Sub-contract machining

Recently established company benefits from a CNC turn-mill capability

Darren Grainger is 27 and has recently installed a 'top of the range' mill-turn centre with sub-spindle and Y-axis cross-feed to the 12 station driven-tool turret, to allow him to fulfil his fast-increasing order book for precision-turned parts. The machine — a Colchester-Harrison Tornado T8MSY, was supplied by the 600 Centre, Shepshed (Tel: 01509 600600).

His business — Hi-Spec Precision Engineering — was started just 3½ years ago and is located on a small industrial estate in the middle of the Leicestershire countryside. Starting with manual capstan lathes and milling machines, the company has grown rapidly following the installation of a Colchester-Harrison Multi-Turn 2000 flat-bed combination. Installed in December 2005, this machine was Mr Grainger's launch pad into real success.

"I still can not believe the impact that our first venture into CNC had on the business. So, in February 2006 we installed a Colchester-Harrison Tornado T6M driven-tool mill-turn centre, to provide more-automated turning and combine operations. Because this machine helped us to win much more work, we took delivery in July 2007 of a larger-capacity Tornado T8M. This was installed in our new unit, which doubled the size of our shopfloor to 1,800ft^2."

Prior to setting up Hi-Spec, Mr Grainger was a CAD designer at a hydraulics company where his father was the workshop manager. His father retired after an illness, and a family meeting in September 2005 led to the decision to set up a small sub-contract shop (with three manual machines) on the Market Overton Industrial Estate near Oakham. His previous employer immediately offered help and was keen to use his ex-employee's experience to top up his capacity and produce 'overflow work' using material supplied on a free-issue basis. Mr Grainger's mother helped to operate the manual machines, as did his wife — who was heavily pregnant when the company was started. After eight months of working weekends and very late into the evenings, Mr Grainger had established a good customer base, plus an order book that involved lots of small jobs and prototype work. His low overheads and on-time deliveries were helping him to secure orders and really get going.

Increasing productivity

However, he also knew that he had to be more productive if he wanted to expand the business, and another family meeting decided that CNC would make their lives far easier. Although Mr Grainger was very computer-literate, he lacked CNC knowledge, yet he found the Manual Guide i programming on the Colchester-Harrison MultiTurn was ideal, enabling him to quickly set up a job and then use the CNC to run the batch while he did other things, only having to return to the machine to unload and load.

The result of this investment was a rapid expansion that he describes as "almost unbelievable but enjoyable. The capability of the machine was such that we could take a significant number of man-hours out of a job; but being more competitive and productive meant that I was hit with loads more work, much of which needed drilling, tapping and milling. Discussions with Colchester-Harrison resulted in us deciding to go to a full CNC capability with driven tools, so that we could combine operations where possible.

"Installing the Tornado T6M was almost like turning a switch. Even more orders came in; and work that we had taken on previously — and on which we knew we were not making money — suddenly became profitable. Take the example of a small coupling for hydraulic-power units. This has a tang and a slot, with the two features tightly toleranced relative to each other.

"This part would be a pain to produce without a turn-milling capability, but the

In less than four years, Darren Grainger has built a successful sub-contract facility, using Colchester-Harrison lathe technology

T6M produces the parts in an automatic cycle without any problems."

By now, customers were increasing pressure on Mr Grainger to produce even larger components, so he decided to step up a machine size to a three-axis Tornado T8M with driven tools and a 66mm bar capacity. "I could not believe the difference that the 22kW spindle made. It was really impressive cutting stainless and EN24T hydraulic cylinders. When we machined a cylinder that had an off-centre bore, we put special jaws on the chuck and ran the spindle to 850rev/min before we had to counter-balance the chuck as vibration began to set in. We then pushed a 40mm-diameter U-drill straight through without any protests from the machine — except for swarf banging on the guarding."

Industry understanding

Hi-Spec Precision Engineering has definitely benefitted from Mr Grainger's seven-year background in design. "I understand the needs of the hydraulics industry, and I can innovate my way around jobs to produce what they need." He has, for example, been able to eliminate grinding on piston rods and honing on some cylinder bores, and is obtaining the required component geometry with single-set-up machining. Tight tolerances and surface finish requirements are being met by diamond burnishing. "We can easily hold 15μm size on stainless, EN24T and EN8, and between 0.2 and 0.4μm surface finish."

He also hard-turns Rockwell C 60 steel on the Tornado T8M, using CBN inserts — without coolant — to produce bearing bores for conveyor rollers and pulleys. "For a 38mm-diameter bore, we run at 100m/min and 0.1mm/rev feed with no problems. Moreover, I can set the machine on a Saturday, prove the program, come in the next day and have 500 parts completed."

With his wife at home helping with the book-keeping and his mother looking after his father, Mr Grainger now employs three full-time people — one skilled setter and two operators. Materials passing through the Tornados and MultiTurn (now used for smaller-quantity batch work) include free-cutting steels, aluminium, bronze, brass, 303, 304 and 316 stainless steels, as well as EN-16T, -19T and -24T. Today, there are 26 customers on Mr Grainger's order book, of which 18 are very regular in placing orders. Over 800 different part orders are currently being processed, and small stocks of parts are even held for customer call-off.

With customer pressure continuing to build for more work to be produced by his company, Mr Grainger needed a heavier milling capability, prompting him to add yet another Tornado to the stable. In his new unit, the latest T8MSY has been installed opposite the T8M. "We are getting more demand for heavier milling, and the Y-axis cross-feed to the turret provides an effective solution for this."

He is now looking forward to the advantages of the latest machine's new high-rigidity Sauter turret with HSK 83 tool interface and 10kW of direct-drive power to the cutting tool — almost double that of the previous version of the machine; and at 10,000rev/min, the driven-tool speed is also twice as fast. The Y axis provides a stroke of ±40mm, which is ideal for the general machining that Mr Grainger is undertaking.

However, what he is really keen to exploit is the machine's one-hit single-cycle capability. "The machine will be absolutely ideal for hydraulic-type parts that have a high requirement for geometrical relationships between features. This means I could be combining up to seven operations into just one."

'High-end' machining

Located near High Wycombe, Crownfield Engineering was established in 1966 as a precision sub-contract machinist. Today, the company specialises in 'high-end' machining that few other sub-contractors will attempt for customers in the aerospace, defence, instrumentation and medical sectors. For a number of years, the 24-employee family-owned business has relied on milling cutters supplied by Tamworth-based ITC (Tel: 01827 304500). These include: 2001- and 2041-series two-flute carbide cutters for high metal removal rates; 2052-series two-flute ball-nose end mills specifically for machining aluminium; and 3011/3021-series three-flute high-performance end mills.

David Bird, managing director of Crownfield, says: "ITC ensures that our essential needs are covered, and that stock is replenished on a Kanban-type system. The ITC representative calls by on a regular basis and liaises directly with the machine operators to make sure that everything is in hand. Placing the responsibility on ITC means that there is one thing less for us to worry about in what is a very busy machine shop. Our customers are increasingly demanding a 'total' service from us, so we don't see why things should be any different for our suppliers."

The materials processed at Crownfield range from aluminium and steel through to titanium and more-exotic alloys such as aluminium-bronze for certain defence jobs. Many of the parts feature complex geometry that requires the use of one of the company's multi-axis Matsuura machining centres. However, Crownfield realises that there is more to successful machining than having the right machine tool.

"Having a machine tool with the capability to offer high speeds and feeds that are compromised by inappropriate or inadequate tooling is not far short of a crime. Or, to put it another way, if you spend £300,000 on a machining centre and it's labouring because of incorrect tool selection, then that is a pretty sorry state of affairs. It is imperative that we achieve maximum productivity from our investments, and that is one of the reasons why we continue to use ITC. The cutters that they supply never fail to respond to our demands."