

# VERICUT<sup>®</sup>

*Right the first time. Every time.*

**CNC Machine Simulation Software**



 CNC Machine Simulation

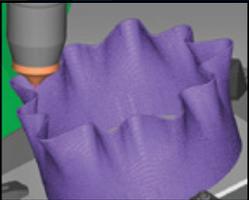
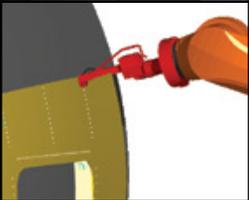
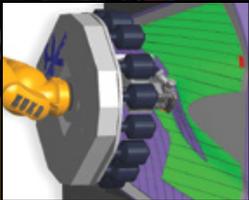
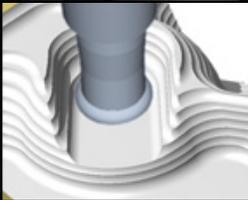
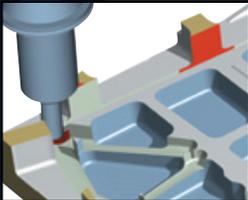
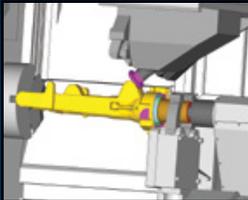
 NC Program Verification

 Cutting Speed Optimization

 Composite Applications

 Drilling & Fastening

 Additive Manufacturing



**“ VERICUT is a non-biased checking mechanism of the post-processed code from both of our CAM systems. Our policy is that no program can go to the floor unless it has gone through VERICUT. ”**

*Frank Dorsey, Engineering Manager  
Ellanef Manufacturing Corporation  
A Subsidiary of Magellan Aerospace USA, Inc.*

Go ahead...

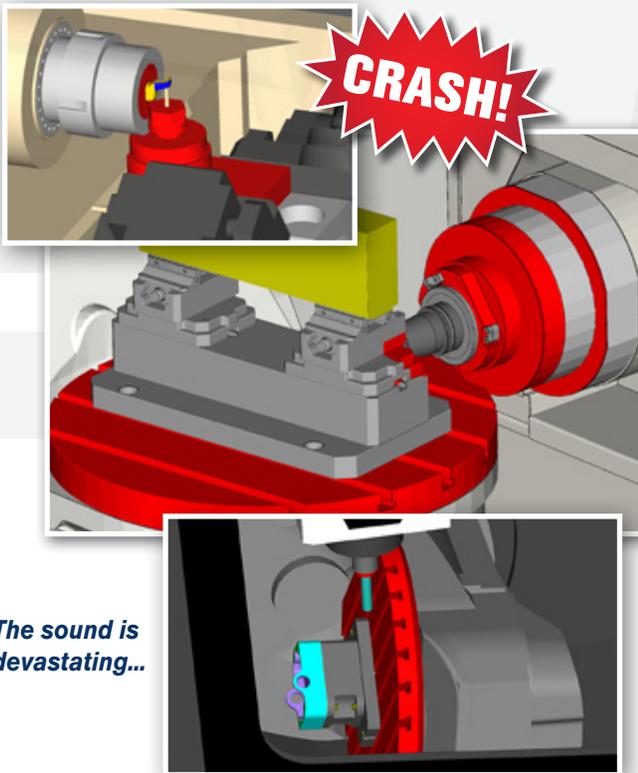
# CRASH YOUR MACHINE

...as long as it's in VERICUT

**A crash on a VERICUT "virtual machine" can save your real machine!**

VERICUT CNC simulation software enables you to machine parts on the computer before actual cutting occurs. You can eliminate errors that could ruin the part, damage the fixture, break the cutting tool, or crash the machine.

VERICUT optimizes the cutting process to make your programs fast and efficient. VERICUT also offers the best tools available for analyzing, inspecting, and using the in-process, "as-cut" model.



*The sound is devastating...*

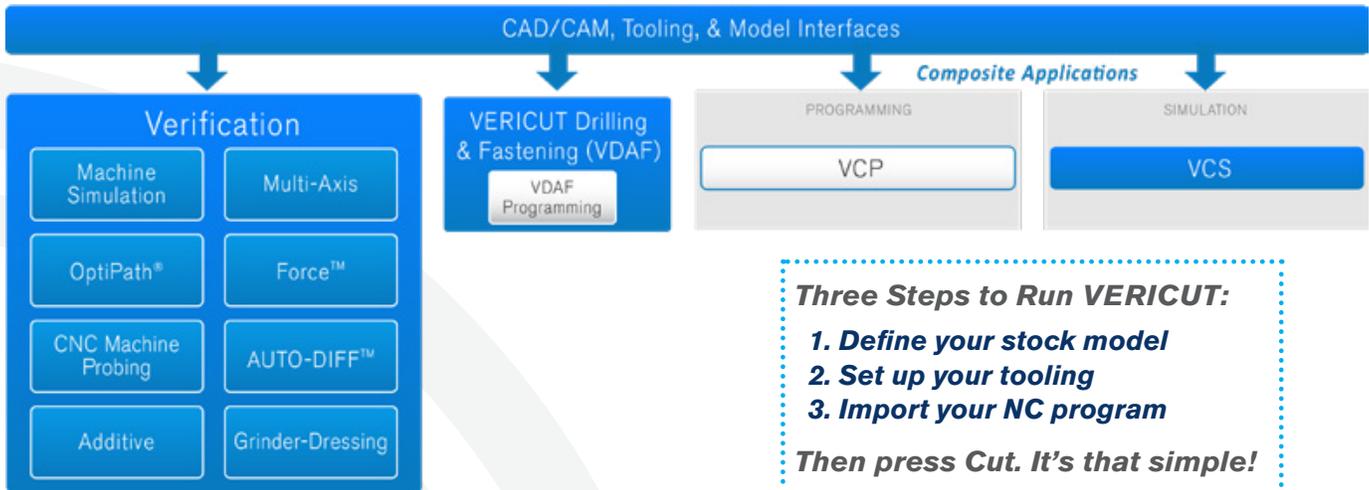
**A simple mistake can ruin your part, tool, machine, or even your machinist! And it can throw your production schedule into disarray.**

**If you use a CNC machine seriously, you should seriously consider VERICUT simulation!**

## **A Little About CGTech**

When you invest in VERICUT, you're not just buying a software program, you're teaming up with the largest group of CNC machining experts in the world. Features and benefits of working with us include:

- ✓ Our core products, including VERICUT simulation technology, are developed in-house. This allows for quick changes and specific customization by the original developers.
- ✓ CGTech enjoys very high retention of its sales, customer support engineers, and resellers. This provides consistent and experienced contacts for a long-term business relationship with your company.
- ✓ Your CGTech contacts work closely with VERICUT developers to best support your needs.
- ✓ Founded in 1988, CGTech is privately held and 100% self-financed, allowing us to plan long-term without concern of investors, stock price, or parent company pressure.
- ✓ A large pool of trained VERICUT users exists in virtually every industrialized country (tens of thousands of seats sold).
- ✓ We are continually exposed to new manufacturing methods and technologies worldwide, and can quickly react to ever-changing industry needs.
- ✓ As an approved vendor/product at most major companies around the world, CGTech is a reliable partner for your NC manufacturing operations.



**Three Steps to Run VERICUT:**

- 1. Define your stock model**
- 2. Set up your tooling**
- 3. Import your NC program**

**Then press Cut. It's that simple!**

**Workpiece Verification and Review . . . Page 4**

Reduce scrap and rework by detecting program mistakes BEFORE machining occurs.

**Reports, Multi-Axis, and AUTO-DIFF . . . . .5**

Generate in-process inspection instructions and other documentation from in-process machined features. Compare the cut stock to the design model.

**CNC Machine Simulation . . . . .6**

Simulate your CNC machine, exactly as it behaves on the shop floor, to detect potential problems before the program goes to the shop floor.

**CNC Program Optimization. . . . .8**

Automatically modify feed rates to make your programs more efficient.

**CNC Machine Probing. . . . . 10**

Create and simulate CNC probe programs.

**CAD Model Export. . . . .11**

Create a CAD model from an existing NC program, at any stage of machining.

**Additive Manufacturing. . . . . 12**

VERICUT simulates "Additive Machining".

**CAD/CAM & Other Interfaces. . . . . 13**

Integrate VERICUT and your CAM system(s).

**Services & Training. . . . .14**

Team up with CGTech manufacturing experts committed to helping you succeed.

**Drilling & Fastening . . . . . 16**

Program and simulate your automated drilling & fastening machines.

**Composite Applications. . . . . 18**

Program and simulate your automated fiber-placement and tape-laying CNC machines.

VERICUT's modular format provides flexibility – you purchase only the capabilities you need. It's easy to add modules; just let us know and we provide a license that gives you immediate access. VERICUT runs on Windows platforms as a 64 bit application. G-codes and CAM center-line (CL) formats are supported.

**“VERICUT paid for itself the first time we used it.”**

Dave Watson, Manufacturing Eng.  
Lockheed Martin  
Aeronautical Systems

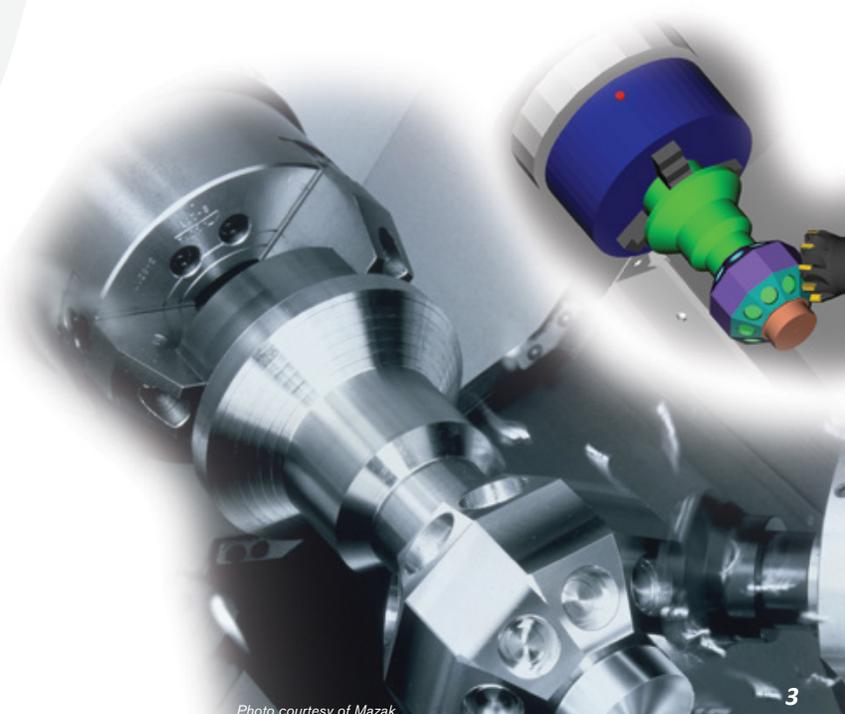


Photo courtesy of Mazak.

CAD/CAM, Tooling, & Model Interfaces



# Workpiece Verification



**Easily detect program mistakes and verify part accuracy with the VERICUT base module: Verification.**

### Superior Performance:

VERICUT's unique algorithm provides fast, accurate results. Performance does not degrade with increased cuts, so VERICUT can process programs with millions of cuts and virtually any type of material removal technique.

### Machining Support:

- ✓ 3-axis milling; 2-axis turning
- ✓ Rotary 5-axis positioning. Add our **Multi-Axis** module to detect collisions during positioning and to remove material during continuous four and 5-axis milling, drilling, turning, and combination mill/turn operations
- ✓ EDM Die Sinking
- ✓ Multiple simultaneous cutting tools
- ✓ Multiple setups or operations

### Control Support:

Verification supports most common control functions, and controls are easily modified.

- ✓ Rotary axis pivot points
- ✓ Look-ahead cutter compensation
- ✓ Supports several different tool length compensation methods
- ✓ Control cycles; fixture offsets
- ✓ Variables, subroutines, macros, looping, branching logic

### Inspection and Measurement:

- ✓ Zoom, reverse, rotate, cross-section the cut stock
- ✓ Measure thickness, volume, depth, gaps, distances, angles, hole diameters, corner radii, scallop heights, etc.

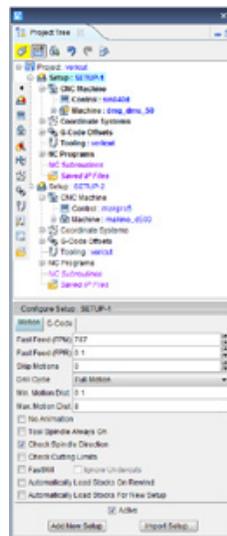
### Other Capabilities:

- ✓ Video and image capture
- ✓ Create a custom user interface for specific applications
- ✓ Add previously removed material back to the cut stock when stepping back in Review Mode

### Included Analysis Tools

The base Verification module enables you to view and analyze the geometry of the cut part. Models can be cross-sectioned multiple times at any orientation, so you can check areas that would be impossible to see in a solid model (such as the intersection of drilled holes).

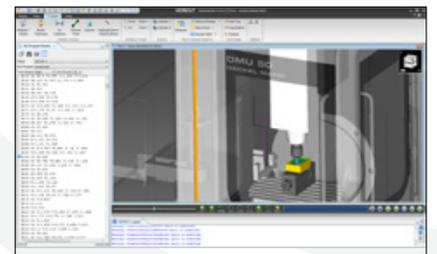
The X-Caliper™ tool measures thickness, volume, depth, gaps, distances, angles, hole diameters, tapping features, corner radii, scallop height, edges, and more. Delta X, Y, Z component distance measurements are included. X-Caliper also allows you to optionally highlight features, such as all planes on the same level. You can view and measure all tool collisions, even after subsequent machining operations have removed them from the screen.



The Project Tree allows you to view and configure all setups for a job. Each setup has its own CNC machine, fixtures, tools, NC programs, and simulation settings. The cut stock automatically orients as it moves from setup to setup.

### VERICUT Reviewer

With VERICUT Reviewer, shop floor personnel, suppliers, customers, and other production engineers can view animations of the CNC machining process. VERICUT Reviewer incorporates all the functionality of NC Review Mode in a stand-alone viewer that does not use a license. Reviewer can play forward and backward while removing and replacing material. You can rotate, pan and zoom just



like normal VERICUT, and the cut stock can be measured using all the standard X-Caliper tools. The "Reviewer" file can be saved at any point in a VERICUT session.

## Shop Floor Documentation

Save time by generating any kind of shop floor documentation needed, including setup plans and inspection instructions and other documentation from VERICUT's simulated in-process machined features!

With VERICUT, you can establish a formal, but simple and efficient method to create and document inspection and setup procedures.

All reports are customizable using a simple template. When modifying a template for any report, you work directly on the document display to manipulate text, images,

and tables. Creating the report is quick and easy because what you see is what you get.

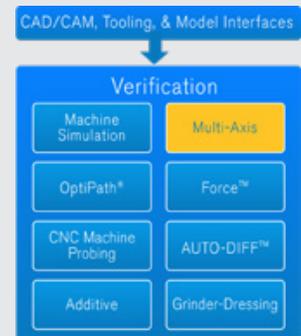
For inspection reports, VERICUT identifies the feature, extracts feature sizes, and applies a standard tolerance for the measurement. You can then add any additional instructions and select the measuring instrument from a list. The setup plan feature allows you to add simple dimensions and notes to a report for any type of shop floor documentation. All reports can be in PDF formats or standard HTML.

Symbol	Feature	Identifier	Instrument	Dimension	Tolerance	Dev.	Measurement	Tool ID
⊙	Slot Thickness	A1	Snap Caliper	0.1181	±0.0050			MILL_2_363_PD.078
⊙	Slot Thickness	A2	Snap Caliper	0.1361	±0.0050			MILL_2_363_PD.078
⊙	PROGRAM_ZC	B						
⊙	Position	B1-X	Caliper	0.0607	±0.0050			TAP_M10
⊙	Position	B1-Y	Caliper	0.0021				TAP_M10
⊙	Angle	B2	Comparator					
⊙	Hole Diameter	B3	Plug Gage					MILL_1_26_PD.078
⊙	Datum Plane	C						
⊙	Radius	C1	Comparator	0.1368	±0.0050			MILL_2_363_PD.078
⊙	Surface Finish	C2	Surface Tester					MILL_1_26_PD.078
⊙	Distance	C3	Caliper	0.1740	±0.0100			

# Multi-Axis

As complexity of the part and the machining operation increases, so does the chance for error. Don't leave the accuracy of the NC program, the quality of the part, or the safety of the operator to chance! The Multi-Axis module verifies and simulates material removal during:

- ✓ Multi-axis milling (i.e. cutting with a changing tool axis)
- ✓ Synchronized motion of multiple independent cutting heads or attachments such as 4-axis lathes/mill-turns or multiple-head machines



# AUTO-DIFF

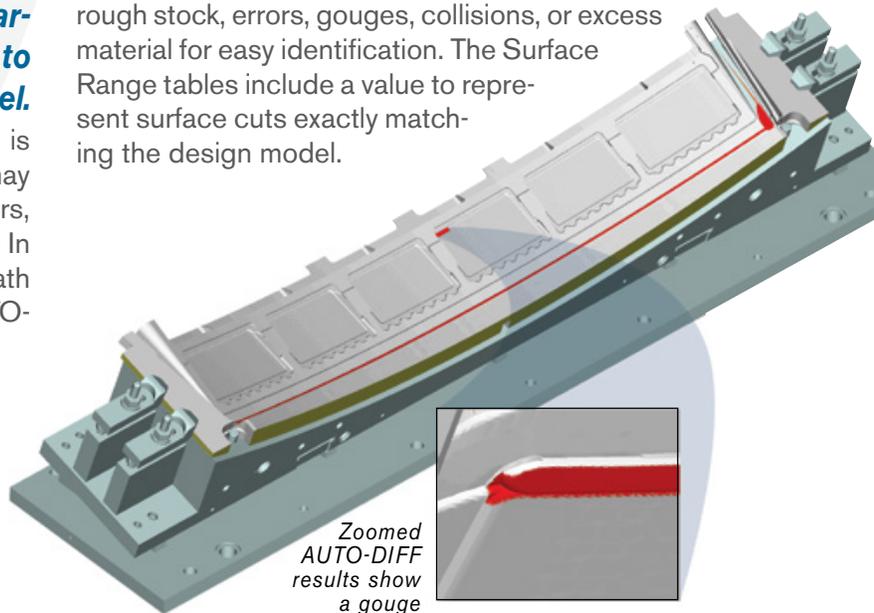
**Detect gouges and excess material by comparing the design model to the "as-machined" model.**

By the time a part design is ready to be machined, it may

have passed through several engineers/programmers, departments, companies, and CAD/CAM systems. In the end, it can be difficult to tell whether the tool path accurately represents the intended design. With AUTO-DIFF, you can be sure.

The design model can be a solid, surface, skin, or points. You can "embed" the design model inside the rough material for interactive gouge-checking. If the tool contacts the design, VERICUT highlights the gouge and records the error. The design model even moves with the cut stock as it transitions between setups.

Different colors can be assigned to the design model, rough stock, errors, gouges, collisions, or excess material for easy identification. The Surface Range tables include a value to represent surface cuts exactly matching the design model.



# Machine Simulation

CAD/CAM, Tooling, & Model Interfaces



**No more expensive surprises! Simulate your CNC machines, exactly as they behave on the shop floor, so you can detect errors and potential problems before the program goes out to the shop!**



A machine crash can be very expensive, potentially ruin the machine, and delay your entire manufacturing schedule! But with VERICUT, you can dramatically reduce the chance for error and avoid wasting valuable production time proving-out new programs on the machine.

Machine Simulation detects collisions and near-misses between all machine tool components such as axis slides, heads, turrets, rotary tables, spindles, tool changers, fixtures, work pieces, cutting tools, and other user-defined objects. You can also set up “near-miss zones”

around the components to check for close calls, and detect over-travel errors. Machine movements can even be simulated while stepping or playing backwards in VERICUT’s Review Mode.

A selection of customizable machine models are included. Or, you can build models from scratch. Machine components can be designed in a CAD system or defined in VERICUT. The “Component Tree” feature makes it easy to connect the machine’s pieces and manage the kinematics of the machine.

Machine Simulation Supports:

- ✓ Multi-axis milling, drilling, turning, mill-turn, EDM
- ✓ Simultaneous mill/turn on different spindles and workpieces
- ✓ Machines with multiple synchronized CNC controls
- ✓ Auxiliary attachments: tail stock, steady rests, part catchers, bar pullers, pallet changers, etc.
- ✓ Automatic workpiece transfer to pick-off or sub-spindles
- ✓ STEP, STL, IGES, and others

Many sample machines and control configurations are included.

VERICUT’s MDI includes axis jog buttons and allows tool positioning by graphical picks. Using the simple MDI controls, you can make sure your machine can reach all the necessary features of the part.

*Prevent CNC machine crashes and near-misses*

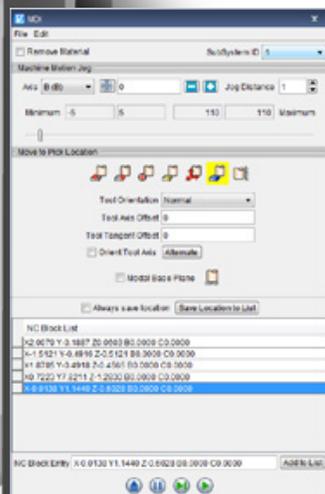
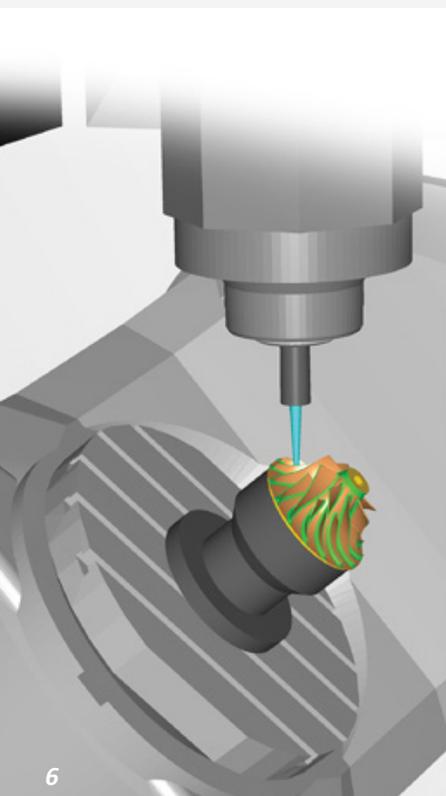
*Reduce the time it takes to implement new CNC machines*

*Show machinists what to expect from new NC programs*

*Improve process efficiency*

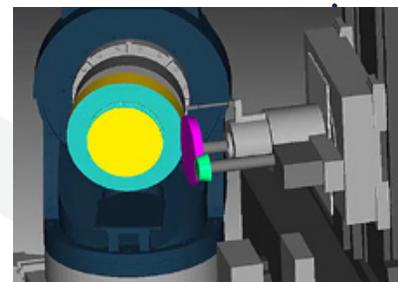
*Increase shop safety*

*Train programmers and machinists without using production time...or risking a crash*



## Grinder-Dressing Verification & Machine Simulation

Simulate dressing where a secondary tool is applied to a grinding wheel to freshen the grinding surface, or to change the grinding wheel cutting shape. VERICUT simulates the dynamic compensation needed while the dresser is used, even while the grinder is engaged with the part.



## Superior Collision Checking

VERICUT features the most accurate collision-checking available. Rather than just checking points along a path, VERICUT checks along the entire path of travel by sweeping through space. You don't have to specify a "step size" tolerance that can slow the simulation if too small or miss the collision if too large!

Today's NC machine tools process complex NC programs. VERICUT was designed by NC programmers and professionals in NC simulation and verification software. Because of this expertise, VERICUT is an excellent tool when using multi-axis machines, complex NC code, and/or advanced programming techniques.

VERICUT is designed to support advanced control functions including:

- ✓ Look-ahead or 3D cutter compensation
- ✓ Tool tip programming & tool length compensation
- ✓ Gage length reference point programming
- ✓ Canned cycles and fixture offsets
- ✓ Rotary axis pivot points
- ✓ Variables, subprograms, and macros
- ✓ Subroutines, looping, and branching logic

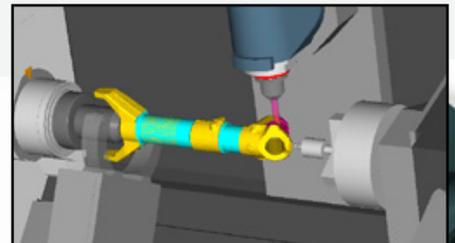
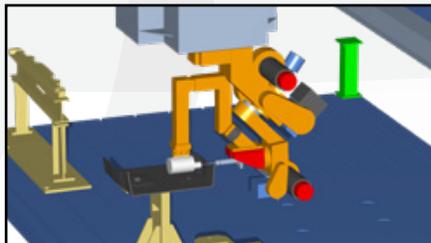
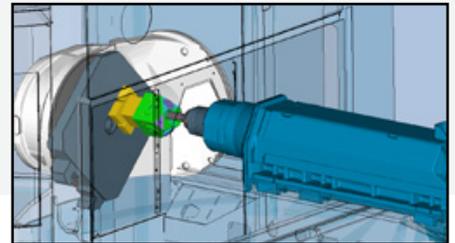
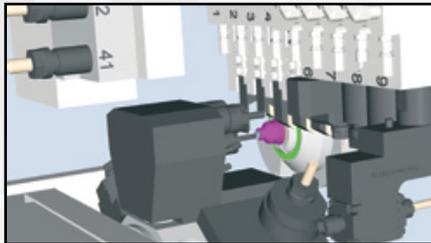
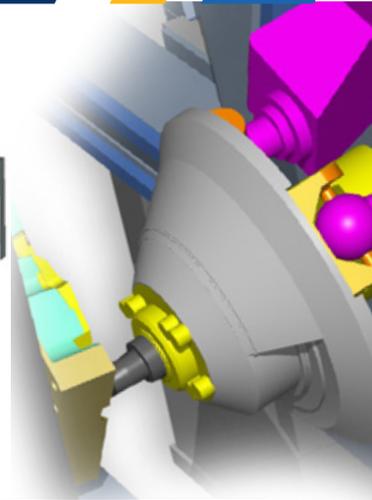
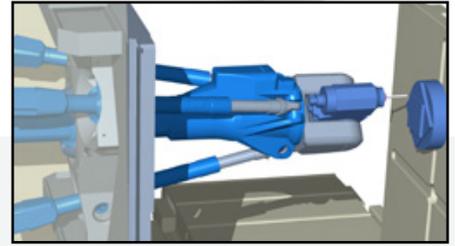
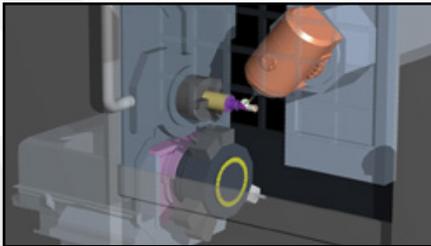
## Tools to Simulate More Complex Applications...

VERICUT also supports:

- ✓ Automatic part transfer between fixtures
- ✓ Facing head (or "programmable boring bar")
- ✓ Mill/turn machining center's multi-channel programming/synchronization
- ✓ CNC controls which allow programming of the tool axis using IJK tool axis vectors
- ✓ Turning operations which are not symmetric about the lathe spindle
- ✓ Machines that use parallel kinematics
- ✓ Multi-axis waterjet cutting operations
- ✓ Material removal for gear hobbing (synchronize spindles)
- ✓ Kuka Robot Language (KRL)

**VERICUT detects the collision!**

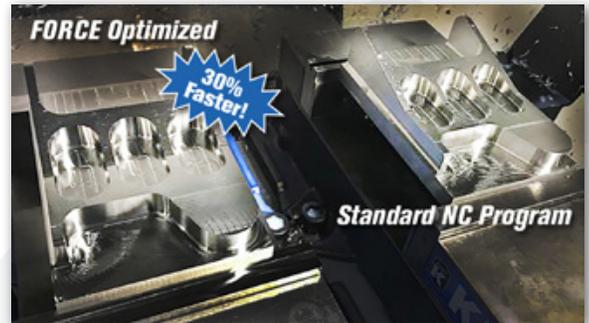
**Point-check methods can miss collisions!**



# Feed Rate Optimization



**OptiPath & Force** help you cut parts faster, improve surface finish, & reduce tool wear without altering the path trajectory!



**VERICUT's optimization modules automatically modify feed rates based on the cutting conditions to make your programs more efficient, while also extending tool life and improving surface finish!**

## Knowledge-Based Machining

VERICUT is a true knowledge-based machining system. Through the simulation process, it learns the exact depth, width, and direction of each cut. And it knows exactly how much material is removed by each cut segment. With that knowledge, motion is divided into smaller segments and the best feed rate for each cutting condition encountered is assigned. It then outputs a new tool path, identical to the original but with improved feed rates. It does not alter the route of the tool path. Two independent modules are available for optimizing feed rates: OptiPath and Force.

## OptiPath

OptiPath uses standard machining formulas, setting the feed rate based on the user's desired volume removal rate, chip thickness, and surface speed.

A setup wizard prompts for cutter settings as you simulate machining operations. Essentially, you add intelligence to the cutter. All the settings for that cutter are stored in an optimization library. You define the settings

once. Then each subsequent time you simulate machining operations with that cutter in the same material and machine the motions can be instantly optimized.

OptiPath also features a "learn mode" for creating the optimization library with no setup required. For each cutter, OptiPath finds the maximum volume removal rate and chip thickness and uses them to determine the optimization settings for the cutter.

## Force

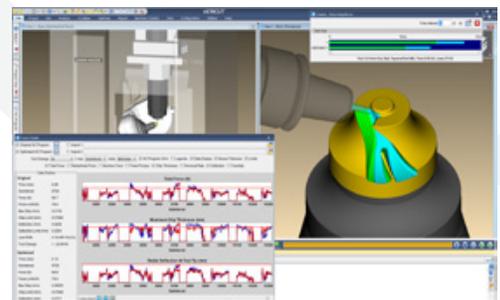
Force uses material properties associated with the workpiece and cutting tool material, plus cutting edge geometry and VERICUT's simulated cutter contact conditions to predict cutting forces and chip load. Detailed charts can be viewed in order to determine potential problems in chip load, force, spindle power and torque. The software then automatically adjusts the feed rate to stay within desired force, chip load and power limits. Force predicts cutting conditions using a proprietary set of material coefficients that account for the shear-strength of the workpiece material and the effects of friction and temperature. The material data is created from physical machining characterization tests and does not rely on extrapolating from finite element theoretical results.

## Which one?

Both methods produce optimized feed rates and achieve impressive reduction in cycle times, improved cutting tool performance and better surface finishes, less tool wear, etc. Both excel in improving NC programs machining any material type from Non-Ferrous materials like: Aluminum, Steels, Stainless Steels, Titanium, Super Alloys, Heat Resistant Alloys, and Hardened Tool Steels. They both efficiently optimize complex five-axis parts.

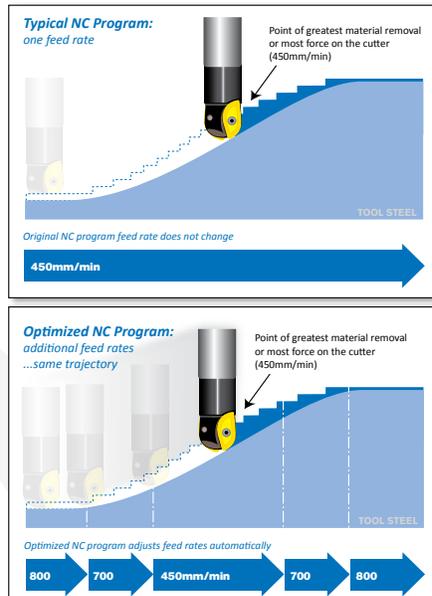
OptiPath, being knowledge-based, requires more knowledge from the user to make the correct cutting condition settings. OptiPath is most effective when ideal cutting conditions are known for each cutting tool, material and machine.

Force, being physics-based, requires less user experience or knowledge of cutting conditions. The user has minimal inputs to get effective optimization results.



## How Optimization Works...

VERICUT chooses the optimal feed rates based on cutting conditions. As the cutting tool encounters more difficult conditions, feed rates decrease. As conditions improve, the feed rates increase accordingly. Optipath uses volume removal rate and chip thickness to determine cutting conditions, and applies the user's feed rate settings for those conditions. Force uses physically-characterized material data and cutter edge geometry to predict cutting forces and chip load for a given cutting condition. It then computes the maximum reliable feed rate, maximizing chip thickness while preventing tool force overload. Both modules calculate and insert optimum feed rates without altering the tool path trajectory.



**“...the result of using the optimization feature is a savings of more than 81 hours on one job alone.”**

Ben Miller  
Tool & Die Programmer,  
Parker Hannifin Corporation

### Machine More Efficiently...

Cut more parts in the same amount of time – it's like getting a free CNC machine! Reducing cycle time increases productivity and gets parts to market faster.

### Save Money...

Increased productivity by reducing the time it takes to cut parts can add up to significant annual savings.

### Improve Part Quality...

Constant cutting pressure causes little or no variation in cutter deflection. Finishes on corners, edges, and blend areas are better so less bench work is required.

### Make Cutters Last Longer...

Optimum cutting conditions prolong tool life. Shorter machining times mean less cutter wear, so you change tools or inserts less frequently.

### Reduce Machine Wear...

A more constant cutting pressure between the machine tool and the workpiece reduces variable forces on the axis motors for smoother machine operation.

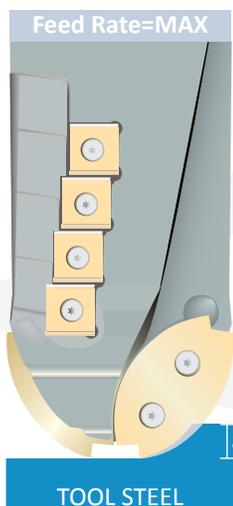
### Make Better Use of Time...

Machinists don't have to be glued to the feed rate override! They can run multiple machines, set up the next job, or attend to other duties.

## Could You Benefit from Optimization?

Do any of the following sound familiar? If so, VERICUT can help!

- ✓ Removing a lot of material
- ✓ Long machining times
- ✓ Large NC programs
- ✓ Interrupted cuts (multiple entry/exit)
- ✓ Cutting at variable depths/widths
- ✓ High speed machining
- ✓ Expensive cutting tools not used to their full potential
- ✓ Lights out - Unattended machining
- ✓ Difficult to cut materials
- ✓ Expensive tooling and materials
- ✓ Hard materials, soft materials
- ✓ Older equipment
- ✓ Multiple parts
- ✓ Optimized NC toolpaths are safer
- ✓ Premature cutter wear/failure
- ✓ Optimizing programs “by ear”
- ✓ Reworking programs for feeds/speeds... or no time to do so
- ✓ CAM system and/or programmers don't have necessary knowledge
- ✓ “Resident expert” retiring/leaving
- ✓ Poor surface finish
- ✓ Excessive bench time
- ✓ Chip thinning problems
- ✓ Cutter deflection problems
- ✓ Chatter in corners
- ✓ Air cuts or light cuts at slow or programmed feed rates



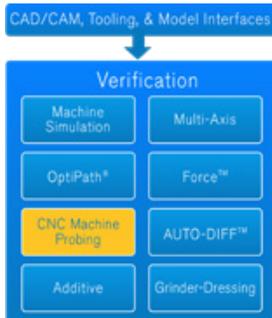
## High Speed vs. High Efficiency Machining

The traditional method of high-speed machining, cutting at high feed rates with very shallow cuts and small step-over, can actually defeat the goal of reducing machining time! Cutting at greater depths removes material more efficiently. But, the cutter may encounter an overloaded condition causing it to break or exceed the machine's horsepower. Adjusting feed rates accordingly and maintaining a consistent chip thickness provides more efficient machining while protecting the machine and cutter.

8mm CUT DEPTH

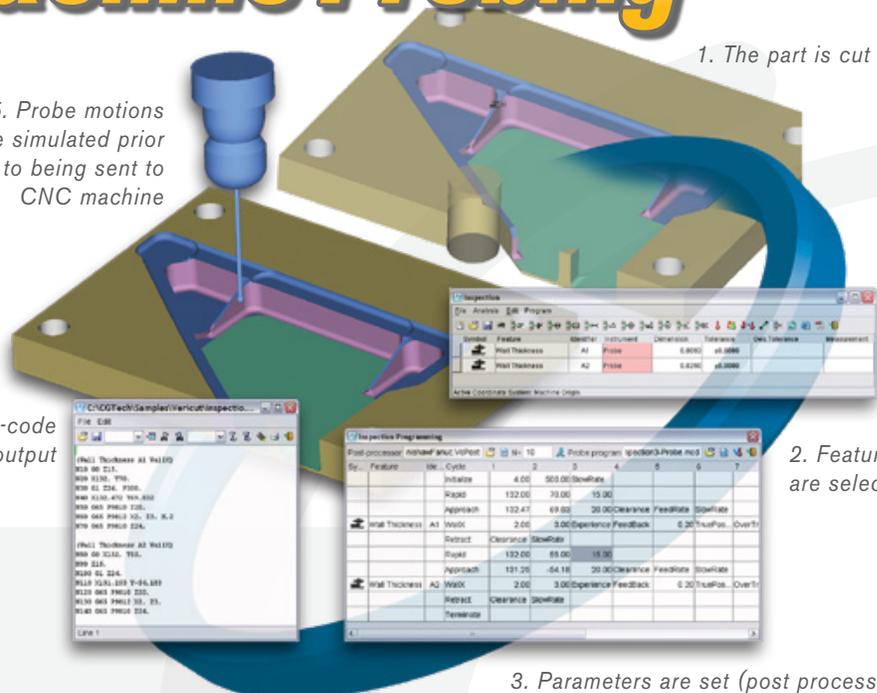
Excess material that could break cutter

# CNC Machine Probing



5. Probe motions are simulated prior to being sent to CNC machine

1. The part is cut



2. Features are selected

4. G-code output

3. Parameters are set (post processor, cycle types, tolerances, etc.)

## Create & Simulate CNC Probe Programs with VERICUT!

VERICUT is an ideal place to create probing sequences in a CNC program because of its 'in-process' model. This in-process feature geometry is not available anywhere else in the CNC manufacturing process.

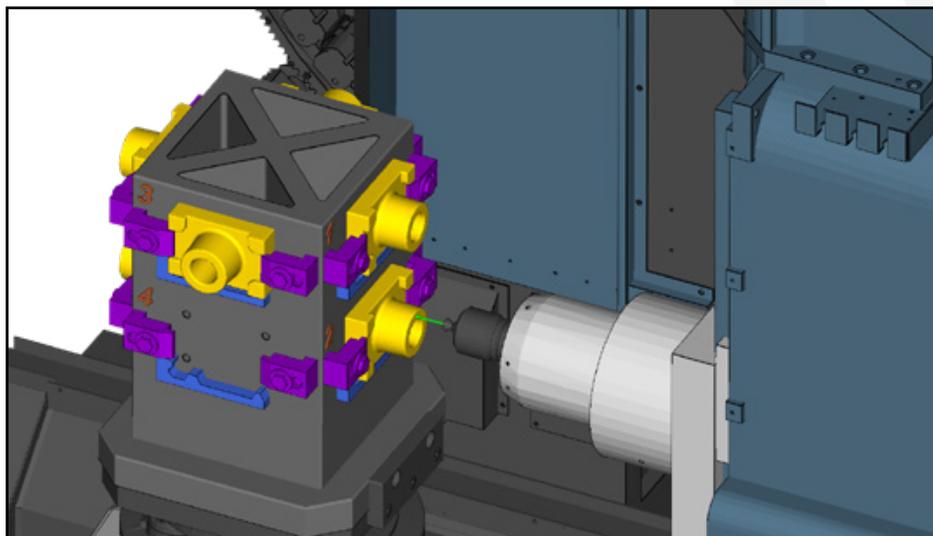
Any number of errors can occur that will likely result in a broken inspection probe when using a CNC machine to perform probing operations. The probe tip/stem could contact another object while not in probe mode. The probe body or other machine component could hit something when moving. Or, an error in the probe cycle logic could cause unexpected machine motion – which could crash the machine, destroy the probe body, or break the probe tip.

With VERICUT simulation, there is no reason creating your probing operations should ever cause a headache. VERICUT notifies you when the probe tip contacts an object while not in 'probe mode,' and detects any collisions. By emulating the probe cycle's logic (which may alter machine motion based on information gathered during probing),

VERICUT helps protect probes and probe tips that could be damaged or broken by programming errors.

VERICUT simulates probe cycle sub-routines or sub-programs, including complex logic and Type II formats used to set offsets and make decisions based on probe results. CNC Machine Probing will help ensure that you will not destroy the probe or crash the machine during tasks such as:

- ✓ Locating the stock and/or fixture and adjusting offsets
- ✓ Measuring and adjusting for stock variations
- ✓ Identifying stock and/or fixture configuration or part number
- ✓ Measuring and adjusting tool or fixture offsets
- ✓ Simulating tool check cycles
- ✓ Inspecting machined features



**Contact CGTech to learn how VERICUT can create and simulate your custom probe cycles!**

VERICUT simulates probe cycle subroutines or sub-programs used to set offsets and make decisions based on probe results.

# Model Export

**With Model Export, you can create CAD models of the cut part from your NC data at any stage of the machining process, complete with machined features.**

VERICUT can be used to create a CAD model from an existing NC program. The model includes features such as holes, fillets, corner radii, pocket floors and walls – just as it's cut on the machine.

- ✓ Export a CAD model at any stage in the machining process
- ✓ IGES and STL output
- ✓ CATIA V5, CATIA V4, STEP and ACIS output with an optional Model Interface (not included with Model Export.)

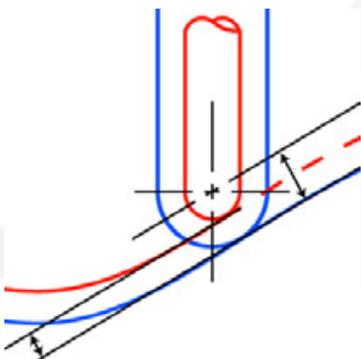
## Make Legacy Data Useful:

- ✓ Create CAD models from old G-code or APT programs

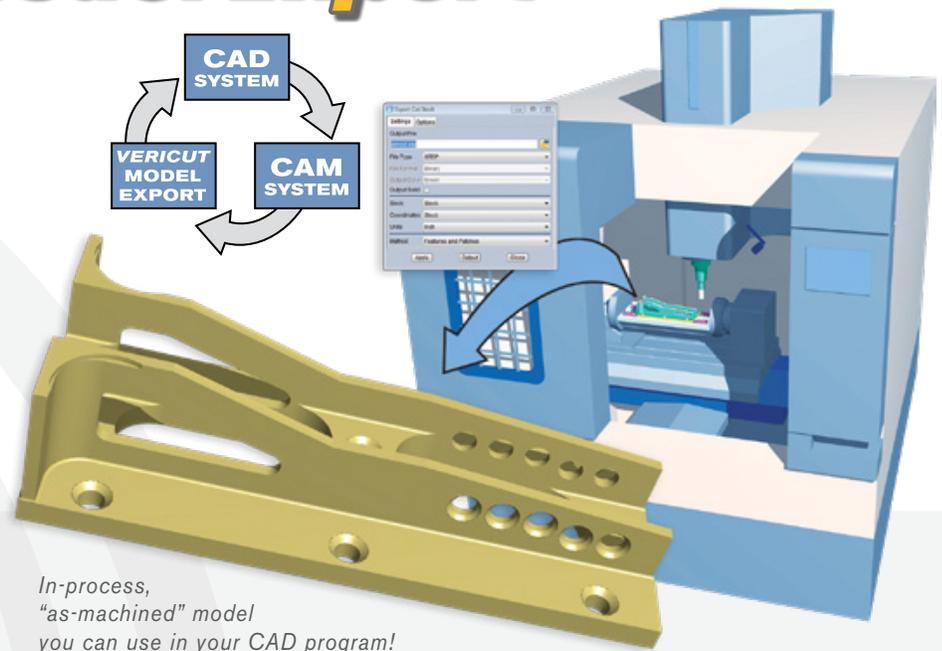
## Perfect Offset Surfaces

Offset surfaces can be created using a CAD program, but this creates undesirable gaps and overlaps that require extensive model clean-up.

Model Export can be used to generate a CAD model without gaps or overlaps!



Running the original NC program with a smaller ball nose end mill automatically creates an offset surface.



*In-process, "as-machined" model you can use in your CAD program!*

## Improve Process Planning:

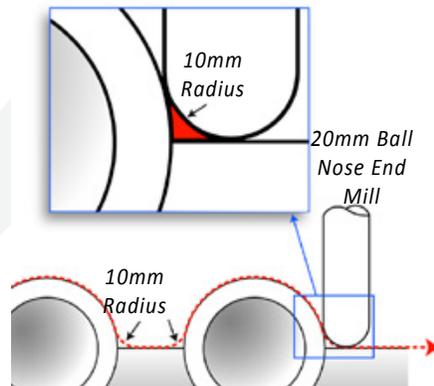
- ✓ Plan for multiple setups or staged machining

## Improve Reverse Engineering:

- ✓ Take the "as-machined" model back into your CAD system

## Create Fillets Automatically

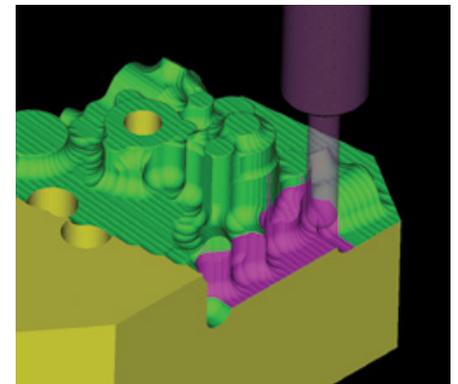
VERICUT's cut stock exactly matches the finished part, including any fillets. The size of the ball nose end mill determines the fillet radius. Model Export will export a CAD model that includes all fillets.



Exported CAD model includes all fillets. Fillet size is determined by the end mill radius.

## In-process stock model

Large or complex models may require several setups. Model Export can be used to export a CAD model after each setup, providing programmers with a starting point for subsequent operations.



An exported in-process model provides a starting point for subsequent operations.

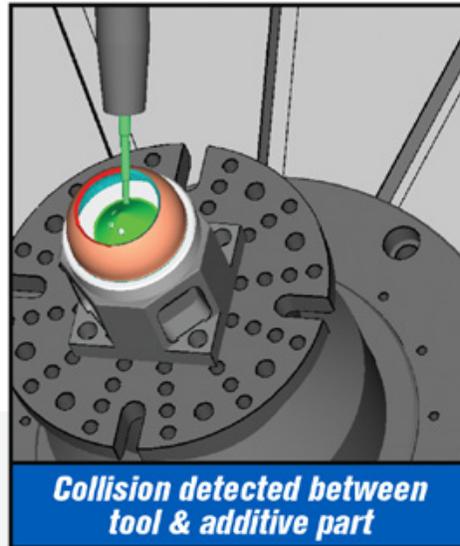
# ADDITIVE Manufacturing

**VERICUT's Additive module simulates "Additive Machining" - a machining mode that adds material to build up the workpiece**

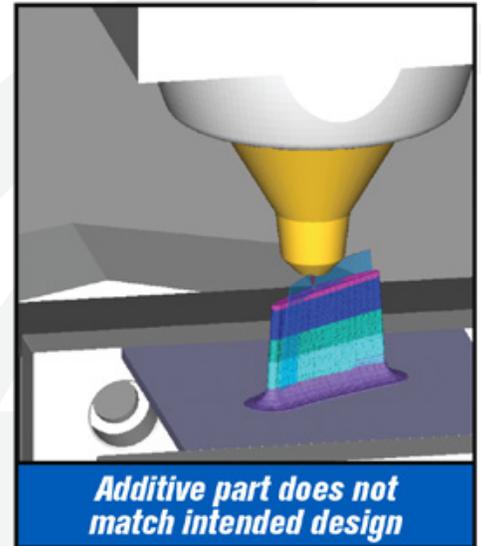
Verification	
Machine Simulation	Multi-Axis
OptiPath®	Force™
CNC Machine Probing	AUTO-DIFF™
Additive	Grinder-Dressing



**Crash detected with laser head**



**Collision detected between tool & additive part**



**Additive part does not match intended design**

## Verify Laser Activity

VERICUT's Additive module simulates added material via directed energy deposition (DED), laser sintering, 3D printer and powder bed layups from their build files, wired additives, thermo-plastic composite additives, welding, and other layup processes that add material. These additive processes are used to create a "near net shape" part.

## Additive Functions

Additive tools have an "Additive Functions" group with options to validate laser, material, and gas usage (sometimes referred to as "recipes") during the simulation. Errors are issued when checked additive functions are improperly used, or set out of the expected range.

## Droplet Technology

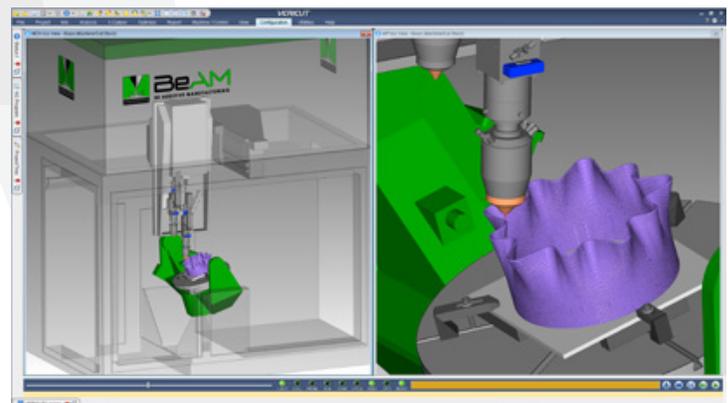
**Realistic Appearance:** Added material in VERICUT is easy to distinguish from machined stock. Programmers clearly see when part features that require finishing have been machined.

**History:** Each bead (or "droplet") stores "built-in" intelligence that NC Programmers use to quickly find the source of errors, voids in material layers, problem cuts in

added material, and where misplaced material came from, with a single click.

## 5-Axis Machining

The verification process of VERICUT accurately checks for errors on all 5-axis milling, turning, and additive laser sintering processes no matter how complex the operation.

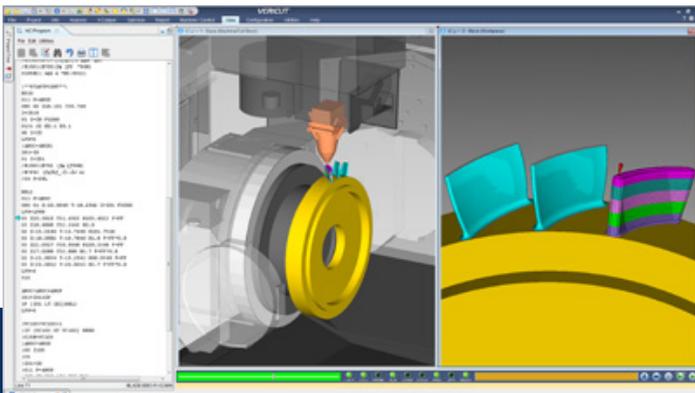


## Hybrid Manufacturing

In VERICUT, additive operations are combined in any order with traditional "subtractive" machining, such as milling, drilling, turning, etc. The realistic appearance of added material allows NC Programmers to tell that all necessary machining has been performed.

## Detect Collisions

VERICUT detects collisions between the machine and additive part with its collision checking extended to cover additive parts as they are being built, and expensive super multitasking machine laser equipment.



# CAD/CAM & Other Interfaces

**Integrate VERICUT and your CAM system(s) to easily create the most accurate and efficient NC programs possible!**

The interfaces make verifying and optimizing NC programs, and simulating CNC machines, a much easier and more efficient process. With most interfaces you can verify individual operations, or a series of operations.

All stock, fixture, and design geometry is automatically transferred to VERICUT in the correct orientation, along with your NC program, tooling, machine and control data, and other simulation parameters. VERICUT

runs independently, so you can continue working in your CAM system while simulating your NC programs. You can also import NC programs from other CAM systems in CL or post-processed G-code format.

CAD/CAM, Tooling, & Model Interfaces



**The following CAD/CAM interfaces are available directly from CGTech:**



**Other interfaces available:**



**Tool Management Interfaces** extract tool lists from your tool manager system and creates VERICUT tool assemblies. It is an on-the-fly live connection to your tool manager.



**Model Interfaces** enable VERICUT to read the designated model file formats and use them as stock, fixture, design, tool holder, and machine models. When combined with Model Export, VERICUT's cut stock may be written out in these formats as well. VERICUT in-

cludes the ability to use several industry-standard model file formats: STL, IGES, VDA-FS, DXF, and NX (with NX Interface). Optional model interface modules allow VERICUT to use these additional formats: STEP, ACIS, CATIA V4, and CATIA V5.

## Do you know how much prove-outs are costing you?

In today's competitive manufacturing environment, software verification is essential to your ability to produce on-time, high quality goods at a reasonable cost. In the conservative example to the right, prove-outs cost \$24,000 a month. This does not factor in additional costs such as scrapped or damaged parts, broken tooling, damaged fixtures, and extra machine tool maintenance. What are prove-outs costing you?

x	12	Number of machines
x	10	Hours per day
x	20	Days per month
x	10	% of time proving programs
=	240	Hours spent
x	\$100	Hourly machine cost
=	<b>\$24,000</b>	Monthly, or
	<b>\$288,000</b>	annual prove-out cost

# Services & Training

*It's easy to implement VERICUT quickly to capitalize on your investment*

**VERICUT training is offered regularly at numerous locations. Following are descriptions of training courses, implementation services, and consultancy that are available. For more information contact your CGTech representative or reseller.**

## **Standard VERICUT Training**

CGTech's hands-on training gives you the knowledge & skills to maximize VERICUT's potential. These courses are suited to NC programmers and CNC machine operators. After completing a course, you will be a better VERICUT user!

## **Machine & Control Building Training**

VERICUT Machine & Control Building training is intended for experienced VERICUT users with a good working knowledge of VERICUT. The class builds on your existing knowledge as you learn techniques for configuring VERICUT Machine Configurations (VMCs) that can be utilized by all users at your company.

## **On-site or web-based VERICUT Training**

Can't make it to a CGTech facility? Need customized training? We'll come to you! On-site or online training can raise your VERICUT skills to the next level and is a perfect complement to implement newly purchased VERICUT Machine Configurations (see "Contract Services" on the next page).

## **New Release Update Training**

Improve your productivity with new VERICUT features quickly as a CGTech expert helps you learn how to apply them to your manufacturing processes.

## **Implementation Services:**

### **Implementation & Automation Consulting**

Get help integrating VERICUT into your manufacturing engineering and NC programming processes: both upstream CAD/CAM systems and downstream shop-floor systems. Ensure that VERICUT fits into your electronic workflow as smoothly and efficiently as possible! On-site advice from a VERICUT expert while working on your initial VERICUT projects, eliminates false starts and confusion, and can be the key to accelerating your ROI.

### **VERICUT Audit**

Are you using VERICUT to its full potential? Here's how to tell! A VERICUT expert comes to your site and evaluates your VERICUT use and provides you with a written report covering potential risks in your current operation and areas where you can achieve better results. We check your VERICUT installation and assess whether your staff is sufficiently trained.

### **OptiPath/Force Mentoring**

Take full advantage of CGTech's manufacturing experts with VERICUT's optimization capabilities. We teach you how to optimize your NC programs using your parts on your machines. We will work with you using VERICUT OptiPath or Force to demonstrate competitive advantages to your company. Results can be proven on your machine and demonstrated to your manufacturing team and management.

*When you invest in VERICUT you are teaming up with manufacturing industry experts that are committed to helping your company succeed with our simulation, verification and optimization technologies. Our dedicated staff of trainers, technical support engineers and developers are available to help you reach your manufacturing goals.*



## Contract Services:

### VERICUT Machine Configuration

Hire CGTech to create VERICUT Machine Configurations (VMCs) of your exact equipment and make running simulations a “push-button” operation!

### NC Program Optimization

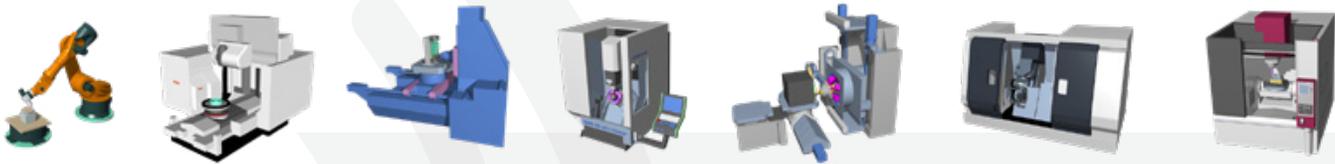
Want to improve the quality and production rates of your NC machining? Send us your NC programs (G-code or APT), and we return faster, more efficient programs. This is an ideal solution for shops with limited time, manpower, or optimization expertise.

### CAD Model Export

Need an accurate CAD representation of your machined part, mid-process, or at the end of the final operation? We convert your NC programs (G-code or APT) into an “as-machined” CAD model.

### Custom Tool Libraries & Custom Software Development

We build VERICUT tool libraries from scratch or from your existing spreadsheets and databases. Do you need special capabilities not currently found in the software? We tailor the software to suit your specific needs!



## Configuring VERICUT to Simulate your CNC Machines

### VERICUT Machine Configuration (VMC)

CGTech has an extensive collection of VMCs developed over several years for customers and with our machine tool partners. We maintain this collection, updating it for new VERICUT versions, features, and added machine and control functionality. CAD models are only part of a working VMC. VERICUT also needs the control emulation logic and machine kinematics contained in the VMC. The VMC is configured to exactly match the Machine Tool options to ensure that your virtual machine and real machine behave identically.

### Supplying VMCs

Each VMC requires some configuration to ensure it meets your exact machine specifications and options. This configuration is usually done by CGTech (or a VERICUT reseller). However, training can be provided to allow an experienced user to create and configure VMCs.

Your CGTech representative or reseller can work with you to

provide a quotation for VMCs. They will discuss your requirements in detail in order to accurately determine the project scope. They will need to know the make and model of your machine(s), control type, special machine features beyond basic motion axes (tool changers, tailstocks, etc.) and control features. They will also make sure that the VMCs are delivered to your satisfaction.

### Our Machine Tool Partners

CGTech has many years of experience creating and editing VMCs to meet the needs of its users. We are able to provide VMCs for machines from many of the leading Machine Tool Builders, often using CAD data supplied through our partnerships with these companies.

Our Machine Tool partners include DMG, Mazak, Mori-Seiki, Matsuura, Makino, Chiron, Hermle, Doosan, and many more. Machine Tool brands we have built VMCs for, include:



# VERICUT Drilling & Fastening

**VERICUT Drilling & Fastening (VDAF) is a software application for simulating and programming auto-drilling & fastening machines. VDAF is independent of both the machine and CAD system.**

CAD/CAM, Tooling, & Model Interfaces

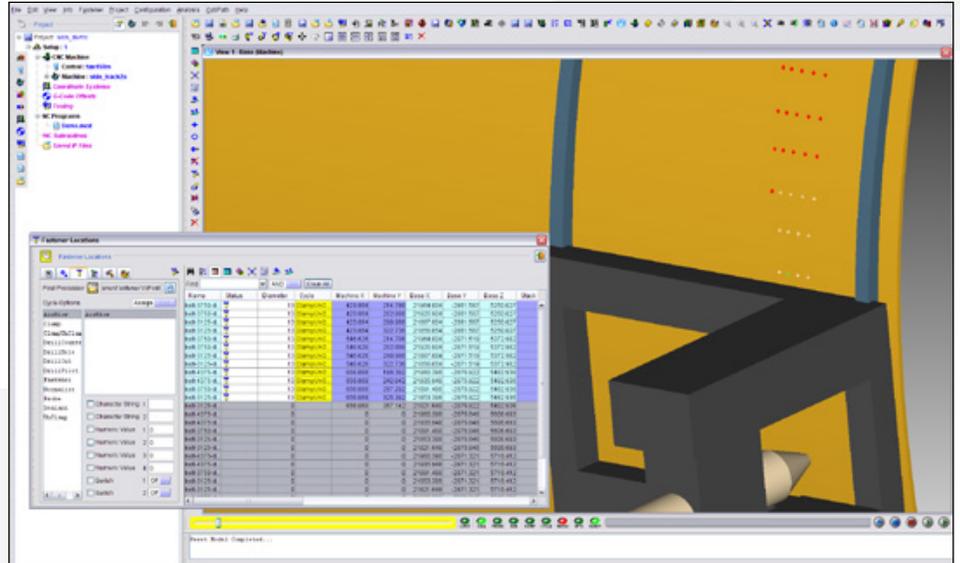
VERICUT Drilling & Fastening (VDAF)

VDAF Programming

**When working with expensive airframe assemblies, the cost of drilling or fastening mistakes are high! How much time do you spend avoiding them?**

## VDAF Simulation

Visualize and simulate CNC drilling and fastening machines using the same NC program code that will be run on the machine. Simulation is independent from programming, and VDAF can simulate NC programs from any programming system for any CNC-automated drilling and fastening machine.



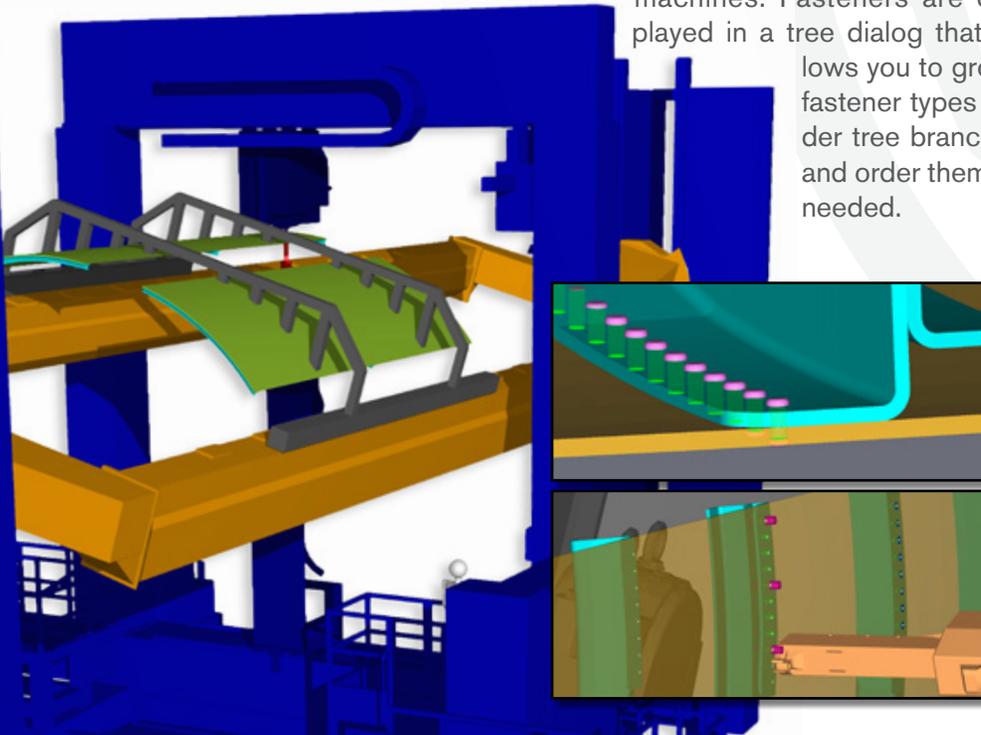
VDAF's programming option adds a user-friendly interface for creating CNC auto-drilling and fastening NC programs.

## VDAF Programming Add-on Option

This add-on module to VDAF gives you the ability to create NC programs for CNC auto-drilling and fastening machines. Fasteners are displayed in a tree dialog that allows you to group fastener types under tree branches and order them as needed.

## VERICUT Drilling & Fastening (VDAF) helps you avoid problems such as:

- ✓ Drilled hole or fastener in wrong position
- ✓ Missed hole or fastener
- ✓ Wrong hole size or fastener position
- ✓ Hole not drilled through the stack
- ✓ Hole double-drilled or double-filled
- ✓ Wrong fastener for material stack
- ✓ Collision with structure
- ✓ Collision with tooling
- ✓ Collision with added fasteners



## Product Descriptions:

### VDAF Simulation

The base simulation software is used to visualize and simulate drilling and fastening from NC program code. VDAF simulation is a universal software application capable of simulating multiple CNC auto-drilling or auto-fastening machines. A single license can simulate multiple different machines using a VERICUT Machine Configuration (VMC) configured for each machine. Every VDAF implementation requires at least one VMC.

VDAF simulates machine motion directly from NC program files to check for collisions and other potential process problems. VDAF simulation also checks specific auto-driller/fastener actions, such as: proper drilling and fastening through the stack, appropriate tool selection for specified hole or fastener parameters, properly inserted fastener for given hole and stack call-out, and collisions with inserted fasteners. VDAF simulates positioning sensors for the existence of perceptible material close to the inserted fastener location.

A Tool Library organizes the drills and countersinks to be used in a simulation session. A Fastener Library contains models of specific fasteners that can be inserted by NC program commands.

### VDAF Programming Add-on Option

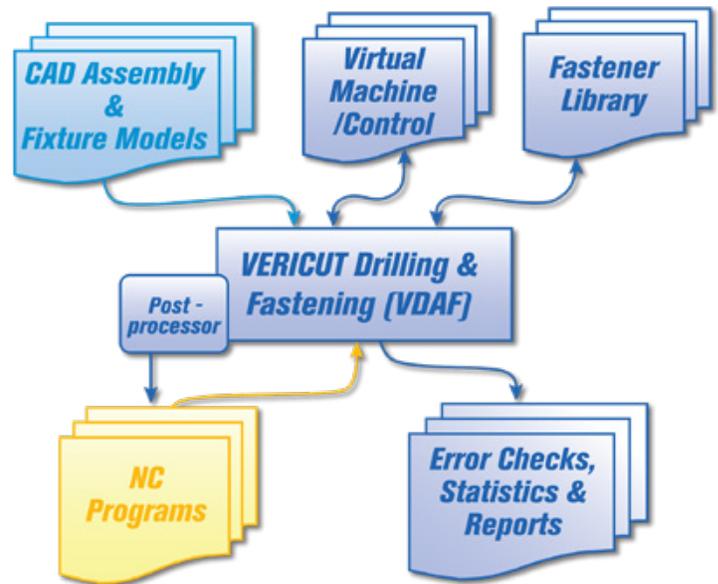
This add-on module to VDAF Simulation creates NC programs for automatic drilling and fastening. This is a universal software application capable of programming many CNC auto-driller/fastener machines. A single license can program multiple different machines using a postprocessor configured for each machine.

The assembly to be programmed within VDAF contains an individual part model for each member of the CAD assembly, located in its proper assembled position. Each part's material is identified, as well as the clamp surface and any fixturing. VDAF's fastener locations are created from the CAD model's fastener locations and attributes, as read by the custom-tailored fastener reader utility. Fastener locations contain the attributes of a fastener and its location in the assembly. The set of fasteners and their attributes define the drill and fastener cycles to be used.

One or more reference locations may be selected, typically at Drilled at Assembly (DA) holes or temporary fastener locations. These selections invoke machine reference operations, but typically do not affect nominal locations in the NC program. Hole or fastener locations are grouped by local and global reference locations. Designating and activating reference holes create commands in the NC program to align the operation to the physical part.

Fasteners and operations are displayed in a tree dialog. The tree layout allows the user to group fasteners under tree branches and order and re-order them as needed. The user interface clearly identifies the fasteners that have been processed and those that have not. Fastener information can also be displayed in different ways to meet other user requirements. For example, fasteners may be displayed by type, diameter, length, etc.

The VDAF Programming Add-on Option requires a VDAF Simulation base license.



### VERICUT Machine Configuration (VMC)

A VMC reads the auto-drilling/fastening NC program for a specific machine. It contains the definition of all drilling, fastening, utility cycles, and functions used in the NC program. It then emulates the CNC control logic necessary to accomplish a simulation of the NC program on the specific machine, including simulated fastener insertion. Simulated fastener insertion requires CAD models of the various fasteners that will be used in the assembly process (stored and organized in the Fastener Library).

### Post-Processor

The post-processor formats the auto-drilling/fastening paths created in VERICUT for a specific machine. The post-processor contains the definition of all drilling, fastening, utility cycles, and functions used in the NC program.

### Other Possible Requirements:

#### CATIA & NX Interfaces

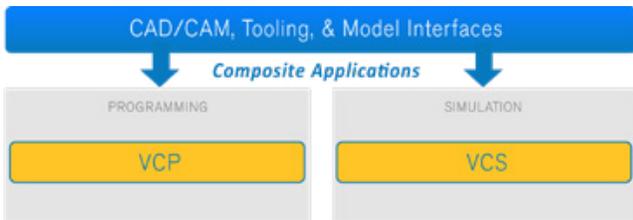
You can verify individual operations, a series of operations, or a set of complete NC programs. All Skins, Fixtures, Structures and Fastener locations are automatically transferred to VDAF in the correct orientation, along with your NC program, machine and control data, and other simulation parameters. Also, the optional 3D model interface modules allow VDAF to directly open native CATIA and NX part files.

#### Custom Fastener Object Reader

A custom script running inside the CAD system that reads user-defined fastener information and converts it into a VERICUT fastener file, in preparation for programming and simulation. This script is custom-written for each end-user implementation.

#### Vistagy SyncroFIT Interface

A standard interface for reading the assembly, fastener definition, and process information from SyncroFIT's Airframe Design Environment, and prepares files for programming and simulation in VDAF.



# Composite Applications

## Programming & Simulation Software for Automated Fiber-Placement (AFP) and Tape-Laying (ATL) Machines

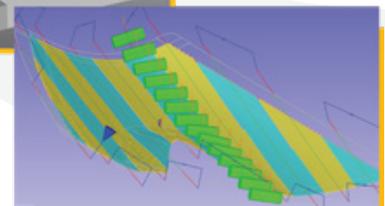
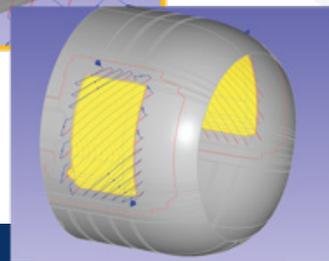
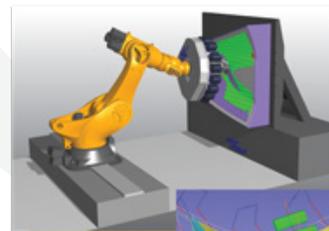
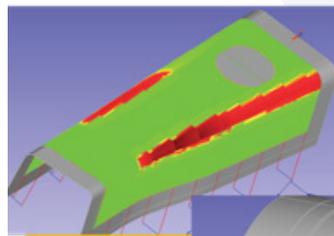
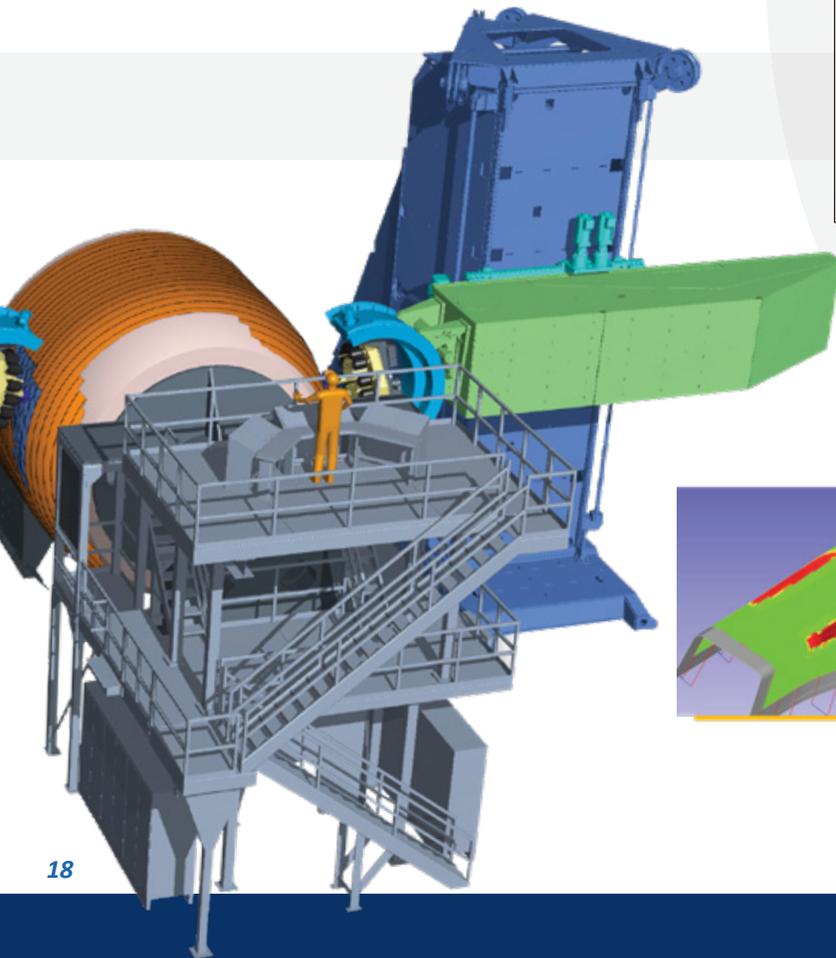
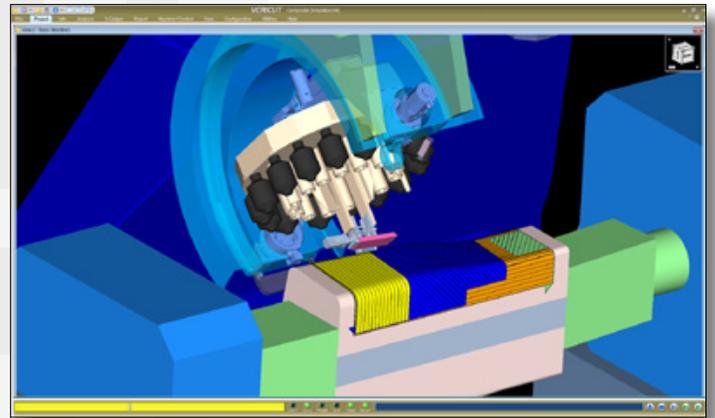
### VERICUT Composite Programming (VCP)

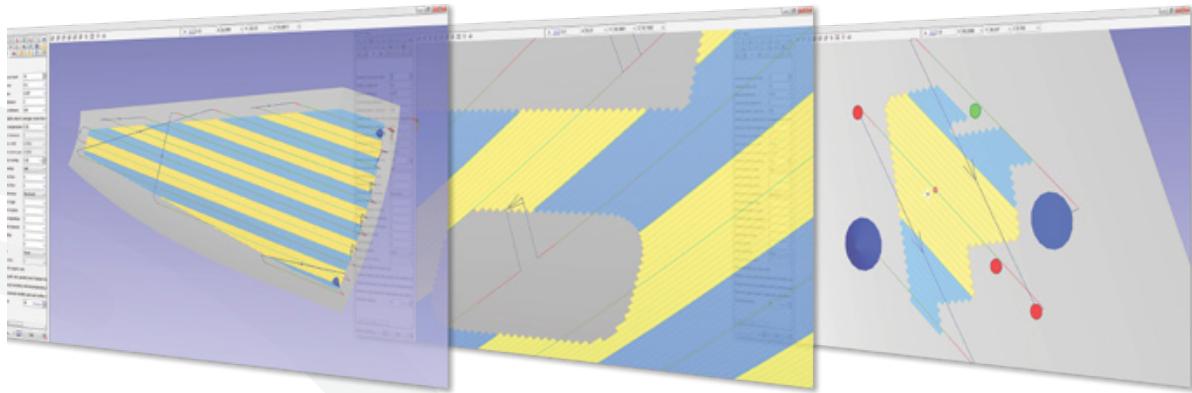
VCP gives a composite part designer, mechanical engineer or process engineer access to the same software tools NC programmers use to create Automated Fiber Placement (AFP) NC program paths. From the designed model to the shop floor, VCP gives you control. Using these tools, the part designer or engineer can easily create and experiment with various AFP path options. They can also evaluate the effects AFP manufacturing has on a composite part's design intent.

### VERICUT Composite Simulation (VCS)

VCS gives an entire organization the confidence needed to run composites NC machines correctly the first time. Users can validate previously programmed NC code of various origins and formats to predict areas of concern, such as:

collisions, NC syntax errors, and material placement quality. Because the material is applied to the layup form via NC program instructions in a virtual CNC simulation environment, the simulated part can be measured and inspected to ensure the NC program follows manufacturing standards and requirements. A report showing simulation results and statistical information can be created automatically to help build confidence to operators and management. VCS can be used to simulate any number of machines, and includes support for probing, knife trimming paths, laser projection, and automated tape laying (ATL) machines.





### VCP Process Features:

Reads CATIA, STEP, Siemens NX, Pro E, Creo, SolidWorks and ACIS surface models

- ✓ Other model formats available upon request

Reads Fibersim, CATIA, and other external ply geometry and information

- ✓ Boundary geometry
- ✓ Ply direction
- ✓ Start points

Generates layup paths based on manufacturing engineering specifications, including:

- ✓ Rosette projection at specified angles
- ✓ Parallel to guiding curve
- ✓ Follows the natural path of the form's surface

Creates NC code for **any** machine vendor, including: Electroimpact, MTorres, Accudyne, AFPT, and others!

### VCS Analysis Features:

Reads CAD geometry of the layup form, machine axes, and work cell

- ✓ Used for collision detection and material application

Uses VERICUT virtual machine and control emulation to simulate the layup machinery

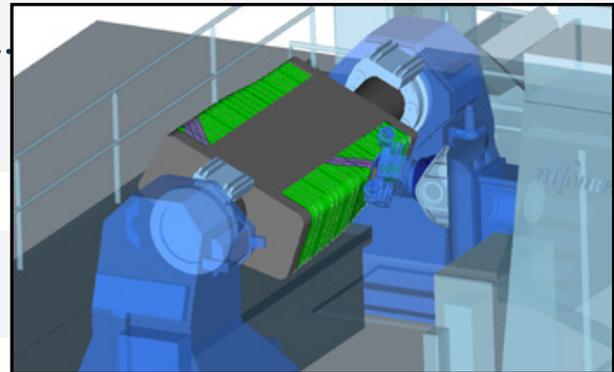
- ✓ Can be configured for virtually any CNC syntax and machine kinematics configuration

Reads the NC program from **any** source and simulates the layup process based on actual NC program commands

- ✓ Validate the actual NC program that will run on the layup equipment
- ✓ Add material to the form based on NC program commands
- ✓ Material is added in discrete layers/sequences, constructing the workpiece exactly like the physical process

Checks the process for compaction roller/form conformance and direction

- ✓ Verify roller orientation to path
- ✓ Verify path correctness to the form and previously applied sequences/layers of material



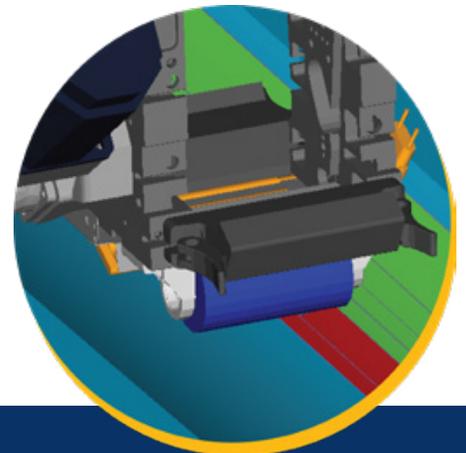
- ✓ Check roller conformance for bridging or excessive compaction

Measures and inspects added material for manufacturing requirements

- ✓ Measure overlap, gap, and thickness
- ✓ Detect steering radius violations

Outputs reports and data

- ✓ Exports reports of machine warnings and errors generated during simulation





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*CGTech® is the leader in CNC machine simulation, verification, and optimization software technology. Since 1988, our products have been the standard in manufacturing industry sectors including aerospace, automotive and ground transportation, mold and die, consumer products, power generation, and heavy industry. With subsidiary offices throughout Europe and Asia, and a global network of resellers,*

*CGTech software is used by companies of all sizes, universities, trade schools, and government agencies.*

*CGTech maintains an active Technology Partnership program. VERICUT users in this program include many of the world's leading machine builders, CAD/CAM developers, and manufacturing software companies.*

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***When you invest in  
VERICUT, you're not  
just buying a software  
program, you're  
teaming up with a  
manufacturing partner  
with the best reputation  
in the business!***

System requirements are subject to change. See the CGTech web site for the most up-to-date product information and system requirements.

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