ICAM

Adaptive Post-Processing™
The Evolution of Machine Simulation

Post-processing ○ Simulation ○ Optimization
In ONE Concurrent Operation

Automatically Correct and Optimize your NC Programs!

ICAM Technologies Corp.

ICAM is fully committed to maintaining and furthering its position as the most well respected developer and supplier of NC post-processing and machine simulation solutions in the advanced industrial software market. This goal is being achieved through ICAM's relentless effort to meet and surpass the needs of its clients on a daily basis.

ICAM employees and partners will always endeavour to invent, develop, manufacture and distribute the finest products possible. ICAM's products are created to meet the demands of both large and small-scale manufacturers throughout the world.

Over four decades of consistent product innovation has led us to the next generation of NC post-processing; **Adaptive Post-Processing™ - The Evolution of Machine Simulation.**

Adaptive Post-Processing™
## The Evolution of Machine Simulation

Adaptive Post-Processing™ is new technology developed by ICAM that changes traditional CNC programming methodology by creating a unique integrated environment for the traditionally independent steps of post-processing, tool-path optimization and G-code simulation. This new methodology allows all these steps to be executed simultaneously, permitting cross-communication among them. Manufacturers can now reduce NC programming and machine cycle times - automatically.

Automatically Create Optimized Tool-Paths

This integration allows for the in-process evaluation of feedback from the post-processor, machining simulator and ICAM's other tool-path optimization technologies to automatically create an optimized NC program for a target CNC machine. This all occurs in one programming step, allowing users to automatically and efficiently reduce NC programming time and machining cycle times. This innovation virtually eliminates the traditional repetitive and error prone process used by manufacturers for tool-path creation, post-processing and verification by simple graphic simulation.

The iterative steps of the traditional method most often generate errors between the CAM system, the post-processor and the simulation software, leaving the investigative work as to where the error occurred in the hands of the CNC programmer. ICAM's Adaptive Post-Processing solutions not only eliminate these errors while reducing programming time, but also allows the programmer to "create tool-paths for the part" without much consideration to machine kinematics and without reprogramming the part at the CAD/CAM level for a second or new target machine. The ability of ICAM's software to automatically find and correct these errors significantly reduces programming time and human errors while allowing for easy movement of part manufacturing jobs between differing machines.

With Adaptive Post-Processing, manufacturers do not have to go through the traditional long iterative process of repetitively correcting NC programs and testing them, as ICAM's software automatically adapts the program to the selected machine in one programming step, saving significant programming time. This is accomplished through the execution of ICAM's seamlessly integrated post-processing, machine simulation and G-code optimization software modules **working together for faster & more efficient manufacturing!**
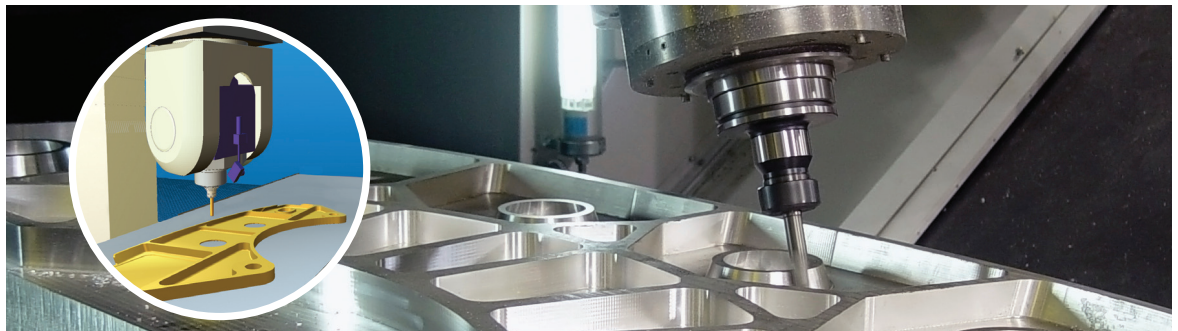
ICAM Product Suite

Adaptive Post-Processing™ provides a unique environment for post-processing, simulation and tool-path optimization inside a single integrated software platform. Adaptive Post-Processing™ relies on ICAM's product suite, CAM-POST®, Virtual Machine® and SmartPACK™, working together and cross-communicating to provide the most advanced NC manufacturing software tool available.

*Development Software

❯ **CAM-POST®** - NC post-processing development software compatible with all major CAD/CAM systems, machine tools and controllers.

❯ **Virtual Machine®** - graphical machine tool simulator depicting the operations and motions of CNC machines during post-processing.

❯ **Control Emulator™** - software allowing NC programmers to emulate and test NC programs using G-Code inside Virtual Machine® or CATIA.

Advanced Technology Solutions

❯ **SmartPACK** – consisting of three Smart modules: SmartPATH®, SmartCUT™ and SmartFEED™ designed to optimize tool-path positioning motions and feed-rates allowing for a significant reduction in NC programming and machining cycle time.

❯ **Solutions for Robots** - provides drilling and milling operations and interfaces directly with the most popular CAD/CAM systems such as CATIA, NX CAM, creo, HyperMill and Mastercam.

❯ **Solutions for UHF Systems** - integrated post-processing & machine simulation solution that allow programmers to quickly program various types of UHF systems - what used to take hours or days can now be done in minutes depending on the machining complexity.

Solutions for CNC Machines   Solutions for UHF   Solutions for Robots
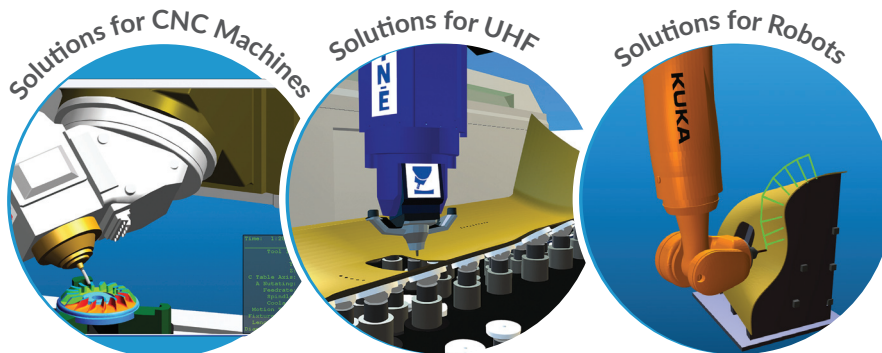
*All products are available as dedicated solutions built by ICAM senior engineers.

ICAM

01 CAM-POST®
NC Post-Processing Solution

CAM-POST® is an advanced independent single source NC post-processing development software supporting all major CAD/CAM/PLM systems, CNC controllers and machine tools. CAM-POST incorporates over 45 years of industry leading NC expertise to deliver the most advanced, intuitive and flexible system architecture available.

CAM-POST Benefit Highlights

Ease of use takes the front seat for a quick & efficient implementation...

CAM-POST includes over 200 NC controller quick-start defaults, which can be selected to simplify and speed post-processor creation. Also, CAM-POST includes a unique comprehensive "point and click" Wizard that allows even the most novice users to generate advanced NC post-processors quickly and effectively. The Wizard easily guides users through all the various steps involved when creating NC post-processors by using illustrated sets of instructions, which provide an intuitive graphical interface for effortless definition of machine kinematics, axis sign conventions, travel limitations and rotary pivot distance offsets.

An instinctive, knowledge-based methodology...

CAM-POST provides a "Navigator" that organizes post development into broad categories and more specialized subcategories. A "Modification Wizard" provides access to a subset of the complete development environment, exposing only those post-processor specifications most likely to require review. CAM-POST's extended depth enables customers to handle complex situations by providing simple responses, rather than having to design and develop logic using macros.

Increased NC programmer productivity and manufacturing process efficiency...

CAM-POST "Visual Debugger" traces and synchronizes the CL file input, NC code output, macro code and diagnostic messages produced during post-processing. The user can view or change any post-processor variable on the fly, in a single integrated workbench. Breakpoints can be set and cleared with the mouse pointer on CL records, macro source, when variables change or when certain blocks are produced. CAM-POST management capabilities include: full do/undo to support for multiple revisions of the post-processor to compare different post versions with "links" to directly jump to differing post specifications; full-time on-line help and a "quick test" button to immediately see the NC code effect on changes for easy experimentation.

Advanced Post-Processing & Multi-Axis Specialization

Embedded CNC optimization technology delivers improvements to part quality, production output and reduced cycle time - the real measure of a post-processor can be taken from the quality of NC code it produces. Several of CAM-POST's most powerful features, providing the user with on-demand access to advanced functionalities in the multi-axes machining world, are outlined below.

Advanced Linearization... provides the user with controls at the tool tip as well as tool wobble (angular) controls. Linearization can be performed based on the expected tool gauge length. The user can optionally linearize RAPID motions as well.

Rotary-Turn-Around (RTA)... is logic that can retract a tool from the material and reset to the alternate pose when rotary or linear travel is exhausted during continuous machining. Rotary axis winding and pre-positioning features provide extended uninterrupted 5D cutting. Preferred rotary positioning can be used to ensure better operator visibility or to enforce a consistent 5-axis pose where possible.

Path Planning... uses ICAM's unique look-ahead technology to automatically select the best possible path during a rapid positioning motion; thereby, avoiding any undesirable dwell marks resulting from a required rotary-turn-around. Path planning also prepositions rotary axes that are parallel to the tool if it discovers that they must be rotated midway through a continuous cut.

Rotating Tool Center Point (RTCP)... is a feature of advanced controllers that permit the user to output tool tip coordinates instead of control point coordinates. RTCP programming supports actual axes, vector, dual point, Euler, RPY or virtual axes rotary control methods. The control computes the kinematics and handles linearization, with the benefit of simpler and more transportable programs, as well as full 5D tool compensation. ICAM fully supports RTCP activation and deactivation throughout the CAM program, while still maintaining full control over the machine travel limit conditions and simulation processes.

Local Coordinate Frame Transformation (LCS)... CAM-POST supports translation, rotation, scale, mirror and additive transformations. Activation of coordinate frames can be set automatically, whenever the tool orientation changes, or can be set on demand. LCS also includes recognition of preferred coordinate frame hints from the CAM system. All travel, feed and timing calculations continue to be based on the true physical configuration of the machine.

02 Virtual Machine®
Graphic Machine Tool Simulation

Virtual Machine enables NC programmers to graphically simulate and test programs, easily & automatically, against collisions and over-travels. Virtual Machine allows NC programmers to avoid and correct possible programming errors that may have resulted in costly machine tool collisions and defective parts. Virtual Machine can also be united seamlessly with CAM-POST, two essential components of Adaptive Post-Processing™, providing Graphic Post-Processing™ - machine simulation during the post-processing phase.

Graphic NC Post-Processing™

Graphic NC Post-Processing is a real-time graphic simulation of the block-to-block machine tool motion instructions generated by the NC post-processor. Graphic NC Post-Processing uses a single database to simultaneously execute the NC post-processor and the Virtual Machine graphic engine. Since the two technologies are fully integrated, Virtual Machine provides real-time feedback to the post-processor; thereby, allowing manufacturing issues such as machine collisions and over-travel to be automatically detected and repaired.

Supports Mill/Turn Machining Centers

Virtual Machine features all the necessary software components to fully support mill/turn centers including the ability to synchronize dual turret merging lathes, the capacity to accurately simulate constant surface speed as well as the provision to define and model lathe tool inserts and generic 3D tool holders. Virtual Machine also provides the environment to define a rotary axis as either a spindle or a lathe tool turret providing greater support for different machines.

Multi-Setup

This feature supports Virtual Machine simulation of manufacturing processes that involve one or more changes of clamping and/or part location on the machine. Multi-setup also automatically tracks the in-process stock state as a part progresses from one manufacturing program to another.

Simulation Recording

This feature automatically records the complete post-processing and simulation session for later review and analysis. Programs can be post-processed with Virtual Machine simulation overnight and/or in background and then later viewed on the same or a different workstation.

Material Removal

Virtual Machine supports superior material removal capabilities for in-process stock collision and gouge detection. This material removal functionality allows NC programmers to compare the processed stock model to the original CAD/CAM design. Virtual Machine computes in-process stock geometry to identify, list and display surface gouges, excess material, inaccessible areas and rapid-motion collisions at any time during the post-processing and verification phase.

SmartPATH®

SmartPATH (patented technology) generates new optimized and efficient positioning tool-paths while avoiding over-travel and collisions. It also eliminates your time consuming dependency on inefficient and unsafe RAPID or high-feed positioning motions generated by CAM systems.

SmartCUT™

SmartCUT eliminates time wasting "air-cuts" by using material removal simulation to detect when the tool is not engaged with the material and moving at a cutting feed. Where feasible, SmartCUT will change these air-cut motions to RAPID or high-feed; thereby, significantly reducing machining cycle time.

SmartFEED™

SmartFEED optimizes cutting feed-rates by using material removal simulation to automatically recalculate the best machining feed-rate based on the machine tool capabilities, tool reference cuts and the real-time engagement of the cutting tool in the in-process stock material.
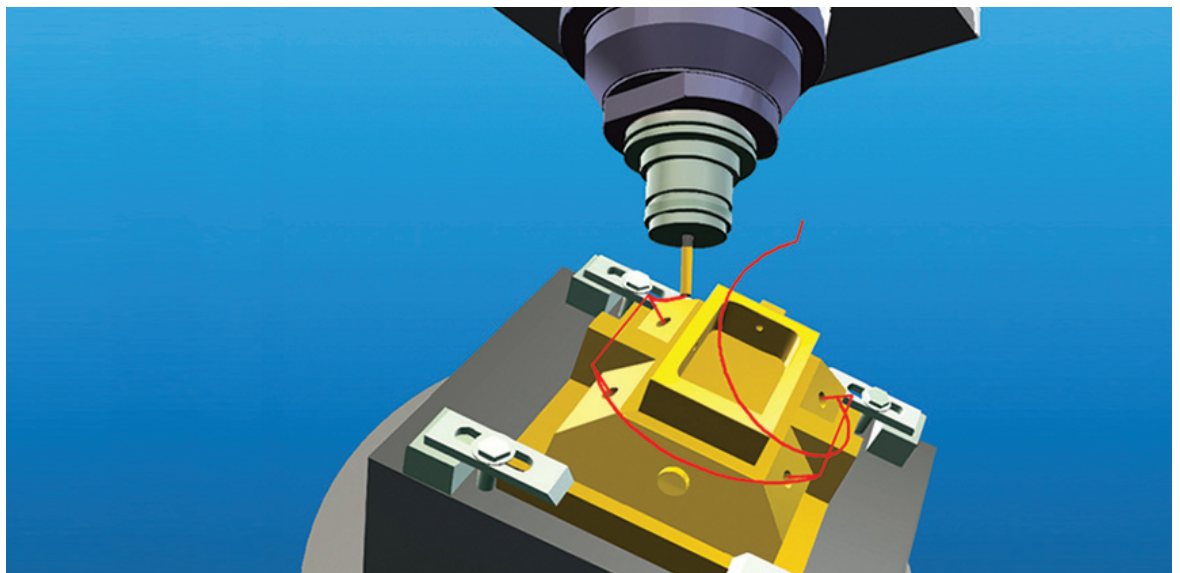
Feature/Benefit Highlights

Unique Timeline Control

■ Virtual Machine offers a unique Timeline Control that provides bi-directional review and playback of NC programs at any moment within the machining cycle. This unique function allows programmers to visualize and test NC post-processor for maximum output optimization.

Efficient Post-Processor & Machine Model Development

■ The machine tool and controller data for both Virtual Machine and CAM-POST are stored and managed in the same database. This eliminates the error-prone and time-consuming alternative of entering the same data twice when using a non-integrated solution.

Cost-Effective NC Tape Proofing

■ Virtual Machine detects and corrects collisions between machine components, in real-time, during post-processing. As a result, Virtual Machine reduces scrap materials and minimizes tool replacements, while increasing machine utilization and improving part quality.

Leverage Existing Technology

■ Virtual Machine works with existing ICAM NC post-processors and Control Emulators. Subsequently, existing post-processors can be tested for errors and updated automatically within a single user interface.

Machine Tool Motion Simulation

■ Virtual Machine may be synchronized with CAM-POST's interface at any collision or over-travel error; thereby, allowing the user to graphically examine the part program and tape output precisely where the problem occurred. With this powerful tool, errors that could have damaged the part, tool and fixture can be eliminated.

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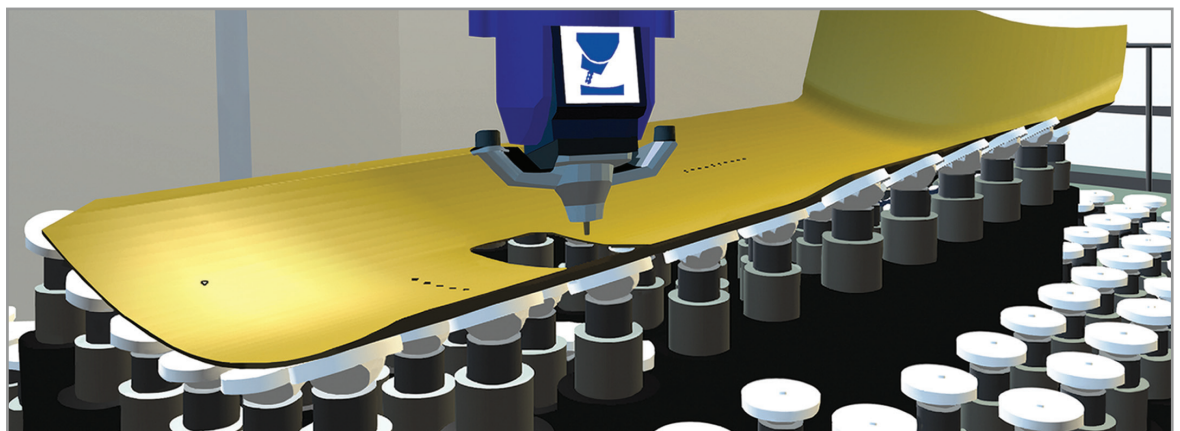
03 Control Emulator™
### for G-code Machine Simulation

Control Emulator™ (CE) is a software allowing users to emulate and test NC programs using G-code inside Virtual Machine or CATIA. CE provides users with a final G-code verification test, including manual inserts inside the NC code, before the code is uploaded to the controller; thereby, certifying accurate and safe NC programs.

As compared to traditional APT-based simulation systems, which simulate the programmer's planned tool-path, CE allows for a more meaningful simulation that represents how the machine tool will react to the G-code output that was generated from the post-processor.

CE provides a powerful validation method allowing users to determine the association between G-code and specific operations inside the NC program and allows for specific modifications to the CAD/CAM NC program depending on the simulation results.

CE reads G-code to emulate the actions of CNC machines and controllers and provides users with the following advanced functions:

- Validates the accuracy of the G-code

- Verifies the actual tool-path as described by the G-code

- Tests the G-code for machine/tool/part collisions

- Allows users to compare the design part against a G-code based material removal part simulation
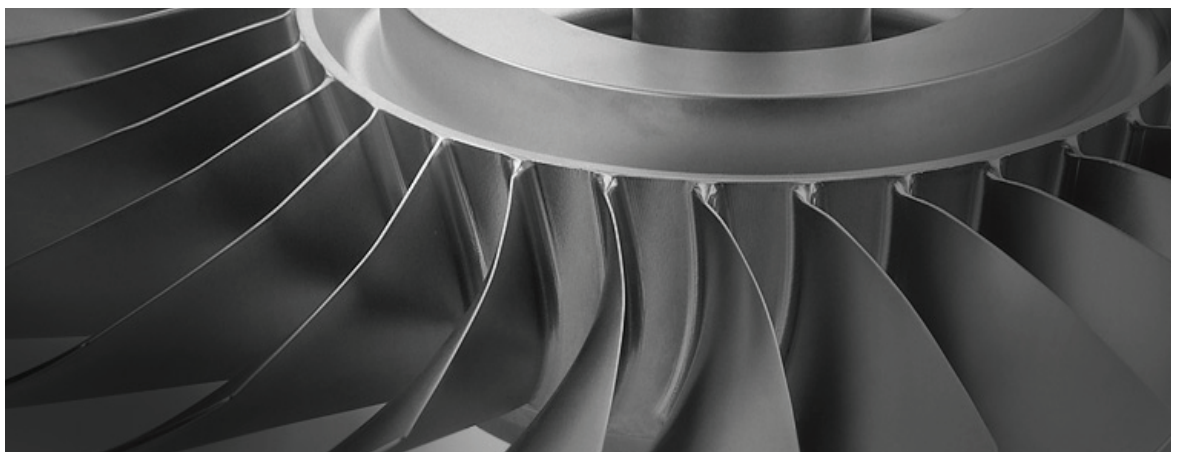
Control Emulator Benefit Highlights

Integrated inside CATIA

■ CATIA users may graphically simulate and test NC programs for collisions and over-travel before the G-code is implemented in the production environment. This unique "single workbench" capability allows programmers to avoid and correct programming errors that may have resulted in costly machine tool collisions and defective parts.

In addition, CE accommodates an "in-process" or "on-demand" CATIA/CE simulation environment vs. the existing multiple process loop currently offered by independent competitive solutions. Benefits include improvements to NC programmer productivity and manufacturing process efficiency.

Seamlessly Integrated with CAM-POST

■ ICAM CE is fully integrated with CAM-POST, ICAM's leading edge NC post-processor development software; therefore, users may employ advanced features inherent to CAM-POST such as Macro Tracing, Call Stack Status, Input and Output Stepping and NC Variable Watching and Modification.

Efficient Post-Processor and Control Emulator Development

■ As a quick start, CE may be created from existing post-processors generated by CAM-POST and subsequently, all post-processor data modifications will be reflected automatically in the CE.

Shortened Learning Time for CAM-POST Users

■ CE utilizes the same macro language as CAM-POST for advanced customization features. All defined CODE and DATA registers are shown in two intuitive tables; therefore, configuration changes are easily executed to fit specific requirements.

Supports Advanced Controller Specific Syntax

■ When dealing with advanced controller programming such as variable definition, expression evaluation, branching and looping, the CE interacts with two plugin libraries that recognize special SIEMENS 840D, FANUC Macro B and HEIDENHAIN (ISO/Conversational) controller features. Users also have the option to develop custom plugin DLL modules to drive the CE to meet specific functions.

Run-Time Flexibility

■ Any NC command blocks can be manually typed or imported as a text file at "Run-Time" using the CE manual data entry (MDI) input console. This feature enables users to test multiple solutions without the need to change the input G-code file and restart the entire process. Users can also edit and save G-code directly.

Control Emulator Feature Highlights

Fully Integrated with CAM-POST

- Stored in same database as CAM-POST post-processors and Virtual Machine models
- Created using QUEST
- Executed and debugged using CeRUN
- Seamlessly integrated with Virtual Machine

QUEST Builder

- CE can be built separately, or based on existing post-processors
- Standard post-processor questionnaire defines base capabilities
- CE customization supports non-standard requirements
- Uses CAM-POST's macro language for customization
- Built-in support for DELMIA models

CE Run-Time (CeRUN)

- Full debugger UI
- Pre-processors to support advanced G-code variables, looping and expressions
- Supports advanced SIEMENS 840D, FANUC Macro B & HEIDENHAIN (ISO/Conversational) programming syntax

Supports Advanced NC Programming Functions

- RTCP and LCS Support
- Linear/circular/helical interpolation
- Drilling cycles
- Tool change and tool pre-select
- Length, diameter, fixture compensation
- Spindle, coolant and feed
- Subprograms
- Tool plane (e.g., G17/18/19)
- Program units (e.g., G20/21)
- Absolute vs. relative positioning (e.g., G90/91)
- Program dwell (e.g., G04)
- Skip code (e.g., G31)

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Supported CAD/CAM/PLM Systems

CATIA, NX CAM, CREO, MASTERCAM, TOPSOLID'CAM, CIMATRON (APT), GIBBSCAM (APT), NCL, OPEN MIND HYPERMILL (APT), POWERMILL, SURFCAM, WORK NC and more.

3DS CATIA   creo   NX Siemens PLM Software   Mastercam   hyperMILL

Supported Machine Tools & CNC Controllers

ICAM develops NC post-processing products supporting all major machine tools and CNC controllers including all classes of CNC equipment supporting any combination of rotary heads and/or rotary tables (Mills, Lathes, Horizontal/Vertical Machining Centers, Merging Lathes, Multi-Tasking Mill-Turns, Punch Presses, Wire EDMs, Water Jet Cutting Machines, Laser Cutting Machines, Plasma & Flame Cutters, Hybrid and Special CNCs).

MAKINO · Mazak · SNK

OKUMA · DMG MORI · MODIG MACHINE TOOL SWED

DST · HAAS · HERMLE

FIDIA · HURON · PARPAS PADOVA

OMAX Corporation · JOBS · CMS

Zimmermann BOKO · +GF+ MIKRON Machining Technology · TORRES

fives ultimate machines ultimate factory · WFL MILLTURN TECHNOLOGIES

HEIDENHAIN · FANUC · SIEMENS

Customer References

GM

"CAM-POST has the ability to make our machines do exactly what you want them to do. Since we have many machines, we save lots of money with CAM-POST."

Jim Barrett
General Motors

CHRYSLER

"Special care and planning goes into manufacturing prototypes. We require a wide variety of machines to make these vehicles go from the drawing board to the assembly plant and CAM-POST has the capability and flexibility to suit our manufacturing needs."

Ken Ryntz
Daimler Chrysler

PRECISE

"Our programming department utilizes CATIA and NX to create complex 3-5 axis programs for a large variety of machine tools. CAM-POST software from ICAM easily enables us to generate the specific output for each machine tool we have.

ICAM's trainer gave us a post building training session that was tailor made for our needs. There were no questions he couldn't answer, or complex posting problems he could not easily solve. Since then the ICAM support team has given us very timely support whenever we have needed it.

We couldn't be happier with our posting capabilities now. Thank you for everything ICAM."

Kevin Williams
Precise Machining
& Manufacturing

BOEING

"ICAM is our selected technology partner, because of the magnitude of their experiences with advanced multi-axis post-processors, expert knowledge of CATIA V5, current relationships with 787 Program suppliers and their in-depth understanding of our unique programming objectives."

Martyn Grist
Manufacturing Process Lead
787 Program
Boeing Winnipeg

VOLVO

"We selected ICAM as our partner for the future growth of our facility because of its commitment to quality, customer service (both in customer support and product development), flexibility to interface with our multiple CAM packages and ICAM's ability to deliver customized multi-axis post-processors in a short period of time."

Brian Brown
Systems Engineer
Volvo Construction Equipment

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Adaptive Post-Processing™
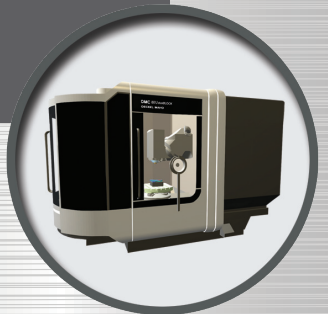## The Evolution of Machine Simulation

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