

ITALIAN MACHINE TOOLS, ROBOTICS & AUTOMATION INDUSTRY ~ NEWS

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PIATTAFORMA INDIA PROJECT

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UCIMU-SISTEMI PER PRODURRE



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ADVANCED SOLUTIONS FOR COMPLEX PARTS USED IN AIRLINERS ENGINES

MCM is a specialist in the design and production of flexible manufacturing systems. The core of them are 4 and 5-axis horizontal machining centres, characterized by technical solutions to achieve maximum performance with no compromises. In addition to the units manufactured in-house, MCM is also able to incorporate, into the production lines, machines featuring complementary technologies. This allows the engineering of complete and customized solutions, giving customers the benefit of a single, competent and reliable partner. MCM's product range includes machining centres, flexible automation solutions, systems integration, management software and process technologies.

THE CUSTOMER

MTU Aero Engines, with 15 production sites around the world, is Germany's major engine manufacturer. The company specialises in the development, production, marketing and commissioning of engines for commercial and military aircrafts. The components produced by MTU Aero Engines are employed in some of the most important civil aviation propellers.

THE TECHNOLOGICAL CHALLENGE

MTU Aero Engines took part in the GE9X programme, the engine for the new long-range aircraft Boeing 777X, planned for serial production from 2020. MTU's main objective is to develop and manufacture the turbine hub casing. This highly complex component is based essentially on the tried-and-tested architecture of GE90 and GENx engines.

To purchase the machines required to manufacture these new components, MTU turned to MCM, with whom it has been cooperating successfully since 2007.

The GENx variant, an intermediate turbine chassis, used in the Boeing 787 Dreamliner, is also manufactured by MTU on MCM machines.

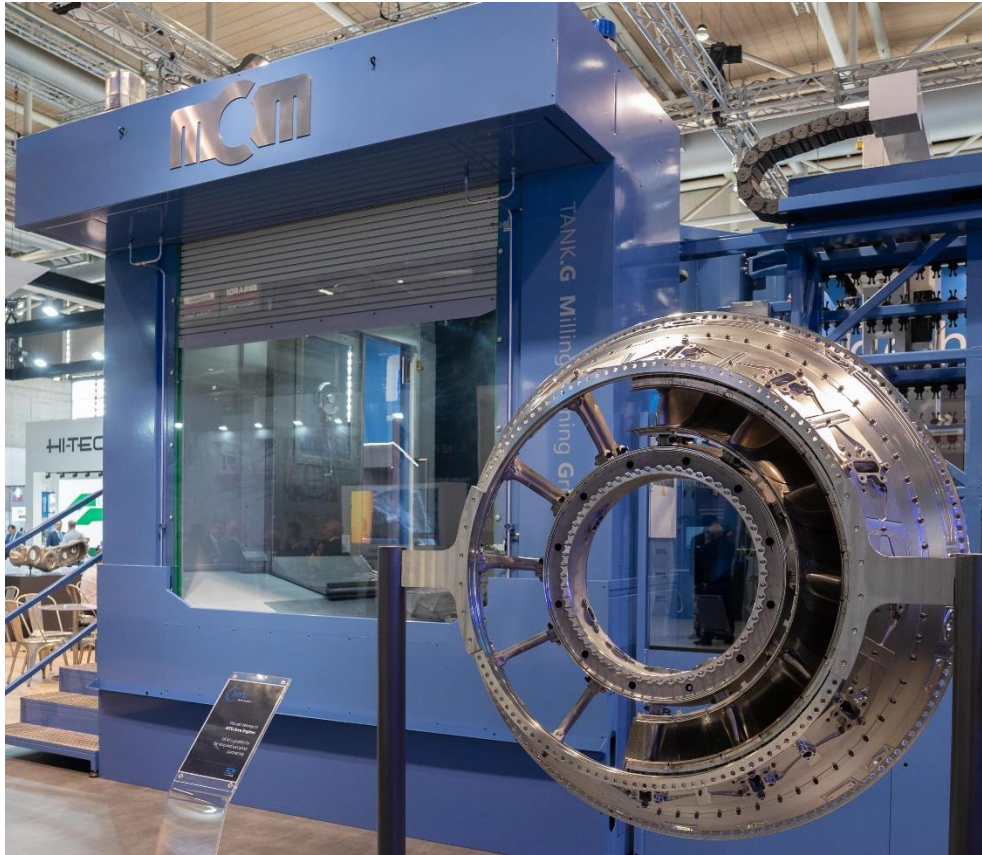
The intermediate turbine chassis is an essential structural component of the engine, because it contains the rear engine bearing seat, and also has an aerodynamic function, channelling the hot gas flow flowing from the high-pressure turbine to the low-pressure one. An essential component of the intermediate turbine chassis is the Hub Strut Case (HSC), consisting of three main parts: external casing, hub and 12 struts. The tough material used, a Nickel-Chrome alloy that is ultra heat-resistant, is particularly challenging for the machines and, above all, the tools. The machining process includes milling, turning, grinding, deburring and assembly, removing 66% of the raw material weight, mainly due to several hundreds of 600 holes made in the flanges, hub and struts and case chamfers. One specific challenge is represented by the need to maintain precise turning tolerances, for example the coaxial tolerance is just a few hundredths of a millimetre. After completing the piece, the HSC has a high - 5-digit - final value.



Aerospace engine case

THE MCM SOLUTION

The MCM solution for manufacturing the GE9X HSC consists of two FMS cells with two different MTU production sites as destination. The first cell includes 3 TANK 1800G Multitasking machining centres with Automation, equipped with a shuttle for the handling of pallets of different sizes (1.250, 1.400 and 1.800 mm). The store-tower holds a total of 14 pallets. The system also includes two high-accuracy piece loading and unloading stations. MCM had to take into account a series of stringent demands by MTU Aero Engines mainly concerning three key objectives: reducing the space occupied in the factory to a minimum, reducing the number of spares to store, and limiting the training fees for the operating and maintenance staff.

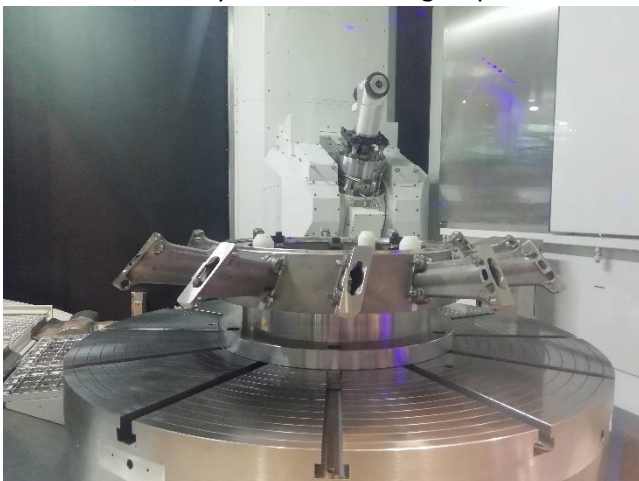


PROCESSING AND AUTOMATION

In MCM Multitasking machining centres, the piece undergoes all processing steps - drilling, milling, turning and grinding - which would normally require the use of different machines. This drastically reduces the piece processing times.

A peculiar aspect of MCM solution is the integration - in the machining centre - of the grinding functions and of all the equipment and devices required to perform this kind of processing. Grinders are managed as tools to all intents, they are equipped with Capto C6 taper and fastened to the spindle in a standard way. The machining centre is configured for a maximum grinding disc diameter of 300 mm, revolved by a driven disc placed within the workarea. The grinding disc wear is accurately assessed and compensated by a four-step process that guarantees that the sizes of the final piece are maintained. This process involves the pre-grinding of the piece on the disc, measuring the size obtained with the probe, subsequent correction of the depth of cut if required and finally finishing. All steps are supervised by a software.

Furthermore, the system can manage up to 3 different types of angular heads for operations in positions that cannot be



Aerospace stern

reached by a standard spindle head. Both angular heads and their tools can be automatically switched and managed on the tool-magazines. Turning tables are driven directly by gearless torque motors that can reach a high speed and acceleration. An integrated measuring system ensures the maximum positioning accuracy. The pallet is locked to the rotary table by means of 5 hydraulic devices. There is also an external disc brake to obtain a better processing stiffness with the B-axis locked.

PALLET AND TOOL MANAGEMENT

MCM automation involves a high quantity of pallet storage stations per cell. The two new units for MTU are configured for 14 and 20 pallets, capable of managing 1.250 mm, 1.400 mm and 1.800 mm diameter pallets.

The pallets are transferred from both operator stations to the storage stations and machining centres by a shuttle. A centring device monitors the correct locking of the machine pallets with a concentricity accuracy of 20 µm.

The FMS system tool-magazines allow to manage a large quantity of tools. The FMS at the production site in Munich, for example, includes 3 store-towers with a capacity of 480 Capto C6 tools per machine. Two of these have a "Mirror" configuration - shared between two machines - for a total of 960 tools that can be accessed.

SOFTWARE AND ENERGY SAVINGS

The entire FMS system is managed by the jFMX system monitoring software developed by MCE, MCM IT division. The software works on an internal network structure (Intranet) that can show the actual system status in real time and share its data on workstations only with authorized people. The Java-based jFMX supervisor allows to manage a flexible production system: it performs production, coordinates automation, manages pallets, piece loading/unloading operations and tools. The system also monitors the tool life. It also schedules programs, calculates machinability and drafts system efficiency, productivity and availability reports, in full compliance with the Industry 4.0 principles.

Lastly, particular attention was given to the system energy management, by employing spring water available in the installation site. An air-water heat exchanger system allows to cool down all the units that produce heat within the machining centres, from spindles to rotary tables, from tilting heads to electrical cabinets and coolant. Another feature aside from the reliability, efficiency, accuracy, flexibility and customisation that led MTU Aero Engines to continue its partnership with MCM.

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The project Piattaforma India has been promoted by UCIMU – Association of Italian Machine Tools Manufacturers and AMAPLAST – Italian Plastics and Rubber Processing Machinery and Moulds Manufacturers Association. The two associations agreed on the idea that promoting a network of associations and entrepreneurs who have developed knowledge and experience on the Indian market, can be useful in favoring of new paths of development for business. The Indian companies who are interested to form JV, cooperation, technical tie up, purchase machinery etc from/with Italian companies can contact below mentioned address for any assistance:

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