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Structured approach to identifying weak links and partnership can bring a step changes in performance

James Needham, AMRC Machining Group

Identify the weakest link in any machining process and you have the key to what could be major improvements in performance, according to James Needham, head of applications with the AMRC's Machining Group.

Finding that weakest link lies at the heart of the AMRC's Critical Path Approach to optimisation, which begins with the current machining strategy and examines limiting factors such as vibration, tool wear, geometric accuracy, surface finish and integrity and part movement.

In addition to studying the limits on productivity and exploring possibilities for improvement, the approach also examines how the process fails if it is pushed harder.

Key technologies underpinning the approach include dynamic analysis, simulation and advanced fixturing and tool design, while AMRC research into machinability and material

characterisation underpins an understanding of how fast it should be possible to remove material and how a component will behave.

"The closer you get to the edge of performance, the more important effect an individual variable can have," said Needham, adding that some of the biggest successes achieved at the AMRC had resulted from bringing different suppliers and partners together to meet a particular challenge.

"When we draw together expertise from different partners we can go beyond marginal gains to achieve a step change in performance, which can help to avoid expenditure on new machines and factory extensions because you can do more with what you have got."

Examples of successes included reducing the time required to manufacture aero engine shafts by 45 per cent and manual intervention by 50 per cent, while raising the 'right first time' target.



Optimising machining performance helps precision engineers double turnover and create jobs

Jeremy Ridyard, Produmax

Optimising machining performance has helped innovative high precision engineering company Produmax double its turnover and the number of people it employs and laid the foundations for similar growth in the future.

Managing director Jeremy Ridyard told the AMRC Forum his West Yorkshire-based company had raised its turnover from £5 million to £10 million and now had the capability to reach a turnover of £20 million.

The company focuses on machining hard metals and titanium, with more than 95 per cent of its output going to the aerospace sector.

Ridyard said Produmax had used backing from the UK Government-backed Sharing in Growth programme to secure advice from the AMRC and other experts on how to get the best out of its five and six axis milling machines.

A combination of Ballbar and Tap testing enabled the company to optimise the physical performance of its machine tools, while further work focused on coolants, fixturing, cutter and tool holder selection and CAM strategies.

Studies identified problems when water was used in cutting fluids at certain times of the year, caused by the presence of pollen and microscopic plants and algae.

Further studies identified the optimum tools, holders and fixturing solutions from a myriad of potential solutions which it would have been impossible for an SME like Produmax to test themselves.

As a result, the company introduced a plunge milling strategy, which it would never have considered before, using new fixturing and a changed spindle.

Switching from a cheap cutting tool which gave reasonable performance

for one operation to a top end tool also resulted in substantial savings, even though the new tool was five times more expensive.

Last, but not least, Produmax trialled different CAM systems - some of which produced "alarming" results - before settling on a system that best suited its production processes.

Each area Produmax optimised resulted in marginal gains that resulted in significant savings over a year and created capacity to meet rising demand which could otherwise only have been satisfied by a £500,000 investment in a new machine tool.

Ridyard told the Forum that the optimisation exercise had expanded Produmax's knowledge and understanding. Above all, the optimisation process had emphasised the importance of one thing.

"Measure everything!" said Ridyard.

