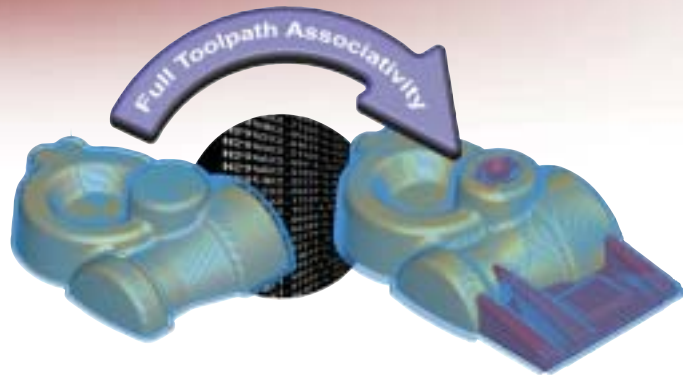


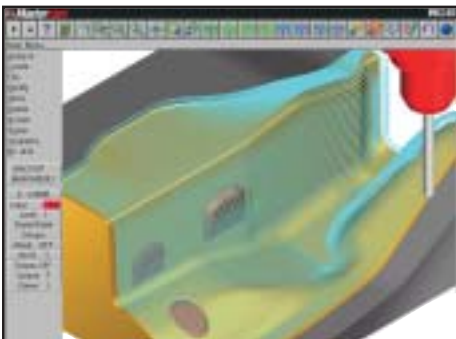
# Mastercam<sup>®</sup>

## Mill Level 3



### Capture Your Machining Knowledge

Mastercam's full associativity gives you the power to capture your knowledge and build on your experience. Once you program a part - any part - you can modify any element of the job and immediately get updated toolpaths without starting over. And Mastercam's intelligent NC programming lets you build a library of machining strategies done the way you want them. Just choose saved operations and apply them to a part, and Mastercam adapts them to the new model. Fast, easy and productive. The way programming should be.



### Powerful Part Modeling

- Easy 2D and 3D geometry creation with multiple ways to create entities.
- Fast creation of a wide range of NURBS and parametric surfaces.
- Flexible surface filleting offers constant radius fillets and point-and-click variable radius fillets.
- Remove trim boundaries and fill trimmed holes.
- Automatic parting line calculation for mold making.
- Associative dimensions update as you change your model.
- Extensive CAD editing tools.
- AutoCursor™ snaps to commonly used construction points.
- User-definable drafting grid simplifies detailed construction.
- Measure minimum and maximum curvature radius, and calculate surface area for single or multiple surfaces.
- Analyze single points, between points, angles and entire entities.
- New user-defined work coordinate system makes it easy to work on a model without having to move it in 3D space. Your new planes and origins are easily transferred to your G-code.

### Efficient Toolpath Management

- Mastercam's Operations Manager stores all your job's operations in one place. Quickly create, edit and verify your toolpaths, or copy and paste parameters, toolpaths and tool definitions from one operation to another.
- Merge, translate, reverse, rotate, mirror, copy, cut and paste segments of your toolpath.
- User-customizable tool and material libraries automatically calculate feeds and speeds.
- Graphical toolpath editor gives you point-and-click on-screen editing tools.

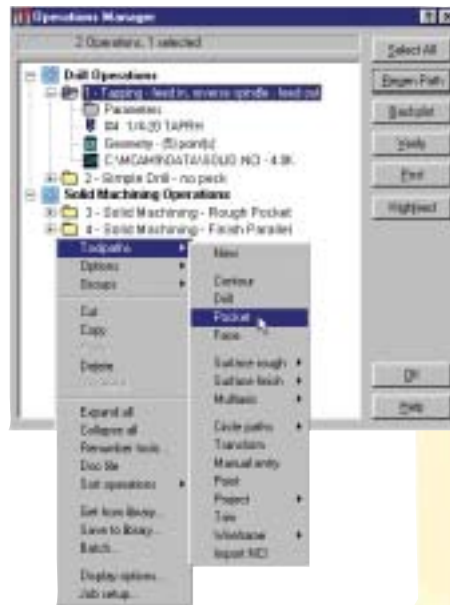
### Associative Toolpaths

- Fully associative geometry and toolpaths let you modify the geometry or machining parameters and immediately get an accurate, updated toolpath.
- Store a library of commonly used operations to automate machining. For example, you can spot drill, peck drill, and tap a series of holes simply by importing one stored operation.

## Pocketing, Contouring and Drilling

2D and 2½D machining ranges from the very simple to the very complex. Mastercam delivers all the tools you need to maximize your time.

- Pocketing styles include high speed, zigzag, one way, true spiral, constant overlap spiral and "morph" pocketing, each with optional finish passes.
- Machine open pockets without creating additional geometry.
- Choose plunge, helical or ramp entry.
- Special spiral pocketing options for removal of material when the tool turns a sharp corner.
- Contour and Pocket remachining use a smaller tool to automatically clean out material left from a previous cut.
- Choose multiple machining areas with a single selection.
- Dynamically drag a pocket finish pass or contour start point to anywhere on your model.
- Automated slot milling.
- Choose separate taper angles for contours, pocket walls, and pocket islands, including islands of different heights.
- Smart pocket depth control lets you machine depths without retracting or machine all cuts in a single area before moving to the next.
- Facing cleans stock from the tops of islands or the entire part.
- Choose separate lead-in and lead-out for contours and pocket finish passes.
- Choose multiple roughing and finishing passes and multiple depth cuts for any contour.
- Easily machine 2D and 3D contours including parametric and NURBS splines.
- Automatically identify and pre-drill multiple operations at their plunge points.
- Automatic drilling countersink depth calculation.
- Optimize drill routines to minimize tool travel.
- With the addition of the Solids option, Mastercam automatically recognizes and programs drill holes on solid models, complete with pre-drill operations.



**Mastercam's Operations Manager puts all job elements at your fingertips.**

## Powerful Roughing

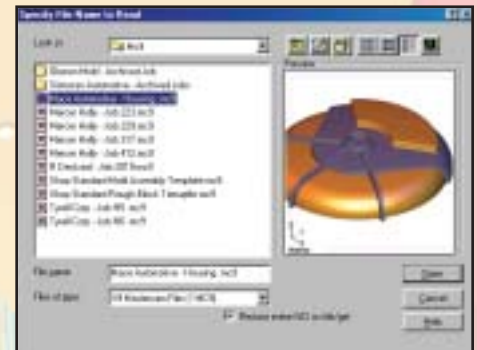
Fast, efficient bulk material removal is essential to efficient NC programming. Mastercam gives you a variety of techniques to rough all of your parts.

- Rough cut multiple surfaces, solid models, or a combination of both.
- Rough cut with constant Z contours or pockets.
- Rough cut by descending parallel or radial cuts, with complete control over plunging with positive and negative Z motion.
- Custom plunge roughing lets you rough straight from the top (with no XY motion) in any user-defined cut pattern.
- Constant Z rough rest milling (remachining) identifies and machines areas that need to be roughed with a smaller tool.
- Automatic facing and critical depth recognition ensure flat surfaces that lie between Z-cuts won't be left with too much stock during rough machining.
- Automatically align all your roughing plunge points, making it easier to pre-drill those spots for production machining.

## Versatile Finishing

Mastercam's suite of finishing tools lets you choose the best method for a specific project.

- Finish machine multiple surfaces, solid models, or a combination of both.
- Parallel finishing delivers robust toolpaths for a wide variety of projects.
- 3D project machining creates a consistent, smooth finish while following the natural curves of multiple surfaces or solids.
- Constant scallop machining maintains a consistent finish on sloped and flat surfaces alike by using a consistent 3D stepover.
- Radial finishing creates toolpaths radiating outward from a selected point, perfect for round parts.
- Flowline machining cuts single or multiple surfaces using their natural shape to define the cutter path, delivering a smoother finish.
- Ruled toolpaths include automatic synchronization by entity, branch or node. Cutting options are constant Z, zigzag, circular, one way or 5-axis swarf machining.

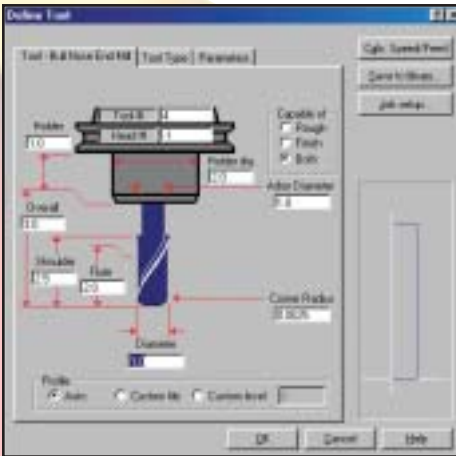


**View your files before opening them.**

## Cleanup Machining

Leftover material causes extra handwork and time. Mastercam automates leftover material identification and removal, leaving you with a finer finish.

- Hybrid leftover machining changes the cut method as the slope of the model changes - in a single toolpath.
- Constant Z Rest milling (remachining) identifies and machines areas that need to be cut with a smaller tool, including automatically detected critical depths.
- Pencil tracing walks a tool along the intersection of surfaces to clean out hard-to-reach areas.
- Steep/Shallow machining cuts only those regions of selected surfaces that have slopes between two specified angles.



Choose from an extensive library of tools or create your own.

## Dependable Toolpath Verification

- Watch your part being cut from a solid block of material with Mastercam's solid-model toolpath verification. The tool and holder are checked and displayed during simulation.
- Step through the program with toolpath backplotting and get an estimate of machining time. Dynamically view all the vital information about tools and operations at any point in the toolpath.
- Verify 2D toolpaths with a pixel paint of the full tool diameter to check the finish.

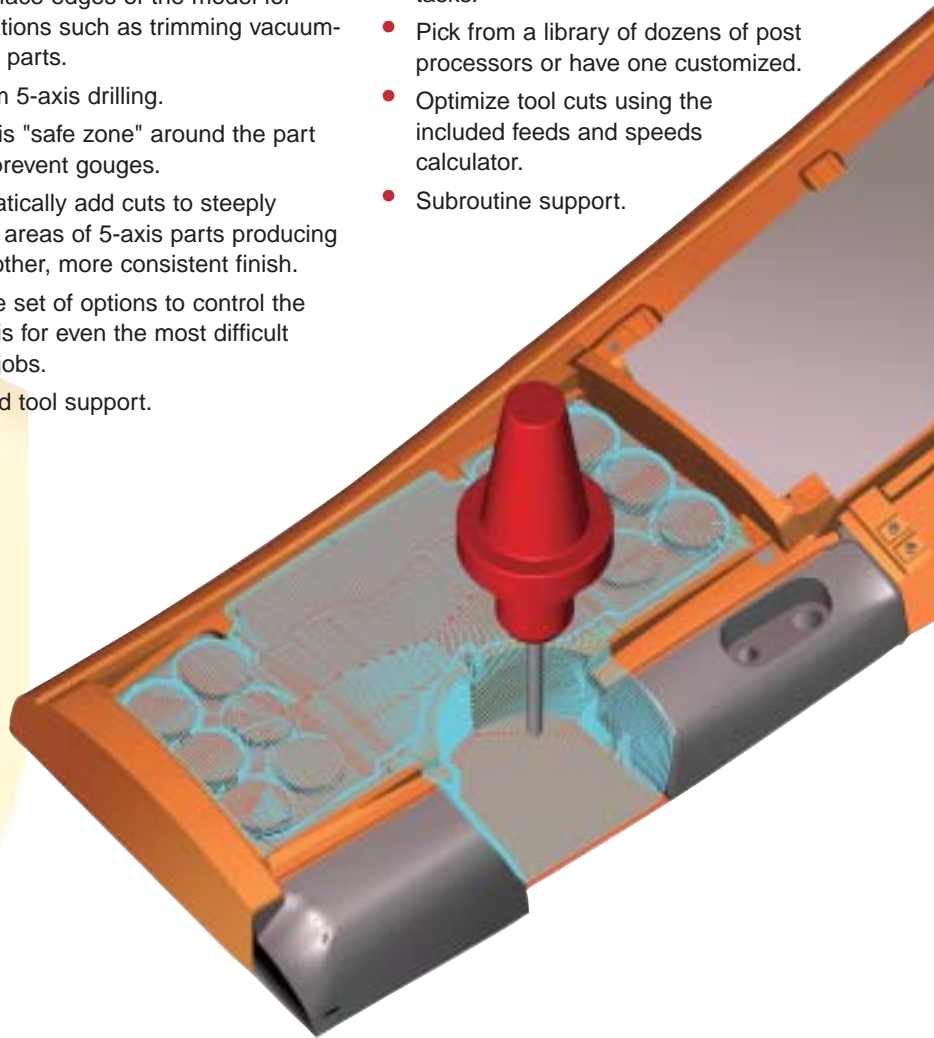
## Multiaxis Machining

Multiaxis machining adds an extra level of flexibility to your machining operations. Mastercam's suite of multiaxis tools lets you program quickly and efficiently.

- Multisurface 5-axis roughing and finishing.
- 5-axis multi-surface flowline machining.
- Machine 5-axis parts using spiral tool motion.
- Machine using 5-axis depth cuts.
- Swarf fanning and swarf machining over multisurface floors.
- Machine curves in 5-axis with definitions of tool side angle and lead/lag angle.
- Create 5-axis contour toolpaths around the surface edges of the model for applications such as trimming vacuum-formed parts.
- Perform 5-axis drilling.
- A 5-axis "safe zone" around the part helps prevent gouges.
- Automatically add cuts to steeply angled areas of 5-axis parts producing a smoother, more consistent finish.
- Flexible set of options to control the tool axis for even the most difficult 5-axis jobs.
- Tapered tool support.

## Practical NC Tools

- Full control over tool approach and retract.
- Easily program in different views for tombstone work.
- Wrap a toolpath around a diameter with rotary axis substitution.
- "Safe zones" help ensure safe tool retract in tombstone and rotary work.
- Significantly reduce the size of a program with toolpath filtering.
- Custom tool geometry can be stored with the part file for easy retrieval.
- Automatically generate customizable setup sheets.
- Macro recording automates repetitive tasks.
- Pick from a library of dozens of post processors or have one customized.
- Optimize tool cuts using the included feeds and speeds calculator.
- Subroutine support.



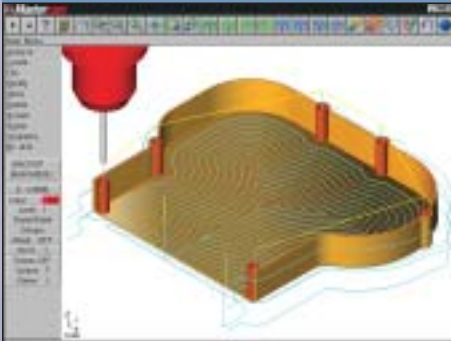
***"We have some of the most demanding jobs in the industry, and we need CAD/CAM software that's bulletproof. Mastercam delivers."***

*- John Petraglia  
Vehicle Development Lab  
Mack Trucks, Inc., Allentown, PA*

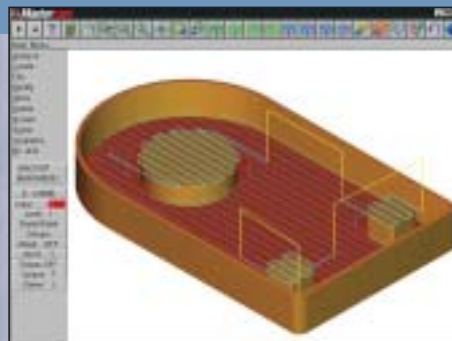
# From simple to complex the toolpaths you need

Here are just some of the tools

## 2D Machining



Versatile pocketing, contouring and drilling

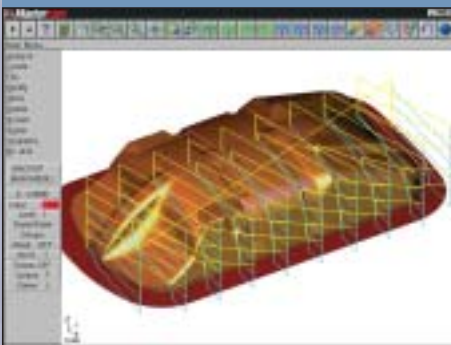


Part and island facing

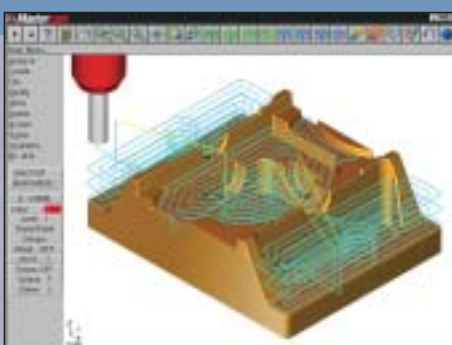


Automated pocket remachining

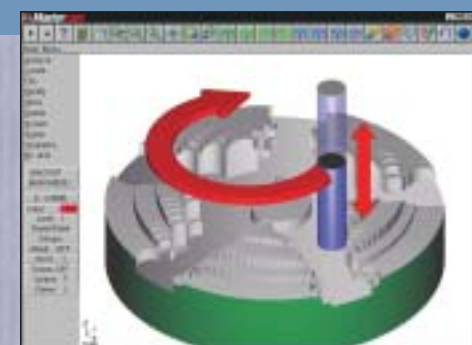
## 3D ROUGHING



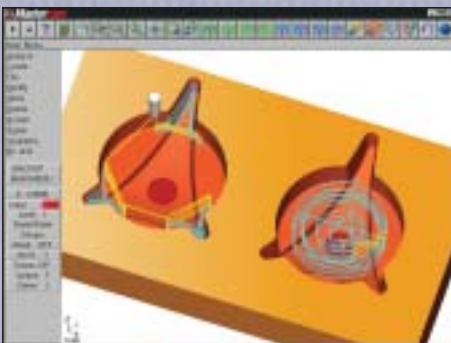
Parallel roughing



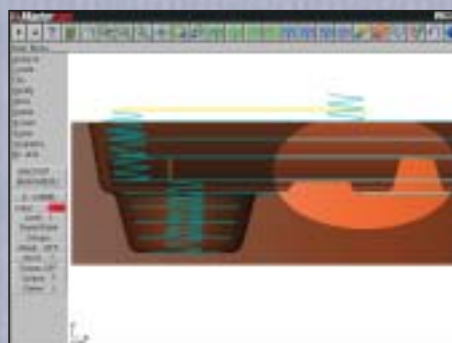
Pocket roughing with multiple entry methods



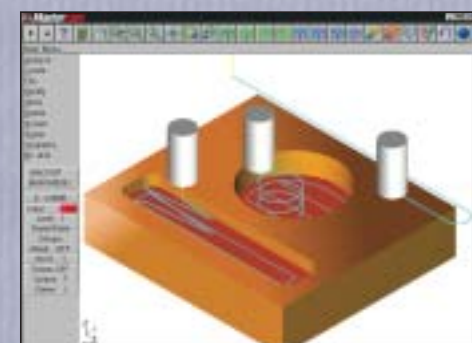
Custom plunge roughing



Complex rough remachining



Automatic machining of user-defined  
critical depths

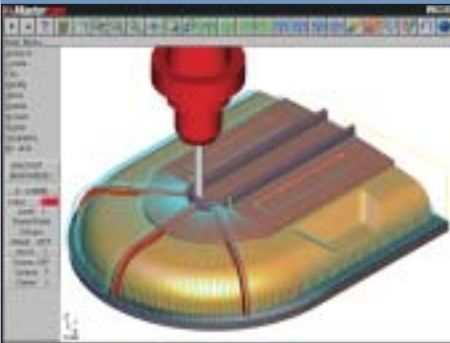


Multiple entry methods for smooth, efficient  
part entry

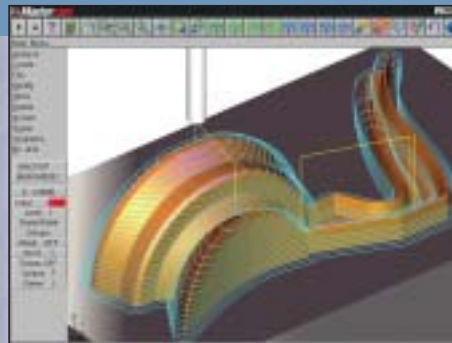
# Mastercam has all the tools you need to get the job done.

Toolpaths that Mastercam offers...

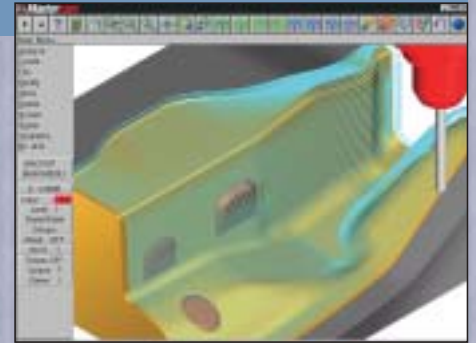
## 3D FINISHING



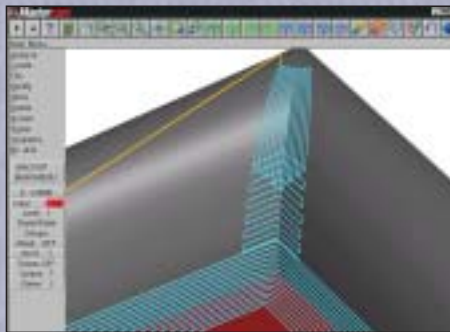
Flexible parallel and radial finishing



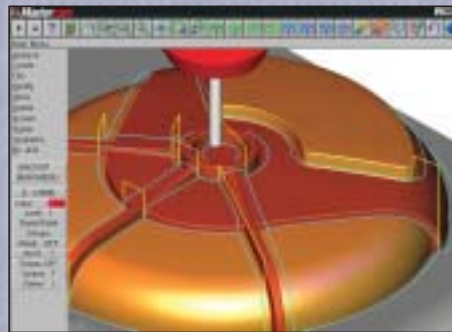
Constant Z contour finishing



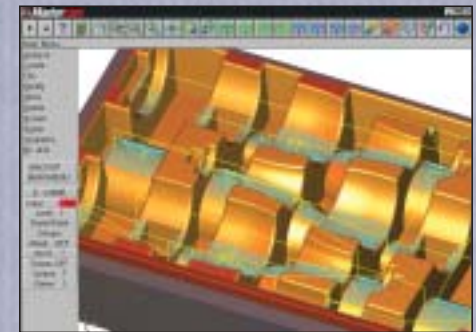
Mastercam's 3D "project" machining follows the natural curves of surfaces or solids for a smooth consistent finish



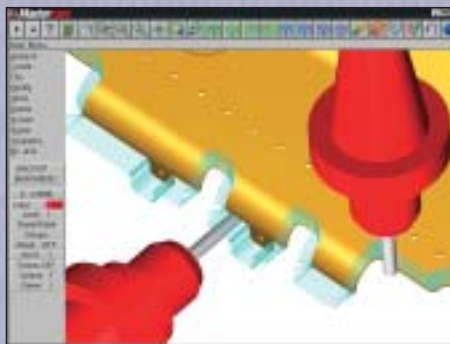
Hybrid remachining changes strategies in a single toolpath



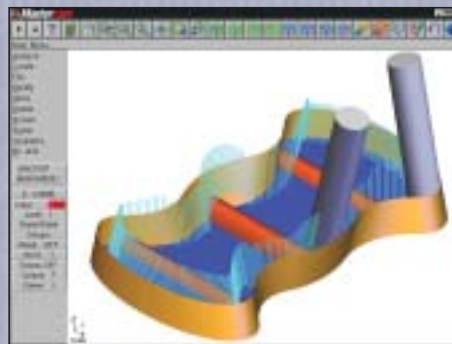
Pencil tracing for a crisp finish



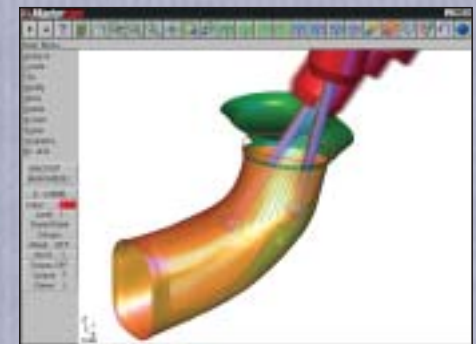
Scallop removal in shallow (above) and steep areas



5-axis contour cutting for easy part trimming



5-axis machining including multi-surface swarf cutting

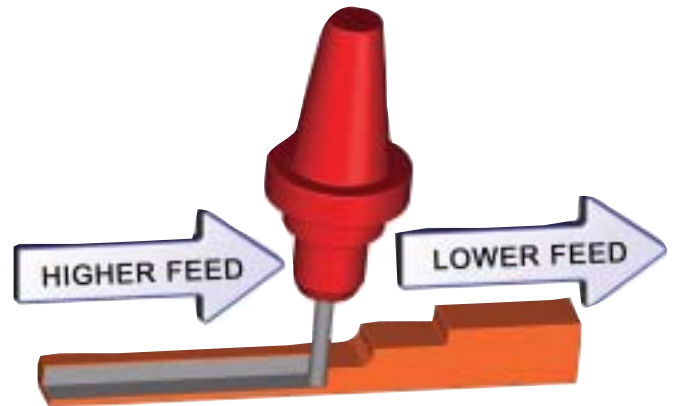


5-axis shank containment simplifies difficult cuts

# From optimization to Mastercam gets the mo


## Intelligent Feed Rate Optimization

Running an entire job at a single feed rate reduces efficiency. Running the same job at varying feed rates can save time, tool wear, and money. Mastercam can optimize any 2-axis or 3-axis toolpath based on volume of material being removed and machine tool limitations to give you efficient, varied feed rates tailored to each job.



**Constant Volume Removal** - Mastercam slows the feed rate through deep material and speeds it up through more shallow stock.

**Pocket**  
Material: aluminum  
Tools used: 1/2" flat end mill and 3/16" flat end mill



	No Optimization	With Optimization	% Saved
Time	2:11	1:48	18.1%



**Smart Cornering** - Based on the part and machine tool characteristics, Mastercam adjusts the feed rate around corners and small radii for smooth transition in tight areas.

**Multisurface Rough**  
Material: aluminum  
Tool used: 1 1/4" flat end mill



	No Optimization	With Optimization	% Saved
Time	17:18	11:16	34.9%

**Multisurface Finish**  
Material: aluminum  
Tool used: .375" ball end mill



	No Optimization	With Optimization	% Saved
Time	2:36:44	1:53:51	27.8%

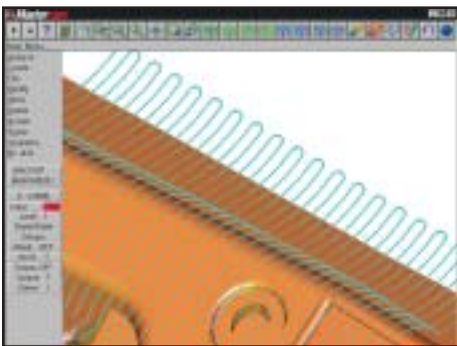


Optimize your entire shop - Save each machine's "maximum efficiency zone" for use with all your 2-axis and 3-axis toolpaths.

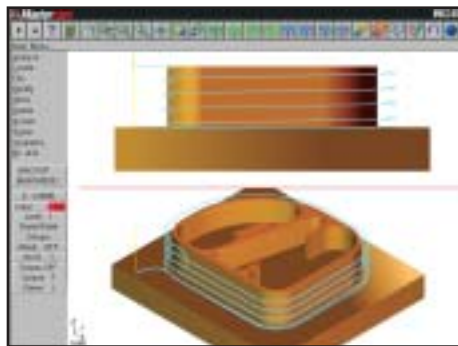
# High Speed motion - st from your machines.

## **High Speed Machining**

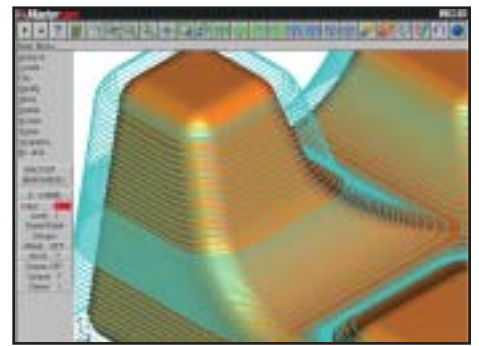
High Speed Machining (HSM) is a powerful machining method that combines high feed rates with high spindle speeds, specific tools, and specific tool motion. HSM can deliver faster turnaround and a superior finish. Mastercam includes a suite of HSM functions designed to help you make the most of this powerful technique.



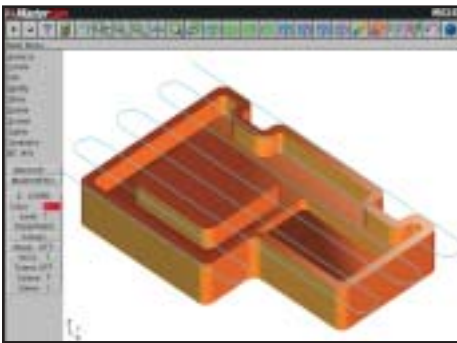
Smooth tool motion on and off the part



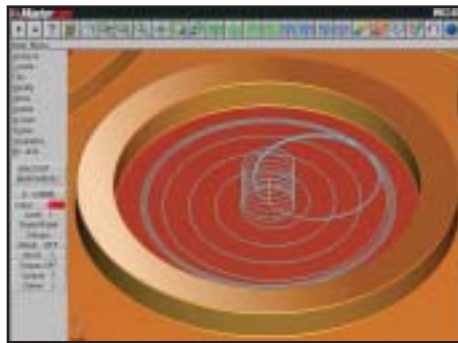
Contour parts with smooth, consistent ramping motion



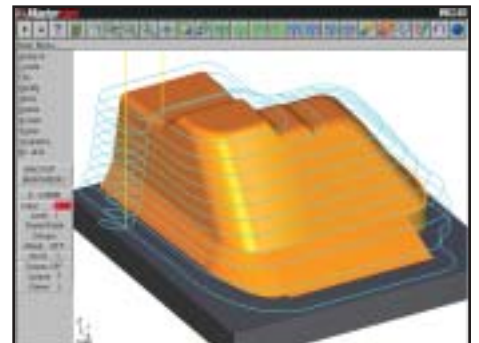
Ensure more consistent material removal with variable Z-level cuts



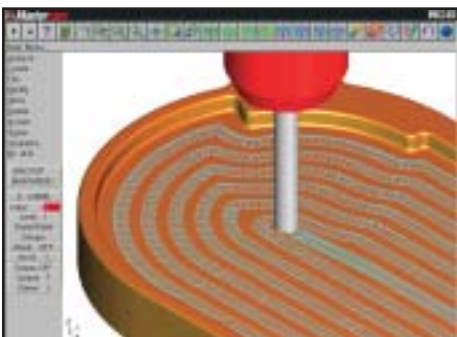
High-speed facing



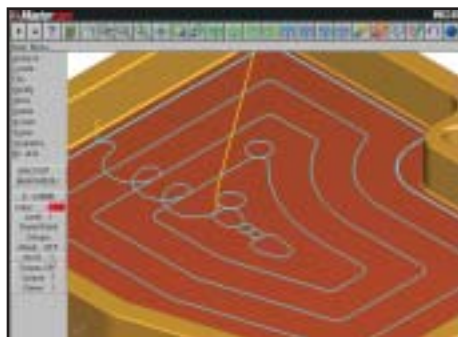
Smooth, automated circle milling



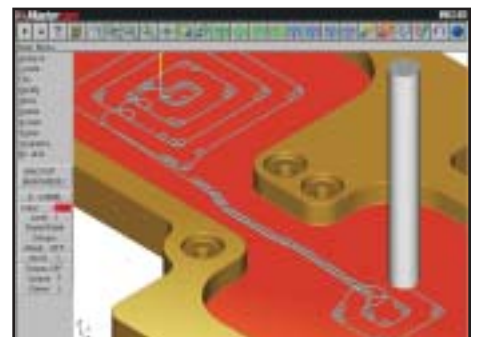
Loop onto and off of Z-level cuts



Full 'trochoidal' cutting prevents tool burial



Specialized high-speed pocketing



Channeling ensures smooth material removal in areas of heavier stock

**“We specialize in complex mold work for consumer products, and Mastercam is the key to our success in this market. It's fast, easy, and very powerful.”**

- Craig Lockwood, Vice President  
ROMOLD, Inc.  
Rochester, New York

## Specialized Options

Very often that little something extra - that one additional CAD or CAM tool - makes a specific job easier, faster and more profitable. Mastercam offers a set of specialized add-on options for these occasions.

- Automatic separation of surface models into core and cavity, including identification of potential problem surfaces.
- Point-and-click mold lock creation.
- Draft angle analysis.
- Automated complex shutoff creation.
- Automated EDM electrode creation including a library of definable stock sizes and materials.

## File Management and Data Exchange

- Built-in data translators for IGES, Parasolid®, SAT (ACIS solids), AutoCAD® (DXF™, DWG, and Inventor™ files), SolidWorks®, Solid Edge®, CADL, STL, VDA, and ASCII. Direct translators for STEP, Catia®, and Pro-E® are also available.
- Save a description with your parts to keep track of revisions.
- View thumbnail images of parts for easier browsing and loading.
- File management includes a variety of options for saving and retrieving files, parts of files, specific elements, and more.

## Easy to Learn and Use

- Logical point-and-click interface lets you program the way you think.
- Fully customizable icon toolbar puts frequently used functions at your fingertips.
- Context-sensitive on-line help provides immediate access to Mastercam tips and instructions.
- Detailed tutorial gets you up to speed quickly.

## System Requirements

- Pentium-based PC
- CD-ROM drive.
- Graphics capability of 800 x 600 resolution and 256 colors.
- Windows compatible mouse
- Windows NT 4.0 or higher, Windows 98, 2000, ME or XP.
- Minimum 64 Mb RAM, 128 recommended; Minimum 350 Mb free disk space in addition to Windows requirements.

# Mastercam®

When Second Best Won't Cut It.

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