



The beast of all machining centres

Keighley company builds Britain's big gest machine tool — certainly within the last decade

What do you need to build a machining centre that requires an isolated foundation pit measuring 21 x 11.5m and leaving the 250-tonne machine sitting almost 1m below the floor level, so the customer's crane can gain access for loading?

For a start, you need a pretty big factory. You also need a team of highly skilled fitters who are well versed in building massive machines

and overcoming the many problems involved; also, a project management team experienced in undertaking multi-million-pound single-machine contracts.

Ian Smith, technical manager of Keighley-based Dean Smith & Grace (DSG) (Tel: 01535 605261 — www.deansmithandgrace.co.uk), the builder of this machine, says: "Undertaking a project such as this requires a marriage of skills from a diversity of sources. Indeed, I don't believe there is any one company in the UK that could take on a project like this in its entirety and within the time-scales required by our customer."

The machine in question is a double-column moving-gantry machining centre for a customer

in South East Asia machining large toughened-steel fabrications. It features an X-axis travel of 12m, a W-axis travel (vertical movement of the cross-beam carried by the two columns) of 2.5m, a Y-axis travel (spindle movement along the cross-beam) of 7.5m, and a ram stroke (Z-axis) of 1.5m. Moreover, with its German-built Cytec head, this machine offers a full five-axis simultaneous-machining capability.

Proven pedigree

While DSG is more usually associated with building heavy-duty lathes — particularly for the oil and gas industry — large machining centres like the one in question are not a new

venture. Indeed, at the turn of the decade, the company made a strategic decision to expand its large-machine-building capability to include milling, drilling and boring machines.

In 2001, a light-duty travelling-gantry machine for producing polystyrene moulds for the casting industry was installed at Drew Simmonds, which is based at Stanford-Le-Hope. This was followed by a similar machine — albeit a more-substantial version — for heavy-duty steel-machining applications at Bedford-based MJB Mining. For Ipswich-based Kocurek Excavators, there was a 12m travelling-table machine

with twin columns, a 1.75m Y axis and 850mm of travel in the Z axis. The spindle was rated at 25kW, and the machine was essentially for drilling and boring, although milling was also undertaken.

The contract for the latest machine was won against stiff competition from Italian and Spanish companies — as well as other UK rivals — with DSG's success based not only on the solution offered, but also on the cost-effectiveness of its tender. However, this machine is in a different league to the previous ones and required input from a number of companies. Assisting DSG in the machine concept and design was PDB Engineering Services; this company's owner, Peter Beadle, has some 40 years' experience in machine tool design and manufacture and was involved with the previous machines of this type.

Sourcing the fabrications and castings was challenging, not only because of the physical capacity required to accommodate these massive parts, but also because of the production capacity needed to achieve the required lead times. The contract for producing the X-axis beds was awarded to Sutton Coldfield-based Pre-Mill (each of the twin bed assemblies is in three sections), while the W-axis columns and Y-axis beam went to Wednesfield-based Metzpro Ltd. The X-axis tables and Y-axis platen castings were made by Hargreaves Foundry in Halifax, and the work table castings were sourced from Preston-based Coupe Foundry Ltd. To ensure that all these

parts were machined on time, no fewer than 12 sub-contract machining companies were used.

Designed for purpose — and for shipping

When designing a machine like this, performance is not the only consideration; lifting and transportation play a major part in dictating the design. For example, the maximum bridge height in the country of destination is 4.5m, which means that the columns will have to be transported on their sides; there is more clearance in the UK, so these large fabrications were delivered lying on their angle faces. That said, the difficulties did not end with delivering the columns and main beam to DSG's factory. The fabrications were too big to fit through the main doors, so getting them into DSG's assembly hall was a task somewhat reminiscent of Bernard Ribbins' 1962 hit *'Right Said Fred'* about three piano movers. They were about to give up when, as the song goes: "Charlie had a think and he said: 'Look Fred, I've got a sort of feeling; if we remove the ceiling, with a rope or two, we could drop the blighter through.'"

Which is just what DSG had to do, although in this case it was part of the roof that had to be removed; and instead of a rope or two, it was a carefully orchestrated operation using two massive mobile cranes with load capacities of 250 and 150 tonnes. These worked in tandem, the larger one lifting, the other manoeuvring (the exercise will have to be performed in reverse when the machine is broken down and shipped out). Furthermore, DSG had to get permission to temporarily remove a lamp-post — and to close the road while the delivery was taking place.

Once all the main components had been delivered, assembly of the machine necessitated the use of rigs that were specially constructed to assist this process — and will be shipped with the machine to facilitate on-site re-assembly. For example, a substantial A-frame structure was used to locate the 17-tonne cross-beam, while the slides — one on each column — were manually wound into position (the frame has jacking studs on its feet for fine adjustment). The beam



universal and straight heads are up to 75kW, and for the right-angle unit up to 43kW; maximum speed is 3,500rev/min. BT50 tooling is used so that the customer can also use existing tooling. Also attached to one of the columns is a Spairish-built Aitek 30-6001 ATC that can change tools to any of the heads in either the vertical or horizontal position.

All axes feature linear guides and linear scales, and there are hydraulic clamping units on each slide. The X and Y axes are rack-driven, while the W and Z axes feature ball screws and hydraulic counter-balancing. Control is via a Heidenhain iTNC 530 — a workshop-oriented contouring control for milling, drilling and boring machines, as well as machining centres. It features an integrated digital-drive control with integrated inverter, which enables it to produce highly accurate workpiece contours while machining at high speed. The iTNC 530, which can control up to 13 axes and the spindle, has a block-processing time of 0.5msec. In fact, the control and drives are being managed as a complete package by Heidenhain (GB) Ltd.

This DSG machine has been designed specifically for wet machining and features twin slat-band swarf conveyors alongside each X-axis bed; there is also a 2,000-litre coolant tank with swarf/sludge evacuation. Also included in the overall specification are: two operator cabins with duplicated controls; a CCTV capability, so that the operator can see the tool when it is 'buried' inside a fabrication; and Heidenhain probing for part datuming and on-machine checking.

The machine passed customer acceptance trials early in April. These were based on the use of just the one bed section, as the customer agreed that the others were not needed for cutting tests and head-exchange demonstration. Because the beds sit below the normal floor level, full acceptance with coolant and swarf systems will take place at the customer's works.

sits on two substantial tenons and is located by 48mm-diameter dowels. Shipping the machine will require a mixture of open-top containers and special crating — some 17 containers in all.

Head-changing capability

The equipment supplied by Cyce comprises the ram spindle (C-axis) and three interchangeable head attachments (A-axis), namely: a universal head that offers simultaneous five-axis machining, a straight head, and a special right-angle head with extended spindle; these heads are changed automatically. Power ratings for the

