

Machining for the aerospace sector

Aerospace manufacturing is highly demanding for all tiers of the supply chain from OEM to subcontractor. We examine the specific machining challenges the sector faces and offer some solutions.

For decades, the commercial aerospace sector has bucked the trend and enjoyed above average growth rates, driven by a continuing increase in passenger travel demand and an exceptionally fast asset replacement cycle. Research by Deloitte suggests that strong increases, year on year, in total passenger kilometres are driving unprecedented levels of aircraft production rates, which in 2015 were about twice the levels experienced 10 years ago.

All of this places exceptional demands on the aerospace supply chain. One consequence is that, in recent years, a number of tier one suppliers have taken the decision to close their non-core machine shops and place their faith in high quality subcontractors equipped with the machines capable of rising to the demands of the sector.

Those involved in aerospace component manufacturing are faced with a wide range of challenges, from the machining of structural parts, such as wing parts and bulkheads, through to engine components and landing gear systems. In addition, a wide range of metals and alloys are being machined, from titanium through to aluminium.

It is worth analysing these different machining challenges in order to identify the issues being faced and highlighting some potential machine solutions.

Structural parts, such as fuselage, wings and bulkheads, require specific machine characteristics, namely the ability to profile large workpieces. The VORTEX HORIZONTAL PROFILER (HP) 160 5-axis horizontal machining centre, is equipped with a horizontal spindle and a large vertically oriented worktable that accommodates a maximum load capacity of 3,000 kg, making it ideal for structural parts. The machine's special box-type design integrates its base, column and table to ensure consistent, highly rigid cutting performance, provided by its 26,000rpm, or optional 30,000rpm, main spindle.

For subcontract manufacturers of structural parts, accurate and efficient machining of large thin walled parts is vitally important and one of the most popular machines for this type of work is the VTC-800/30SDR vertical machining centre. The machine features a 40 taper or HSK-A63 18,000rpm spindle, swivelling spindle head (B Axis) and a full traveling column design with two synchronised NC rotary tables each 3,690mm apart. This facilitates a large trunnion fixture with an 820mm diameter swing, for an effective solution for machining aerospace structure components up to 3,000mm long.

Large chip volumes typically associated with this type of application are efficiently dispersed from the working area by the combination of a chuted bed design with an integrated Niagara coolant wash that covers the full X-axis length. The enhanced swarf management characteristics are further complimented by a large volume coolant tank and a specialised conveyor system, enabling prolonged and uninterrupted machining.

Additionally, the VTC-800/30SDR is available with a choice of either MAZATROL Matrix 2 or SIEMENS SINUMERIK 840D sl CNC, giving additional choice to customers who may have standardised upon Siemens control in their production facilities.

The ability to machine complex geometrical surfaces with a high degree of accuracy is vitally important for the aerospace sector. The machine of choice for many aerospace suppliers, therefore is the VARIAXIS i-series, which offers full simultaneous 5-axis machining allied to a variety of spindle options to suit multiple applications.

The VARIAXIS i-1050T, for example, combines both 5-axis milling and turning capability in a single set-up for large components up to a maximum diameter of 1,250mm x 900mm in height, which makes it ideal for machining engine components. Performance is delivered by a powerful 10,000rpm and 37kW 50 taper milling spindle and a high rigidity turning table, that utilises a 500rpm direct drive motor integrated inside a fully supported trunnion table for maximum stability. Additionally, the milling spindle can be optionally specified, with a high torque 5,000rpm spindle for difficult-to-cut materials, and a 15,000rpm spindle for high speed machining requirements.

The size of the machining envelope, which impacts on the size of the component that can be machined, is also a major issue for the aerospace sector. The INTEGREGX e-V series, a highly popular machine in the aerospace sector, possesses full multi-tasking capabilities, including 5-axis contouring, with a large workpiece capacity. The INTEGREGX e-1600V/10, for example, can machine a maximum workpiece diameter of 2,050mm up to a height of 1,600mm, whilst the high-rigidity base construction, coupled with the double column design enables the spindle to reach 540mm beyond the centre line. This makes the INTEGREGX e-1600V/10S ideal for the high accuracy requirements of aerospace components, such as engine and fan cases.

This ability to machine large, heavy workpieces is also shared by the INTEGREGX i-V vertical multi-tasking series. The INTEGREGX i-630V/6S, for example, is equipped with a single table that provides a generous machining capability of 1,250 mm in diameter and 1,400 mm in height, with a maximum load capacity of 1,750 kg. This enables the machine to process large aerospace components, such as turbine disks, fan cases and bulkheads.

Complex workpieces, such as actuators, turbine blades and hydraulic valve blocks, require a variety of machining disciplines that can lead to bottlenecks in production. The INTEGREGX i-series with its DONE-IN-ONE capability, including 5 axis simultaneous, can dramatically reduce the number of operations and production lead time to dramatically reduce manufacturing costs. The INTEGREGX i-

series, with bed lengths from one metre to 2.5 metres, offers a flexible configuration according to the application requirements. The machine has powerful main and second turning spindles, tailstock, lower turret and a fully contouring B-axis that houses either a high-power 12,000rpm or a high speed 20,000rpm milling spindle, making it ideal for machining complex workpieces.

The combination of powerful turning capabilities allied to milling is very important for the aerospace sector, particularly for large workpieces. The INTEGREX e-H multi-tasking series combines turning centre capabilities with high powered milling and full 5-axis, making the machine a popular choice for the sector. The INTEGREX e-670H, with an exceptionally large 1,050mm swing diameter and bed lengths up to six metres, incorporates a powerful 10,000rpm 37kW milling spindle in a fully contouring B-axis. Machining capability is enhanced further by a fully automatic NC tailstock and steady rest to support long shaft components; whilst a long boring bar stocker provides a solution for deep hole machining applications, making it ideally suited to meet the demanding requirements of large aerospace applications, such as landing gear struts.

The range of different components required by the aerospace sector inevitably means that a one-size-fits-all machine philosophy is impossible. The differences in machining a bulkhead compared to a gear or flap trap inevitably require different capabilities. Our advice is to partner with a machine supplier that can offer the necessary breadth of machines and application support that will enable you to choose the best machining solution.