EADS Socata TBM 700C2

Grand Touring

Any private pilot tempted by a demo flight in the TBM 700C2 should think twice about taking up the offer. Because once you've seen what it can do, you'll want one yourself.

Text and fotos : Alexis von Croy

Tarbes, south of France, autumn 2005. We've come here to the northern foothills of the Pyrenees to visit one of the showpieces of French general aviation. 130 kilometres southwest of Toulouse, in its long-standing facility at Tarbes-Lourdes-Pyrenées airport, Socata builds an aircraft that private and business pilots the world over dream about – the TBM 700C2.

The TBM700 concept

For almost 30 years Socata has been a prime player in general aviation with its TB9 to TB21 range of light, single-engine piston aircraft – one would be hard pushed to find an airfield anywhere in the world where one of these low-wing monoplanes is not being used for flight training or private aviation. But the jewel in the crown of the Socata product line-up is the TBM700, the single-engine turboprop launched back in 1988. The aircraft was developed jointly with U.S. plane maker Mooney starting in 1987 (Mooney later pulled out of the project), and made its maiden flight on 14 July 1988. The first production aircraft was delivered on 21 December 1990. Since then the sporty low-wing monoplane has set the benchmark in its class among private pilots and business aircraft operators alike.

It's been a bumpy ride at times though. When the first TBM700 prototype took to the air in 1988, developing a single-engine turboprop was a risky venture. It was thought that the market either would not support the high price expected for this type of aircraft or would simply be too small to be profitable. Beechcraft in the USA had a similar concept ('Lightning') tucked away in a drawer – where it remained, gathering dust after the management decided not to stake their hopes on its chances of market survival.

Meanwhile several companies, spurred on by the success of the TBM, have changed their minds and even developed and successfully marketed single-engine 'propjets' – the U.S. term for turboprops: Pilatus launched the PC-12, Piper unveiled the Meridian (an upgraded PA-46 Malibu) in 2000, and Cessna entered the fray with a veritable 'air truck', the 'Caravan'. Other companies, particularly in the USA, have specialised in retrofitting piston-engine aircraft with turbine engines. The U.S. outfit JetProp based in Spokane, Washington State, is just one such company that has successfully converted used Piper PA-46 Malibus by fitting PT-6 turbine engines.

None of these competitors can match the flair of the TBM700 on the ramp, though. The formidable Pilatus with its 11 seats is more akin to a small commercial aircraft; the Cessna Caravan is ideal for would-be bush pilots. In contrast, certain details on the Piper Meridian betray its piston-engine heritage – the performance data also show that the TBM is in a different league altogether.

Right from the outset, the TBM700 was built as a serious rival to the business jet. The impression of robustness and build quality that strikes anyone inspecting individual subassemblies in the Socata factory is borne out as you look at the finished product. Just take the main wing spars and wing attachment points on the fuselage. Their generous dimensions immediately explain why the aerodynamic load limits on the TBM700 are higher than on any other aircraft in its class.

Impressive on the tarmac. The French Army has been using the TBM 700 as a liaison aircraft

Solid quality

Handcrafted, top-quality production: Socata currently builds around 35 TBM 700C2s a year in its facility at Tarbes.

Extremely robust: the solid main spar of the TBM 700 wing (left) and the four wing attachment points on the fuselage.

The virtually complete fuselage with the engine mounts already fitted. The firewall between the engine and the cabin is made of titanium. The version shown features the optional pilot's door.

An assurance of optimum reliability and low thermal stress: the PT6 has been downrated from 1200 to 700shp for use on the TBM 700.

Socata - much more than just the TBM 700

Socata puts together numerous sub-assemblies for airliners, business jets and helicopters as an industry subcontractor. Customers include Airbus, ATR, Eurocopter, Embraer and Dassault.

Socata is also involved in building the A380. The company builds the lower nose section for the super-jumbo as well as the nosegear doors. Parts for the Airbus A400M military transport aircraft will also be made at the factory.

Fuselage sections are assembled for the Embraer ERJ 170 & 190 regional jets in Tarbes; Socata builds engine cowls for ATR.

Socata builds cabins for the EC 130 and AS 350 Eurocopter helicopters, doors for the AS 365 Dauphin, as well as the cabin floor for the AS 332.

The standard-fit wide door dates back to the 1999 'B' version. The interior appointments are every bit as good as on a light business jet

A closer look at the TBM700 reveals details that hint at the kind of engineering expertise you could only get from a multinational concern. After all, Socata does not only build single-engine training, touring and business aircraft; it is a major contractor in the airliner business too (see box). Everything about the structure of the TBM700 comes across as extremely robust and well thought-out. Even the finish, down to the paintwork and quality of the exclusive interior appointments, are at least a match for any bizjet.

Walkaround

Walking around the aircraft, which seems beefier and bigger than I expected from the photos, I discover an interesting technical detail. To get the stall speed in landing configuration to the 65 knots required for FAR 23 certification, the Fowler flaps slide back a long way to cover 71 percent of the wing. That leaves little room for the ailerons, so the engineers resorted to an ingenious solution straight from the plane-builders' box of tricks: narrow spoilers that emerge from the top of the wing are connected directly to the aileron linkage and thus assist with roll control. The ailerons perform well in the air and the aircraft responds very swiftly to inputs.

The interior of the TBM 700C2 more than lives up to its impressive exterior – with appointments one would more readily expect from a business jet. The 20-g seats, required as part of certification for the C2 version given the increased weight, are clad in top-quality leather. Also provided are a fold-out worktable, adjustable reading lights, 12V utility power outlets, sunshades on the windows and a generous baggage compartment in the aft fuselage.

Unlike the 'B' model, the C2 is certified for 31,000 feet. Hence the complete oxygen emergency system with quick-donning oxygen masks for the pilots and airliner-style drop-down masks for the passengers. The previous 'B' model only had chemical oxygen generators on board, effectively restricting the service ceiling to 30,000 feet (i.e. FL300). Since the airspace system in the USA jumps from flight level 290 to 310 with no 300 in between, pilots in the new version gain another 2000 feet.

Impressive performance

300 knots cruise speed was the design benchmark for the TBM700 in the late '80s. Even the latest version, with its increased maximum take-off weight and further reinforced wing structure and landing gear, reaches the magic '300' mark. At flight level 260 –

Cockpit

1. External lighting
2. Electric switches
3. Engine start switches
4. Ammeter and voltmeter
5. Stand-by compass
6. Autopilot mode controller (Bendix/King KFC 325)
7. Annunciator panel
8. 2 From top to bottom: Engine gauges for torque, propeller RPM, ITT (interturbine temperature), gas generator speed (Ng), oil pressure and oil temperature
9. Altimeter
10. Altitude preselect
11. Airspeed indicator
12. VOR 2 indicator
13. EFIS Bendix/King EFS 40 (Electronic Flight Instrument System)
14. Trim, push-to-talk and autopilot disconnect
15. Deicing
16. Engine Trend Monitoring Computer
17. ADF (Automatic Direction Finder)
18. Power lever, reverse, Trim indicator
19. Air conditioning and cabin pressurization
20. Multifunction Display (MFD) for weather radar, stormscope, traffic and terrain warning
21. Transponder
22. Left and right: Two Garmin GNS 530 (COM, NAV, GPS, Moving Map)
23. Fuel quantity and fuel pressure
24. Co-pilot instruments
25. Transponder 2

the engine delivers 100% nominal power up to this altitude – 303 knots is possible according to the handbook, providing the atmosphere at this altitude is the textbook 'standard atmosphere'. Any colder than ‘normal’, and FL310 even theoretically permits 311 knots (575kph).

In practice this tremendous performance, both on short- and medium-haul flights, translates into marginally longer flying times than in a bizjet but offers a whole range of advantages. The TBM can be flown by an experienced IFR-rated, single-engine pilot after a short transition course. Within a week (the factory-based transition course is part and parcel of the contract) most pilots are able to fly the aircraft home without any problems. Since all pilots will have cut their teeth on a propeller aircraft, most rookies in the TBM quickly feel at home and develop good flying technique within a couple of hours – a definite bonus in an aircraft class where the boss still enjoys piloting the aircraft.

Small airfields with short runways, a familiar setup, especially in Europe, are the ideal home base for the TBM700. The additional 40 to 80 knots one gets out of a twin-engine, six-seater bizjet comes at a price though: less flexible operational capabilities, longer training and higher fuel consumption.

Six passengers, 2000 kilometres

The C2’s maximum ramp weight is 3370kg (7430lbs). Assuming a typical basic empty weight of 2109kg plus 852kg for a full tank of fuel, that leaves 409kg of payload capacity for passengers and baggage – sufficient for a fast IFR leg of 1375 nautical miles, the equivalent of over 2500 kilometres. Flying a little slower will yield nearly 3000 kilometres (1600 nautical miles). And with the maximum payload of 634kg (or six passengers, each weighing 80kg, plus 154kg of baggage), one still has a range of 1100 nautical miles – 2040 kilometres. That could be six people from Munich to Crete (including the statutory fuel reserve to allow diverting to an alternate airport within a hundred-nautical-mile radius).

The competition

...trails in its wake

Pilatus PC-12

Maximum take-off weight 4500kg, 270 knots

Piper Meridian

Maximum take-off weight 2310kg, 260 knots

JetPROP DLX

Maximum take-off weight 1959kg, 265 knots

Images: Alexis von Groy

Let's fly!

How does the TBM700C2 handle? Socata demo pilot Alain Jaubert lets me put the TBM's flying qualities to the test – by way of introduction! Anything that looks so good is bound to handle well – an old pilot's adage you can generally rely on.

Socata pilot Alain Jaubert (right) and the author in the TBM 700

Pedigree and class. The TBM 700C2 is the epitome of everything a pilot looks for: great design, high performance, solid construction and lots of comfort.

The excellent flight characteristics of this south of France speedster have been common knowledge for over 15 years, and I've naturally seen reports from other pilots. In 2004, 'Professional Pilot Magazine', a U.S. publication, surveyed commercial operators and pitted the TBM700 against six turboprop competitors ranging from the twin-engine Raytheon Beech King Air 350 to the Pilatus PC-12. The TBM700 came out on top, receiving excellent ratings for reliability, performance and handling – in poor weather in particular.

One boards the aircraft via the wide rear door in the fuselage, standard specification since the 1999 'B' version. As an option, the aircraft is also available with a separate pilot's door – an indispensable feature for freight pilots unable to clamber over stowed cargo to reach the pilot's seat. However, more and more private pilots are coming to appreciate the added convenience a separate door offers.

The cockpit's comfortable leather seats can be adjusted perfectly to the pilot's build, and even the pedals can be adjusted. Your eye is drawn to the clearly laid-out panel, on which all the control and monitoring elements are mounted in logically arranged groups. On the right, next to the six basic flight instruments, all the engine parameters are lined up in a vertical column; other important controls, including the high-quality autopilot subpanel and cabin pressurisation system are just as easy to locate. One small but nifty detail I discovered was that if one sets the tank selection switch to 'Auto', the electric motor activates the tank selection switch at regular intervals to empty the two wing tanks evenly.

Starting the 700shp engine involves a few simple steps, just as one would expect from an aircraft in this class. All one needs to do is ensure the ITT (interturbine temperature) does not exceed 870 degrees during the ignition process – get it wrong and you have to terminate the start-up procedure in strict accordance with the checklist and start again from scratch.

As soon as the parking brake is released, this high-performance speedster moves off smoothly. However gingerly you move the throttle lever, you end up having to nudge the brakes after a few metres to keep your speed in check. An even better solution is to use the propeller's reverse thrust function now and again for braking. Simply reach down under the throttle lever knob and pull the reverse stop up a fraction while opening the throttle. One gets the knack after a bit of practice, so there is no need to bother with the wheel brakes when taxiing – and you save on brake pad wear as an added bonus!

After our pre-takeoff checks – with the flaps extended to ten degrees for takeoff – we roll towards the starting point on runway 20. With my foot on the brakes, I push the power lever forward until the gauge reads 100 percent, then release the brakes, which is when I get my first taste of the PT6's 700shp. The powerful four-blade propeller generates massive power, forcing the aircraft to slew off to port of the runway centreline. This is a situation every single-engine pilot will be familiar with. But in the TBM700 it's easy to correct with firm use of the right rudder. Naturally, I'm too tentative with the rudder at first, so the aircraft begins to weave as we hurtle down the runway. But I don't have to worry about maintaining the heading for long because we reach the previously agreed 80 knots Vr (rotation speed) in no time at all. A gentle pull on the control column and the runway plummets away from beneath the TBM. I nudge the brakes (to stop the tyres spinning), then retract the landing gear.

At 130 knots, the best rate of climb speed, we climb at 2500 feet per minute into the blue skies that day over the Pyrenees. By now I've got the hang of the electric rudder trim that irons out any pronounced yaw during the climb.

We level out at flight level 120 – we have not filed an IFR flight plan, so this is as high as it goes. Even at this height our true airspeed is over 260 knots, or more than 480kph. Around 245 litres of jet fuel an hour flow through the combustion chambers at this speed.

'Gran Turismo' of the air: fast, stylish, safe

The aircraft's high speed is barely noticeable in the cockpit. The cabin is very well sound-proofed, and the BOSE noise-cancelling headsets take care of the rest. According to several Airbus and Boeing pilots who have tested the TBM700, the aircraft flies as quietly as an airliner, but without coming across as sluggish or unresponsive. The TBM700 is to flight what a 'Gran Turismo', or grand touring, is to motoring. Only if you jerk the elevator too hard do you get any sense of the speed you are travelling at – in a matter of seconds the TBM loses or gains 300 feet or more.

It doesn't feel like a red-blooded sports car à la Ferrari F40 or Porsche 911, much more like the equivalent of a Maserati Quattroporte, a Mercedes SEC-Coupé or a four-seater Aston-Martin. The slower Pilatus PC-12 cargo aircraft has a higher payload; the daintier, less powerful Piper Meridian, by contrast, cannot keep up with the TBM. In this class the TBM700 embodies the perfect symbiosis of hot-bloodedness and composure. Not too difficult to fly, an adrenalin machine and thoroughbred racehorse, all rolled into one – yet good-natured in the air.

How does a heavy single-engine aircraft like the TBM700 respond to a sudden loss of lift? Co-pilot Jaubert gives the thumbs-up as I decide to find out. I throttle down the power to a modest 20 percent torque, maintaining height with a little help from the electric pitch trim. The angle of attack increases rapidly and we lose airspeed, the siren sounds and shortly afterwards the wings stop generating lift. The port wing drops slightly, but is easily corrected by 'pushing' a little and then levelling out. Every time I try, the aircraft banks to port – the large weather radar housing in the port wing causes loss of lift on the port side first.

A couple of steep circles and a zoom later, and Monsieur Jaubert suggests an emergency descent. The idea is to simulate dropping as fast as possible to an altitude where we could breathe in the unlikely event of an emergency.

The manoeuvre is child's play with the TBM700: point the nose down until the vertical speed indicator (VSI) shows a sink rate of almost 8000 feet per minute! That's just the way I imagine a space shuttle approach – the sensation that you're falling out of the sky. No need to worry about the airframe, since the red-line speed is 270 knots. In the denser layers of air below 10,000 feet we reach no more than 250 knots even at this dive angle, so our descent could have been even steeper. At 5000 feet the computer warns us with a loud "Sink rate! Sink rate", and we pull out of the emergency descent.

On the approach to Tarbes, with permission from air traffic control, we try out a high-speed approach. If you really had to get down as fast as possible, this would be your best option. We head towards the regional airport at approach height at 240 knots, and even in the final approach we are doing almost 450kph. An approach that would be impossible with a piston-engined twin or a jet - but is possible in a turboprop. Two kilometres out from the runway threshold, I ease off the power and the broad propeller blades immediately switch to fine pitch, generating enormous drag. The perfect air brake in fact! Just before the start of the runway we are doing an optimum 80 knots, and no sooner are we down than we engage reverse thrust and briefly apply full throttle. 400 metres further down the runway we come to a stop; I only had to touch the wheel brakes a couple of times. I am allowed to perform two more landings, one 'touch-and-go', one normal – which go well. If one is used to flying lighter aircraft, there's a tendency to overflare the aircraft as one flattens out and not fly 'down' to the ground as a professional would. But one soon gets the hang of it after a few attempts – as with everything in flying it's just a question of practice, and the TBM700 is astonishingly easy to land for such a 'fiery lady'. Personally I'd say it's much easier to fly than a conventional piston twin like the Piper Seneca.

Okay, I'm totally smitten! The next 2.7 million dollars I've got to spare .... I'll be globetrotting before you can say TBM700C2!

SOCATA TBM700C2

Technical data

Powerplant:	Pratt & Whitney PT6A-64
Nominal power:	700shp
TBO (time between overhauls):	3500 hours
Propeller:	Hartzell, four-bladed constant speed, full-feathering, 2.31m diameter
Length:	10.64m / 34.92ft
Height:	4.35m / 14.3ft
Wingspan:	12.7m / 41.6ft
Wing loading:	166kg/m2 / 34lb/sq.ft
Seats:	6
Cabin length:	4.05m / 13.3ft
Cabin width:	1.21m / 4ft
Basic empty weight:	2109kg / 4650lb
Maximum take-off weight:	3354kg / 7394lb
Maximum payload:	634kg / 1398lb
Maximum payload with max. fuel:	405kg / 893lb
Total tank capacity:	1100 litres / 290.6 U.S. gallons
Take-off run:	860 metres / 2830 feet
Rate of climb:	24 minutes from sea level to 26,000 feet
Max. cruise speed:	300 knots (range 1375 nautical miles / 2510 kilometres)
Long-range cruise speed:	255 knots (range 1650 nautical miles / 3055 kilometres)
Landing run:	740 metres, 2427 ft
Price:	$2,699,190

Spoilers on the top of the wing assist the short ailerons