Automating Out the Skills Gap with PowerMill and FeatureCAM

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NexGenCAM

“The best kind of human life you can actually have is one
in which you apply your reason – your intelligence,
to improve social living;
to improve everybody else’s life”.

-Massimo Pigliucci | TEDxAthens-

Stoicism as a philosophy for an ordinary life

About the speaker

Stan is a 20 + Year CNC machining and programming professional with a wide range of industry experience; including companies like Nike, Lockheed Martin, & Eagle Claw. He has aided several companies, from the aerospace industry to small job shops, with their most complex machining projects. Stan’s expertise is in CNC programming and tool design using Autodesk CAD/CAM platforms, with a focus on Multi Axis/Multi-Tasking manufacturing technology.

The Skills Issue and CNC Programming

More Accurately, we have a Training & Implementation Gap

The most common reason why shops don't train

My Day as a CNC Programmer

20%
SHOP TIME

Time on the shop floor solving problems and proving out programs

10%
Q.A./ DOCUMENT REVIEW

Reviewing prints for future work, solving GD&T issues, helping to get product out of the QA department

40%
ENG, DESIGN, PROJECT MEETINGS & EMAILS!

Meh

30%
PROGRAMMING
15% DESIGN

I didn’t do a whole lot of programming as a programming lead!

Class Focus

- **Building Automation within CAM.**
  - **To use as a tool, to speed up the programming process.**
  - **To use to teach and delegate CNC programming using your organizations processes**
- **Analyzing and choosing your processes for successful automation.**
  - **Mind mapping your processes**
  - **Gathering your team**
- **Identifying the tools for automation in Powermill and FeatureCAM**
  - **Common CAM tools for automated CNC programming**
  - **The FeatureCAM workflow**
  - **The Powermill difference**


Automation for
CAM

Criteria to Automate a Process

- **Specific**
  - The process you choose should be focused on a single problem.
- **Time Saving**
  - In the case of most software processes it should always cut down clicks and reduce the tasks time by a measurable percentage.
  - Create a percentage goal that is realistic to the automations task.
- **Measurable**
  - Results of the automation should be the same across the board for users and clearly defined to the end outcome.
  - Create a S.O.P with the automations instructions that can be easily followed by the intended users.
  - Run tests to determine the measurable outcomes.
- **Executable**
  - Given the inputs, the output and/or results should be able to be made by anyone following the process.
- **Repeatable & Recoverable**
  - All users should be able to duplicate the process with the same results
  - If the automation should fail or breakdown the processes should be retraceable to troubleshoot the issues
  - If the process is damaged it should be backed up as well as documented within the automation so it can be brought back online in a timely manor.

Considerations When Looking to Automate a CNC Programming Process

TEAM

Assemble a team from all of the different aspects of the process that is the focus. A peer review of the automation is key to its success. The team should also consist of a mitigator such as the shop floor supervisor and a control subject such as an operator.

OBJECTIVES OF THE AUTOMATION

Outline the objectives based on the teams criteria from both time savings and training purposes.

In the case of the DT Operation, we came up with the Facing operation, Roughing OP to get rid of material, the contours of the edges, and the dovetails

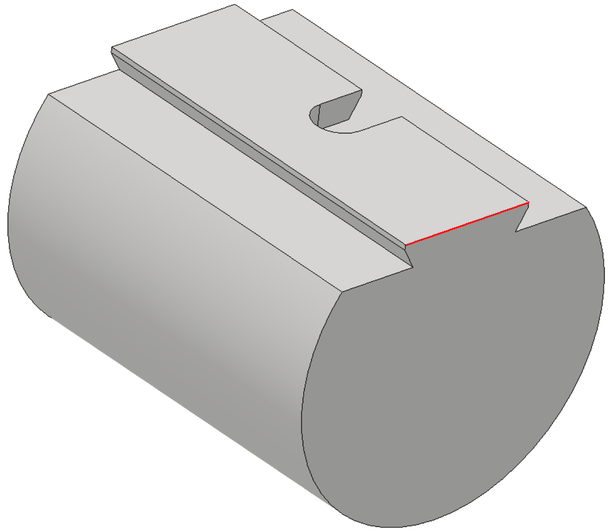
EASE OF USE

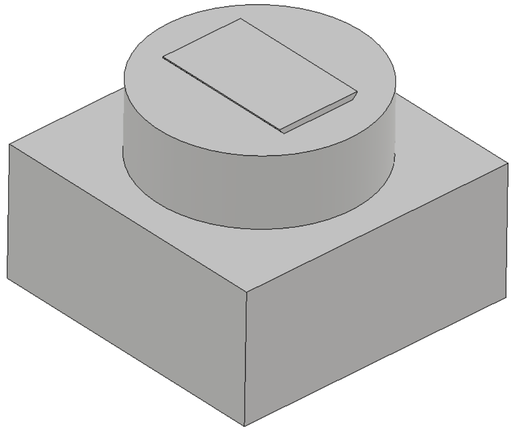
Implementation of the automation should be organic and work with a flow commensurate with the way you would do each processes assigned to the automation. The steps should also be guided within the software to secure its usage without external resources for operational guidance.

AUTOMATION VARIABLES

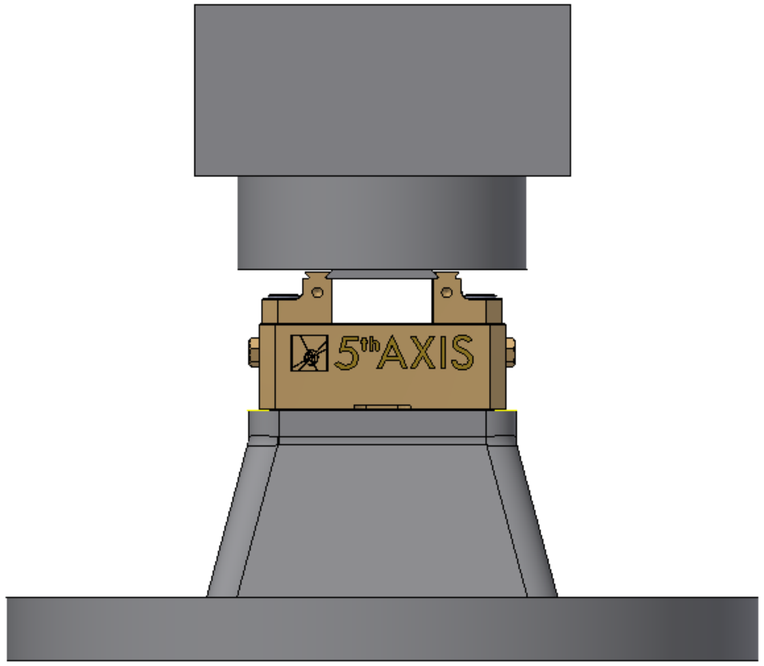
Mind Map the process from start to finish! Chances are you have data to cover most of the variables in the work you do. Leverage this in the team meeting.

The Dovetail Processes





The dovetail operation is a preparation OP preformed to put a dovetail feature on to the stock used for the part to secure and hold the work for the 5th axis machine both rigidly and allowing the most access to the works features.



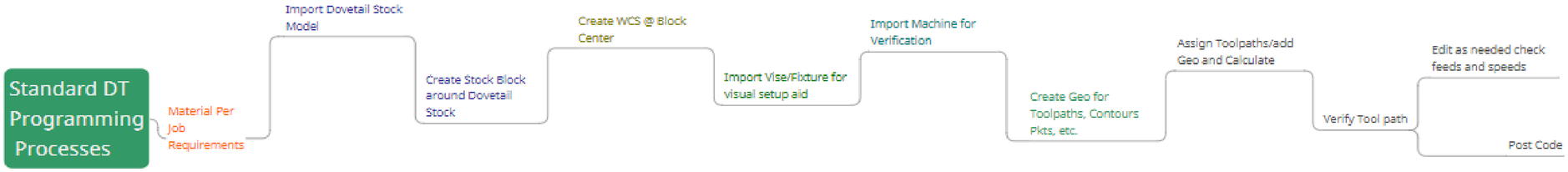
We decided to use the dovetail operation for several reasons.

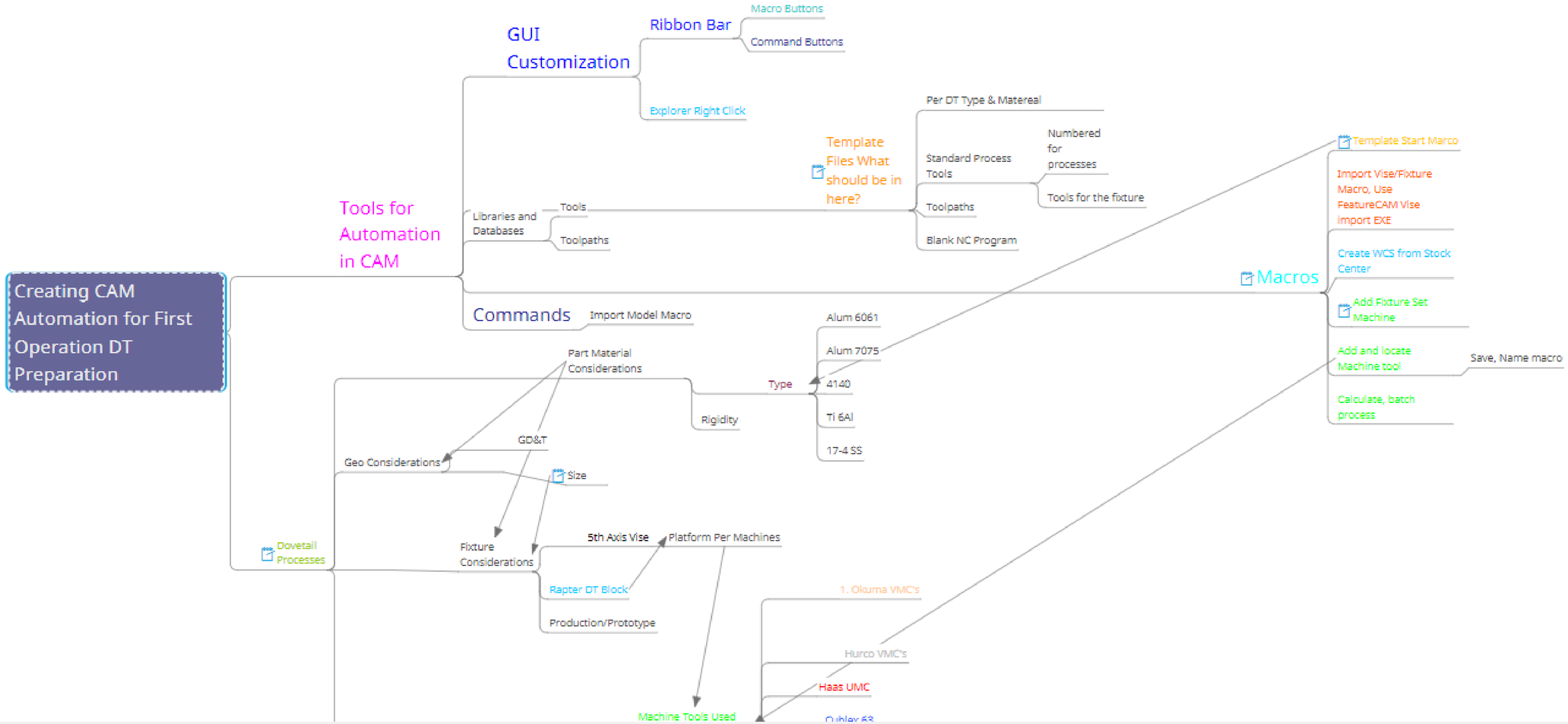
- The dovetail prep op has versatility and a large amount of variables that if properly automated could save time.
  - Stock preparation operations are great learning tools and can be easily preformed by those newer to the organization
    - Automating this process and delegating it frees up programming time that can be used at he more difficult level of operations.

Criteria to Automate the dovetail Process

- **Specific-** **The dovetail stock preparation for 5th axis machining.**
- **Time Saving-** **Reduce the steps to successful toolpaths and posted code by 30% or more based on complexity.**
- **Measurable-** **Typical dovetail programming time through the machine shop and time spent by the programmer on this task. (process as is)**
- **Executable-** **Process was completed and can be replicated 100% (Test)**

The Mind Map


Standard DT Programming Processes
Material Per Job Requirements
Import Dovetail Stock Model
Create Stock Block around Dovetail Stock
Create WCS @ Block Center
Import Vise/Fixture for visual setup aid
Import Machine for Verification
Create Geo for Toolpaths, Contours Pkts, etc.
Assign Toolpaths/add Geo and Calculate
Verify Tool path
Edit as needed check feeds and speeds
Post Code


Creating CAM Automation for First Operation DT Preparation
Tools for Automation in CAM
GUI Customization
Ribbon Bar
Macro Buttons
Command Buttons
Explorer Right Click
Libraries and Databases
Tools
Toolpaths
Template Files What should be in here?
Per DT Type & Matereal
Standard Process Tools
Numbered for processes
Tools for the fixture
Toolpaths
Blank NC Program
Commands
Import Model Macro
Macros
Template Start Marco
Import Vise/Fixture Macro, Use FeatureCAM Vise Import EXE
Create WCS from Stock Center
Add Fixture Set Machine
Add and locate Machine tool
Save, Name macro
Calculate, batch process
Dovetail Processes
Part Material Considerations
Type
Alum 6061
Alum 7075
4140
Ti 6Al
17-4 SS
Rigidity
GD&T
Geo Considerations
Size
Fixture Considerations
5th Axis Vise
Platform Per Machines
Rapter DT Block
Production/Prototype
Machine Tools Used
1. Okuma VMC's
Hurco VMC's
Haas UMC

Typical Tools for CAM Automation

- **Tool Libraries**
  - **Created with material specific cutters and typical machine requirements .**
  - **Organized with a naming convention that points to specific use. Use abbreviations and have a legend to follow. (3/4 CEM 4FL 1.25 LOC Adaptive RGH 300 SST)**
  - **Searchable to all user for the specific programming task.**

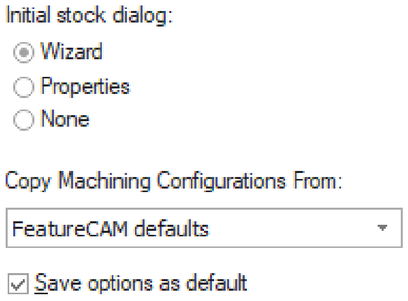
Toolpath Templates

- **Pre-populated toolpaths specific to the programming task.**
- **Named to the programming task as well as any hint to its function and geometry. (Curve Pro DT Cuts)**
- **If using abbreviations be sure there is a legion to follow. (RGH = Roughing, FIN= Finish)**

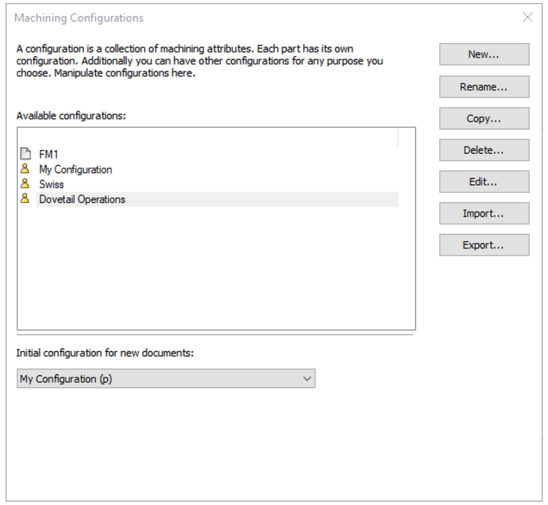
GUI Customization

- **Customize built tool bars and options to streamline processes.**

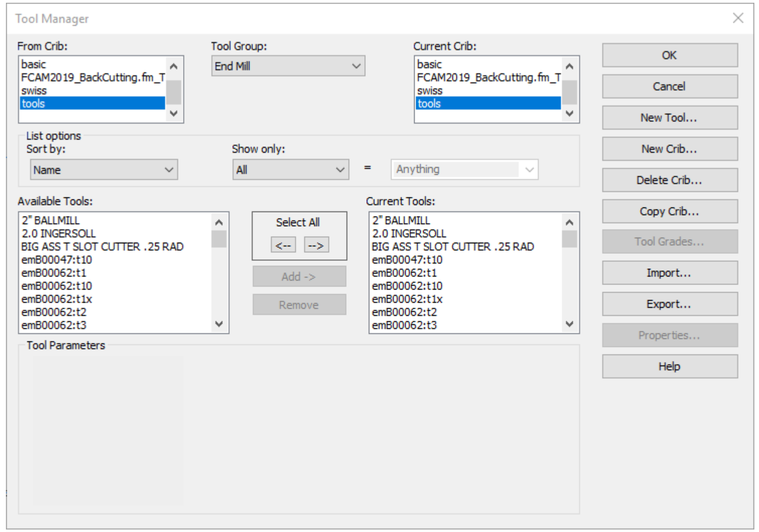
Wizard Guided Interface



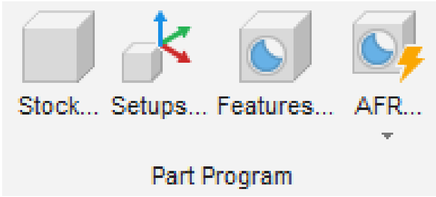
Machine/Feature Specific Settings



Tools and Libraries Assigned to the Feature Operations

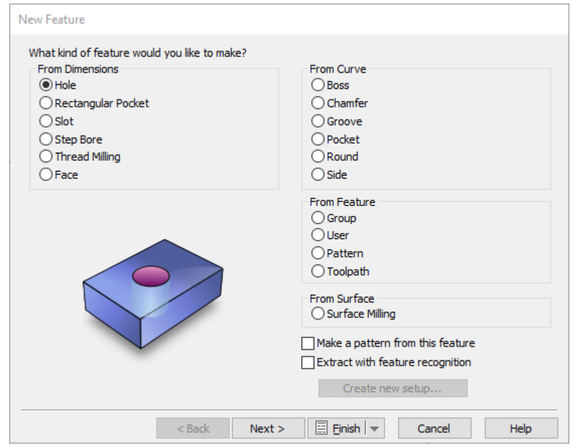


Automatic, Guided, and Manual Feature Creation Tools

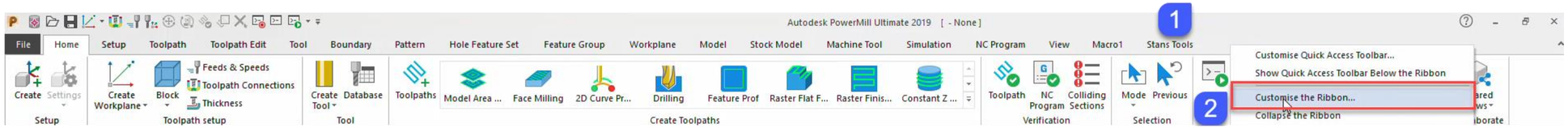


FeatureCAM

FeatureCAM’s unique wizard driven interface is one of the best tools to capture and customize your shops knowledge base to automate any operation.



Complete GUI Customization for Workflows



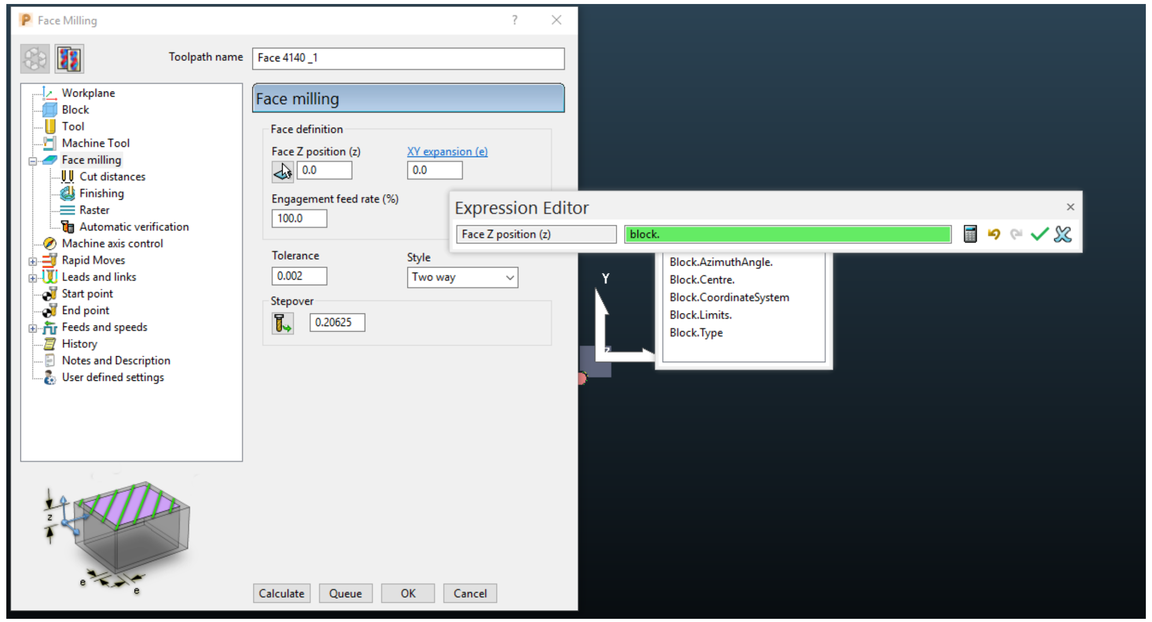
Template objects

Save as a set of template objects.

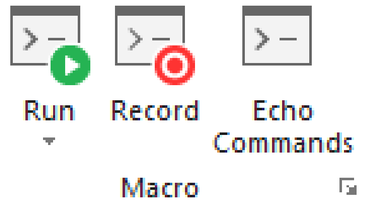
Powermill

PowerMill being true to its name gives the user complete access to customization tools, the API in every field, and most importantly is it's ability to record clicks and automatically create macros for operations.

Wide Open & Complete Access to the API, nothing is hidden in PowerMill



Custom Macro's



GUI Customization

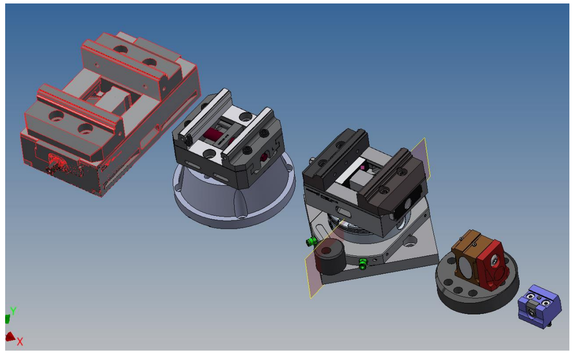
Templates Object Files

Template Criteria Details

FIXED OR MOST COMMON VARIABLES

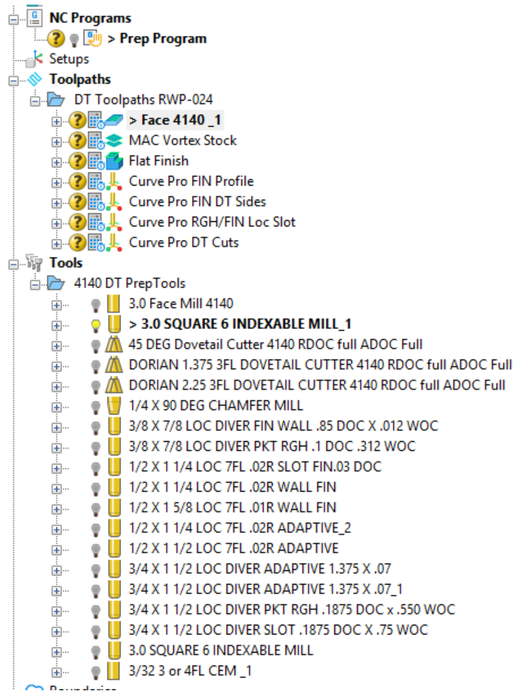
From the meeting on the process, what were the key variables that control the majority of the process?

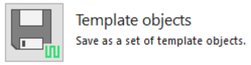
For our demonstration they are; Material and DT Work holding solution. These are what you will want to make the template around, named to the parent process.



FLEXIBLE VARIABLES

These are the processes in the template file that will be able to be changed or altered to the fixed or common variables. For this demonstration they are the NC Program, Toolpaths, and Tools.





Macros and Custom Commands

Macro’s VS Commands

CUSTOM COMMANDS

Theses are just functions within Powermill that execute the single command prompt selected or typed into the Echo commands window. Use this tool when you want to execute just one command.

MACRO COMMANDS

Macro’s are a series of commands tied together to preform an operation and can be sequenced together or nested to achieve the desired results. Macros can also be assigned to a button for ease of access.

Use the echo command and preform the task you want to assign to an automation function. If it is more than one line it is recommended that you wright a macro to preform this.

Using the Automation

EXPERT
HELP
IS HERE

Get help for training, software development, customization, and more.

NexGenCAM

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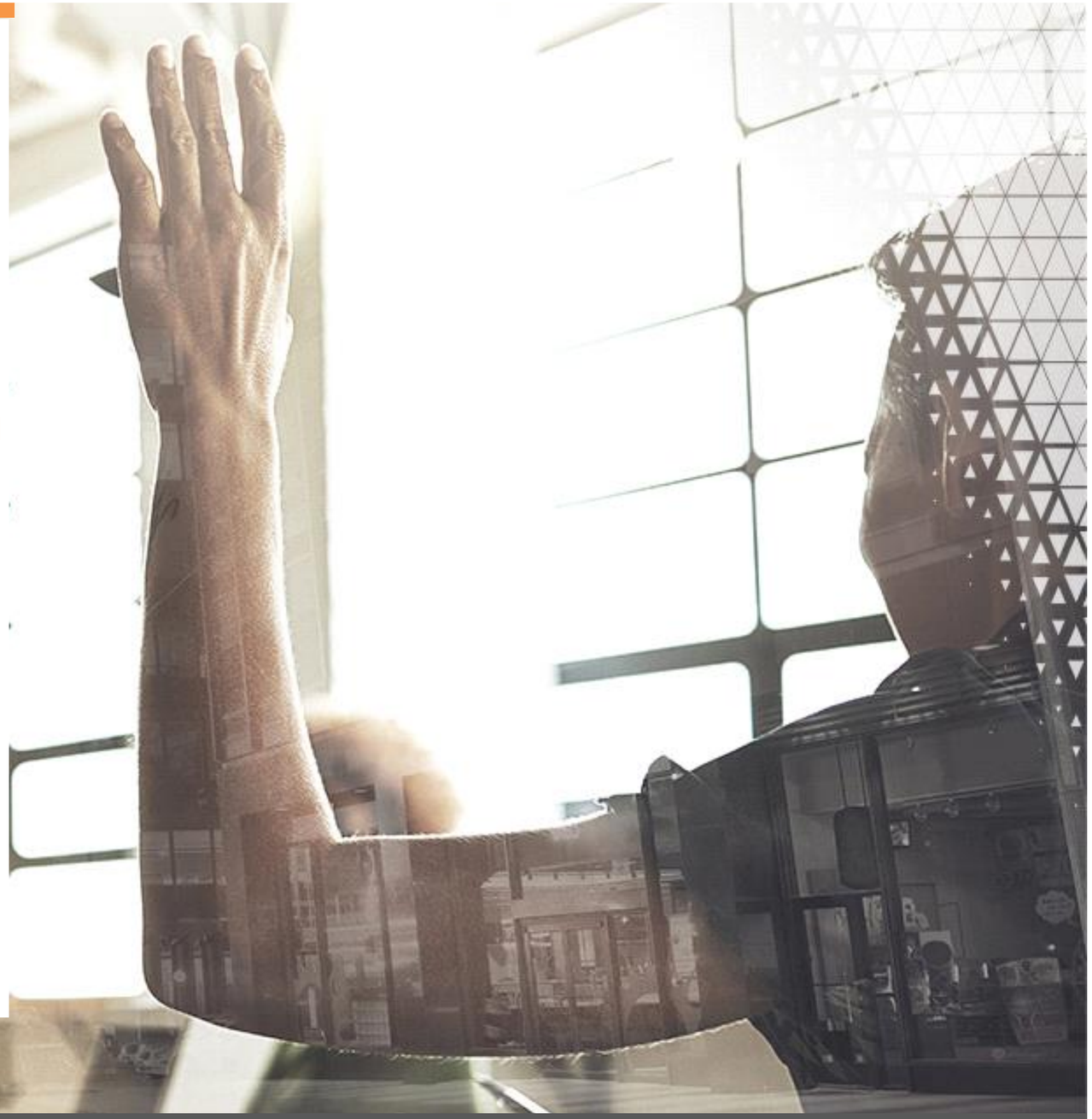

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