

## Teaching company project on cold forging at UEF Automotive Ltd.

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International developments in the forging industry, academia and customer demand are driving metal forming technology to produce more advanced, higher quality components. Ever more economical process routes have to be found by forging companies to reduce manufacturing costs and meet imposed customer demands for cost down. Through the facilitation of technology transfer from the University of Birmingham, UEF Automotive Bromsgrove has been the base for a recent Teaching Company Scheme Programme aiming to meet this imposed challenge. The TCS Programme set out to develop precision metal forming techniques within UEF by taking advantage of the technical capability and facilities of Birmingham University. The following article outlines some of the Programme achievements.

The technical trend in the automotive forging industry points towards net or near net-shape, higher added value components, which can only be produced by precision forming methods, based on warm and cold forging. The resulting benefits in component quality and value can substantially justify the necessary pre-forging processing requirements. Components benefit from having no draft angle and good material yield, near net-shape geometry combined with high dimensional accuracy and excellent surface finish.

The first milestone in the TCS Programme was the establishment of a dedicated research and development precision forging area equipped with a refurbished 1000 tonne hydraulic press. The most important piece of equipment in the R&D area was a versatile tool set designed in the early stages of the Programme. The flexibility of which allowed a range of sample components to be produced using novel tool design. Figure 1 details some of the components developed; Component 1 is an automotive brake adjuster produced to net-shape with fully formed tooth profile; Component 2 is a splined hub which is part of a clutch assembly; Component 3 is part of a turbocharger unit and was previously produce as a powder forging but has now been developed as a near net-shape cold forging; Component 4 is a diesel engine valve tappet that requires only finish grinding.



**Fig.1 – Precision Forged Components Developed During the TCS Programme.**

Advanced 2D and 3D Finite Element Method simulation software was also implemented during the TCS Programme and now enables UEF designers the freedom to experiment with novel tooling design. Analysis of the forging process with simulation software allows designers to optimise the process by; Eliminating forging defects such as folds as laps; Prolong die life by predicting and reducing stress patterns within tool sets; Improving workpiece material utilisation; Enhancing product quality and performance through forging process design.

Precision forging philosophies have now permeated all businesses within the UEF Group. The major achievements have been –

- Established a fully equipped R&D facility for precision forging.
- Developed a selection of sample precision forged components.
- Developed a knowledge-based system for tooling design.
- Developed a customer enquiry database.
- Implemented FEM simulation software within the UEF Group saving an estimated £250,000 P/A.
- Increased awareness of alternative metalforming methods and improved understanding of heat treatment, tribology and lubrication for cold and warm forging.
- Compressed lead times through the introduction of CAD and FEM software.
- Investigated alternative metalforming processes at Japanese forging companies.
- Established a technical library of conference proceedings, journal extracts and technical books.

Development work in the transmissions field is still ongoing after completion of the TCS Programme. Product and process development is of major importance to the successful achievement of the long-term company strategy and growth. As a result of the TCS Programme, links with academia and research institutes have been formed and strengthened. The result of which has led to the following development programmes –

- Warm and/or cold forging development programmes.
- Materials and process development.
- Incremental forging laboratory established at Birmingham University.