



**CAN TAKE THE HEAT**

Avio in Pomigliano manufactures low pressure turbine parts for the GENx engine of the Boeing 787. The blades are made of René N5 and René 515 (depending on the version), nickel-based alloys with high heat resistance.

# High-flying partners

**Pomigliano, Italy.** Through a three-way partnership with machine tool maker Makino and Sandvik Coromant, Italian company Avio was able to dramatically reduce machining time and improve process reliability and quality.

■■■ **MORE THAN HALF** a century before the term “high technology” was coined (in 1964), the Italian company Avio S.p.A. was creating high-tech solutions for aerospace problems.

Avio was founded in 1908 as a subsidiary of Fiat, Italy’s largest auto company. Its original mandate was to develop and manufacture an aircraft engine, the SA 8/75, based on the racing car engine. World War I was a catalyst stimulating further R&D for aerospace applications, and the division that was to become Avio transitioned from building engines to constructing complete aircrafts. In 1918, the group became known as Fiat Aviazione.

Diversification during the 1930s included the development of engines for industrial use. When World War II ended, experience and know-how in this sector led, through a collaboration agreement in 1954 with Westinghouse, to the development of a gas turbine. The success of this project convinced the management of Fiat Aviazione to concentrate on gas turbines. Specialization accelerated when Fiat sold its aircraft construction activities



Luigi Cuccaro

in 1972 and sharpened its focus on aero engine production.

**IN 1989**, Fiat Aviazione became Fiat Avio, with customers such as Boeing, Airbus and NATO. New areas of expertise developed in 1994 and 1996, thanks to strategic acquisitions in space propulsion and civil aircraft MRO (maintenance, repair and operations). The latter came about through the purchase of Alfa Romeo Avio in Pomigliano d’Arco, situated near Naples. Today Pomigliano is an important production centre for the company, with production lines for combustors, afterburners, airfoils and small structural components for aero engines, as well as three test cells for the engines. “More than 90 percent of our business here is with General Electric, specifically the GEnx (General Electric next-generation) high-tech turbofan jet engine earmarked for the new Boeing 787,” explains engineer Luigi Cuccaro, manufacturing chief engineer for stator blades at Avio’s Aeroengine Division based in Pomigliano.

Pomigliano is also the site of the company’s Civil AvioService Division,



**FOUNDED:** 1908 in Turin as part of Fiat’s entrance into the aeronautical sector  
**MANAGEMENT:** Francesco Caio, CEO  
**PRODUCT LINES:** Design, development and manufacture of aerospace propulsion components and systems for aircraft, with a strong technological component  
**NUMBER OF EMPLOYEES:** 5,200 – 86 percent in Italy

which carries out MRO and support assistance for civil aeronautical engines and the repair and overhaul of components designed and produced by Avio.

While the company's customers are overwhelmingly global, its production capabilities outside its home country only began in 2001, with the creation of Avio

Polska in Poland. Continual investments in R&D and collaborations with top Italian and international universities and research centres have consolidated Avio's reputation in aeronautical and aerospace sectors around the world.

In 2003, as Fiat struggled with the automotive crisis, its core business, it sold Fiat Avio to a consortium controlled by the US-based Carlyle Group. Avio S.p.A. was born. In August 2006, the European private equity fund Cinven acquired the Avio shares owned by Carlyle. Currently Avio is owned by Cinven and the Italian government.

While the company's ownership has stabilized, business

challenges and economic pressures have increased and converged. The pressure to increase productivity is both fierce and global. "All our challenges come down to two words: costs and timing," says Antonio Maurelli, turbine blade processing manager at Avio's Turbine Airfoil Centre in Pomigliano.

**SO WHEN GENERAL ELECTRIC**, Avio's largest client, asked for faster turnaround and lower costs for the stator turbine blades of its GENx jet engine with no loss in quality, the Italian company was eager to accommodate.

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**Domenica Di Palo**, machine operator, Antonio Maurelli, turbine blade processing manager



**SEATING**

210 to 250 passengers, twin aisles.

**WINGSPAN**

The aeroplane has a wingspan of 60 metres.

**RANGE**

14,200 to 15,200 kilometres

**SUPER EFFICIENT AEROPLANE**

The Boeing 787 uses 20 percent less fuel than any other aeroplane of its size.

GETTY IMAGES



#### DIMENSIONS

Body is 57 metres long, 17 metres tall and 5.74 metres wide.

#### THE SITUATION

Cooperation can be as important as technology and innovation in lowering costs and improving quality in industrial production. Introduced at an early stage, it can lead to process innovation and the integration of new technologies with cost benefits for suppliers and customers alike.

Avio's customer GE was asking for greater speed and quality in the production of turbines for the new Boeing 787. Avio worked closely and collaboratively with a team from Sandvik Coromant and engineers from Makino, a machine tool maker, to come up with a solution.

#### THE SOLUTION

"Sandvik Coromant Machine Investment specialist Roberto Appiani worked out a milling method and calculated the theoretical cycle time, using Sandvik Coromant CoroMill 316, based on results from previous tests in Avio," recalls Sandvik Coromant area specialist Bruno Schisa, who was deeply involved in the project. A Makino engineer developed the milling paths and set up the machine – equipped with a Hydrogrip chuck – to ensure process stability; Avio technicians designed component fixtures.

"We cooperated to guarantee the quality of components, and Sandvik Coromant milling product and application specialist Stefano Bertoni supported Avio in the optimization of tool life," says Schisa.

#### THE RESULT

The process the team developed was a new approach to machine tooling, neither strictly component-based nor completely integrated. The test results were so compelling that Avio opted for this solution, with a resulting productivity increase of 70 percent.

#### NEW TOOL PROCESS

The new process of machine tooling resulted in a 70 percent productivity increase.



The GEnx will be original equipment on Boeing's new 787, which after a number of setbacks and delays made a successful test flight in May 2011. The overall engine market for the 787 is estimated at USD 40 billion over the next 25 years.

GE's specific request was to improve the machinability process of the blades, which are made of René N5 and René 515, nickel-based alloys that have high resistance to heat.

Starting in September 2011, a team from Avio, Sandvik Coromant and machine tool maker Makino met to discuss the situation. They developed a process to lower production time from 46 to 30 minutes or less per component without loss of quality. "Our problem was not only the material but its geometric form, its bulk and the issue of vibration," explains Maurelli.

Through the three-way partnership, Avio reduced machining time by 16 minutes and improved process reliability and quality. Since production began in January 2012, there has been only one defective piece – and that was due to something other than the new process. ■

Antonio Maurelli, turbine blade processing manager (left), with Bruno Schisa, Sandvik Coromant area specialist.

