The Airbus A380 project has been – and will continue to be – good for the UK’s manufacturing base and for suppliers of production technology. Andrew Allcock explores its impact

Airbus’ A380 superjumbo is due to take its first flight in 2005. It challenges Boeing’s 30-odd year dominance at the largest end of the commercial aircraft market. If its impact within the plane-making industry is significant, its impact on UK manufacturing and on manufacturing technology supplier base is similarly so.

The 555-seater, double-decker aircraft that is the A380 is said to “secure and generate over 100,000 long-term jobs in the UK”, according to Noel Forgeard, Airbus president and CEO, which is no small share of the current 3.49 million UK manufacturing jobs and only 25,000 fewer than the number of jobs lost in manufacturing in the last 12 months.

Airbus itself supports some 64,000 jobs in the UK, a further 26,000 being added by the A380 programme, confirmed Mr Forgeard. And the knock-on effect to prime UK OEMs is demonstrated by the fact that the Rolls-Royce Trent 900 engines that can power the A380 generate some 14,000 jobs.

Around 400 UK companies have been awarded some £7.5 billion worth of work for the A380 with this set to double over the life of the programme, says Mr Forgeard. And, as the new plane enters service, Airbus’ contribution to the country’s balance of payments is set to rise to some £1.5 billion annually: that’s about 10 per cent of one month’s total exports of goods at August 2003 rates and...
is 50 per cent of July’s confirmed trade deficit in goods.

For a single product, the impact across the UK economy is huge. No wonder, then, that at the opening of Airbus’ new West Factory at Broughton, North Wales, in July Prime Minister Tony Blair was in attendance to ‘cut the ribbon’.

HAVE YOU SEEN THE ‘WEST WING’?
The £350 million West Factory is where the wings for the A380 are to be assembled, equipped and painted. The wings are the largest ever to have been designed and built for a commercial aircraft – 36.3 m long and 46 m along the swept-back leading edge – so the new factory is commensurately large. It is the size of 12 full-size football pitches – 400 m long by 200 wide with a maximum height of 35 m. During peak production, this new building – hailed as the largest factory opening in the UK for years – will employ 1200 people.

Each wing assembly comprises 20 aluminium alloy panels or ‘skins’; 124 ribs – 76 metal and 48 carbon fibre; 314 wing stringers or stiffeners – 124 for the top and 190 for the bottom; trailing- and leading-edges; 360 000 m of wire, piping and ducting; plus 750 000 fasters (nuts, bolts, rivets).

The West Factory is supplied with parts from both near and far. In April this year, the first mid and outer fixed leading-edge component was delivered to Broughton from Sweden’s Saab Aerospace, for example. At 31 m, it is the largest single part that Saab has manufactured.

And from Germany, the massive so-called ‘bathtub’ components were delivered to the new West Factory. These parts, along with wing flap tracks, are manufactured at EADS Military Aircraft’s Augsburg plant. The ‘bathtub’ is the leading-edge inner wing component, which abuts the fuselage and is an aluminium/titanium/composite assembly.

The machinery employed at Augsburg to make this part – which will be delivered at the rate of 100/year at full production – represents the largest machine in the world using DS Technologie’s ‘tripod’ technology. A DS Technologie Ecospeed horizontal machining centre fitted with Z3 head tackles components on a 7000 by 2200 mm vertical table.

Z3 technology comprises a horizontal spindle that is moved and tilted by three linear z axes set about the spindle body at 120º increments (see Machinery, page 13, 21 January 2000). Linear movement of the axes provides both z-axis motion and a-, b- and c-axis virtual rotation when there is differential linear movement between the three.

At Augsburg, a two-machine cell is responsible for the ‘bathtub’ and these two Ecospeed machines join the four smaller ones that were installed for Eurofighter parts production. Indeed, the development of the Z3 spindle was spurred by the requirements of the Eurofighter.

The existence of this manufacturing technology at Augsburg was crucial in winning the A380 work, says EADS. This is because Augsburg did not automatically get the contract as part of Germany’s share of the production but rather through an open tender floated by Airbus UK in competition against other international companies.

TECHNOLOGY PUSH
From within the UK, come ribs from Airbus’ Filton, Bristol facility. Once again, leading-edge machine tool technology has been employed in the manufacture of parts here.

As part of a £16.5 million investment in a new rib manufacturing unit, a flexible machining cell comprising two Makino MAG4 five-axis, horizontal machining centres linked by rail-guided vehicle and served by a six-pallet handling and storage system was installed last year by machine tool supplier NCMT.

The facility is dedicated to the production of 40 of the 124 A380 wing ribs which are machined from solid blocks of a new, weight saving and high-tensile strength aluminium alloy – 7085. Chris Harland, project manager A380 ribs explains: “Each A380 rib enters the Makino FMC and emerges fully machined in less than two days, whereas using our previous production process – which dates back 10 years to the production of Airbus A300 wing ribs – floor-to-floor time
Stringers are produced in the Centre and having 25 m x-axis travel. Bottom skin of the three times faster benchmark development expected to take that times greater than would be possible on spindles can remove metal at a rate 2.6 tooling, and one of these high-speed tooling enables the necessary grip for the high-speed Gewefa heat-shrink toolholders provide the storage area and a work-set station. linking the machining areas, the pallet-picking crane runs on rails, machining centres linked by an in-line spindle Makino MAG4 horizontal machining centre which UWE installed as three-axis machines but can be upgraded at a later date to full five-axis capability.. But gantry machines have their place in the A380 manufacturing world. In fact, right next door to the new West Factory in the case of those being put to use in the UK. During the period that the West Factory has been established, Airbus has poured a further £73 million into developing the East Factory. Included in this are two 40 m Henri Liné gantry milling machines which machine 18 of the 20 different aluminium wing skins.

In December last year, the first panel was machined from a 35 m long aluminium-alloy billet weighing nearly 4500 kg. Over 70 per cent of the material is removed during the process. This bottom wing panel is one of the largest of the set of 18 at over 33 m. The dual high-speed spindle Henri Liné Macbormill 285 HS/3-2 gantry machines installed at Broughton are believed to be the only two of this type of design installed within Europe. The 36 m x-axis machines were installed as three-axis machines but can be upgraded at a later date to full five-axis capability.

And within the Stringer Manufacturing Centre, also located in the East Factory, can be found a DS Technologie EcoSpeed with Z3 head having 25 m x-axis travel. Bottom skin stringers are produced in the Centre and there are 100 different bottom stringers on an A380 wing (200 per aircraft, some up to 22m long).

AEROSPACE RESEARCH IN THE UK

More generally, it is clear that the machining of aerospace components from solid blocks of material pushes and pulls machine tool and manufacturing technology. Indeed, Airbus is a prime partner in research being undertaken at the University of West of England (UWE (see Machinery, page 12.5 September)) into ultra-high-speed machining of various aerospace alloys.

UWE's target is to explore the limits of high-speed machining through research over many years. As the project manager Dr John Lanham told Machinery, even with high-speed machines such as the Makino MAG5, a cycle time still stretches to double figures in hours, so halving, say a 20-hour cycle is very attractive. At the heart of this project is a Heckert CWD 400 horizontal machining centre which UWE intends to modify so that its 1.5 g acceleration becomes 4 to 6 g. The machine is also to be upgraded, in five year's time with a 100 kW, 100 000 rews/min spindle supplied by Cranfield Precision.

While the project will have a 'big deliverable' for Airbus, the intention is to include contract manufacturers in the project so that they can also benefit. Collaboration with the West of England Aerospace Forum is intended to aid this. Other project technology supply participants include tooling suppliers Stellram and Safety.

But Boeing is looking at similar things and is the main industrial sponsor of the Advanced Manufacturing Research Centre (AMRC), which is to be based at the new Advanced Manufacturing Park just north of Rotherham (see Machinery, page 10.17 October). Here, once again, the higher speed machining of materials is under the spotlight, although talk here is not of machine tool improvements of the type targeted at UWE.

Areas of study include the elimination of vibration in thin-walled components under machining and the increase in metal removal rate by identifying a machine's 'sweet spot' and through damping. Metal removal rates of three to nine times greater can be achieved just through the latter, offers the Centre's Professor Ridgway. And working with the aerospace supply chain is also a crucial part of the Centre's remit.

Getting the measure of big parts at Broughton

Supplied by Measurement Solutions, Peterborough, Airbus has chosen Automated Precision Inc (API) as the main supplier of laser tracker measuring systems to the company's Broughton wing production facility. Designed for large scale measuring applications requiring high precision and accuracy, the Laser Tracker II Plus will enable Airbus to make critical measurements and alignments during A380 wing manufacturing.

Measuring with a laser tracker sees an operator move a spherical mounted reflector (SMR) to the point to be measured, and once the tracker's sensor system 'locks on' to the target, it measures the position of the point up to 2000 times per second. As the SMR is moved around the object, the tracker follows the target anywhere within the instrument's measuring envelope. Data recording can be triggered by keyboard commands at the PC, wireless remote control, remote voice commands, or 'intelligent' software functions.

Broughton has also been the destination for a DEA Brown & Sharpe Delta AB 30.105.05 co-ordinate measuring machine. The gantry machine can travel 10 500 mm along and has cross and vertical travel of 3000 and 500 mm, respectively.

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