

**GET  
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**P**ost-processing  
**S**imulation  
**E**mulation

N46 X-37.2653 Y-142.085 Z256.1751 A-64.134 C82.183 F15196.114  
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**MANUFACTURING  
SOFTWARE SOLUTIONS**

**ICAM Technologies Corporation**







### ICAM's Mission

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 endeavor 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.



*Client photo courtesy Airbus, France*

## About ICAM

ICAM Technologies Corporation is an international company specializing in the development and implementation of advanced NC post-processing and machine tool simulation solutions for manufacturers in major industries around the world.

For over 40 years, ICAM has been providing aerospace, automotive, medical, heavy equipment and electronic organizations with advanced NC post-processing solutions that have enabled them to increase productivity and achieve greater manufacturing performance and precision.

ICAM's product line includes:

- **CAM-POST®** - a permanent NC post-processing software solution compatible with all major CAD / CAM / PLM Systems.
- **Virtual Machine®** - a graphical machine tool simulator depicting the operation and motions of CNC machines during post-processing.
- **Control Emulator™** (CE), a software allowing NC programmers to emulate and test NC programs using Machine Code Data (MCD) inside Virtual Machine® and / or CATIA.

ICAM provides custom NC post-processors, machine simulation solutions and advanced machining productivity tools including: High Speed Machining, NURBS and Arc Fitting.

ICAM also offers a complete range of consulting and training services designed to accelerate implementation and promote proven best practices to help customers achieve their specific manufacturing objectives.

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



## Integrated PSE

**Integrated PSE** (Post-processing - Simulation - Emulation) is a new NC manufacturing methodology providing interactive post-processing, machine simulation & control emulation inside a tightly integrated software solution which includes: CAM-POST®, Virtual Machine® and Control Emulator™.

**Post-processing** - CAM-POST® is an independent single source NC post-processing development software supporting all major CAD / CAM / PLM systems, CNC controllers and machine tools.

Advanced forward-looking optimization features are offered in CAM-POST including path planning, rotary axes pre-positioning and winding to optimize the machining process while avoiding dwell marks, over-travel and rotary repositioning.

CAM-POST supports advanced machine tool features such as tool-tip programming, coordinate frame transformations, NURBS interpolation and arc fitting of point-to-point data.

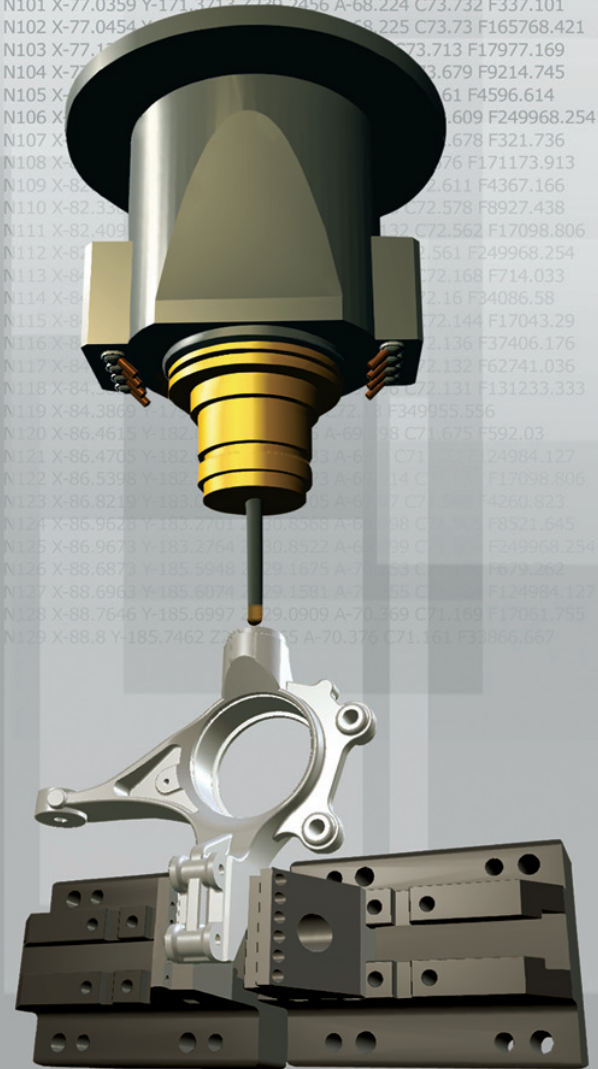
**Simulation** - Virtual Machine® is a comprehensive CNC machine tool simulator that enables NC programmers to graphically simulate and test programs, easily and automatically, against collisions and over-travel.

Deploying Virtual Machine with CAM-POST provides an interactive post-processing and simulation environment that allows modeling of the physical CNC machine and detection of errors while CAM-POST calculates alternative options to optimize the generated NC code.

**Emulation** - Control Emulator™ (CE) is a software product allowing NC programmers to emulate and test NC programs using Machine Code Data (MCD) inside Virtual Machine and / or CATIA.

Implementing Virtual Machine with CE allows NC programmers and machine operators to simulate and emulate the final MCD before running the NC program on the actual NC machine. This process enables the user to avoid costly prove-outs and reduce scrap material while increasing machine utilization on the shop floor.

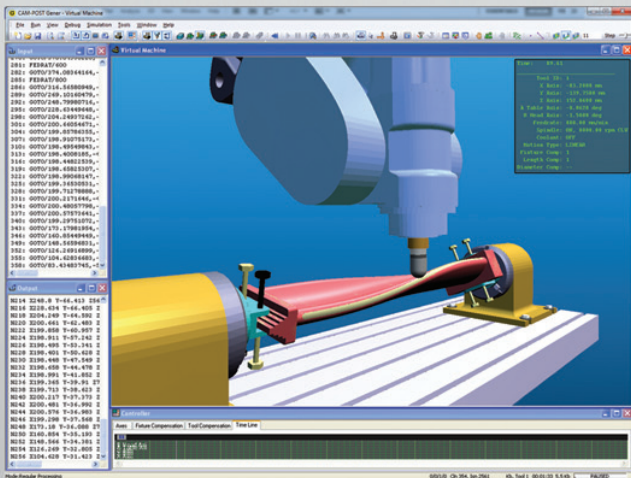
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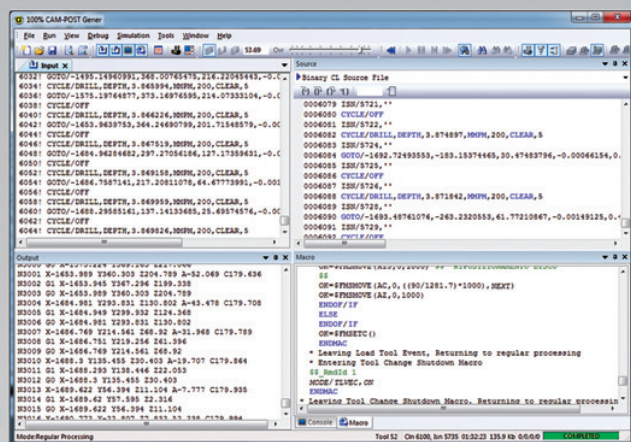
# POST-PROCESSING



## Custom NC Post-Processors

Also available, custom NC post-processors, created by ICAM's senior NC manufacturing experts, that are developed to optimize the performance of CNC machines and to allow users to benefit from advanced functions of their respective machine tools.

ICAM's custom NC post-processors are created using CAM-POST; therefore, these posts inherently interface with all major CAD / CAM / PLM systems, controllers and CNC machines & support various advanced multi-axes machining applications. All ICAM post-processors can also be configured to support multiple CAM systems.



## 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 40 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-Axes 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 most powerful features, providing the user with on-demand access to advanced functionalities in the multi-axes machining world, are outlined below.

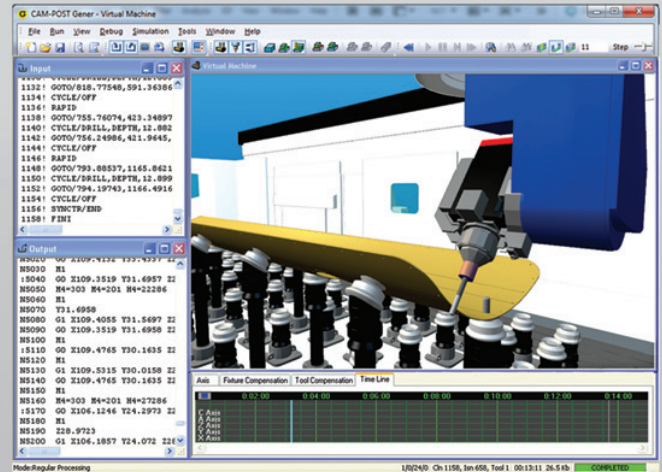
**Advanced Linearization...** provides the user with controls at the tool tip as well as tool wobble (angular) controls. Linearization can be performed based on the expected tool gauge length. The user can optionally linearize RAPID motions as well.

**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 look-ahead to automatically select the best path during the rapid positioning motion, to avoid the requirement for rotary-turn-around if possible. 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.

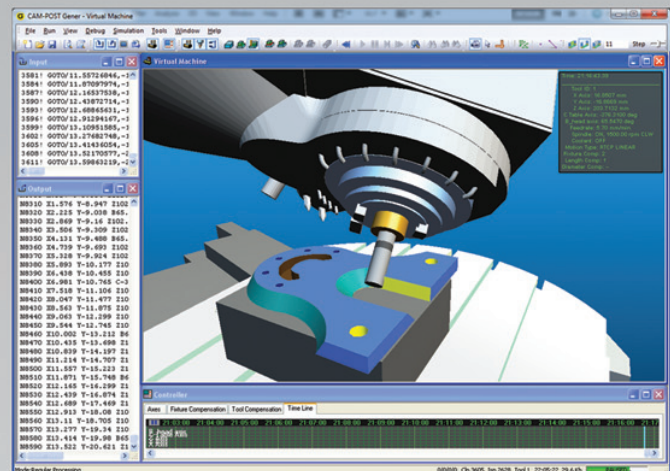
**Rotating Tool Center Point (RTCP)...** is a feature of advanced controllers that permit the user to output tool tip coordinates instead of control point coordinates. RTCP programming supports actual axes, vector, dual point, Euler, RPY or virtual axes rotary control methods. The control computes the kinematics and handles linearization, with the benefit of simpler and more transportable programs, as well as full 5D tool compensation.

**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.



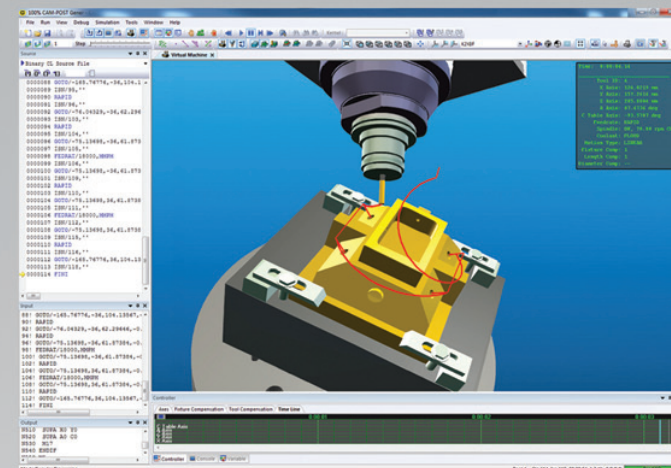
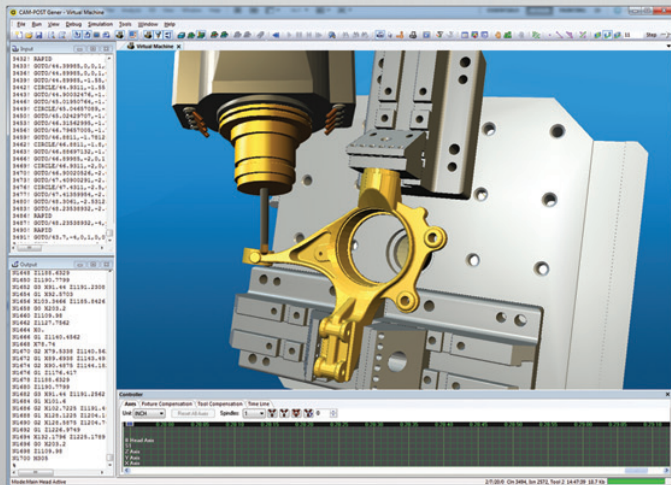
Integrated PSE offers an array of new features

- Support for 3D tool compensation
- Support for positioning/continuous B axis when turning
- Supports probing and part-transfer of in-process stock
- Advanced Timeline presenting more info on simulation process (tool change, coolant, sub-programs, etc...)
- Support for merging lathes and multi-control workcell applications
- Supports Windows 8



# ICAM





## Virtual Machine® Graphic Machine Tool Simulation

Virtual Machine seamlessly unites ICAM's advanced NC post-processing solution, CAM-POST, with a comprehensive graphical machine tool simulator. Virtual Machine enables NC programmers to graphically simulate and test programs, easily & automatically, against collision and over-travel during post-processing. Virtual Machine allows NC programmers to avoid and correct possible programming errors that may have resulted in costly machine tool collisions and defective parts.

### 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 technology uses a single, complete database to simultaneously execute the NC post-processor & 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 & 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.

### Material Removal / Verification

Virtual Machine supports Material Removal / Verification capabilities for in-process stock collision and gouge detection within a completely simulated machining environment. Material Removal / Verification, available for 3-axis & 5-axis machining applications, 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™ for Automatic Toolpath Optimization

SmartPATH™ is unique software designed to automatically optimize rapid positioning toolpath motions generated by CAD/CAM systems. This software provides savings both in CNC run-time positioning & in CAD/CAM toolpath preparation.

Rapid positioning motions generated by CAD/CAM software do not take into account machine tool kinematics, workpiece setup and travel limitations and therefore, place the burden of responsibility for safe and efficient positioning onto the NC programmer. Rapid positioning tool-paths often must be redeveloped and carefully verified by the NC programmer when migrating programs from one CNC machine to another.

SmartPATH™ identifies inefficient and unsafe positioning motions and automatically replaces them with minimized collision free safe motions based on the actual machine tool kinematics, physical travel limits, axes positioning rates and the dynamically changing state of the in-process stock.

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## 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 and 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 NC post-processors generated using CAM-POST. Subsequently, existing post-processors can be tested for errors and updated automatically within a single user interface.

### Machine Tool Motion Inspection

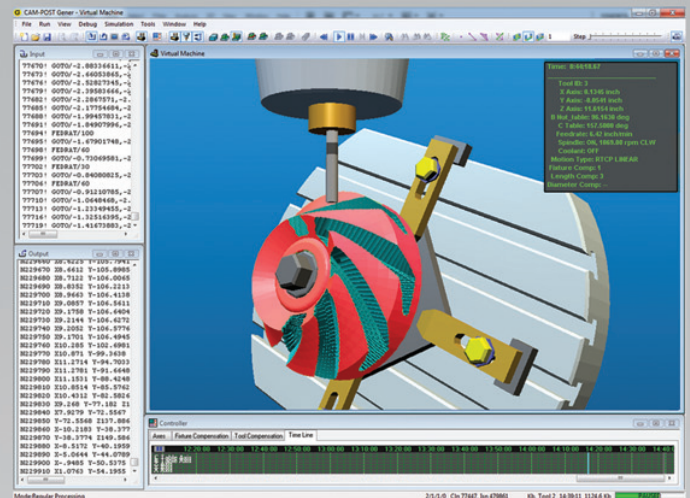
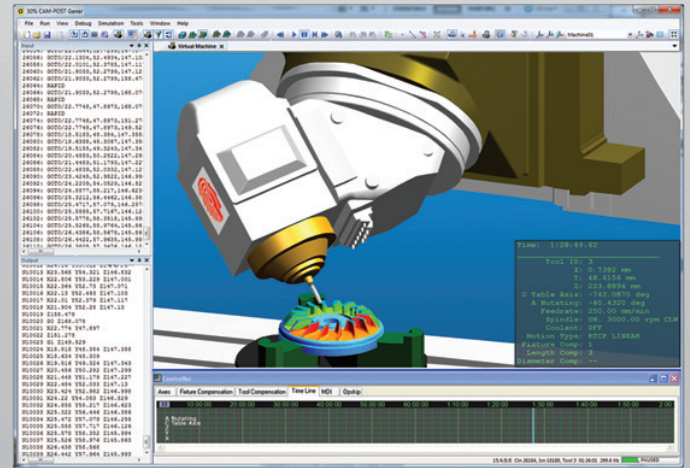
Virtual Machine may be synchronized with CAM-POST's interface at any collision or over-travel error; thereby, allowing the user to graphically examine the part program and tape output precisely where the problem occurred. With this powerful tool, errors that could have damaged the part, tool and fixture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

### Virtual Machine Provides a Training Environment

Virtual Machine's unique software environment provides users with a comprehensive understanding of their machine tool. With its intuitive user interface, Virtual Machine may be used as an efficient, cost-effective training tool that allows NC programmers and machine operators to explore advanced features of their machine tools and test NC programs, off-line, in a virtual environment.

### Technical Highlights

- Mill / Turn Simulation with Material Removal
- Shows the machine status at any point of the simulation process
- "Nearness concept" function allows collision detection and reporting to account for safety margins uniquely defined in each machine component
- Macro functions are available to customize the behavior of complex models
- New tool definition and functions to support probe simulation
- Windows XP, Vista, 7 and 8 compliant installation & operation



# ICAM



## Control Emulator™ MCD Based Machine Tool Emulation

Control Emulator™ (CE) is a software allowing users to emulate and test NC programs using Machine Code Data (MCD) inside Virtual Machine and / or CATIA.

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 MCD output that was generated from the post-processor.

Deploying Virtual Machine as an integrated package enables the user to run simulations on a per operation basis during the NC programming session, resulting in a significant reduction in NC programming time.

CE provides a powerful validation method allowing users to determine the association between MCD and specific operations inside the NC program and allows for specific modifications to the CATIA CATProcess depending on simulation results.

CE reads MCD to emulate the actions of CNC machines and controllers and provides users with the following advanced functions

- Validates the accuracy of the MCD
- Verifies the actual tool path as described by the MCD
- Tests the MCD for machine / tool / part collisions
- Allows users to compare the design part against an MCD-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 MCD 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.

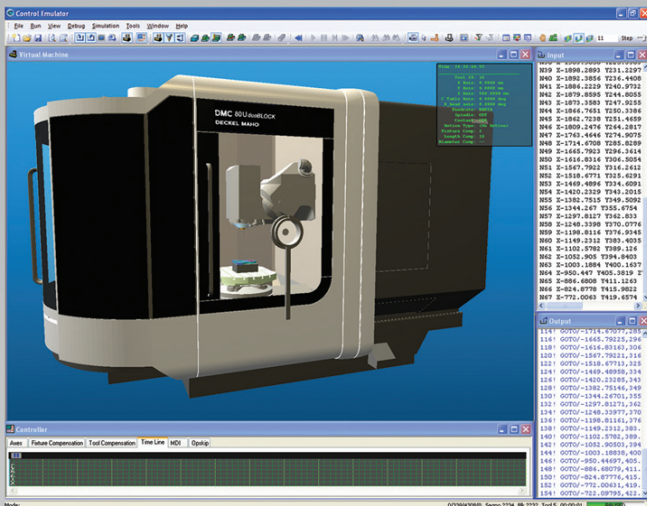
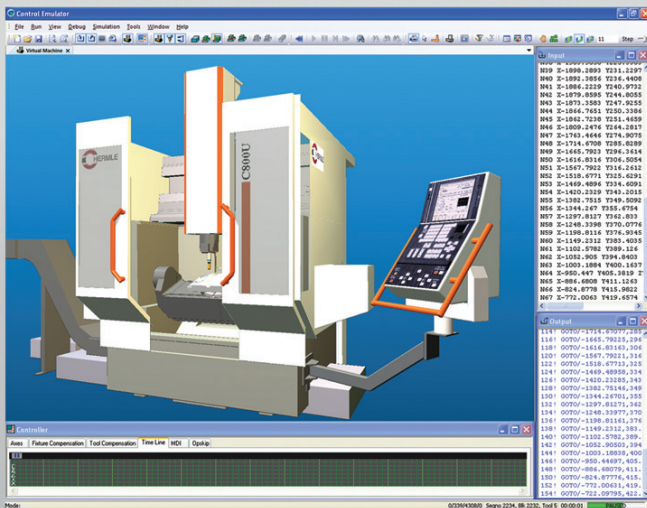
In addition, CE accommodates an "in-process" or "on-demand" CATIA / CE simulation environment vs. the existing multiple process loop currently offered by independent competitive solutions. Benefits include improvements to NC programmer productivity and manufacturing process efficiency.

#### Seamlessly Integrated with CAM-POST

ICAM CE is fully integrated with CAM-POST, ICAM's leading edge NC post-processor developer; 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.

#### ICAM CE / SIEMENS VNCK Integrated with Virtual Machine

The SIEMENS Virtual NC Kernel (VNCK) product deployed in conjunction with ICAM's CE allows for the simulation of all the advanced features and functionalities of the SIEMENS SINUMERIK 840D Controller. VNCK contains a virtual copy of the SINUMERIK CNC encompassing a NC kernel motion logic which uses the same motion algorithms used by an actual 840D Controller; subsequently, VNCK enables NC programmers to reliably emulate NC programs with regard to cutting conditions, axes movements, collisions, work piece geometry and motion behavior of CNC machine tools equipped with SINUMERIK 840D Control.





## Efficient Post-Processor and Control Emulator Development

CE may be created from existing post-processors generated by NC manufacturing experts utilizing CAM-POST. In this case, CE is generated at the "Start-Up" or at "Run-Time"; subsequently, all post-processor data modifications are reflected automatically in the CE.

## Shortened Learning Curve 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 and FANUC Macro B 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 MCD file and restart the entire process.

## 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

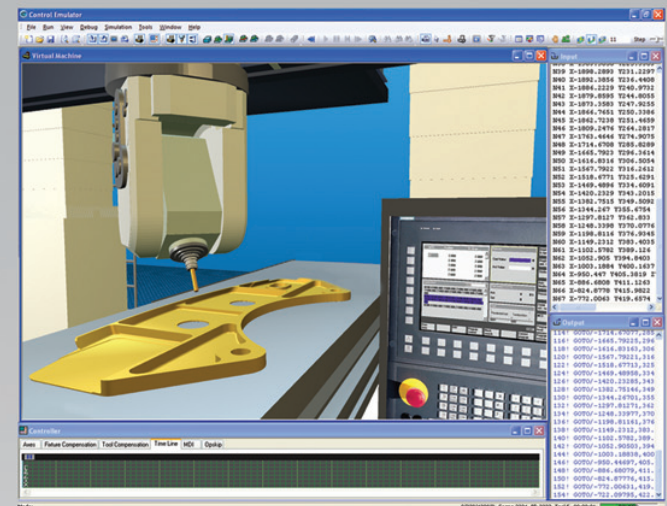
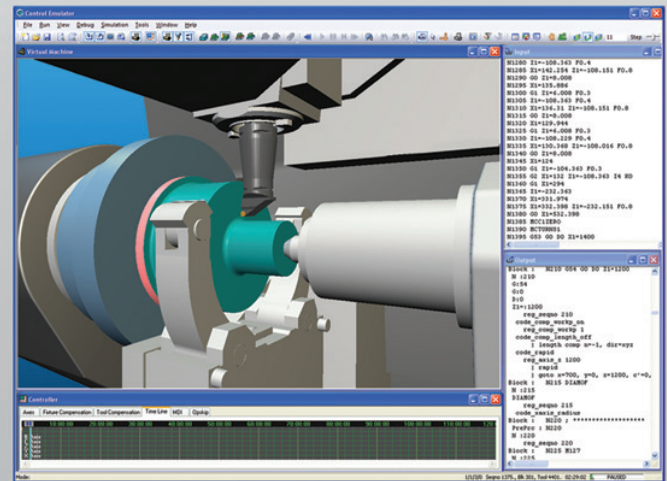
- CEs can be built separately, or based on existing post-processors
- Standard post-processor questionnaire defines base capabilities
- CE customization supports non-standard requirements
- Uses CAM-POST's macro language for customization
- Built-in support for DELMIA models

### CeRUN Run-Time

- Full debugger UI
- Preprocessors to support advanced MCD containing variables, looping and expressions
- Supports advanced SIEMENS 840D and Fanuc Macro B programming syntax

## Supports Advanced NC Programming Functions

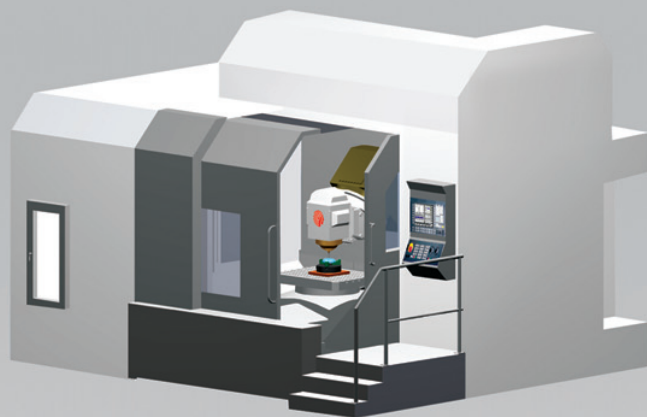
- RTCP and LCS Support
- Linear / circular / helical interpolation
- Drilling cycles
- Tool change and tool pre-select
- Length, diameter, fixture compensation
- Spindle, coolant and feed
- Subprograms (basic)
- Tool plane (e.g., G17/18/19)
- Program units (e.g., G20/21)
- Absolute vs. relative positioning (e.g., G90/91)
- Program dwell (e.g., G04)
- Windows XP, Vista, 7 and 8 compliant installation & operation





## Supported CAD/CAM/PLM Systems

CATIA, NX SIEMENS PLM Software,  
PTC Creo, MASTERCAM, CADD5 NC,  
TopSolid'Cam, CIMATRON (APT), DUCT,  
GIBBSCAM (APT), I-DEAS MASTER  
SERIES, NCL, OPEN MIND HYPERMILL  
(APT), POWERMILL, SURFCAM, WORK NC.



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## 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).



## Customer References

"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

"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

"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



"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



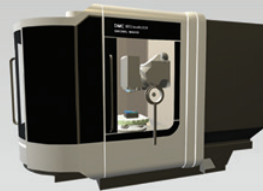
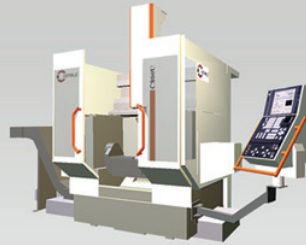
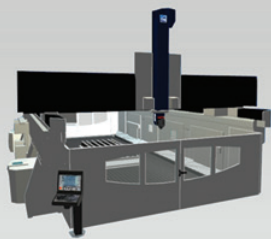
"We selected ICAM as our partner for the future growth of our facility because of its commitment to quality, customer service (both in customer support and product development), flexibility to interface with our multiple CAM packages and ICAM's ability to deliver customized multi-axis post-processors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



Brian Brown  
Systems Engineer  
Volvo Construction Equipment







## Post-processing • Simulation • Emulation

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