



Success Story

F1 Subcontractor Bucks The Trend By...

...manufacturing a mountain bike. As a fifth generation engineer, Stewart Palmer knew from a young age the path his career would take. As a child, Stewart was always more interested in dissecting his bike and finding out how it worked, rather than

... riding it. Now, as a highly skilled engineer, Stewart has spent the last 18 months designing and manufacturing his own downhill mountain bike.

Stewart's engineering pedigree has been earned as a programmer and machinist of F1 components and high performance engines. However, the dream of designing his own product didn't arise until he joined North Bucks Machining Ltd (NBM), the family owned company started by Stewart's parents in 2011. As the brainchild of Stewart's father Mr Dave Palmer, NBM was started when Dave was made redundant from his machining position at a blow mould outfit producing plastic packaging products. Dave and his wife started with a HAAS machining centre and eventually brought in their son Stewart and daughter Jo-Anne, to take NBM to the next level.

Reflecting back on the early days of the business, Stewart says: "The business rapidly became successful in the 3-axis machining arena but a contract to design and manufacture eight mould tools for 5-litre Jerry Cans, meant we had to invest in technology. I previously worked at a prestigious company producing 5-axis F1 parts, so my ambition was always to evolve into the 5-axis market. This arrived in the guise of a Quasar 5-axis ma-

chining centre from the Engineering Technology Group (ETG) and high-end CAM software from OPEN MIND Technologies. I had a great relationship with ETG; and from previously working with an F1 component manufacturer, I knew *hyperMILL*® from OPEN MIND was the only option with regards to CAM software."

"High-end CAM software can be an expensive outlay for a small business with just 6 staff and a few HAAS 3-axis machining centres, but if you can comprehend the potential benefits, its a no-brainer. My family took some convincing, but the penny dropped



About North Bucks Machining

North Bucks Machining are equipped with 3, 4 and 5 axis machining centres, also a CNC turning centre. All powered by top of the range CAD/CAM software. They have the experience to offer a complete design and manufacturing process. North Bucks Machining offer customers reliable, high quality comprehensive maintenance and repair from breakdown to refurbishment.

www.northbucksmachining.co.uk

Rear Suspension of Alpha Bike



“From previously working with an F1 component manufacturer, I knew *hyperMILL*® from OPEN MIND was the only option with regards to CAM software.”

North Bucks Machining Ltd (NBM)



when we had to produce a knife blade for a box-folding company. Using our previous CAM system was a struggle that made this relatively easy re-modelling task a 2 hour job. I convinced the family of the benefits of OPEN MIND's *hyperMILL*® and as soon as we bought it, I modelled the next knife tool in just 10 minutes. Everyone was immediately convinced.”

Why Build a Bike?

Stewart's background in designing and producing complex parts soon gave the biking enthusiast the idea of designing his very own bike. In his spare time, Stewart created numerous drafts of his first bike design. He eventually took the concept to Laser Scanning, a design agency that developed a 3D CAD model from Stewart's sketches. From this 3D CAD model, comprehensive Finite Element Analysis (FEA) was conducted to put shocks, loads and particular stresses on the frame design. Once the 3-piece frame design passed the simulated stress testing, NBM set about machining its first bike.

The aim of the design was to improve the strength and structural integrity of a mountain bike. As Stewart says: “Standard bikes are produced from hollow tubes that are fabricated together. This design automatically has weak points on every weld seam. To reduce weight, we realised we couldn't machine hollow tubes, so we used solid aluminium billets and i-beam technology to scallop out the sides of the frame to reduce mass. We calculated that we could machine our rib thicknesses down to 5 mm whilst retaining structural integrity.”

A Bike Was Born....

The bike design consists of three core features, the main frame, the seat post and the swing arm that connects the main frame to the rear wheel and suspension. To emphasise the level of machining required, the main frame is machined from a 100kg aluminium billet down to a 4.5kg frame. The seat

post starts as a 15 kg billet and ends as a 250 gram part and the swing arm is machined from a 50kg billet down to a 2kg part. This leaves an aluminium frame of less than 7kg from an overall billet weight of 165kg. This may appear a costly and time consuming method of production, but NBM investigated waterjet cutting and the time and cost element was similar. The aim was to prove the concept and manufacture the best possible product.

Using OPEN MIND's *hyperMILL*®, the frame is machined in 40 hours, the swing arm in 18 hours and the seat post in 15 hours. However, with just two frames produced to date, time is not the key issue for NBM. As Stewart continues: “At this early stage, the machining time is not the key issue, its the surface finishes. Once this frame is machined, it has no secondary hand finishing, its ready for final assembly or shipping. Its all about delivering an aesthetically perfect bike to the customer.”

To this end, *hyperMILL*® has genuinely been in a class of its own. As Stewart mentions: “The project wouldn't have been possible with our previous CAM software. Without *hyperMILL*® and the 5-axis Quasar, it would have been impossible. But what sets OPEN MIND's *hyperMILL*® apart is its finish machining cycles. *hyperMILL*® automatically groups together the Z-level finishing and 'profile finishing' cycles to blend perfectly between two surfaces and the two separate cycles. This is critical for our ambitions of the perfectly finished frame.”

“Furthermore, the frame has a lot of pocket machining, so naturally there is a radius left at the bottom of each pocket by the cutting tool. To resolve this, *hyperMILL*® has a 'pencil milling' feature that can isolate all the remaining fillets for re-machining. The machine then selects a small tool, which removes the excess material in the corner of each pocket.”

Rear Suspension of Alpha Bike

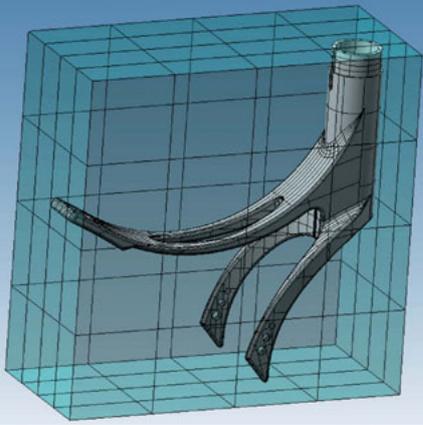


Alpha frame seat post



Swing Arm on 5-axis Machine





Simulation of the Alpha Seat Post



Seat Post Alongside Billet to Demonstrate Rough Machining



The Quasar Machine Producing Bike Frames.jpg

Taking Productivity to the MAXX

Whilst surface finish is more critical than cycle times, Stewart is aiming to reduce the machining time by implementing OPEN MIND's new *hyperMILL*® MAXX machining package for rough machining. Marketed by OPEN MIND as the next generation in CAM software for cutting hours from machining cycles, NBM has run tests of *hyperMILL*® MAXX and found the cycle time reduction to be extremely positive. Just one of the roughing cycles on the main frame has been reduced from 2 hours 20 minutes to less than 1 hour 30 minutes, a 40% reduction. It is estimated that if the part was run on a machine with a spindle speed in the region of 15 to 18,000rpm, as opposed to the existing 8,000rpm, the cycle time is projected to fall close to 30 minutes, a massive 80% reduction on the existing run-time.

Bikes For Sale...

As a project in its infancy, Stewart has ambitions of further enhancing the design of the frame to reduce the overall weight from 6.75kg to approximately 5kg. As an engineer with a pedigree in F1 design & production, getting the frame to shed a few grams as it progresses, will be second nature. At present, if you are a mountain biking enthusiast, you can contact North Bucks Machining Limited in the heart of the UK motorsport valley Milton Keynes to get more details. The company will look to retail the 3 part frame and rear suspension unit in the region of £7000 or a completely built bike with a top specification at approximately £10,000.

For further details, please contact OPEN MIND on Tel: 01869 290003. ■

About OPEN MIND Technologies AG

OPEN MIND is one of the world's most sought-after developers of powerful CAM solutions for machine and controller-independent programming.

OPEN MIND designs optimized CAM solutions that include a high number of innovative features not available elsewhere to deliver significantly higher performance in both programming and machining. Strategies such as 2.5D, 3D as well as 5axis milling/mill turning, and machining operations like HSC and HPC are efficiently built into the *hyperMILL*® CAM system. *hyperMILL*® provides the maximum possible benefits to customers thanks to its full compatibility with all current CAD solutions and extensive programming automation.

OPEN MIND strives to be the best and most innovative CAM/CAD manufacturer in the world, helping it become one of the top five in the CAM/CAD industry according to the NC Market Analysis Report 2016 compiled by CIMdata. The CAM/CAD solutions of OPEN MIND fulfil the highest demands in the automotive, tool and mould manufacturing, production machining, medical, job shops, energy and aerospace industries. OPEN MIND is represented in all key markets in Asia, Europe and America, and is a Mensch und Maschine company.



We push machining to the limit

www.openmind-tech.com