When Filippo Bagnato took over the helm of ATR to steer the company out of its perilous blind flight through the fog, the prestigious European aircraft-builder had only ten aircraft on its order books. Despite the good reputation of its products, ATR was at that time within inches of a sudden crash landing. The crisis was so acute that plans were already afoot to close down the final assembly line in Toulouse. Well-known manufacturers such as Saab (‘340’, ‘2000’) and Dornier (‘328’) had already ceased to produce regional aircraft, yet the situation was still dire for the largest two remaining manufacturers in the market for turboprop regional aircraft, ATR and Bombardier.

The newly appointed CEO of the joint venture between EADS and Finmeccanica – who had previously been head of Eurofighter – could not know with certainty whether his ‘touch-and-go’ manoeuvre was going to succeed. More aptly than through this aviation image, the situation on the turboprop market in those days can be summed up by an analogy with sailing: it was in the doldrums.

Now, in 2006, ATR has changed beyond all recognition. With over 130 aircraft on its order books, the company has enough work to keep it busy for years to come. It holds a record 65 percent market share in the turboprop airliner business and is pressing ahead with a consistent, if cautious, enhancement of the ATR42 and 72 series. According to Bagnato, “ATR will deliver another 25 aircraft in 2006, but numbers will reach 44 in 2007 and as many as 60 in 2008.”

The market took a sudden about-turn in 2005, and this time the situation was reversed. Rapidly escalating fuel prices posed insuperable difficulties for regional jets – whose rising popularity, as recently as the mid-1990s, had been the reason why many a turboprop model was taken off the production line. Almost overnight, there was a great demand for the significantly thriftier turboprop airliners.
Jean-Michel Bigarrée, head of ATR Training & Flight Operations, in the virtual procedures trainer

ATR’s new full flight trainer (FFT) creates an almost perfect illusion of flight at a significantly lower cost than a full flight simulator (FFS)

The latest training tool is a simulator known as the ‘FFT’ (Full Flight Trainer), which uses the same realistic flying sensation at a fraction of the cost of a full flight simulator. It uses a sophisticated sight-and-sound system coupled with a seat cushioning system to realistically transmit the aircraft motion and vibration to the pilot via his seat. The FFT simulator uses systems to generate brain motion, an unavoidable illusion which, as many pilots vow, conveys an even more realistic impression of flying than a highly elaborate Level-D-compliant full flight simulator, which is moreover many times more expensive to operate.

The author decided to put matters to the test at ATR’s training centre in Toulouse, and the results were amazing. In short, I felt during all phases of the ‘flight’ as though I were sitting inside a full flight simulator. The ten-minute flight through heavy turbulence and thunderstorms even produced a most realistic queasy feeling in my stomach.

A further cost-saving feature of the FFT are the TFT monitors installed behind the panel lining, which simulate all the mechanical displays such as those of the engines at a much lower cost than has ever been possible before. Currently still under development, the system is expected to cost about 2.0 million euros – way below the price of an FFS.

Simplicity and commonality are ATR’s guiding principles

ATR moved far ahead of its rival Bombardier in 2005, its low operating costs evidently play a major role in the company’s 65-percent market share. Offering cruising speeds of up to 60 knots faster than ATR, Bombardier’s de Havilland Dash-8 consumes a great deal more fuel – whereas its greater speed gains it only five to ten minutes on most routes. In practical operations on average routes, such an advantage is virtually irrelevant.

The other side of the coin is that the higher speed necessitates hydraulic support for the flight control systems – which in turn results in greater weight and complexity and hence a greater need for maintenance. For ATR, on the other hand, the simplicity principle seems to pay off.

The first-generation ATR-42 launched on the market in 1985 was supplemented in 1989 by an elongated ‘72’ version featuring various technological enhancements – though only to details that do not jeopardise the aircraft family’s ‘commonality’ principle. The ATR72’s wing box, for example, is made of carbon fibre composite materials. In 1996 the manufacturer presented the ‘900’ series for both types, which is distinguished

### Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Max. takeoff weight</th>
<th>Max. cruise speed</th>
<th>Max. range*</th>
<th>No. of seats</th>
<th>Max. payload</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATR 42-500</td>
<td>18.8 t</td>
<td>300 kts</td>
<td>2000 km</td>
<td>48-50</td>
<td>5300 kg</td>
</tr>
<tr>
<td>ATR 72-500</td>
<td>22.8 t</td>
<td>300 kts</td>
<td>2200 km</td>
<td>68-74</td>
<td>7000 kg</td>
</tr>
</tbody>
</table>

* at max. takeoff weight

### Turboprops: A Clear Advantage in Terms of Fuel Consumption and Emission Levels

The traditional ‘St. Martin’ plant in Toulouse. The other side of the coin is that the higher speed necessitates hydraulic support for the flight control systems – which in turn results in greater weight and complexity and hence a greater need for maintenance. For ATR, on the other hand, the simplicity principle seems to pay off.
The airframe for the ATR42 and 72 is built by Alenia at Pomigliano, close to Naples. It was significantly reinforced as part of the redesign prior to the introduction of the ATR72-500 in the mid-1990s. This reduces vibration and thus also noise, and – along with the enhanced acoustic insulation and the six-bladed propellers – is one of the factors responsible for keeping the noise level as low as that of a jet airliner. The standard configuration includes two cargo compartments, each with a capacity of five cubic metres. Alenia in Italy has developed a ‘quick change kit’ with which the aircraft can be converted into a freighter in 30 minutes. A special version with an enlarged cargo door is also available.

Cabin
The cabin is reminiscent of that in a jet airliner, having the widest aisle of any aircraft in its category. The interior equipment, with reading lamps and large overhead lockers, is as generous as you would find in a jet. A good view out of the windows is ensured by the fact that there are more windows than rows of seats. A luxury cabin with leather seats is available as an option.

Propellers
The two 568F propellers (diameter 3.94m) are manufactured by Hamilton Sundstrand. They each have six blades with an electric de-icing system, are made of composite materials and feather automatically in their steel hub in the event of engine failure. The blade pitch is controlled electronically, with a hydraulic backup. Damaged propeller blades can be individually replaced on a fully installed propeller. The whole propeller only weighs 164 kilograms.

Flight deck
The avionics system of the ATR42/72 can optionally be certified for CAT II ILS precision approaches. The navigation system is based on the Honeywell global navigation satellite sensor (GNSS). The system is linked to a modern autopilot flight director system and the electronic flight instrumentation system (EFIS). The colour weather radar can be displayed on the electronic horizontal status indicator (EHSI). Data from the enhanced ground proximity warning system (E-GPWS) are displayed on the artificial horizon. The TTR 921 traffic alert and collision avoidance system (TCAS) is manufactured by Rockwell Collins.

Wings
The entire wing is manufactured by EADS Sogerma in Bordeaux and delivered to Toulouse ready for assembly. All the electrical, hydraulic and mechanical components are already installed at this point, as are the two welded titanium engine mounts.

While the wing of the ‘42’ model is made entirely of aluminium alloys (its outer wing box is built in Xian, China), the outer wing box of the ‘72’ is made largely of carbon fibre composite material. The ailerons, each of which has a trim-tab, are mechanically actuated via control cables and rods, and their rudder control horns can be electrically de-iced. The Fowler flaps extend hydraulically into their 15-, 25- and 35-degree positions and the ground spoilers are hydraulically actuated as well.

The wing leading edges are pneumatically de-iced, as are the engine air inlets. The engine nacelles are made of carbon/Nomex sandwich material and partially reinforced with Kevlar. Composite materials account for 15 percent of the overall structure on the ATR42-500 and as much as 30 percent on the ATR72-500.

A 10-42/72
As complex as necessary, as simple as possible

Landing gear
Messier produces the ATR’s hydraulically retractable tricycle landing gear. The wheels and tyres are made by Dunlop, with Michelin or optionally Goodyear providing special tyres for operation on unpaved runways. The anti-skid control system for the main landing gear is supplied by Crane Hydro-Aire.

Engines
The high-wing monoplane’s two powerplants are the proven PW127E (2160shp, ATR42-500) and PW127F (2475shp, ATR72-500) propeller engines from Pratt & Whitney Canada, the established market leader in the manufacture of gas turbines for propeller-driven aircraft. The right engine is series-produced with a propeller brake (‘hotel mode’) that allows the turbine to idle before and during boarding, thus providing an autonomous power supply and air-conditioning for the cabin.

Tail unit
The T-tail with its mechanically actuated elevators and rudders is made entirely of composite materials by Alenia in Foggia. The horizontal and vertical tailplane leading edges are de-iced pneumatically and the elevator horns electrically.

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A TR 42/72
As complex as necessary, as simple as possible
A flying visit to the ATR flight test department

A four-hour flight with Eric Delesalle, the ATR flight test director and our ‘co-pilot’ for the two-day visit, is a unique experience. ATR quickly proves that commercial aircraft are made of sterner stuff when it comes to power and performance!

Impressive flight performance

During the flight, the ATR pilot will wear a headset and talk radiotelephony with the ATR project team. At the same time, the test pilot will receive the necessary information via a two-way audio system.

Between two acceptance flights: ATR72-500 on the apron at Toulouse airport

ATR flight test director Eric Delesalle in the cockpit of an ATR72-500. ATR, a typical European company

particularly by the low level of noise in the cabin, the six-blade propellers and new cabin furnishings.

According to ATR CEO Filippo Bagnato, engineering simplicity has been and will be a decisive factor for ATR’s success. In his opinion, more modern technology can have only one purpose: to help airlines achieve their goal of saving costs. He categorically rejects any form of high technology that bears the taint of a marketing tool and involves higher operating costs. Fly-by-wire controls, or electric brakes? None of these things will find their way into the ATR, unless they make the aircraft simpler rather than more complex, says Bagnato. Fewer spares parts in the depot would be a good reason for introducing ‘FBW’ and thereby further reducing operating costs. However, the technology is not yet sufficiently advanced.

Nevertheless, ATR has invested a great deal to advance the development of its turboprops in keeping with current needs, while taking care not to dissipate its energies in a technologically complex aircraft. Bagnato explains this strategy with a metaphor from the world of sports: “You have to be in mind which league you are playing in – and the choice depends on sports where you know you can’t win.” This is one of the reasons why there will not be an 85-seat ATR in the future. The CEO is determined ATR remains only in the ‘game’ in which his company is the market leader – regional aircraft with 50 to 74 seats. All the same, he is keeping his eyes open: “You never know, there may come a time when I consider having 85 seats.”

A midlife update to be carried out in the near future will not only introduce an Airbus-style glass cockpit but also enhance the aircraft’s performance on short runways by using more powerful engines to enable takeoffs with a heavy payload. This improvement additionally calls for a modified rudder with greater deflection to reduce Vmca, the minimum speed at which a pilot can recover directional control of his aircraft, using the rudder, after one engine fails – an indispensable criterion in certifying an aircraft for takeoffs at low speed. Once it has obtained the extended certification for this modification, the ATR42/72 will be even better equipped to land on short island airstrips such as those in the Philippines or the Caribbean. By September 2006 ATR had delivered 700 aircraft – 100 more than had been predicted for the entire life cycle of the product when it was first introduced. And having emerged from the doldrums in 2003, the company’s turnover in 2006 is estimated at about 730 million dollars. It expects to pass the billion-dollar mark in 2007 and anticipates revenues of 1.2 billion dollars in 2008.

Nobody in Toulouse talks about a crisis in the turboprop sector any more.

Filippo Bagnato