Mill Turn Best Practices

Unigraphics® NX 2

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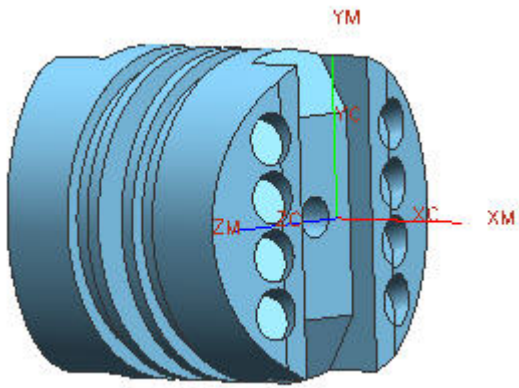

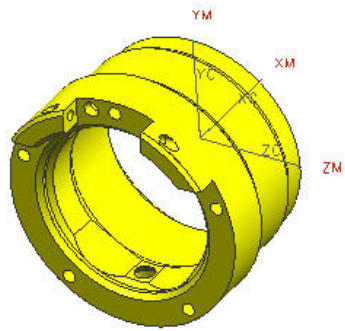

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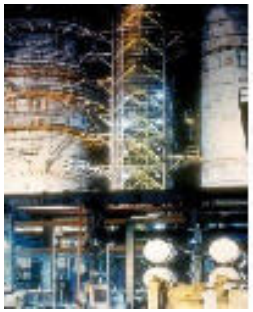

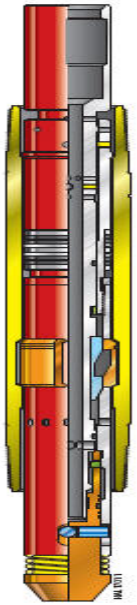

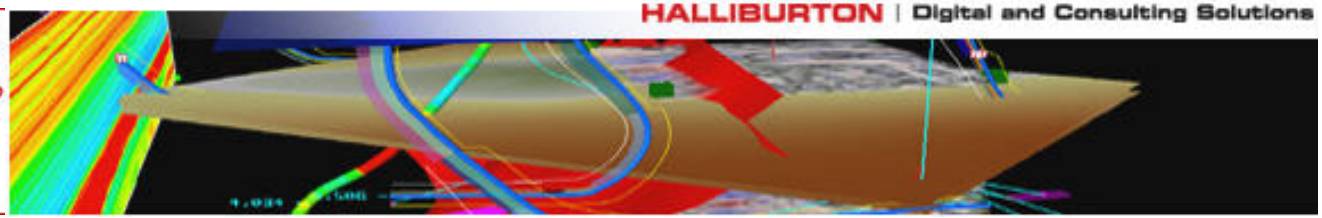

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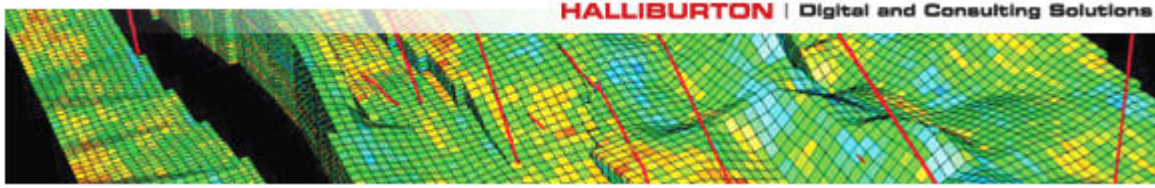
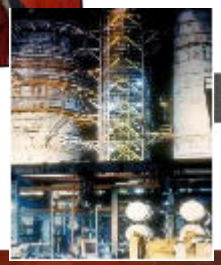
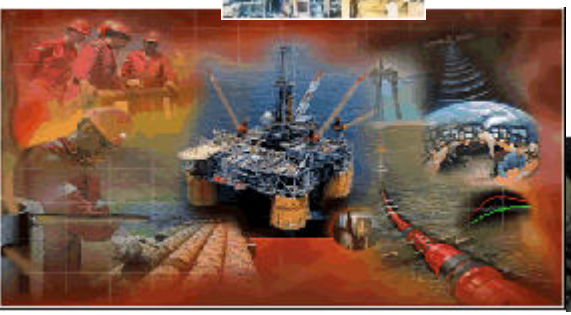






Mill Turn Best Practices

Mazak MULTI-TASKING

- **What Mazak Multi-Tasking can do for you:**

- Compress lead times - from days to hours
- Reduce lot sizes with no cost penalty - lots of one, or assembly kits
- Improve cash flow - higher frequency shipments
- Reduce part costs - fewer fixtures, tools and FAR LESS LABOR
- Slash non value-added time - multiple setups, handling, and queue time
- Improve part accuracy - no tolerance build-up
- Reduce shop burden - fewer machine tools/space/utilities
- Run "lights-out" - increase cutting time, but not labor costs
- Increase throughput and profitability

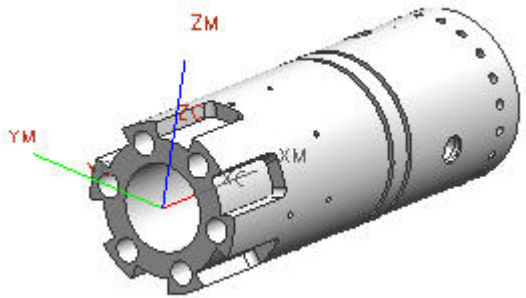
Mill Turn Best Practices

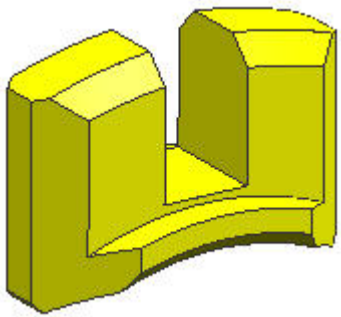
What are your M/T Best Practices

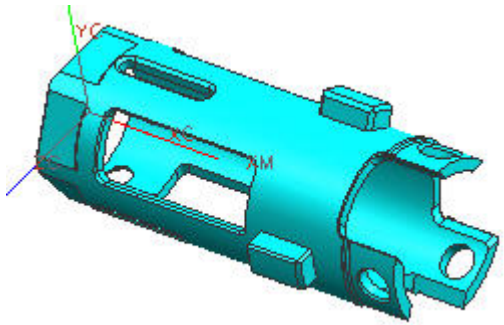
- Work Space Requirements
- Defining Tooling
- Organizing NX
- Post Processor Creation and Testing
- Verification
- Communication
- Refining

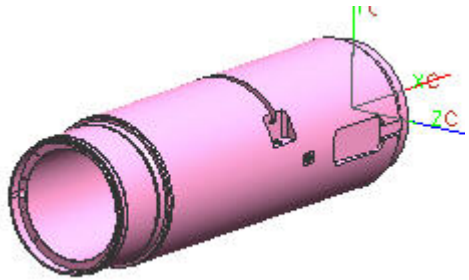
Mill Turn Best Practices

- What Equipment Should You Buy?
  - Defining the work envelop is critical
  - Work space restrictions
  - Volume requirements









Mill Turn Best Practices

“Do I have to?”

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Mill Turn Best Practices

Mill Turn Best Practices

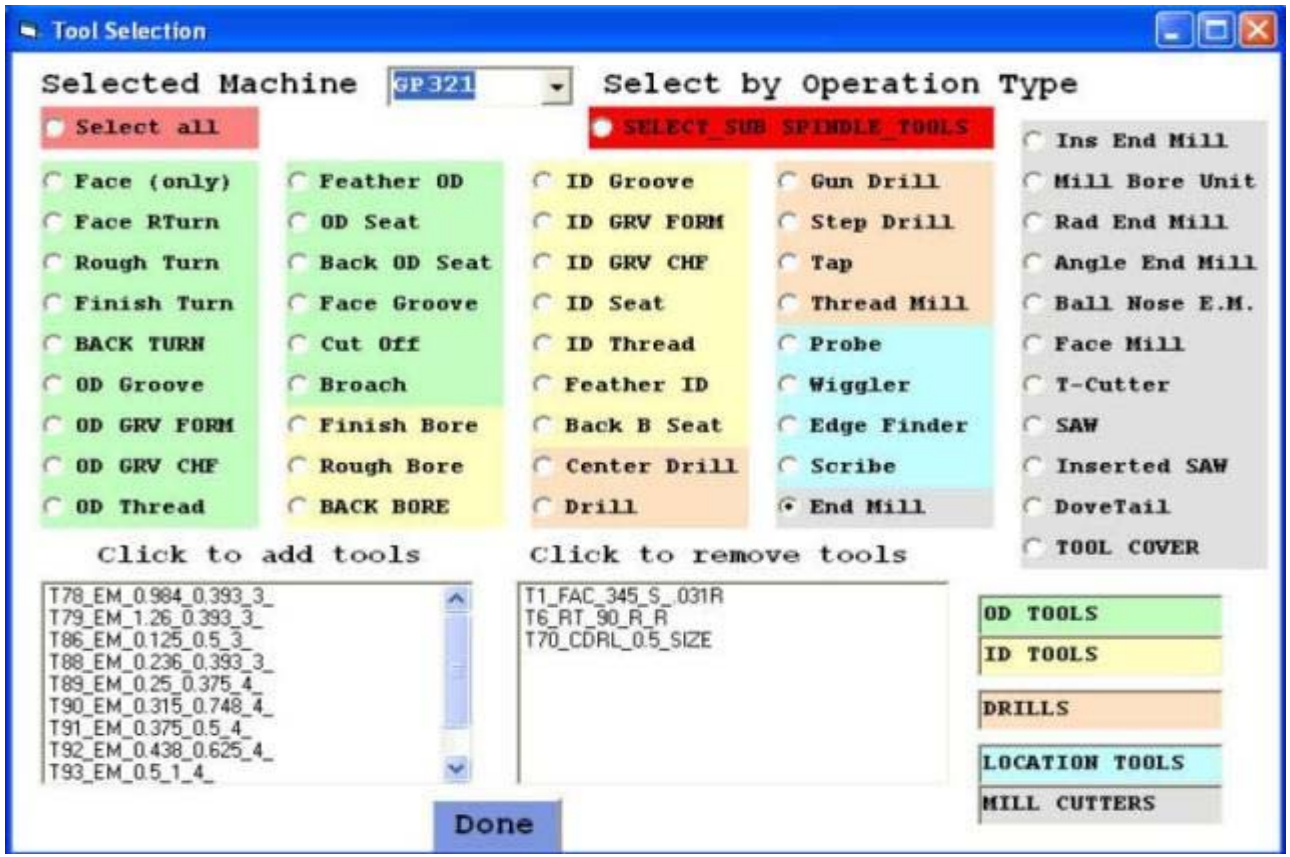
Mill Turn Best Practices

- Tooling Impacts are HUGE
  - You can not program with out first defining tooling
  - Should all the machines in the cell have the same tooling?
  - Tooling is the second largest cost next to the machines themselves (example 120 pockets x $500 = $60,000)
  - Tooling changes require reprogramming
  - Always maintain tooling packages in NX

Reduce your stress level by dedicating the necessary resources for Tooling

Mill Turn Best Practices

Make a Tool Library and Maintain it



Mill Turn Best Practices

Make the tooling available to everyone

HALWORLD

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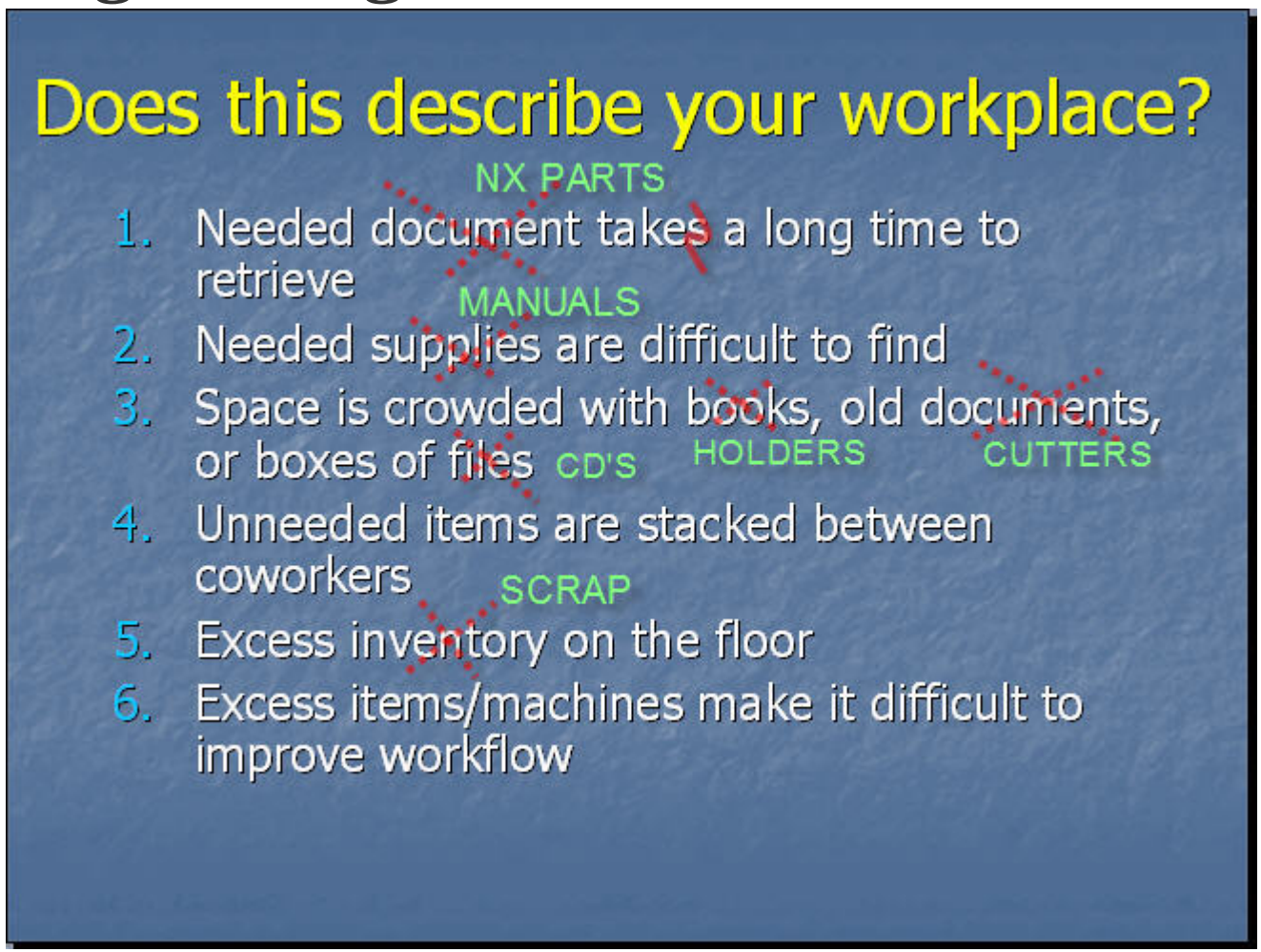
Carrollton Electronic Tool Book

Title	Revision Date
Drawing Tab-Ons	March 17, 2006
Tool Classification Guide	July 29, 2005
Tool ASSY Book	December 27, 2005
A Book	
• AA-AC External Lathe Tools	March 10, 2006
• AD-AX External Lathe Tools	March 10, 2006
B Book	
• BA-BD Internal Lathe Tools	March 10, 2006
• BE-BX Internal Lathe Tools	March 10, 2006
C Book - Milling Cutters	March 17, 2006
D Book - Drilling Tools, Access	March 17, 2006
E Book - Grooving Tools	March 17, 2006
F Book - Taps & Accessories	February 24, 2006
J Book - Threading Tools	March 17, 2006
M Book - Milling Accessories	March 10, 2006
R Book - Reamers & Accessories	January 17, 2006
Turning Insert Book	March 17, 2006
MISC	

Mill Turn Best Practices

Organizing NX



Mill Turn Best Practices

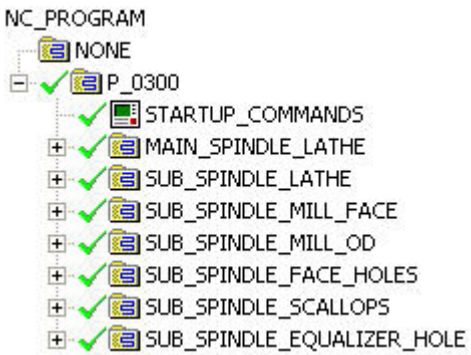
Organizing NX

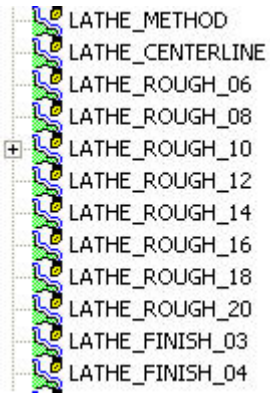
“A clean office is a productive office”

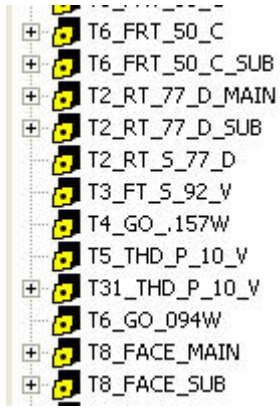
Mill Turn Best Practices

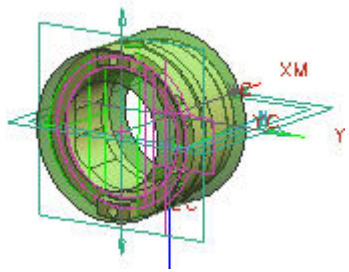
Organizing NX

- Remove any unused programming data
  - Program Groups
  - Tooling Groups
  - Geometry Groups
  - Method Groups









Mill Turn Best Practices

Organizing NX

- Naming conventions should be standardize through out the cell
- Names should describe the operation
- Names can be carried over to the set up instructions
- Defining templates will help

Mill Turn Best Practices

Organizing NX

- Set up instructions should be extracted from the operation names
- RSBLK# represents the starting place in the program to restart a certain tool#

POS.	OFF SET	----- CUT DESCRIPTION -----	RSBLK #
1	001	FACE BFACE 2TMS MAIN	N1
3	003	ROUGH TURN OD MAIN	N2
4	004	FINISH TURN OD MAIN	N3
25	025	RGH GROOVE OD MAIN	N4
28	028	FIN GROOVE OD MAIN T28-ID	N5
78	78	MILL 15DEG-AT-C270.	N6
78	78	MILL 15DEG-AT-C90.	N7
77	77	RGH MILL 30DEG AT-CO.	N8
77	77	RGH MILL 30DEG AT-C180.	N9
77	77	RGH MILL CENTER AT C90.	N10
93	93	FIN MILL CENTER AT-C90.	N11
93	93	FIN MILL CENTER AT-C270	N12
93	93	FIN MILL 30DEG AT-CO.	N13
93	93	FIN MILL 30DEG AT-C180.	N14
89	89	MILL1 15-17DEG ANG CBORES MAIN	N15
54	54	DRILL CENTER HOLE MAIN	N16
99	99	DEBURR HOLE AND SIDES	N17
99	99	DEBURR RIGTH SIDE OF PART MAIN	N18
99	99	DEBURR LEFT SIDE OF PART MAIN	N19
104	104	THREAD MILL .375-16 MAIN	N20
4	004	DEBURR FACE-N-OD MAIN	N21
		PART TRANSFER 9001 MAIN 2 SUB G59A	N22
1	201	FACE BFACE SUB 1TIME	N23
3	203	ROUGH TURN OD SUB	N24
4	204	FINISH TURN OD SUB	N25
25	225	RGH GROOVE OD SUB	N26
28	228	FIN GROOVE OD SUB T28-ID	N27
78	78	MILL 15DEG-AT-C270.	N28
78	78	MILL 15DEG-AT-C90.	N29
77	77	RGH MILL 30DEG AT C18O.	N30
77	77	RGH MILL 30DEG AT-C90.	N31
77	77	RGH MILL CENTER AT C90.	N32
93	93	FIN MILL CENTER AT-C90	N33
93	93	FIN MILL CENTER AT-C270.	N34
93	93	FIN MILL 30DEG AT-CO.	N35
93	93	FIN MILL 30DEG AT-C180.	N36
89	189	MILL1 15-17DEG ANG CBORES	N37
54	54	DRILL CENTER HOLE SUB	N38

Mill Turn Best Practices

Post Processor Creation and Testing

- Your largest technical challenge
- Build and test your post processor before going into production
- Allow considerable time for testing
- Use **ONLY** well established vendors to write your posts
- Expect crashes

Mill Turn Best Practices

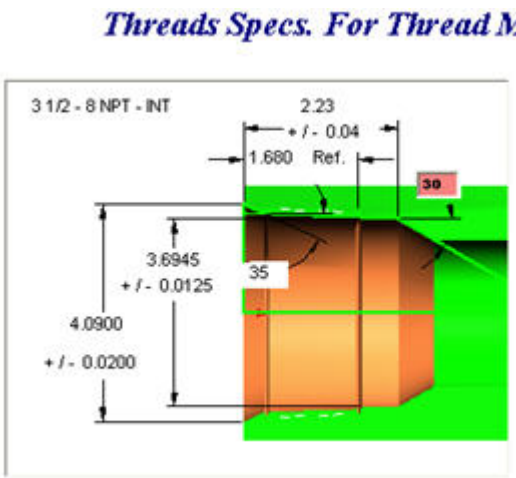
Post Processor Creation and Testing

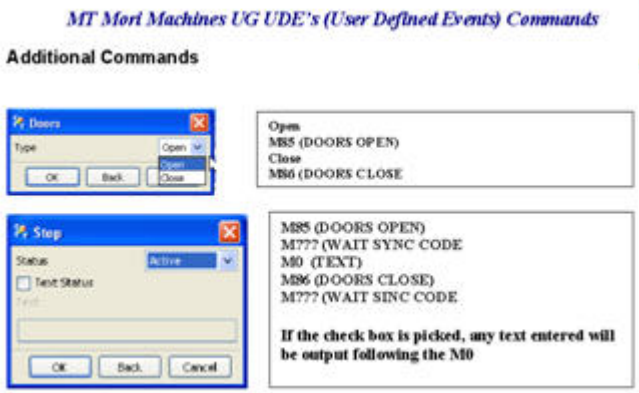
- Halliburton Carrollton uses **UG POST Builder**

Mill Turn Best Practices

Post Processor Creation and Testing

- UDE (User Defined Events)
  - Excellent for tough to define G and M codes
  - Draw back is they don't display in verification
  - Documentation is a must!





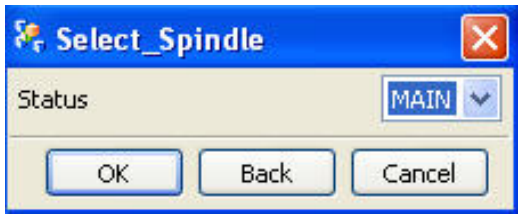
After working on the part in the sub spindle, use this command to return the part to the Main spindle.

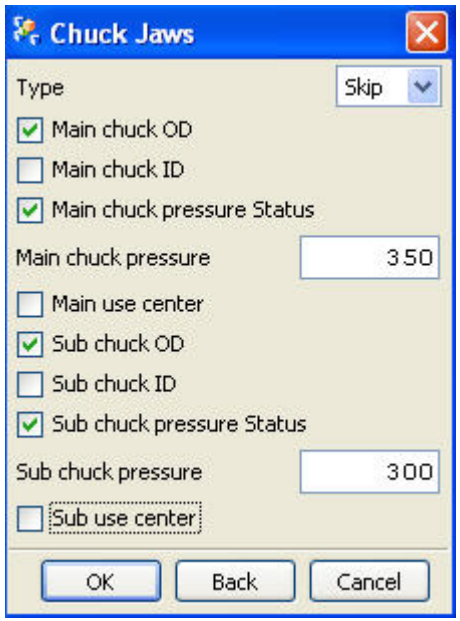
```
M??? (WAIT SYNC CODE)
M1
(RETURN PART TO MAIN)
G28 U0. V0.
N?? (RESTART RETURN PART TO MAIN)
(PUT LBB BLANK IN PLACE)        } if LBB was
G461 A1.                        } previous tool
T??
G362 B-90. D1.
M11 (MAIN CHUCK OPEN)
G04 X5. (DWELL)
(ALIGN CHUCKS)
M45 (MAIN MILLING MODE)
M69 (UNCLAMP MAIN)
G28 H0. (HOME MAIN SPINDLES)
M245 (SUB MILLING MODE)
M269 (UNCLAMP SUB)
G28 H0. (HOME SUB SPINDLE)   * 321
G04 X3.0                     * 321
M46 (MAIN MILLING MODE)      * 321
G28 E0. (HOME SUB SPINDLE)   * 361
G58 (G58 A FOR SUB TO MAIN)
M79 (INCLAMP SUB)
M348 (STEADYREST SYNC RELEASE) only if SR
closed
G0 A2.
G1 G98 A0. F20.
M349
M10 (MAIN CHUCK CLOSE)
G04 X5. (DWELL)
M??? (WAIT SYNC CODE)
```

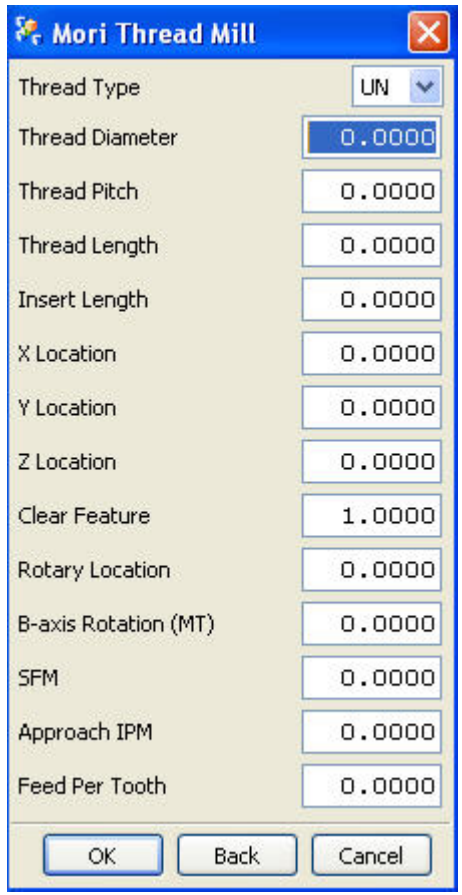
Mill Turn Best Practices

Post Processor Creation and Testing

- Some examples of simple to complex UDE's we use daily



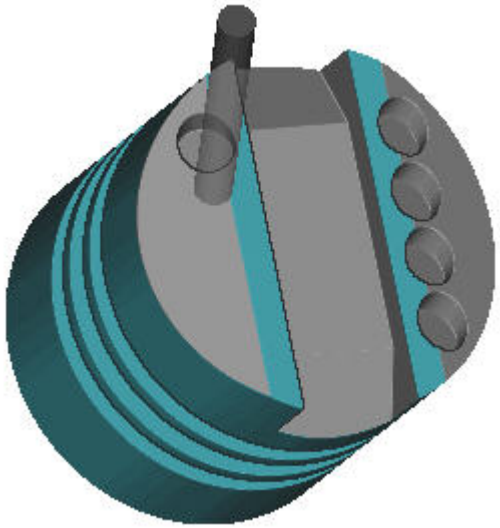


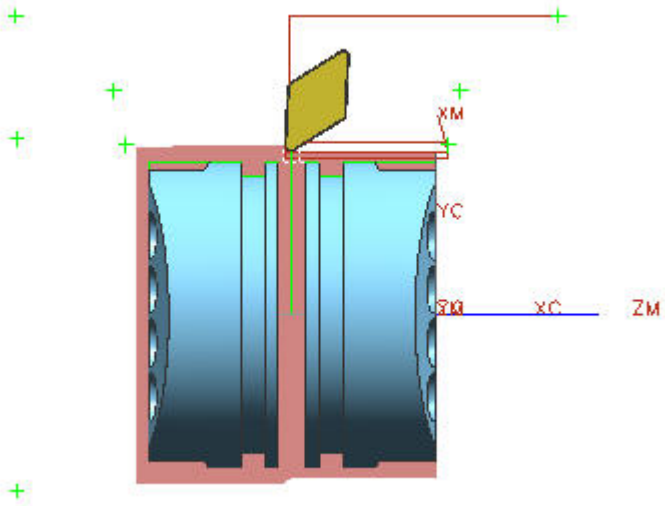


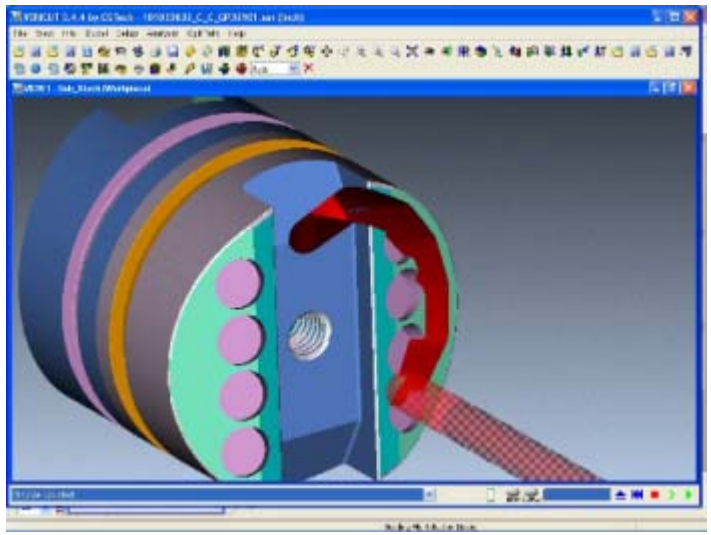
Mill Turn Best Practices

Verification

- Verification is vital during the testing of new post processors







Mill Turn Best Practices

Verification

- UDE's are not visible during verification
- Finding G and M codes that are incorrect is very time consuming and almost impossible in some cases
- 137 pages of code = 130,690 characters
- FIND THE BAD G CODE

```
X-.0175 Y.94
X-.0013 Y.9322
X.018 Y.9265
G0 X.0189 Z1.2389
G40
G0 X-.9672 Z-1.1407 (PROGRAM CRASH)
M269 (UNCLAMP SPINDLE)
G0 C319.75
M268 (CLAMP SPINDLE)
G0 X-1.6468 Y-.0974 Z1.5847
Z.5018
G41 G1 G99 X-1.648 Y-.0965 Z.5017 F.002
X-1.6592 Y-.084 Z.5004
```

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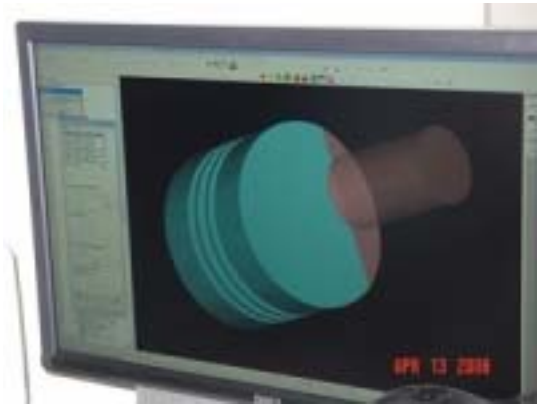
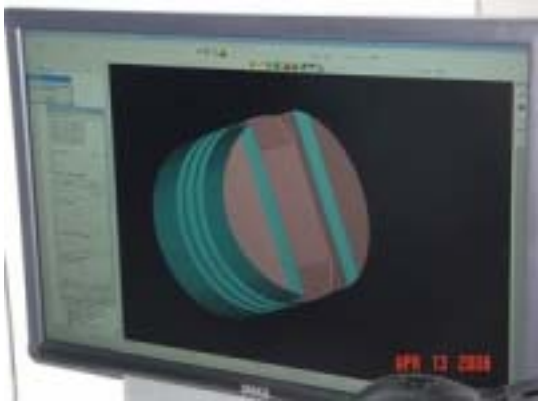
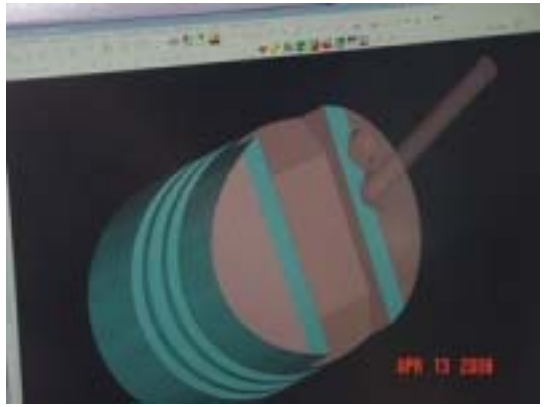
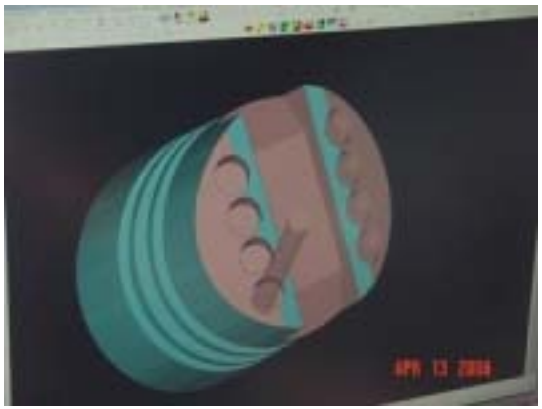
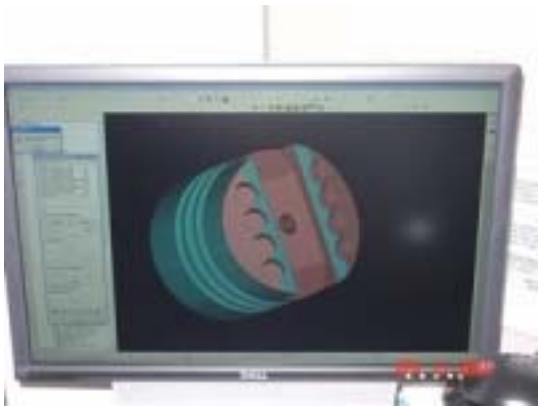
Verification











Mill Turn Best Practices

Communication

- Creating a team for startups works best
- These should include a machine operator, a programmer and the post writer
- Everyone should experience running the machine
- Learn the M and G codes

Mill Turn Best Practices

Communication

- Providing a terminal at the machine is a priority
- Use the functionality inside of NX to create a useful setup sheet
- A level of confidence between the team is essential
- Would you run your own programs?

Mill Turn Best Practices

Communication

“Trust me, I figured out the problem this time”

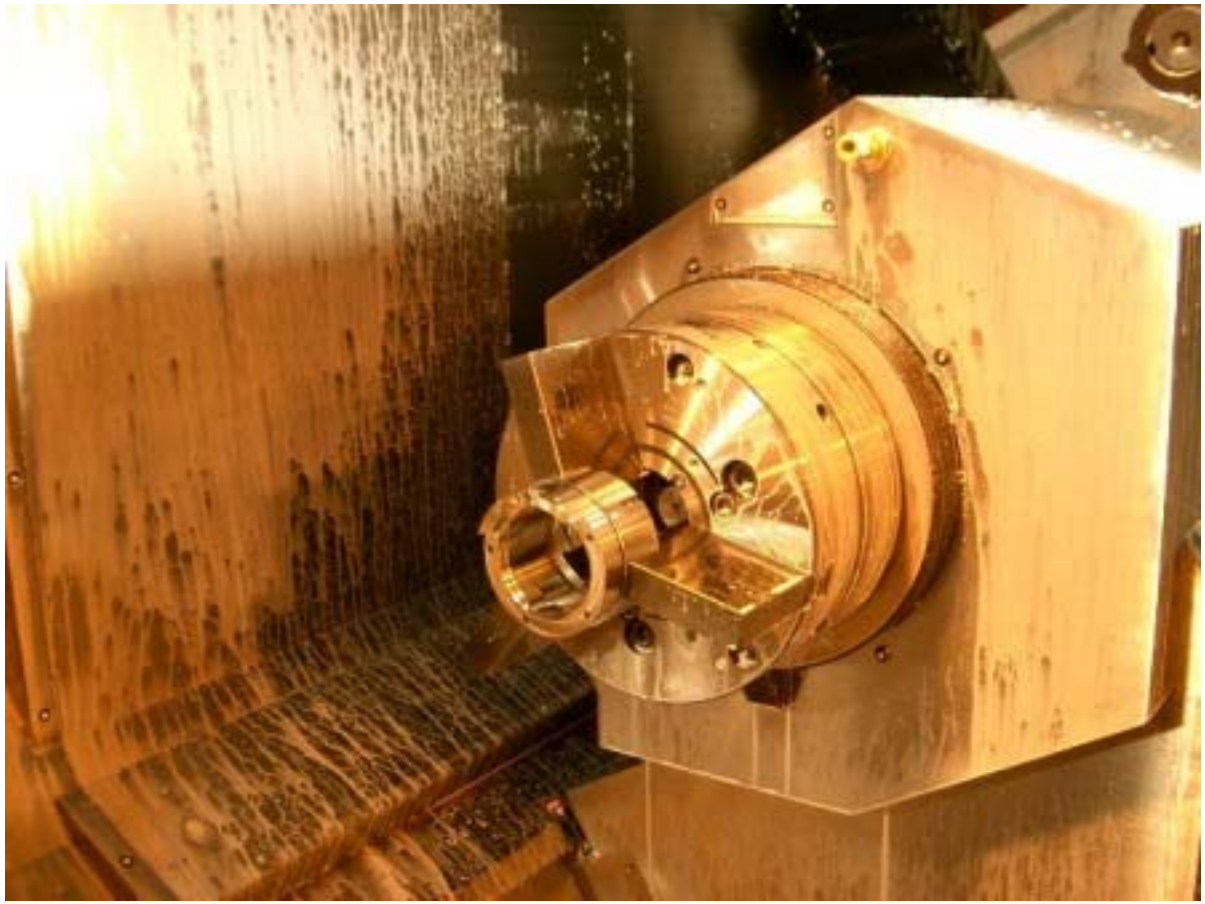
Mill Turn Best Practices

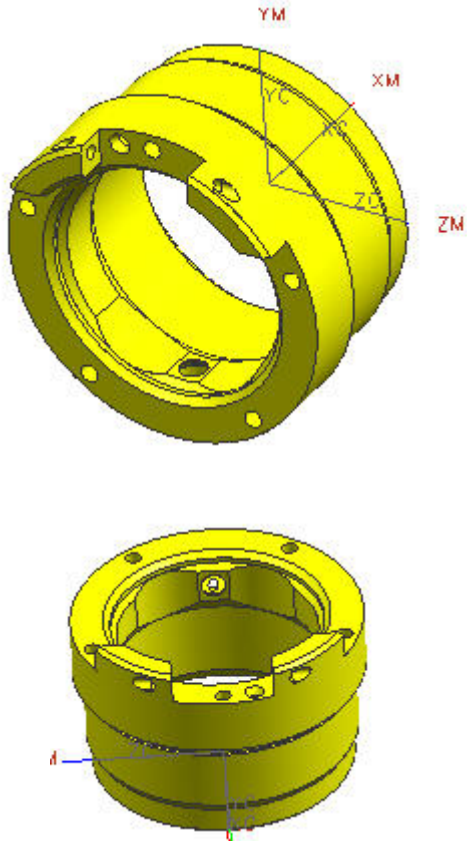
Refining

- This takes patience, be sure your schedule allows adequate time for tune ups
- Expect setbacks
- Start simple
- Speed will come after the process is developed

Mill Turn Best Practices

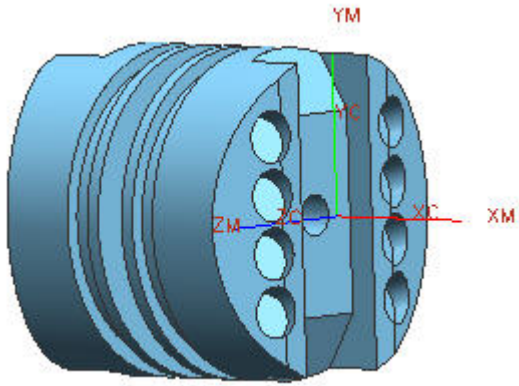
Mori Seiki Sub Spindle

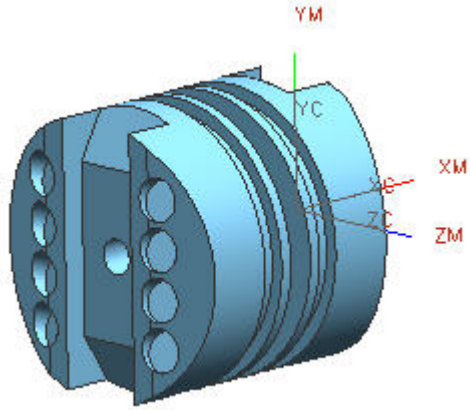




Mill Turn Best Practices

Mori Seiki Sub Spindle





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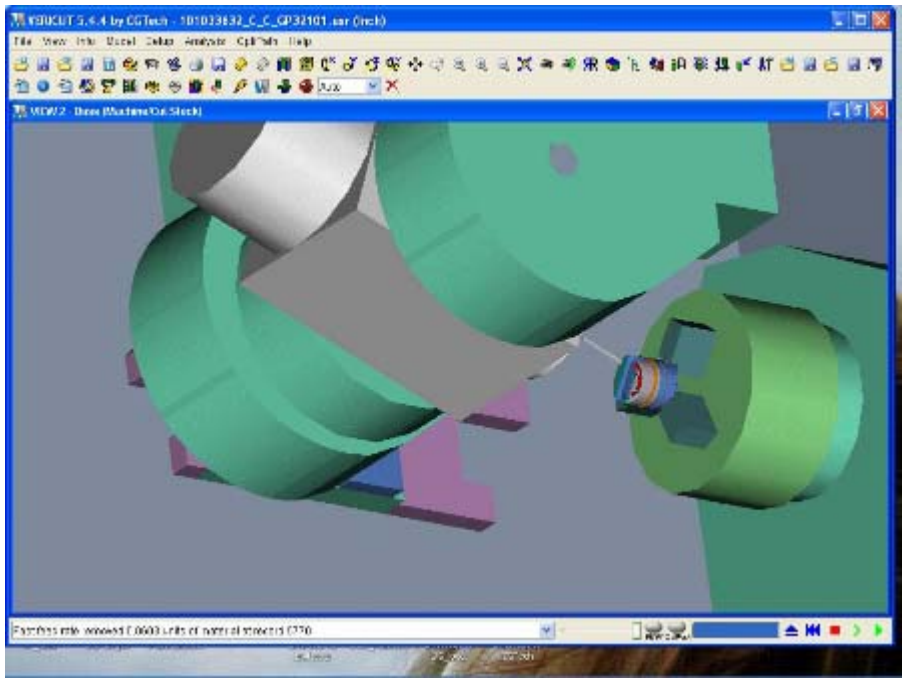

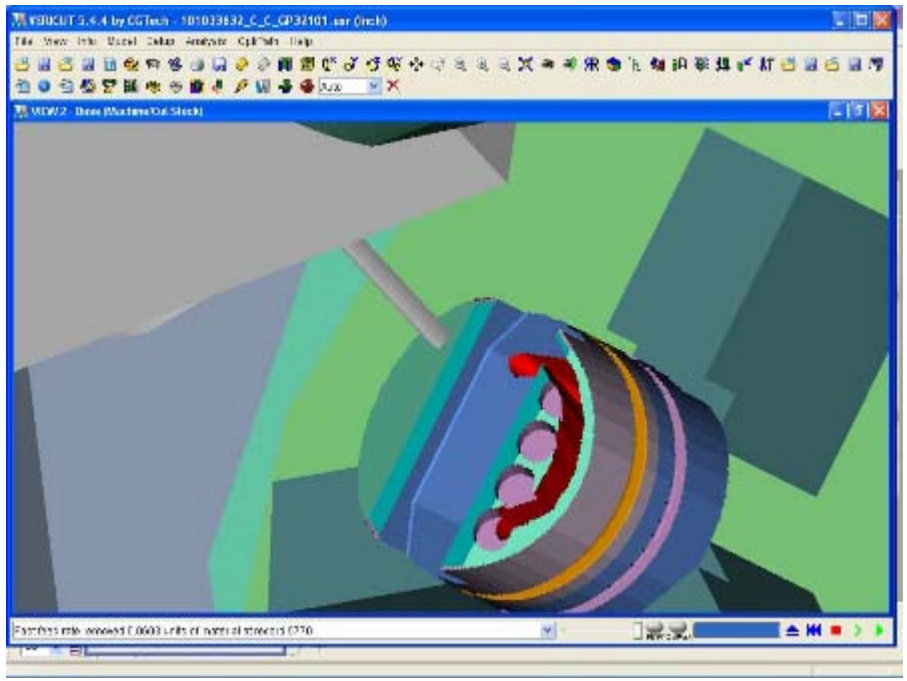

Mill Turn Best Practices

Please help in thanking the following contributors:

Celso Garza
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