use it; by the third, you will have adopted it fully. There is, of course, a manual fuel override control in case of an unlikely failure of the PT6's fuel control unit.

Engine starting is simplified thanks to a starter, which cuts out automatically and becomes a generator. The pilot now just has to check there is enough electric power for the start, use the single engine lever to turn on the fuel at 13% Ng and monitor ITT, which should not exceed 870°. With a warm engine, I recorded a peak of 734°C. With 226usg of fuel on board, or 856 litres out of the 1,086 litre capacity, it also meant that we were not particularly light.

Stéphane Jacques then reminded me of two speeds to keep in mind: 85 KIAS for rotation and final approach, and 120 KIAS for the climb, best glide and holding. With these speeds, you can do anything, he said!

There's also another reason not to worry. The pilot no longer needs to think about pressurisation. The system sets itself based on the field elevation of the destination set in the FMS flight plan. Simplicity itself!

Performance and price

Our flight began with a climb to FL310 at Vy or 124 KIAS, monitoring power to maintain 100% torque at all times. Starting from Tarbes, which is at 1,260ft, we passed FL70 after three minutes, then FL100 a minute-and-a-half later, and reached FL200 after 9min 15sec, still with 100% torque. From FL220, power started to decline gradually and we finally reached FL310 in 15min 45sec with a maximum torque of 89%. This was a remarkable result, even if we cheated a bit with a head start at take-off. Starting from sea level at gross weight, the POH gives a time 18min 45sec to FL310 in ISA temperatures, a 4% improvement compared to the TBM 850, and 21min 45sec in ISA + 20°, which is a significant 16% improvement. Fuel burn averages 60usg per flight hour. With a 6psi pressure differential, our cabin altitude was 9,800ft at FL310.

Next, I wanted to check the maximum cruise speed at the certified ceiling of FL310. With 91% torque set (you gain a little power with speed from the ram effect), I recorded 325 KTAS with a fuel flow of 58.3usg. That's 7% faster than a TBM 850. At the recommended power setting of 85% torque, we saw 316 KTAS for a consumption of just under 56usg per hour, still 7% better than the 850.

Finally, I set long range power of 50% torque, and saw a speed of 260 KTAS for 38usg per hour. At this setting, we could have flown for five hours before running out of fuel. In still air you can therefore now fly from Reykjavik in Iceland to Goose Bay in Canada non-stop, and land with a 1:20 fuel reserve. That opens up some interesting possibilities!

Whether it's a coincidence or not, the performance increase is matched by a 6% price increase. The TBM 900 costs $3.71m compared to $3.5m for the 850. And the 850 is no longer a choice; by the time you read this, the TBM 900 will be Socata's only model.

We descended gently down to FL290, the best level to get the promised speed of 330 KTAS. Thanks to the torque limiter, you no longer need to monitor the over-torque warning in descents. Once level, with the maximum torque of 96%, I got 328 KTAS. Unusually, the weather conditions were precisely ISA. Stéphane Mayer, President and CEO of Daher-Socata, had told me excitedly about getting 331 KTAS. I will put the insignificant difference down to me being a little heavier than Stéphane!

We then carried out an emergency descent, which would be necessary in the event of a pressurisation failure or a fire. To check the chances of survival, I asked Stéphane Jacques to put on his emergency oxygen mask: it took him less than 10 seconds. Once the masks are on, just pull the power lever all the way back, roll sharply to one side and let the nose drop until the speed reaches the Vmo of 266 KIAS. The result is an impressive 8,000fpm descent, and we are back in breathable air within two minutes. ▸

There have been lots of detail changes, but if it wasn't for the winglets you'd have to look closely to spot them

Hot-and-high performance has been dramatically increased, expect a 23% improvement if you are lucky enough to visit Aspen in the summer

On a previous flight with Nicolas Chabbert in TBM 850 Elite, he showed me how this very fast aircraft could fly comfortably at just 80 KIAS, even in 30° turns. I was happy with slow flight, but Stéphane Jacques suggested we try some stalls. At climb power, pulling the nose up to 25° and working a little with the rudder and ailerons to keep the wings level and the ball centred, we stalled at just 61 KIAS – helped by the slipstream effect of the engine. At idle power, clean, the stall came at 78 KIAS. In landing configuration, once again the stall came at 61 KIAS. There was no drama to the stalls, and the aircraft resumes normal flight if you release the controls.

I also wanted to check the efficiency of the torque limiter, gradually pushing the power lever forward at low altitude. Power rose to 108%, and no further. Power above 100% might seem surprising, but it is allowed because this powerful turboprop is de-rated from 1,825hp down to just 850hp, and the special alloys used in its turbine blades will withstand high temperatures.

Before returning to Tarbes we flew some lazy eights, just for fun! On this fine winter's day there was a strong contrast between the welcoming immensity of the deep blue sky and the sharp white teeth of the Pyrenees, each alternately filling the screen as we played. Finally, I carried out a couple of reasonable landings with go-arounds. That allowed me to confirm that the approach was simple if you set power to 18% torque and leave it there, without worrying too much about the speed, which varies between 85 and 90 KIAS. If you touch the power in an effort to be more precise, you will end up chasing the airspeed indicator. The first landing was a little firm as I flared slightly high, but not too bad. The go-around was easy, despite the torque effect one might expect from the 850hp.

Waiting for us on the ramp at Tarbes were Nicolas Chabbert and my German friend Dr Birgit Hutz, the President of the European Mooney Pilots and Owners Association (EMPOA). Nicolas had wanted her to be part of this very special day. It took quite a while to come down to earth after the flight, and there was so much to talk about. As we chatted, Stéphane Jacques explained the philosophy behind the project: "Every irritant that could be removed… well, we've removed it!"

I was already a TBM enthusiast, so to be objective I will leave the last words to Birgit, the pilot-owner of a Mooney Ovation2 who sent me this email once she arrived back in Germany

'Thursday was a great day for me, I am so happy I could fly this fantastic aeroplane. It was the first turbine I've flown, as well as being the fastest and highest I've ever flown. You can feel its power and performance. I was astonished how easy and how much fun it is to fly. It combines both a fast aeroplane to get from A to B, and an aeroplane that you can have fun with, and because it is 'handy' so you can play with it in the air. It also has such an ergonomic design. And besides its performance, it's fun, it handles beautifully and it looks great inside and out. I wish this TBM a lot of success!'

What can you add to that? ■

TECH SPEC

TBM 900

DIMENSIONS
Wingspan..... 42ft 1in (12.83m))
Length..... 35ft 2in (10.74m)
Height..... 14ft 3in (4.36m)

WEIGHTS & LOADING
mtow..... 7,394lb (3354kg)
Empty weight..... 4,623lb (2097kg)

PERFORMANCE
Max cruise speed (28,000ft).....330kt (mph)
Time to climb to 31,000ft (at mauw) 18min 45sec
Max range (45min reserve)..... 1,730nm

ENGINE
Pratt & Whitney PT6A-66D 850shp

SEATING
6

PRICE
$3.71m

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