VisualMILL at OESH Shoes

Dr. Casey Kerrigan is a Harvard Medical School graduate with a master's degree in Kinesiology (the study of body movement). Dr. Kerrigan is known internationally for her peer-reviewed published research on gait (the study of walking & running) and the effects of footwear on the joints in the body. She published her first research paper in 1998 demonstrating a link between high heels and knee arthritis. She subsequently discovered that even a small heel elevation, as well as a lot of other features in traditional shoes, similarly increase impact on the joints.

Casey's research, along with her years of clinical experience treating the wide variety of problems linked to poor footwear, led her to develop and launch OESH Shoes in Charlottesville VA, where she and her team designs and manufactures her footwear with the help of VisualMILL from MecSoft Corporation.

We recently sat down with Dr. Kerrigan to discuss her remarkable contributions to the footwear industry and her use of VisualMILL software.

OESH & VisualMILL

In 2009 Casey was the first woman tenured professor and chair of the department of physical medicine and rehabilitation (PM&R) at the University of Virginia (UVa). Casey was also professor of mechanical and aerospace engineering when she left UVa to concentrate full time on footwear development. When it came time to prototype her footwear sole designs, Casey taught herself CAD/CAM and purchased a Supra 3 Axis vertical mill from CNC Masters. They highly recommended that Casey take a look at VisualMILL from MecSoft Corporation to generate the 3 Axis CAM toolpaths she would need to machine the sole design molds her footwear required!

"VisualMILL is easy to learn and easy to use! I self-taught myself how to use the program from the MecSoft training videos. I've also trained two apprentices to use the software and neither one of them has had any trouble learning it."

Dr. Casey Kerrigan, Founder & President
OESH Shoes, Charlottesville, Virginia

OESH Shoes developed their footwear prototype molds using VisualMILL CNC Software from MecSoft Corporation. Here we see the OESH La Vida shoe design and mold plate.

VisualMILL helps OESH design their 3D Printers!

Dr. Kerrigan has also developed her own production 3D printers that OESH uses to produce the soles for their line of 3D printed sandals. With a grant from the National Science Foundation, Casey was able to refine the development of the thermoplastic extruder that her 3D printers required.

Casey also taught her apprentice Maggie Rogers how to use VisualMILL! Maggie is a recent UVa graduate, designer and fabrication specialist with OESH. Maggie assists in the development of the company's 3D printer extruder designs using Fusion 360.

All of the g-code required to machine the design components are generated in VisualMILL using 2, 3 and 4 Axis toolpath strategies.

(Left) Dr. Casey Kerrigan inspects the bulk thermoplastic pellets used by the OESH 3D printers also shown. (Right) The OESH Athena 3D printed sandal in Poppy White.

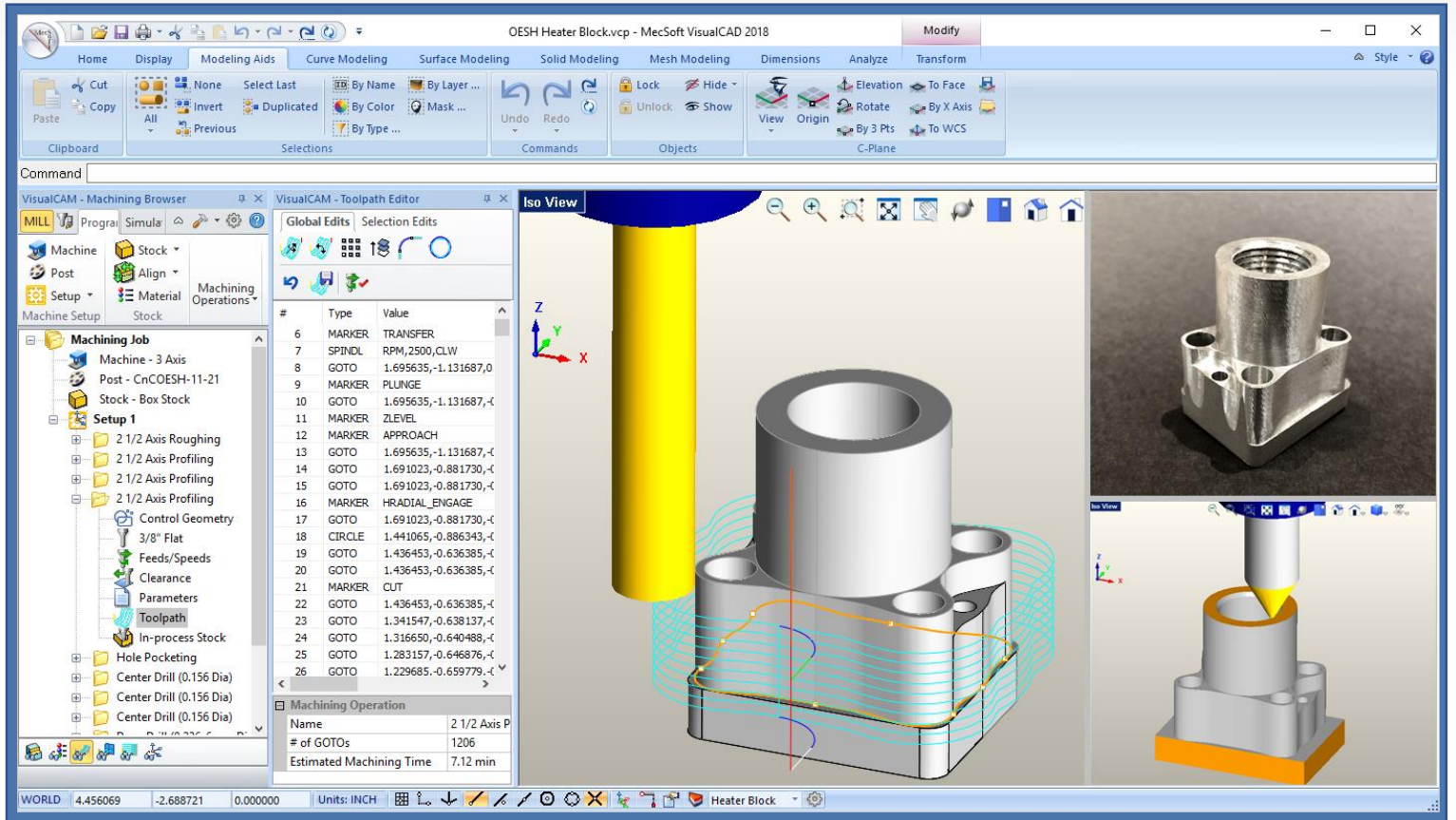
Here is what Maggie Rogers had to say about VisualMILL:

"With the VisualMILL program and our CNC milling machine, I can quickly and easily machine new components for our 3D printers. We machine almost all the parts of our 3D printers right here in our Charlottesville factory, so development can go very fast and we can be constantly improving our shoe printing processes."

Maggie Rogers, Design & Fabrication Specialist
OESH Shoes, Charlottesville, Virginia

Thermoplastic Heater Block

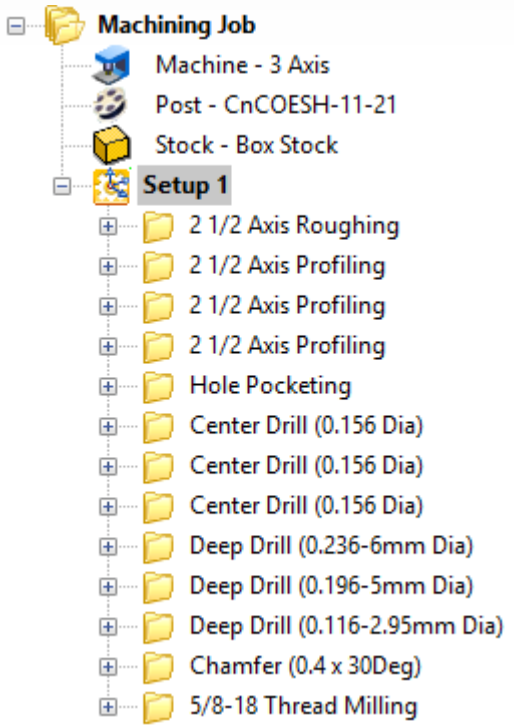
The Thermoplastic Heater Block design in 6061 aluminum shown below is a great example of how VisualMILL's 2½ Axis toolpath strategies can be used to quickly and effectively rough and finish a complete 3-dimensional component. Maggie used VisualMILL's Roughing, Profiling, Hole Pocketing, Drilling, Chamfering and Thread Milling on this part. She generated the required g-code using the CncMasters-Inch post-processor, one of over 300 posts included with VisualMILL. More details about each of the toolpath strategies (with cut material simulations) used to machine this part are provided below.



Here we see VisualCAD/CAM with the VisualMILL plugin loaded. (Center) The Heater Block 3D model is loaded and one of the 2½ Axis Profiling toolpaths is shown with the cutting tool displayed. (Left) Here we see the VisualMILL Machining Browser showing the Machining Job and the Toolpath Editor to the right. (Right) In the bottom right we see the cut material simulation for the 2½ Axis Chamfering operation. In the top right we see the actual machined component.

Want to see how VisualMILL can help you? Click Here to download a demo!

The Thermoplastic Heater Block incorporates an interesting mix of 2½ Axis toolpath strategies. In the Machining Job, we see that it starts with an initial Roughing path and then continues with Profiling, Hole Pocketing, Drilling, Chamfering and Thread Milling to complete the finished component. More details on each strategy are provided here:



A. **Heater Block Model:** The 3D part model is displayed in VisualCAD.

B. **Heater Block Stock:** The stock model 1.5 Long x 1.0 Wide x 1.5 High is displayed.

C. **2½ Axis Roughing:** This strategy uses a 3/8"" end mill, offset cut pattern, mixed cut direction, a 0.05" stepover and a 0.10" stepdown with a 0.01" stock allowance. A straight vertical approach is used with linear XY extensions.

D. **2½ Axis Profiling 1, 2 & 3:** These are profiling strategies to make finished perimeter cuts using the same 3/8"" end mill. All have a mixed cut direction, radial entry and exit motions, a stepdown of 0.05" and a stock allowance of 0".

E. 2½ Axis Hole Pocketing: This hole pocketing strategy cuts the minor diameter of the 5/8-18 internal thread at the top of the heater block, again using the 3/8” end mill. The path incorporates a helical cut motion and a cleanup pass at each cut level of 0.03” for a total depth of 1.2441”. The cut parameters are illustrated in the dialog icon shown here. The path also includes a helical entry and vertical retract.

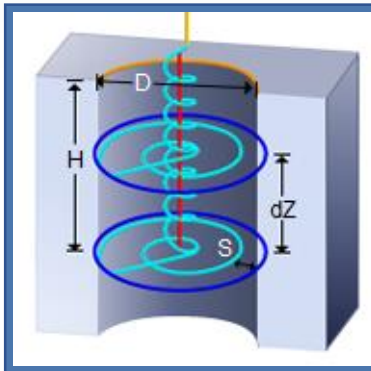
F. Center Drilling: The next three are center drilling operations (only the first is shown in figure (F). Each uses a 0.156 diameter drill and center drills to a depth of 0.10”.

G. Deep Drilling: The next three are deep drilling operations, each using different drill tool diameters of 0.236”, 0.196” and 0.166”. The first operation is shown in figure (G). Each has a step increment of 0.05” (similar to peck drilling) and an approach distance of 0.10”.

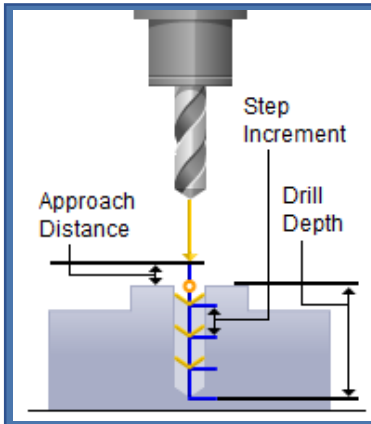
H. 2½ Axis Chamfering: In further preparation for the 5/8-18 internal thread, a chamfer operation is added to the top inner perimeter of the larger center hole using a 30 degree V-mill at a depth of 0.04”.

I. 2½ Axis Thread Milling: This operation cuts the internal right-hand 5/8-18 thread using a thread mill cutting tool. The path uses a linear approach and radial engage and retract.

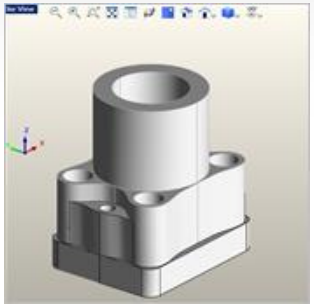
J. Actual Machined Part: The actual part is shown here.



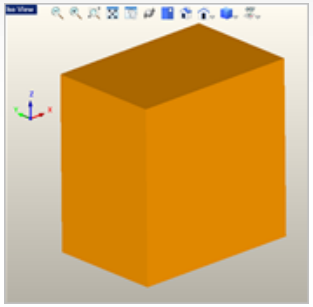
2½ Axis Hole Pocketing Cut Parameters



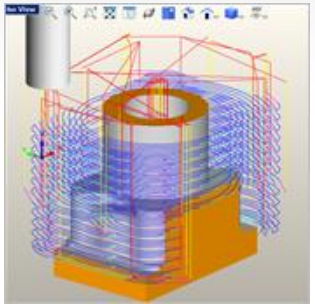
Drilling Cut Parameters



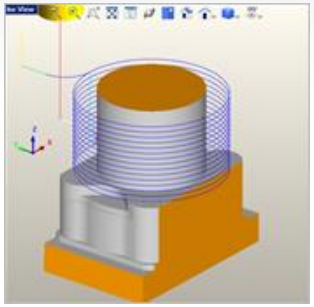
(A) Heater Block Model



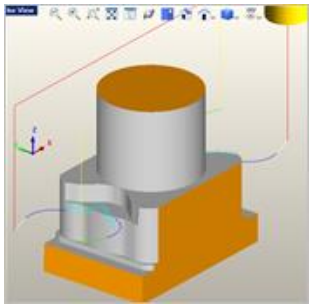
(B) Heater Block Stock



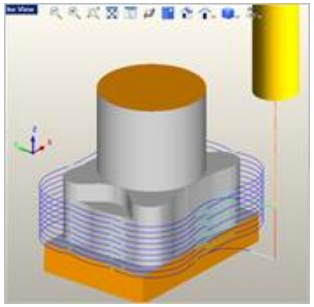
(C) 2½ Axis Roughing



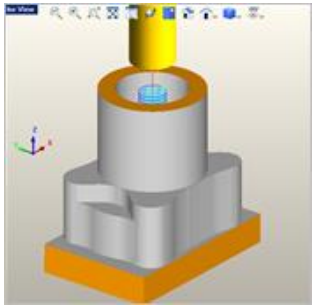
(D) 2½ Axis Profiling 1



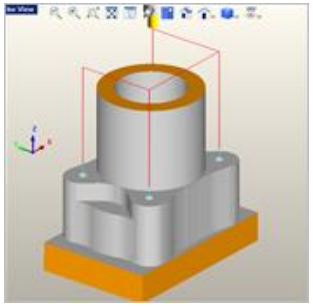
(D) 2½ Axis Profiling 2



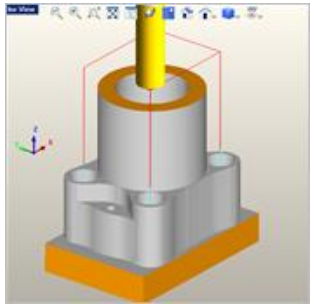
(D) 2½ Axis Profiling 3



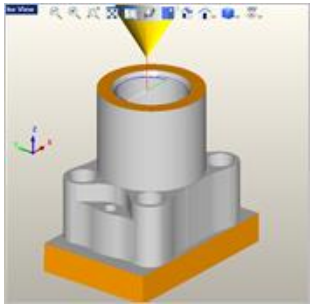
(E) 2½ Axis Hole Pocketing



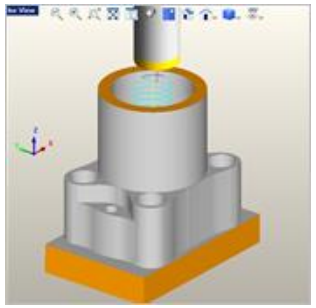
(F) Center Drilling



(G) Deep Drilling



(H) 2½ Axis Chamfering



(I) 2½ Axis Thread Milling

(J) Actual Machined Part

More About OESH Shoes

We want to thank Dr. Casey Kerrigan and Maggie Rogers for their time and contributions to this article. For more information about Dr. Kerrigan's research and OESH Shoes, we invite you to check out the following web links:

- The Dream Flat by OESH
- OESH Shoes online, Facebook and Twitter
- Dr. Casey Kerrigan appears in the ABC 20/20 television program
- More about Dr. Casey Kerrigan
- Women in CAM: Dr, Casey Kerrigan & OESH Shoes (MecSoft Blog)
- Machining a Heater Block in 2½ Axis using VisualMILL (MecSoft Blog)
- VisualMILL Helps OESH Shoes Design Production 3D Printers (MecSoft Blog)

More About VisualMILL

VisualCAD/CAM (also referred to as VisualMILL) is available in 5 product configurations (Express, Standard, Expert, Professional and Premium). Here are some additional details about each of the available configurations. For the complete features list, we invite you to visit the VisualMILL Product Page.

- **VisualCAD/CAM Express:** This is a general purpose program tailored for hobbyists, makers and students. Ideal for getting started with CAM programming. Includes 2 & 3 axis machining methods.
- **VisualCAD/CAM Standard:** This is a general purpose machining program targeted at the general machinist. This product is ideal for the rapid-prototyping, hobby and educational markets where ease of use is a paramount requirement. Includes 2-1/2 Axis, 3 Axis and Drilling machining methods.
- **VisualCAD/CAM Expert:** Includes the Standard configuration plus 4 Axis machining strategies, advanced cut material simulation and tool holder collision detection.
- **VisualCAD/CAM Professional:** Includes the Standard and Expert configurations plus advanced 3 Axis machining strategies, 5 Axis indexed machining, machine tool simulation, graphical toolpath editing and a host of other features.
- **VisualCAD/CAM Premium:** Includes the Standard, Expert and Professional configurations plus 5 Axis simultaneous machining strategies.

More About CNC Masters

To learn more about the great team at CNC Masters and the Supra 3 Axis vertical mill, we invite you to visit them online at their website, Facebook and Twitter pages.

Try VisualMILL Today!

Powerful 2-5 axis machining capability on your desktop.