

# Software Helps AVFCO Meet

# Design & Machining Challenges

THIS 30-PLUS YEAR OLD COMPANY USES  
GENERATE CAD DRAWINGS FOR OUTPUT.

ITS EXISTING CAM SOFTWARE PROGRAM TO



AVFCO used Mastercam software for the design and manufacture of this four-station, vacuum-formed ATM machine.

Experience, ingenuity and seamless toolpath generation were combined to help Auburn, NY-based Auburn Vacuum Forming Co. meet the challenge of machining a 30-inch by 50-inch production mold with existing equipment — saving outsourcing costs, and eclipsing hand-tooling.

The assignment was a custom-formed front panel for a leading manufacturer's through-the-wall ATM machine. The customer furnished the profile for the face. Adding 2-inch sidewalls to the face following the radial curves at the top and bottom was one of AVFCO's post-design challenges.

AVFCO uses CNC Software's Mastercam program for all its 2-to-5-axis machining and for much of its solid design work directly intended for moldmaking rather than drawing output. AVFCO's programmer/network administrator, Dave Eno, first tried other CAD packages to design the sidewall from the customer's profile prior to using the Mastercam program for drawing output.

"One of Mastercam's features that is very useful for us is its ability to work simultaneously with solids and surfaces," says Eno. "After we created the design section of the part as a solid, we converted the inside faces of the model to NURBS surfaces. Then we used the surfaces to create the mold model, extending the vertical side, top and bottom sur-

faces to a common plane, which completed the mold form. Mastercam's associativity saved us a lot of time as well. It links the model and the NC program so that, after creating the initial toolpath, any changes we made to the model were automatically made to the toolpath."

### MEETING THE MACHINING CHALLENGE

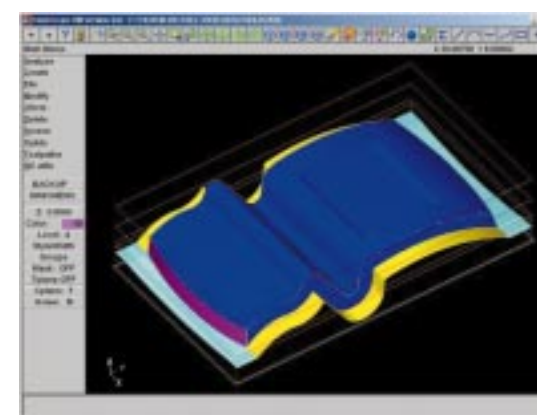
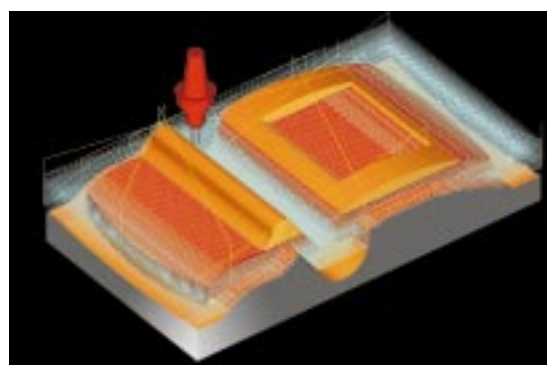
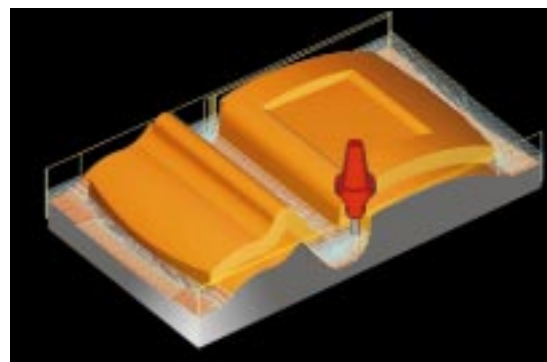
Cutting the mold on one of AVFCO's three Thermwood 5-axis routers posed the major challenge. "Since the mold was now 15 inches from the base plane to its highest point," Eno says, "our existing Thermwoods couldn't plunge the depth, yet clear the top of the mold with their tool length restriction. We also needed the Thermwood's table size for the square area of the project, though we only used 3-axis toolpathing for this part of the process.

"In the past, we worked one layer of RenShape at a time, from the bottom up, but had to toolpath for each layer independently. Now we have Mastercam not only create



RenShape blocks have been added to the Mastercam-machined third layer prior to roughing. Each layer has been cut to precise boundaries and is ready to accept the bottom plane of the next.

With the solid model of the complete design is readily visible, Mastercam has generated a toolpath for the base layer (top) and second layer (bottom) separately, conforming to depth boundaries according to the height of each RenShape layer in the stack.



The seamless fit of all four layers of the ATM mold are graphically evident in this solid model.

the toolpaths for the entire piece, but also create the toolpaths with depth boundaries according to the height parameters of the RenShape layer, on up-stack, and gluing each new block to the already cut lower one.

"We roughed each layer with a 3/4-inch end mill using a 'pocket surface roughing' toolpath, then ran a finish pass with a 1/2-inch ball end mill with 'contour finish' for the bottom layers and 'parallel finish' for the top layer. Each layer fit seamlessly with the previous one, exactly as we needed. Once ma-

chining and coating with sealer were done, we drilled holes from 0.015 inch to 0.030 inch as needed for the vacuum draw," Eno explains. "This was a hand process which relies on the experience of the moldmakers to understand where greater draw — more holes — needs to be."

After normal vacuum forming on several of AVFCO's seven machines, the ATM covers required accurate removal of the excess plastic to join with the interior case of the body. Using Mastercam's 5-axis capabilities, AVFCO developed the trimming toolpaths from the original solid part geometry. The entire perimeter of each part was trimmed vertically to the 2-inch sidewalls. Openings for the transaction monitor screen, keypad, card insert slot, receipt slot and cash dispensing mechanism exit required toolpaths to maintain an edge normal to the curved surfaces of the design.

"I picked an arbitrary starting point and chose two boundaries. First, the tool-tip boundary delineated the 5-axis machining area. The second calculated the 5-axis tilting needed to produce the normal-to-the-surface trim angle. It only took two hours to program the 5-axis work, and each piece is trimmed in just eight minutes," Eno says. All trimming was done in single passes of a 1/4-inch carbide end mill.

"It would take a patternmaker at least 100 hours to make this mold from templates which would, themselves, take days to create. After a little over an hour to convert the customer's profile to the full Mastercam toolpath, it took just over 20 hours to rough-and-finish all four layers of RenShape and to seal it. What's more," Eno adds, "with CAM, the mold is virtually exactly to the customer's design." ▀

For more information, contact CNC Software, Inc./Mastercam at (800) 228-2877 or (860) 875-5006, [www.mastercam.com](http://www.mastercam.com).



The ATM front panel mold is now complete — finish-cut and sealed — and ready to be mounted for production vacuum forming.