



Faster inspection and reporting with 3D laser scanning



Bob Rose, Quality Manager at Birmingham Prototypes inspecting a pressed aluminium engine bay mounting plate for a Jaguar car on the Nikon Metrology LK V 15.10.8 co-ordinate measuring machine in Redditch.

Automotive and aerospace pressings specialist invests in bridge-type and portable arm CMMs for freeform surface data acquisition

A significant increase in orders for the supply of prototype pressings and bracketry, notably to Jaguar Land Rover (JLR), has prompted Birmingham Prototypes (www.birminghamprototypes.co.uk) to install two multi-sensor co-ordinate measuring machines (CMMs) from Nikon Metrology. The goal was not only to measure the sheet metal parts more quickly but more importantly to speed subsequent report generation. The investment has also resulted in the establishment of a new subcontract service offering laser scanning and inspection work.

Based in Redditch, UK, Birmingham Prototypes started working directly for JLR two years ago. To receive its supplier's code, the subcontractor needed to be able to fulfil the OEM's stringent quality control requirements in respect of first article inspection reporting and PPAP (production part approval process) documentation. These required an increase in the number of reports that had to be produced as well as more detail on component accuracy and repeatability than is requested by other customers in the automotive, aerospace and other sectors.

Using the former manual CMM at Redditch, report generation was a laborious process requiring entry of data and drawings by hand into Microsoft Office applications. A single report took anything from an hour to half a day, depending on its complexity, according to Birmingham Prototypes' managing director, Mick Adams. So in 2013 he decided to install a Nikon Metrology LK V 15.10.8 ceramic bridge co-ordinate measuring machine to automate and speed the reporting process. It also allows inspection cycles to be completed faster and without operator attendance after components have been

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*Mick Adams,
Managing director*



Close-ups of the Jaguar prototype pressing being inspected using the Nikon Metrology LC15Dx laser scanner head.

fixtures, saving further time especially when measuring a batch of identical components.

A Nikon Metrology LC15Dx laser scanner is the default method of inspecting pressings at Birmingham prototypes. It allows high accuracy resolution of freeform surfaces and geometry. For measuring tight dimensional tolerances and sometimes for initial job set-up, a touch probe is picked up automatically from the stylus changer on the LK V 15.10.8 by a Renishaw PH10M motorised indexing head.

Most drawing tolerances on pressed parts at Redditch are fairly open, ± 0.25 mm being typical on surfaces and ± 1 mm for trim edges. Only hole positions are measured to within tens of microns. The LK CMM is capable of measuring to an accuracy that is at least an order of magnitude better than is required for these applications.

Software is key to data handling and reporting

Nikon Metrology's multi-sensor CAMIO V8 software in use at Redditch produces industry-standard DMIS programs that support both laser scanning and touch probing. The software applies the optimum measurement strategy based on the feature and sensor selected. For measuring complex surfaces, it automatically generates scan paths that result in fast and smooth laser scanning that closely follows the part surface, with full machine simulation and collision detection. CAMIO also has instant, highly productive reporting functionality based on standard templates. Tabulated tables, graphics and form plots derived from scanned point clouds and touch probing are combined in a single, concise report.

It is Nikon Metrology Focus 10 software that manages the point clouds acquired during laser scanning and allows inspection data to

be compared against the customer's original CAD model. A typical pressing at the Redditch factory, such as a prototype aluminium engine bay mounting plate for a Jaguar car, comprises seven to eight million points. Focus software produces annotated, colour deviation maps showing how the 3D scanned model correlates with and deviates from the original CAD file. For such global comparisons, a 0.1 mm grid is generally selected by Birmingham Prototypes' quality manager, Bob Rose.

Scanning with articulated arm is twice as fast

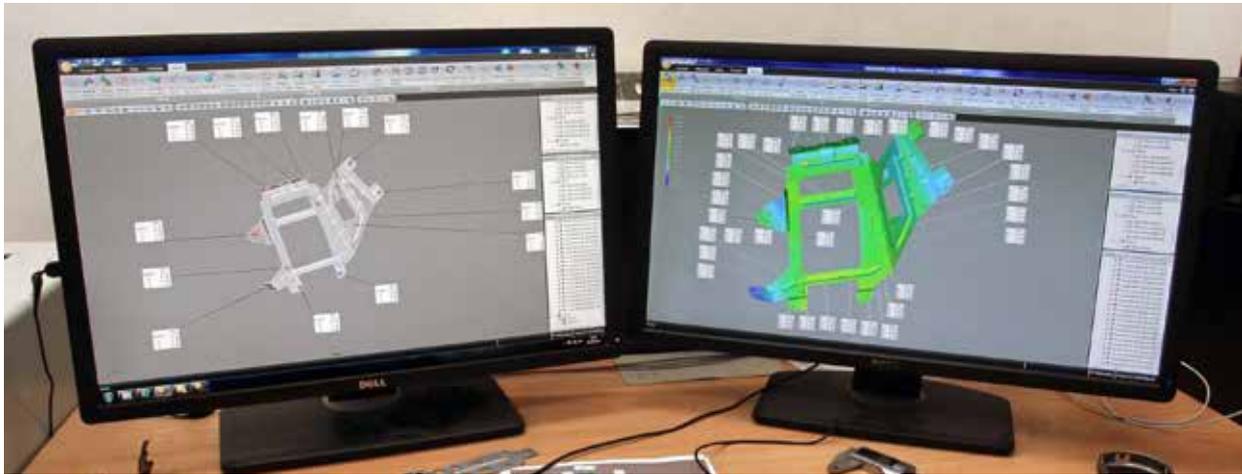
Early in 2015, Birmingham Prototypes installed a Trumpf 5-axis laser profiling machine so that it could bring in-house the laser cutting work it was subcontracting at a cost of £350,000 per year.

Mr Adams commented, "Practically every job that comes off the machine is a unique prototype that needs to be inspected, a job that was previously done by the laser cutting subcontractors before parts were delivered to us.

"As our CNC CMM needs to be programmed for each new part, making it more suited to our low volume, pre-production runs, it made sense for us to invest in a manual measuring system to check the output from the Trumpf laser.

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The facility is used in-house on a dedicated steel table in the quality control room. It often inspects or reverse engineers components and fixtures for other manufacturers that have requested subcontract



The CMM control screens, showing on the left hand screen a CAD model with hole comparisons and on the right hand screen a global comparison of the measured data against the CAD model. Different colours denote where each measurement is within the tolerance band.

measuring to be carried out, a service that was introduced two years ago when the CNC CMM arrived. The measuring arm has extended the scope of the service by allowing off-site inspection at customers' premises of fabrications that are too bulky to be transported easily.

The MCAx 7-axis, counterbalanced arm with continuous rotation is used mainly with a digital laser scanner at Redditch, together with Focus 10 handheld scanning and inspection software. Occasionally a touch-trigger probe is employed if additional accuracy is needed. The arm is equipped with absolute angle encoders for high precision and the model at Redditch has a four-meter diameter measuring envelope. Features of the equipment are the ability to reliably scan steep sided and reflective components, temperature stability and zero warm-up time.



The MCAx measuring arm with a hand-held laser scanner inspecting part of an aircraft seat.

Other departments served

The Nikon CMMs have greatly enhanced quality control of sheet metal parts at Birmingham Prototypes and allowed the firm to increase turnover by launching subcontract inspection and reverse engineering. They are backed by ISO 9001:2008 quality management accreditation, which has been held for over 10 years.

The move to laser scanning has improved not only the firm's sheet metalworking activities, but also its additive manufacturing service using a Dimension 1200es 3D printer. The laser scanner generates a CAD model of components for which there is no drawing or electronic data. It is altered as necessary, STL files are exported for printing the plastic part layer by layer and the customer is given both the component and the CAD file in any format.

The factory also houses four Hurco CNC machining centres including 5-axis models to manufacture prototype tooling and low volume production components around the clock. The output from these machines is also checked on the Nikon Metrology CMMs.