

Machining formula

Highest precision in the production of reliable parts used at speed is the aim of those involved with the motorsport field. Andrew Allcock reviews recent applications and approaches

Over 600 different jobs were produced in 2007 on Deckel Maho 5-axis, universal machining centres by CommaTECH (Braye). Each job, of which more than half were new, involved very intricate features in difficult-to-machine materials such as titanium, high grade stainless steels and aircraft alloys using five Deckel Maho DMU 50T, two DMU 50 eVo and the very latest installation, a linear driven DMU 50 eVolinear.

CommaTECH (Braye) is a small batch specialist where quantities rarely exceeding 10 are produced out of free-issue materials from the leading F1 race teams and their Tier 1 industry suppliers. Such is the level of complexity required that it is not unusual for cycle times on a single part to take up to eight hours, although machining times between two to five hours are more commonplace.

PROJECT MANAGEMENT

Bray has a turnover of some £2 million and shares the facilities of another group division, CommaTECH (Hertford), which has the capability to provide a complete project management service from its 60,000 ft² facility covering design, prototyping, pre to full production machining involving sheetmetal, fabrication, assembly CNC machining and power press work.

Both business operations at Hertford are part of the CommaTECH group of companies which has high precision machining as its focus. The group employs 500 people with sales of some £40 million. Other group businesses include CommaTECH (Northampton), CommaTECH (Leicester) and

CommaTECH Holdings, based in Birmingham. Within the group, DMG of Luton has installed eight 5-axis machines at Braye and another DMU 50 eVolinear at Northampton to produce racecar engine components.

Prior to the acquisition by the CommaTECH group and relocation in Hertford with the name changed to CommaTECH (Braye), Braye Precision operated out of Cricklewood and built a track record of component supply to motorsport, medical and aerospace industries over

some 40 years. Today, 95 per cent of production is motorsport orientated with around five per cent aerospace.

"Sometimes a combination of part design, material and the intended function of the part dictate extra special attention," says CommaTECH (Braye)'s managing director Graham Saunders. Just one end of a particular racecar suspension fixing bracket in titanium chalked up 40 hours in a single cycle on

Some 95 per cent of CommaTECH (Braye)'s production is given over to motorsport



Probes and bikes

When world class motorcycle racer Martin Gopp retired from competition, it was a foregone conclusion that he would return to toolmaking, a career for which he originally trained and qualified. He set-up shop in his home town, Feldkirch, situated in one of Europe's most beautiful areas, the western tip of Austria.

The company's guiding mantra is "precision, precision, precision". And, suitably equipped with advanced machining equipment installed in temperature and humidity-controlled premises, it specialises in prototype manufacturing for an ever-increasing raft of high profile companies seeking Mr Gopp's help with their own product development.

A Blum LaserControl NT Micro Compact System provides a measuring accuracy of less than 5 microns for the length, radii and wear of all the tools used on the company's Hermle C40U 5-axis machining centre with Heidenhain iTNC 530 CNC. It is, says Mr Gopp, the starting point for virtually each and every machining task, but in this particular case is specially mounted at the front of the machine.

Most machines of this type have the laser unit sited at the rear, as close to the automatic tool changer as possible to minimise time lost in positioning the spindle for tool measuring checks. Mr Gopp, however, is always looking for that extra minute improvement in accuracy and likes to physically clean each tool when in position before checking. The front mounting allows easier access for this operation.

Over in Italy, Ducati is applying Renishaw non-contact laser technology to check for broken tools in production (pictured, above). An example is camshaft production for its Desmodromic engine designs, carried out on two Stama vertical machining centres. The machines work non-stop throughout the year producing camshafts for all the different Ducati engines.

Fulvio Abbondi, manufacturing technology specialist at Ducati Motor, comments: "Great precision is required when making the shaft, with the rather elaborate machining process carried out entirely within our factory. This is a very expensive component. It is made of a special steel alloy and is already expensive when, as a blank, it reaches the machine tool after its first rough-turning".

A tool breakage during the camshaft production process would be serious, and could result in scrap, costly re-machining and wasted time. There could also be damage to the machine spindle which, when added to the cost of the specialist tools themselves, would total thousands of euros.

"It is essential that checks be carried out on the work performed by the machines. Renishaw NC4 systems were installed on two work centres. Immediately after a tool is loaded in the spindle ready for machining, it crosses the device's beam at a set height. If the cutting tip is broken, for example instead of being 100 mm long it is 97 mm, the laser system triggers an alarm. Clearly, each tool has its own length, diameter, etc, and the system takes this into account when it passes through the checking beam."



Saunders. "Almost all are very weight critical involving very narrow sections as they are used on suspensions, in transmissions and as part of the on-board hydraulic systems. Due to their very nature, most are produced out of solid so we combine as many features as possible into a single operation – hence the need for all our machining centres to be highly flexible to enable a 5-face approach to the job.

GEOMETRIC RELATIONSHIPS

"Although 5-axis can be quicker – especially when lead times are considered, our goal is to maintain very strict geometric relationships of features and it is the presentation of the tool to the job that is important. We also save on fixturing and the possible introduction of errors that could creep in if we had to relocate the part."

Most toolpaths followed by the Deckel Maho machines have convoluted 3D profiles, any numbers of cut outs, reliefs and forms with the added complexity of compound angled features requiring drilling, boring and milling cycles. "The DMG-supplied machines were selected partly for their accuracy and flexibility of positioning, but especially their ability to enable negative angle machining in-

one of the Deckel Maho machines.

The process involved considerable 3D contouring of the outer form with a cross bore and various holes. However, the *pièce de résistance* was at the opposite end to the cross bore which involved a fairly narrow, around 12 mm tapered cavity, about 60 mm wide at the mouth and

around 75 mm deep with a wall thickness of under 1 mm. The internal cavity, blendings and outside contour had to be perfectly smooth without any machining marks being visible.

"Most of the parts we produce will be highly stressed and often have recorded life cycles on the racecar," explains Mr



As part of a sponsorship deal, Leanders Brothers Racing has access to Haas machine tool technology

cycle," explains the managing director.

"The machines provide very good tool access but also important is their excellent track record machining the type of work we produce. We like the commonality of controls, tooling and machine operation on the shopfloor, and the Deckel Maho design only requires a small footprint which helps on space requirements."

FAST AND FURIOUS

In the dragster world, and at a somewhat smaller outfit's works, Haas is playing its part to support Sweden's 2006 FIA European champions, Leanders Brothers Racing. In its 3,000 hp 'funny' cars, the clutch plays a crucial role.

It doesn't matter how skilled the driver is, the biggest challenge is getting the power down. Since electronic launch controls are banned, it's down to a slipper clutch – similar in concept to those used to reduce engine braking on motorcycles – to transfer power quickly and smoothly.

"A slipper clutch partially disengages to regulate the amount of engine power delivered to the wheels," says Jörgen Leanders, one of the two-brother team. "However, because the clutch uses friction to do its job, the pads are prone to serious wear, so we need to be able to quickly strip and reassemble the clutch, often between runs."

In most racing situations, clutches are made in aluminium to be as small and light as possible. In an F1 car, for example, they're designed to last just long enough

to get the car to the end of the race. Bolted steel segments help to dissipate the heat, but they flex and bend and can quickly fail. In drag racing, the clutch has to be built to transfer a huge and violent surge of power, so aluminium is replaced by titanium, which is tougher but heavier. The Leanders clutch uses a floating-plate system in place of bolted segments, which improves heat dissipation and makes it easier to take apart and rebuild after a run. The Leanders clutch is, in fact, a new project; one that the team hopes will give them the split second advantage they need to retain their title in 2008.

In the corner of the drag racers' workshop, surrounded by glass fibre vehicle body parts and semi-used balloon tyres, sits a brand new Haas EC400 horizontal machining centre, on loan to Leanders Brothers racing as part of the Haas sponsorship deal.

"We mill just about everything on the clutch except the bolts and some small

axles that hold the fingers and the adjusting screws," says Jörgen Leanders. "The aluminium is Alumecc," he adds, a relatively hardwearing tool-making aluminium with good machining characteristics and low weight. We also machine quite a lot of coated titanium, as well as tool steel for the fingers. The facings and floaters are made from regular carbon steel."

At another Scandinavian company, Swedish former motorcycle speedway star Roland Dannö has expanded his mechanical engineering business with a new generation Colchester-Harrison Alpha 1550XS Manual/CNC lathe.

After a serious accident in 1990 ended his riding career and confined him to a wheelchair, the ex-Hackney and Bellevue team racer began producing custom-made motorcycle parts and components for various specialist industries.

To speed up turned parts production, Mr Dannö sourced his first Manual/CNC lathe in 1996 – an Alpha 460 machine with a bed-length of 1,500 mm – from the 600 Group's Swedish distributor, Maskin AB A Fransson.

The company has since expanded and moved to larger premises, taken on extra people and can offer enhanced turning capability, thanks largely to its recent purchase of a new Alpha 1550XS, which has a distance between centres (bed length) of 2,000 mm and is equipped with a swarf conveyor.

The machine is, in fact, helping the company to expand its non-motorsport activities such as paper mills.□.

Storage solution supports skills training

Wiltshire College Motorsport commissioned a new building at Castle Combe Racing and has equipped it with storage equipment from System Store Solutions.

Wiltshire College Motorsport has grown rapidly over the past four years, and prior to installing the new storage system, the college randomly stored items in a disparate collection of cupboards and racks. "It gave an unprofessional display and made for a disorganised work place," explains the college's Haydn Earl. "Now, the students can take pride in their work and their environment and have a much more diligent approach to tools and parts management." Wiltshire College has plans to extend the workshop and System Store Solutions is again likely to supply the additional storage required.