



ATI Stellram has worked on tooling development with Messier-Dowty

Aerospace challenges

Andrew Allcock reviews recent aerospace manufacturing applications, from EDM through machining to degreasing – increased quality and productivity are main themes, he finds

A series of innovative machining solutions for latest generation aerospace materials have been developed through collaboration between aircraft landing gear systems maker Messier-Dowty and cutting tool specialist ATI Stellram.

The solutions spring from a research programme undertaken by Messier-Dowty to evaluate the use of new metals; in particular, titanium-based alloys such as ATI 5553 for Boeing.

ATI Stellram was challenged to identify a range of strategies for producing high performance machining solutions. "It was crucial for us to learn more about these new, complex materials and their machining characteristics to expand the use of titanium in our landing gear components in place of high strength 300M steel," explains Philip Spiers, manufacturing development manager at Messier-Dowty's UK facility in Gloucester.

"Our decision to work with ATI Stellram on this undertaking was influenced by our long-standing relationship, which now spans more than 20 years, as well as by their vast experience in the field of difficult-to-machine materials," he adds.

In turn, ATI Stellram's ability to draw upon the capabilities of sister companies such as ATI Allvac, ATI Allegheny Ludlum and ATI Wah Chang, the speciality metal producers, brought more benefits to the project, it is said.

VIBRATION BEATING CUTTER

Among the series of new solutions devised by the ATI Stellram team headed by global aerospace manager John Palmer, was the introduction of the Stellram 5230VS chevron, long edge milling cutter, comprising 35 Stellram X500 inserts.

The cutter is used to machine the

external ring and internal counterbore of a truck beam that forms part of the landing gear for the Boeing 787 Dreamliner.

"Machining this tubular component had previously been tricky due to the problem of vibration. However, the new Stellram tool is more stable and much smoother under cutting pressure, eliminating the harmonics that caused the vibrations," says Mr Palmer.

"This new chevron long edge cutter is specially designed for machining the new generation of materials, including titanium-based alloys, helping to deliver better levels of productivity and high metal removal rates."

The success of this solution has also prompted Messier-Dowty's engineering team to investigate using the new tool in another location on the same component as well as for a profiling application on a steel part used on a different aircraft

landing gear system.

In August 2008, family-owned tooling manufacturer and sub-contractor, Burcas, installed its first 5-axis machining centre to supplement 3-axis prismatic metalcutting and extensive multi-axis mill-turning at its Birmingham factory.

An early job put on the trunnion-type, 5-axis Hermle C 40 U (Geo Kingsbury Machine Tools) was a mild steel component for a well-known UK aero engine manufacturer.

The outer part of the circular component requires complex features to be machined around the inside circumference, while the outside of an inner section has similar milled features.

Other components currently produced on the Hermle include stainless steel brackets and complex aluminium components such as aero engine housings.

Says Burcas managing director Mike Burrows: "Our aerospace work has been growing rapidly year on year and will continue to do so until at least 2015, so we are building this side of our business and already have approvals from GE Aviation, Messier Dowty, Bombardier and Goodrich.

"Forty per cent of our £5 million turnover is currently related to aerospace sub-contracting and we intend to double that in the next few years. The UK is the second largest aerospace parts manufacturer in the world, behind the US, but it is difficult to break into supplying the sector without significant investment plus the right approvals."

FIVE-AXIS INVESTMENT

Leading precision engineering sub-contractor Arden Precision, Solihull, has similarly recently invested in 5-axis machining technology, but not for the first time: it has installed its second HPM 1350U from GF AgieCharmilles.

The new machine was installed in the Spring of 2008 and, like the first machine, is being used to manufacture high precision complex and performance-critical parts predominantly for the aerospace sector that today accounts for



Burcas has installed Hermle 5-axis machining technology supplied by Geo Kingsbury Machine Tools. The sub-contractor expects its aerospace business to grow until at least 2015

over 90 per cent of the company's annual turnover.

Arden Precision, established in 1980, has developed successful partnership relationships with many leading civil and military aerospace OEMs and Tier 1 and 2 suppliers. The company's latest 5-axis machine tool investment has enabled it to further improve its performance.

The aerospace parts and kits manufactured by Arden on its new 5-axis machine vary in size, complexity, material and volume. Typically, parts are made from aluminium, stainless steel, titanium and super alloys, and are required in low-to-medium batch sizes.

Parts are machined on the HPM 1350U from castings or from solid with part tolerances on certain features (like internal radii and small diameter bores) being as tight as 0.01 mm. Similarly, exacting surface finish standards (Ra 0.4-0.8 micron) are also frequently required. The company uses the new HPM 1350U for both 3+2 (positional) and full 5-axis simultaneous machining – depending on the application.

"Our new 5-axis machine tool capability gives us significant productivity gains and manufacturing flexibility," says Ian Glead, senior manufacturing engineer. Prior to investing in the Mikron



Arden Precision has installed its second Mikron 5-axis machining centre. Cycle times have been reduced by up to 30 per cent

machines, we relied on our 3- and 4-axis machines for all our milling requirements. Although these machines could be relied upon to deliver, we knew we were spending significant time and resources on frequent job set-ups, workholding and fixturing, and operator intervention.

"Through our 5-axis machine tool investments, we have improved our performance and competitiveness across the board. Machine cycle times have been reduced (by up to as much as 30 per cent), parts can be machined in a single set-up and as a consequence we have improved machine tool utilisation, freed-up machine tool capacity and removed production bottlenecks."

Reducing cycle times is as much an issue in aero engine testing as it is in production. To measure critical factors such as pressure and temperature, one leading aero engine OEM manufactures

special-purpose probes that feature an array of sensors capable of recording and checking different engine attributes.

The machining of the complex, hardened steel probe bodies is undertaken by Coventry-based Hi-Tech Aerospace Components which has a host of blue-hip client approvals in the aerospace sector including Rolls-Royce, MTU and BF Goodrich.

EDM OPERATIONS APPROVAL

Specialising in aerospace machining since its formation in 1981, the company is also AS 9100:Rev 3B accredited and has NADCAP (National Aerospace and Defense Contractors Accreditation Program) approval to undertake wire, die sink and hole drilling EDM operations – something that few other Tier 2 suppliers in the UK can claim, it is asserted.

The probe bodies are machined at Hi-Tech using a combination of die sink and the latest high specification CNC Sodick wire erosion machines, and like most of the company's aerospace work, there is little margin for error.

"We process a lot of exotic materials,

including titanium, which is particularly difficult to machine using EDM techniques," says company co-director Bob Duffin. "Sometimes we might only be producing a £250 feature on a component worth £3,000. However, the feature in question might specify tolerances as tight as 0.005 mm, which puts a lot of pressure on the operator and the performance of the machine."

Hi-Tech's Coventry facility boasts a number of die sink, hole and wire erosion machines. The latter, of which the company has eight, are all Sodick models that have been supplied by Sodi-Tech EDM, including a brand new AQ300L wire EDM purchased at MACH 2008. The machine's linear motor technology provides instantaneous response which maximises cutting efficiency. Since there are no ball screws or couplings, backlash is totally eliminated, which provides several advantages including improved positioning and cutting accuracy, while delivering smooth and vibration free table movement.

The company's new AQ300L is used to machine the aero engine probe bodies in batches of around 40-off. The shaft-like components are approximately 200 mm in length and feature a series of 'chimneys' at one end that accept the different sensors required by the customer.

Parts arrive as turned blanks and first a wire EDM roughing operation is performed on the Sodick. Parts are then transferred to a die sink machine for the creation of one particular feature before going back to the AQ300L for finishing operations. Finally the probe bodies have



Rowan Precision says its aqueous degreasing system can better solvent cleaning results

a few finishing details produced on them by another die sink model. This is followed by polishing. Dimensional tolerances are in the region of 0.05 mm. Each probe body, which has a net value of approximately £1,200, takes around 2-3 days to produce.

"Although we've been manufacturing these engine probes for a while now, new variants are always being introduced to

keep us on our toes," says Mr Duffin.

"Our expertise and quality accreditations are also helping us win plenty of new business. I think we can now rightly call ourselves one of the largest EDM sub-contractors in the West Midlands, if not the country."

CLEANING EXCELLENCE

Degreasing of parts after manufacture is another step in the total production process. Rowan Precision recently moved from solvent-based to aqueous cleaning. The company produces a wide range of turned and milled parts from 0.5-85 mm diameter in all materials and plastics, and is achieving highest levels of cleaning excellence, it says.

Rowan Precision meets increasingly stringent requirements from customers – including many in aerospace, medical and electronics – who demand not only excellent results but also environmentally responsible procedures. In some cases, director Martin Barker reports customers have even been able to minimise their own in-house cleaning requirements because of the cleanliness of the products

it now produces .

A single MecWash Aqueous Vapour Degreaser (AVD) unit is now the facility through which all parts produced at Rowan Precision's Birmingham factory now pass. The cleaning system – providing rotational spray/flood washing, rinsing and ultrasonics – removes all types of soils. The high standard of cleanliness achieved sometimes betters that previously achieved with solvent-based systems, it is claimed.

"The flexibility of the system is very important because of the diverse range of products and customer requirements," comments Mr Barker, as orders can involve anything from 100 to 1 million components.

"The decision to install the MecWash system has not only overcome the environmental issues associated with solvent cleaning but has also eliminated the need for regular cleaning of the wash system," he adds. "We also specified the unit with a free-standing Aqua-Save Junior wastewater recycling system which has enhanced our environmental performance." □

Machine tool maintenance around the world

Lockheed Martin has awarded MAG Maintenance Technologies a contract that covers global service and support of its manufacturing equipment. This new agreement enables lean efficiencies and economies, and provides a schedule of discounts to Lockheed Martin as the volume of work increases. The programme, instituted earlier in 2008, is both global geographically and in scope, says Gary Finney, director of sales North America for MAG Maintenance Technologies.

As well as covering service and support of all manufacturing equipment at major Lockheed Martin locations around the world, the agreement includes interactive diagnostic help, preventive maintenance, field service, training, replacement and spare parts, productivity improvements, machine rebuilding and even machine and system relocation and set-up.

MAG Maintenance Technologies has service centres in the North America, South America, Europe and Asia, with over 250 service engineers strategically located worldwide to service Lockheed Martin's major facilities.

The agreement covers the full range of machine tools produced by MAG's family of companies, including over 50 different machine tool legacy brands. It also covers Lockheed

Martin's large installed base of specialised MAG Cincinnati aerospace machining and composites fabrication equipment. The agreement is not limited to MAG equipment only, however.

Integration of the programme into Lockheed Martin's global sourcing system allows easy access to everything from discounted parts and consumables such as tooling to comprehensive repair and relocation services. "This is a key breakthrough. Any Lockheed Martin facility can now order service simply by checking off a couple boxes on a one-page form. This can save substantial time and costs at the operating level over lengthy supplier evaluation and bid processes," says MAG Maintenance Technologies' Mr Finney.

"Manufacturers of all sizes, not just global giants like Lockheed Martin, are finding that they cannot afford – and in many cases cannot find – the maintenance staff and expertise needed to achieve world-class productivity and competitiveness. Thanks to its unique combination of high expertise in specialised areas and the back-up of a global enterprise, MAG Maintenance Technologies can provide tailored solutions for a great variety of enterprises," Mr Finney concludes.