

eBook

# Maximizing Multi-Axis CNC Mill Turn Machine and CAM Software Investments

Reduce Cycle Time, Improve Part Quality,  
Increase Profitability



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# The Case for Multi-Task Machines

The term multi-task machine broadly applies to any multi-axis machine that can complete a part in a single setup and typically has more than one flow of operations (aka flow, channel, or path). Each flow can be defined as the part program for each turret or tool group—such as a spindle, tool holder, or ancillary device—with one flow per tool group.

For a multi-axis turning machine to be considered a multi-task machine, it must have live tooling. It typically has a horizontal or vertical lathe with spindles for milling and drilling available at some or all of the tool positions.

Multi-task machining (MTM) is when you combine several cutting processes—including turning, milling, drilling, tapping, and deep-hole boring—on one machine with one setup. The goal of MTM is to produce an entire part in a single, uninterrupted, automatic program without stopping to change the setup or tooling manually. MTM enables getting at many sides without re-chucking, a high level of precision, increased productivity, and lights-out machining.



“Since we’ve purchased the MTM equipment, we’ve essentially eliminated two lathes and using live tooling on those lathes. Easy 60% saved time.”

Eric Podmore, CNC Programmer, ARCH Cutting Tools, Mentor, Ohio, USA

## MULTI-TASK MACHINE NAMES

- Milling lathe
- Mill turn lathe
- Mill turn machine
- MTM
- Multi-axis machine
- Multi-function machine
- Multi-mill machine
- Multi-spindle machine
- Multi-task machine
- Multitasking machine
- Sliding headstock machine
- Swiss machine
- Swiss-style machine
- Swiss turn machine
- Turn mill machine

## MULTI-TASK MACHINE KEY FEATURES

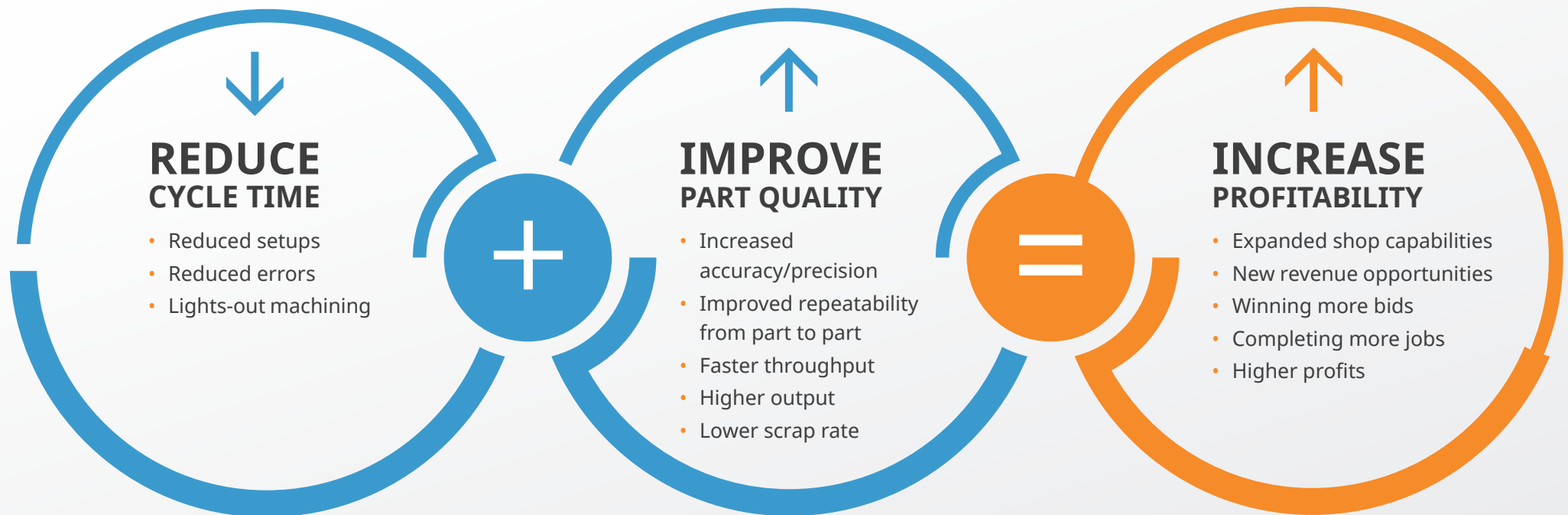
- One machining center
- Single setup
- Multiple flows
- Multiple axes
- Milling/drilling
- Live tooling
- Lights-out machining

# Benefits of One Machining Center

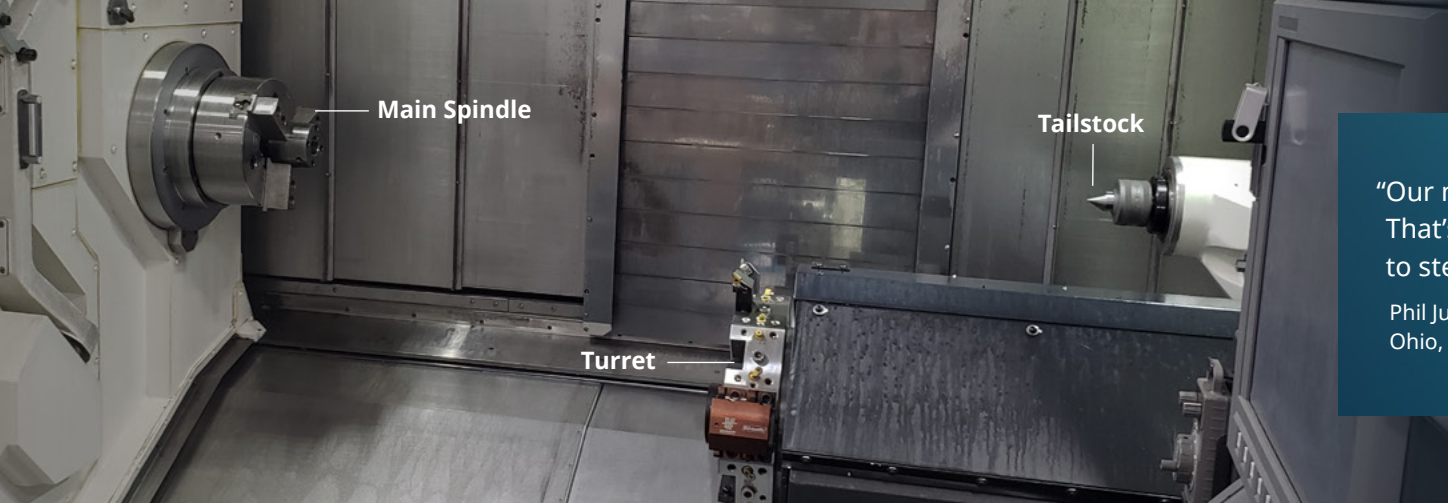
Using **one machining center** with a **single setup** eliminates variability caused by multiple operations and setups and enables you to deliver higher-quality parts faster—resulting in increased profits.

“Having a single machining center and setup enables us to create more accurate parts. It eliminates a lot of variables, travel time between machines, transporting parts, and doing multiple setups. We could do it, guaranteed, 50% faster just from not having to change out parts.”

Eric Podmore, CNC Programmer, ARCH Cutting Tools, Mentor, Ohio, USA





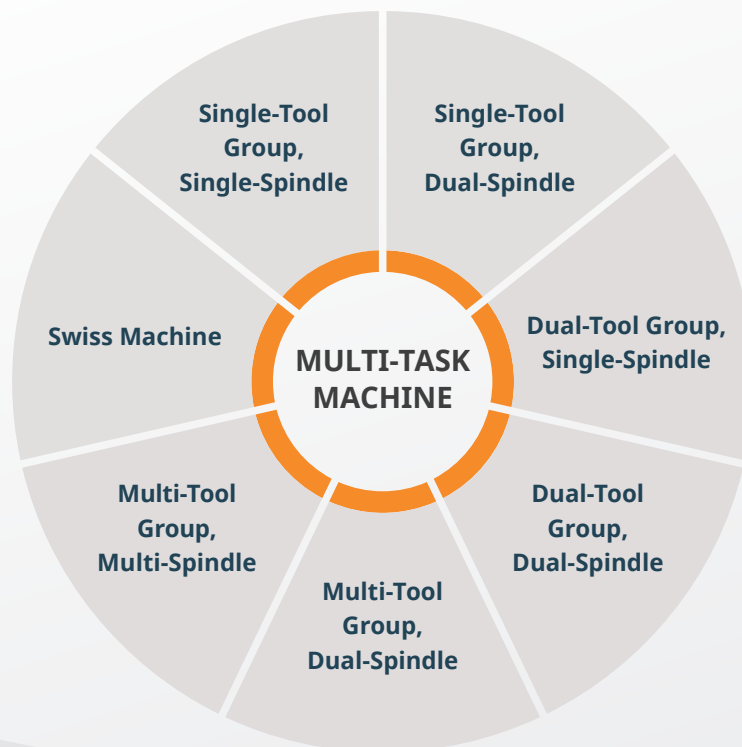


"Our multi-task machine is the strongest mill in the shop. That's why we purchased it, to take us further; it was time to step it up."

Phil Jurick, Steel Department Foreman, ARCH Cutting Tools, Mentor, Ohio, USA

## Types of Multi-Task Machines

There are several types of multi-task machines with various configurations of turrets, spindles, and other moving parts or ancillary devices.



### MULTI-TASK MACHINE TERMINOLOGY

#### Components

- B axis
- C axis
- Chuck
- Collet
- Flow/path/channel
- Gang
- Head/automatic tool changer (ATC)
- Lathe
- Post/back post
- Slide
- Sliding headstock
- Spindle/table/part station
- Sub spindle/pick-off spindle
- Tool group
- Tool holder
- Turret
- Vise

#### Ancillary Devices

- Bar feeder
- Parts catcher
- Parts loader/unloader
- Parts mover
- Probe/stylus
- Robot arm
- Steady rest/center rest
- Tailstock

#### Capabilities

- Balanced turning
- Boring
- Broaching
- Drilling
- Lights-out machining
- Live tooling
- Milling
- Non-cutting motion
- Pinch turning
- Probing
- Thread whirling
- Turning
- Utility operation/process

# Machine Configurations

		Single-Tool Group, Single-Spindle	Single-Tool Group, Dual-Spindle	Dual-Tool Group, Single-Spindle	Dual-Tool Group, Dual-Spindle	Multi-Tool Group, Dual-Spindle	Multi-Tool Group, Multi-Spindle	Swiss Machine
COMPONENTS	Tool groups (turrets, gangs, slides, ATC heads)	1 Turret or ATC head	1 Turret or ATC head	2 Turret or ATC head upper, turret lower	2 Turret or ATC head upper, turret lower	3+ Typically turrets	3+ Typically gangs or slides	1+ 1+ gang, optional slides and turrets
	Spindles	1	2	1	2	2	3+ Typically 6-12	1+ Typically 2
	Axes	3-5	4-6	6-8	7-9	11+	12+	3+
	Vise		Optional		Optional	Optional		
	Sliding headstock							☑
CAPABILITIES	Live tooling	☑	☑	☑	☑	☑	☑	☑
	Milling (flats, hexes, etc.)	☑	☑	☑	☑	☑	☑	☑
	Rotary milling (polar and cylindrical)	With C axis	With C axis	With C axis	With C axis	With C axis	With C axis	With C axis
	5-axis simultaneous milling	With B axis and C axis	With B axis and C axis	With B axis and C axis	With B axis and C axis	With B axis and C axis		With B axis and C axis
	Drilling/tapping holes	☑	☑	☑	☑	☑	☑	☑
	Cross drilling	☑	☑	☑	☑	☑	☑	☑
	Balanced and/or pinch turning			☑	☑	☑	☑	For 2+ tool groups
	Turn threading	☑	☑	☑	☑	☑	☑	☑
	Thread whirling							☑
	Making and dropping parts complete	☑	☑	☑	☑	☑	☑	☑
	Good for	Basic milling and turning	Turbo machinery, shaft machining	Increasing throughput	Parts that have complex features on each end	Complex parts such as electrical/medical components	High-volume production of simple parts	Small parts with tight tolerances, especially thin, long parts

# Ancillary Devices

To maximize output and reduce scrap with unattended or lights-out machining, look for ancillary devices like:



**Bar feeder:** Device that automatically loads bar stock.



**Parts catcher:** Receptacle that catches finished parts, usually a basket (good for small parts).



**Parts loader/unloader:** Non-articulated, Cartesian robot that loads/unloads parts (good for larger parts that you need to grip).



**Probe/stylus:** Measuring device for metrology that performs in-process and on-machine tolerance checking. E.g., Verify that a drilled hole is the correct size, the overall part size is correct, a part meets GD&T data, and understand where your part is after it's been loaded.



**Industrial robot arm:** Articulated, robotic arm that can manipulate stock and parts including loading, unloading, or changing the part orientation.



**Parts mover:** Robot that moves parts around after manufacturing to take to another non-machining process.



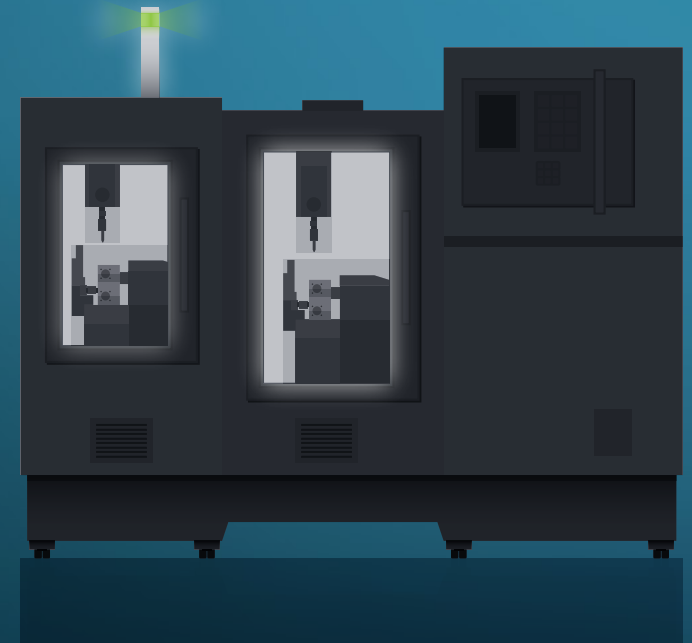
**Programmable tailstock:** Device that supports the radial center of a long part.



**Programmable steady rest:** Device that supports the longitudinal center of a long part.

“We can put in a piece of bar stock, do both milling and turning, and complete a part in one setup.”

Randy Theken, Founder, Slice Mfg. Studios, Akron, Ohio, USA



The number of turrets, spindles, and ancillary devices you need depends on the types of parts you're manufacturing.

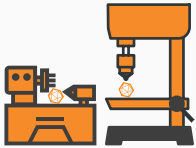
# Why You Might Need One

It might be time to invest in a multi-task machine if you experience these common challenges:



## Increased Part Complexity

Your current CNC machines can't handle the part complexity needed.



## Multiple Machines for One Part

You need to manufacture complex parts that require multiple machining tasks (milling/turning) and multiple axes in a short amount of time.



## High Scrap Rate

You have a high scrap rate due to multiple setups.

Multi-task machines are the most efficient machines for manufacturing parts that require multiple types of machining functions. Compared to standard lathes and mills, a typical multi-task machine is most efficient when you need to alternate turning and milling operations to machine a part.

You can use multi-task machines for single, discrete parts or production runs. The advanced capabilities make it perfect for parts that are difficult to machine. The automation capabilities make it a great option for production runs. Sometimes a large multi-task machine is the only way to machine a part.

"Multi-task equipment is really helpful when you get into small runs and many types of parts or many iterations/ permutation of parts in a single-part family. I don't know that we would even have the ability to pull off some of the parts that we're making without the multi-axis equipment."

Joe Lah, General Manager, Slice Mfg. Studios, Akron, Ohio, USA





## Prime Candidates for MTM

- Parts that require both turning and milling (e.g., indexable drills)
- High-precision parts (e.g., spinal cages, femoral stems)
- Complex parts (e.g., plane landing gear, engine blocks)
- Prismatic parts milled on many sides (e.g., electronic chassis, satellite components)
- Parts that would require complex or expensive set-up on conventional mills (e.g., hip cups)
- High-volume production of parts that can be made from bar stock (e.g., hydraulic fittings)
- Small parts with tight tolerances, especially thin, long parts (e.g., screws, rods)



# What You Can Achieve

Using multi-task machines with the right CAM software enables shops to reduce cycle time and improve part quality, which leads to increased profitability.

The ability to manufacture more complex parts or parts that couldn't be done on any other machine results in expanded shop capabilities, new revenue opportunities, winning more bids, completing more jobs—and higher profits.

Through one machining center and a single setup, shops have reported significant time and cost savings.

"Part quality is better. It's more accurate. It's less set up, less human error. And it shortens lead time."

Brad Fowler, Lead CNC Programmer/Manufacturing Technician,  
Slice Mfg. Studios, Akron, Ohio, USA



## Increased Profits

Reduce errors, scrap, downtime, inventory, and costs.



## Reduced Delivery Time

Improve speed to first part, throughput, accuracy, part quality, and tolerances.



# Why You Might Not be Maximizing Your MTM Investment

Maybe you already own a multi-task machine, but suspect you aren't maximizing it. Some common scenarios include:

"In our business, what's important is speed to first good part. It's critical that we have the machine capability coupled with the software capability to work quickly."

Joe Lah, General Manager, Slice Mfg. Studios, Akron, Ohio, USA

## Challenges

- ✗ You're not using your multi-task machine to its maximum capability.
  - ✗ Your post processor can't process all machine capabilities (e.g., broaching).
  - ✗ You're not using the maximum speeds and feeds for the machine.
- 
- ✗ You bought a multi-task machine for a certain job and don't know what to use it for once that job was completed.
  - ✗ You don't understand the total machine capability.
- 
- ✗ No one knows how to program/run the MTM. For example, the employee who knew how to program/run the multi-task machine left the company.
  - ✗ The CAM software is too complicated and/or isn't geared towards MTM.



## Solutions

Spend time manually optimizing your programs. Invest in CAM software that optimizes your multi-task machine's maximum capabilities and has good post-processor support.

Use MTM to reduce cycle time, improve part quality, and increase profitability versus manufacturing on multiple machines. Bid on more jobs that could only be done with MTM.

Close the knowledge gap with synchronized onsite training conducted by your machine and CAM software vendors. Invest in new CAM software that is easy to learn, implement, and use and works on any machine.

The right NC programming software and support team can help you address these challenges and ensure that you're getting the most out of your MTM investment.

# Efficient NC Programming for Multi-Task Machines

To use multi-task machines effectively, you need specialized CAM software to define the tool movement, simulate the operations, and post process the output.

Multi-axis machine programming becomes much more complicated with the addition of any axis over three. There are a lot of things going on at the same time. You have various moving components, especially with more than one tool group, and motion that is dependent on machine modes. Therefore, programming and using complex multi-task machines does present challenges.

"I've got a 7-axis machine out there and we have a lot of things moving around. And the ability to watch the simulation and make sure we're not going to crash the machine is very good."

Brad Fowler, Lead CNC Programmer/Manufacturing Technician,  
Slice Mfg. Studios, Akron, Ohio, USA

## CAM SOFTWARE TERMINOLOGY

- G-code
- Geometry
- High-speed machining
- Kinematics
- Machine simulation
- Macro
- Operation simulation
- Part/program prove out
- Post processor
- Process
- Rendering
- Setup
- Setup sheet
- Solids
- Sync control
- Tool/operations list
- Toolpath simulation



# Common CAM Software Challenges

Some common CAM software challenges for MTM include:

"Less operators getting more done. We found that investing in technology has really helped us along the way."

Charlie Novak, Vice President, ARCH Cutting Tools, Mentor, Ohio, USA



## Machine Complexity

Tool waits, interference, and crashes due to number of tools working simultaneously and inability to optimize the full functionality of complex machine tools



## CAD Support

Inability to make use of design data encapsulated in CAD files during the manufacturing process



## Time to Market

Non-competitive time to first good part due to lack of automation, ease of use, increased part volume, and using multiple CAM systems with multiple interfaces



## Program Prove Out

Unverified toolpaths producing scrap or breaking tools due to lack of or subpar tool, operation, and machine motion simulation and wasting machine time with repeated manual dry-runs instead of verifying in software



## Post Processing

- High scrap rate due to inefficient, inaccurate, or incomplete post processing
- Spending time and introducing errors by editing post-processed programs
- Machine crashes and interference due to inaccurate G-code
- Machine downtime due to lack of post-processing support



## Machine ROI

Decreased machine return on investment (ROI) due to inability to program all machine kinematics

Download the [What You Need to Know about Programming Multi-Task Machines \[White Paper\]](#) to learn more.

# Top 10 CAM Software Features Checklist

The primary solution to the challenges of MTM is having modern, up-to-date CAM programming software.

To address common CAM software challenges and program and run multi-task machines with confidence, look for the following top 10 CAM software features:



## Quick Uptime

Easy to learn, implement, and use



## Flexibility

Supports any CNC machine



## Dedicated to CAM

Designed specifically for CNC programming



## Ease of Use

Single, modern, customizable interface



## MTM Capability

Designed for machinists with MTM- and Swiss machining-specific capabilities



## Post-Processor Support

Large inventory of post processors



## Increased Machine ROI

Synchronized machine kinematics



## Interoperability

Works with most CAD systems



## Automation

Reuses common processes



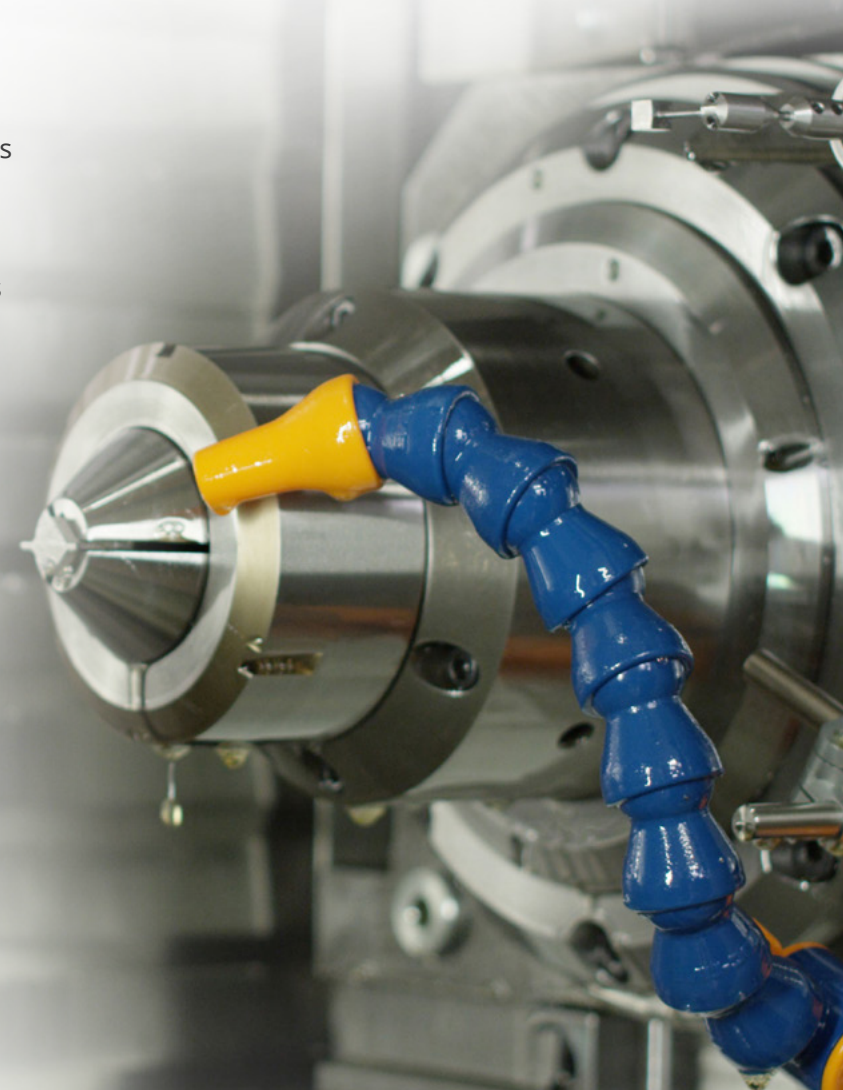
## Minimized Downtime

Fast, local support

"The customization of saving multiple tools, speeds, and feeds to reuse saves us hours a day for mills, lathes, multi-task machines—you name it."

Eric Podmore, CNC Programmer, ARCH Cutting Tools, Mentor, Ohio, USA

Download the [10 Things You Need to Know When Replacing Your CAM System \[White Paper\]](#) for more information.





"The speed and ease of use of our CAM software allows us to quickly program one-off parts before the machinist is even finished with the current part he is working on. This allows us to maximize the use of our MTM machines for greater profitability."

Brent Beistel, Founder, Beistel Machining, Inc., Donora, Pennsylvania, USA

## CAM Software Benefits for MTM

With the right CAM software solution for their multi-task machines, shops have reported significant time and cost savings.



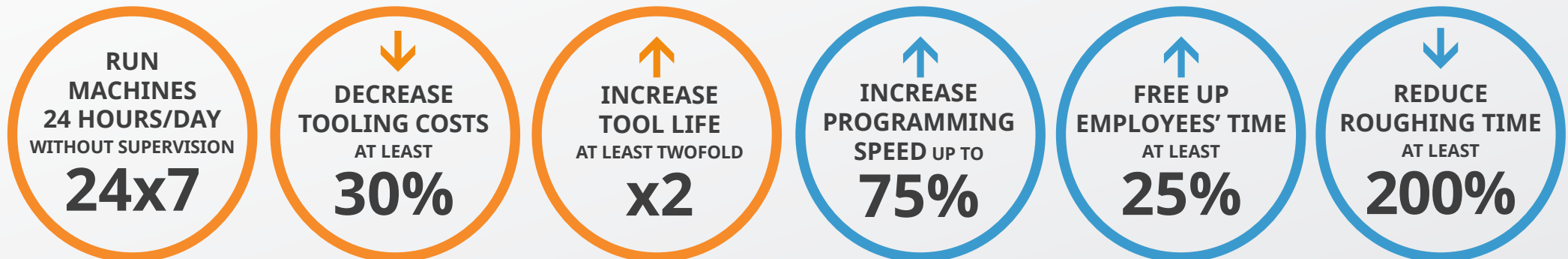
### Increased Profits

Avoid machine crashes, eliminate human errors, reduce scrap, and improve machine ROI.



### Reduced Delivery Time

Automate repetitive tasks, reduce clicks, and free up employees' time.



## Proven CAM Software Solution

GibbsCAM® is a powerful, single-interface CAM system for all your CNC programming needs. From simple 2-axis milling and turning to complex multi-task machining—GibbsCAM has you covered.

Specifically designed to address the CNC programming requirements of multi-task machine tools, GibbsCAM MTM provides powerful, flexible features that are easy to learn, configure, and use for both milling and turning.

### GibbsCAM checks all the boxes:

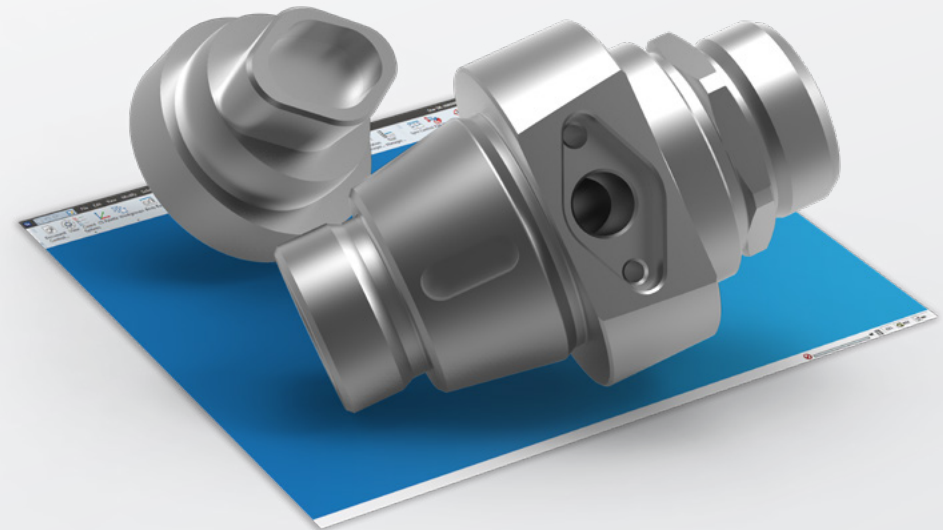
- ✓ Proven and trusted since 1985
- ✓ 16K+ customers
- ✓ For machinists by machinists
- ✓ 100% focused on CNC programming
- ✓ Can program and simulate any CNC machine
- ✓ Easy to use
- ✓ Single, customizable user interface
- ✓ Industry-leading machine simulation
- ✓ Built-in support for multiple spindles and flows
- ✓ 16K+ proven post processors developed in-house, representing 100+ manufacturers
- ✓ Custom setup sheets and tool lists
- ✓ Regular updates
- ✓ WW local sales, training, and support
- ✓ Vast network of industry vendor partnerships
- ✓ 30-day money-back guarantee

"I whole-heartedly recommend GibbsCAM for anyone who's considering buying multitasking equipment or changing their current software. GibbsCAM has given us the capability to be more efficient and make components that couldn't be made any other way."

Joe Lah, General Manager, Slice Mfg. Studios, Akron, Ohio, USA



Powerfully simple, simply powerful





# Ready to Learn More?

Try GibbsCAM yourself  
with a 30-day free trial.

**Request Free Trial**

[www.gibbscam.com](http://www.gibbscam.com)

