Growing into a 5 axis

John Saunders

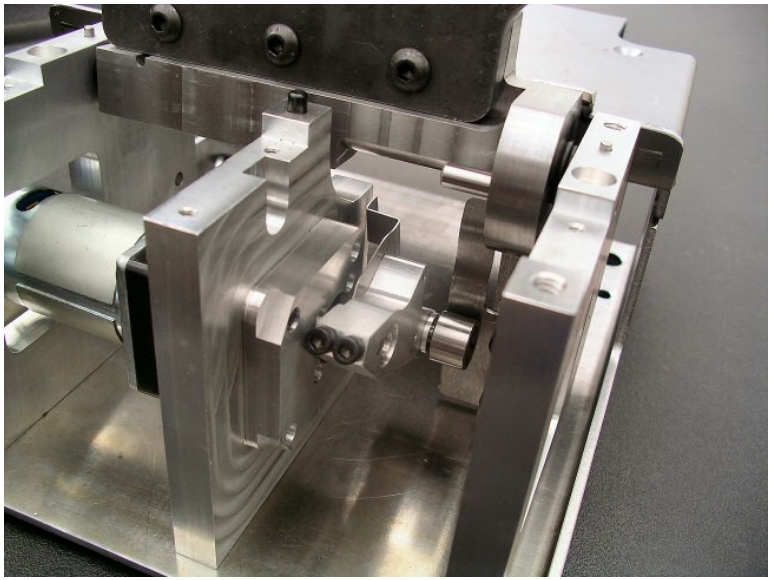
Saunders Machine Works / NYC CNC

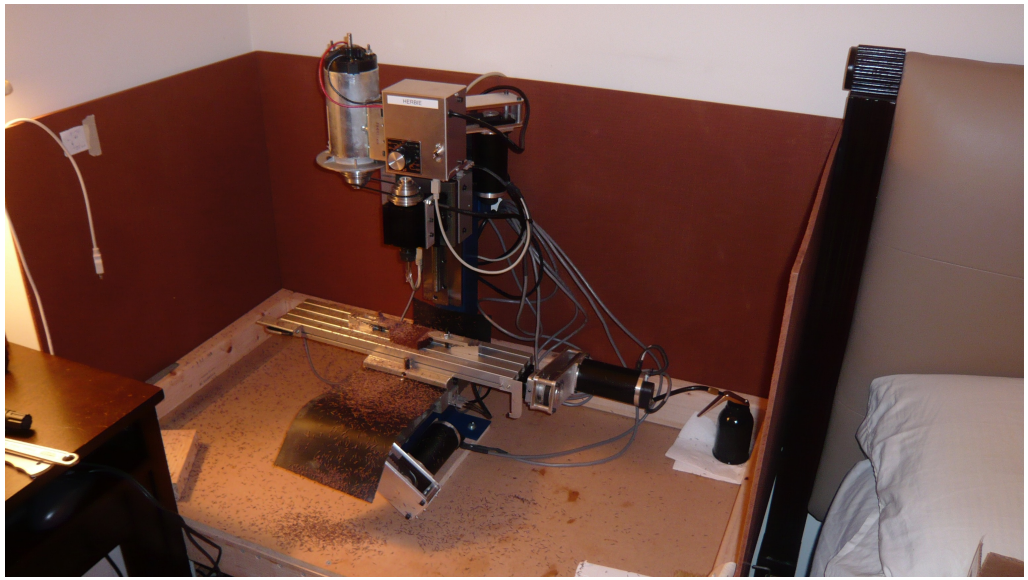
About the speaker

- **Saunders Machine Works**
  - Fixture Plates & Mod Vise
- **NYC CNC**
  - YouTube Channel on CNC Machining, Fusion 360
  - NYCCNC.com – Manufacturing Entrepreneurship Resources
  - Hands On CNC Training Classes
- **ProvenCut**
  - Use it each time you program a new part
  - Better Feeds & Speeds

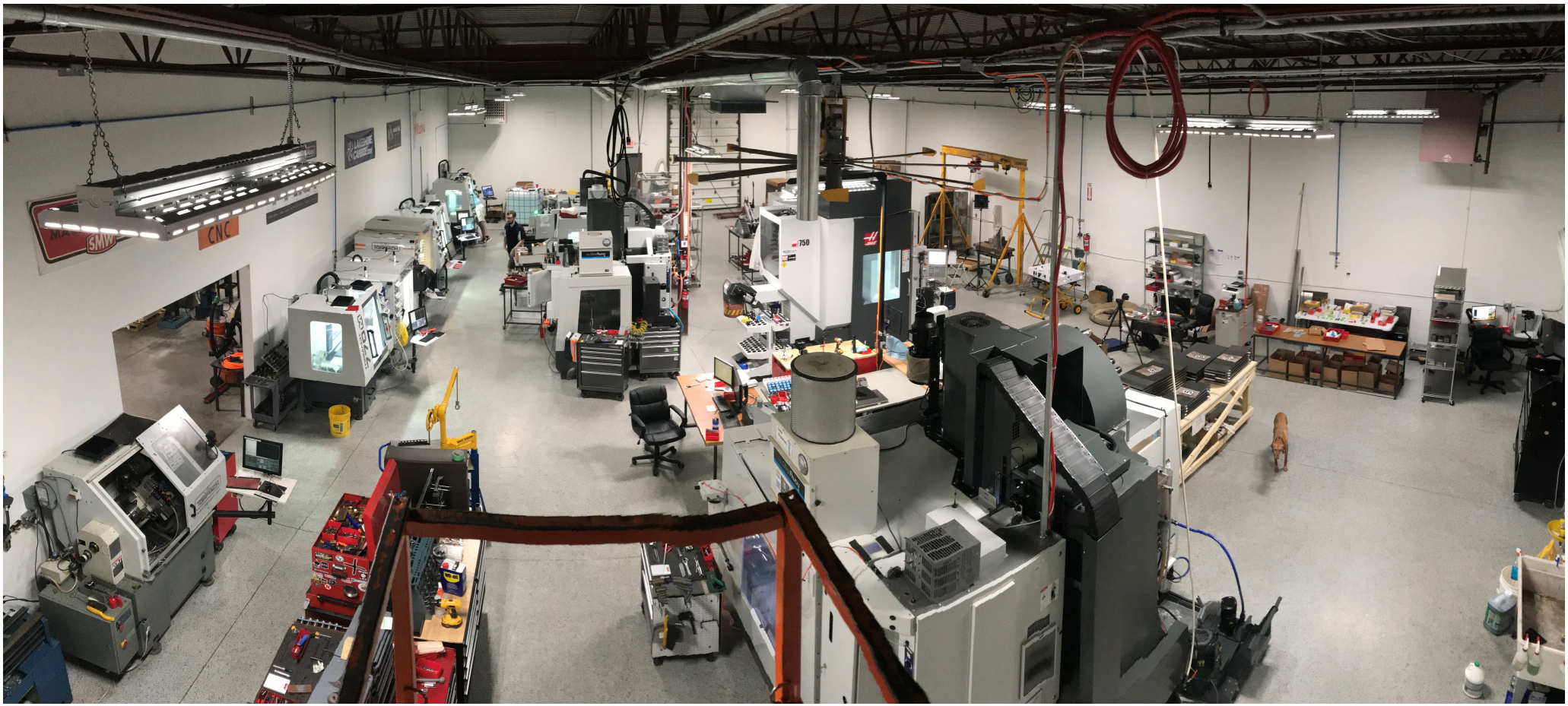
John, his wife, and two children are proud to call Zanesville, Ohio home

2007: Trying to Develop a Product





2014: Ohio!



Class Goal

5-Axis isn't for other people!

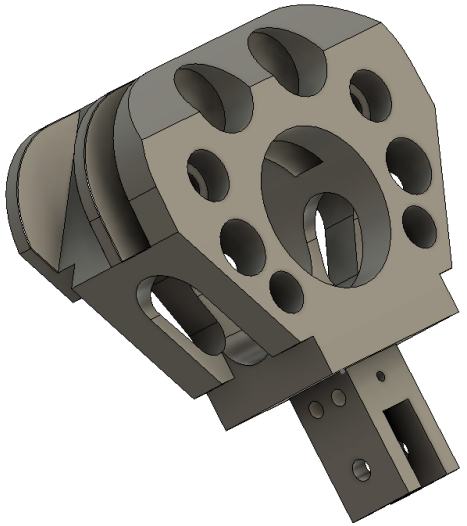
Topics

- What is 5-Axis
- Sample Parts: Basics of how to Program
- Workholding
- Buying: Machines, Tools, Holders, Software
- Our Next Steps, Resources for you

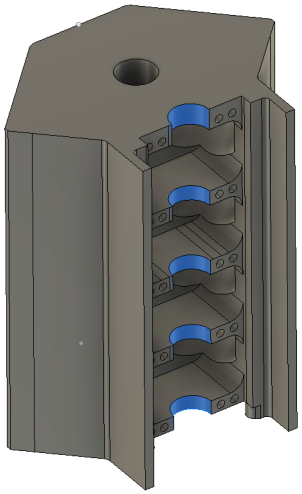

SS CADCAM
Inc.

5 Axis Parts

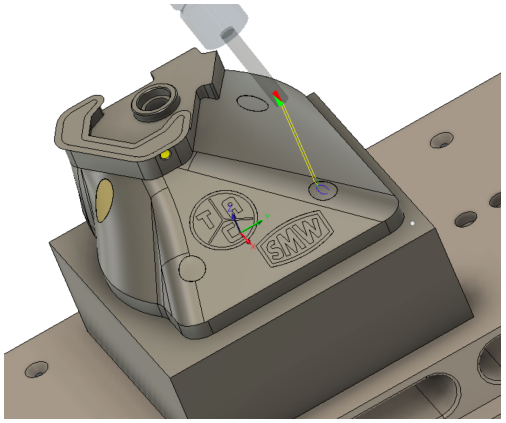
3+2



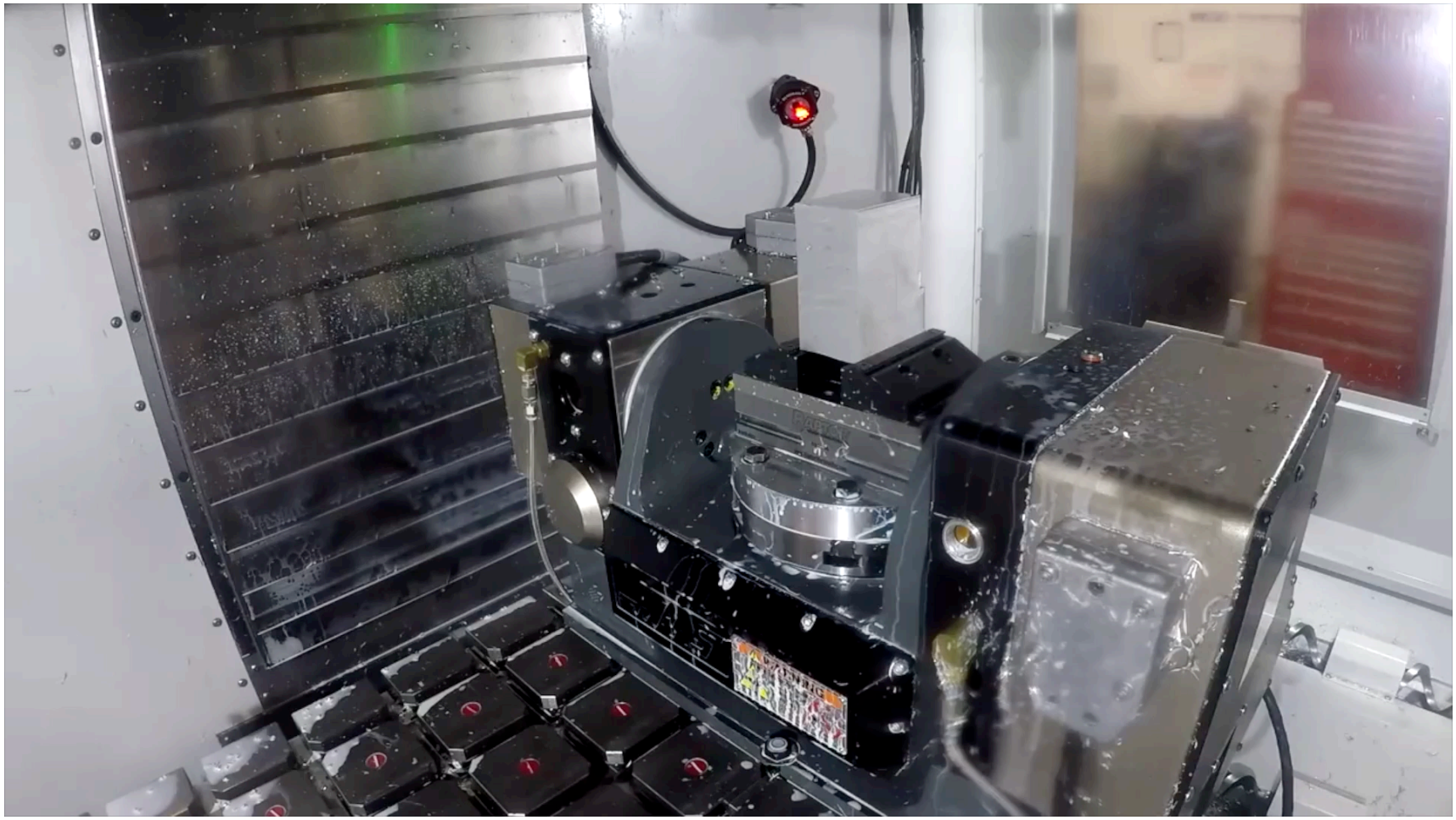
Hybrid Simultaneous



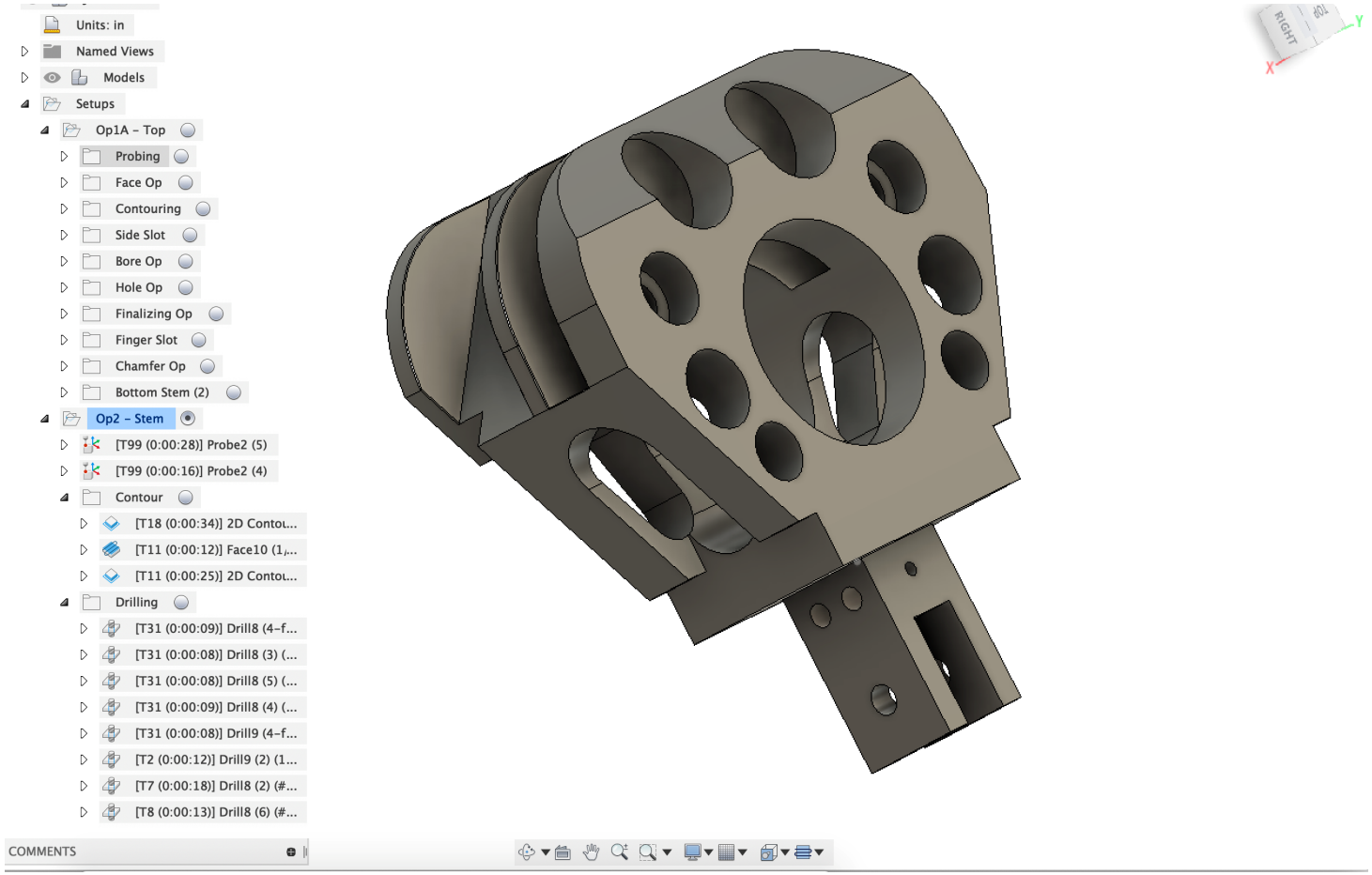
Simultaneous



Johnny 5 Wrist

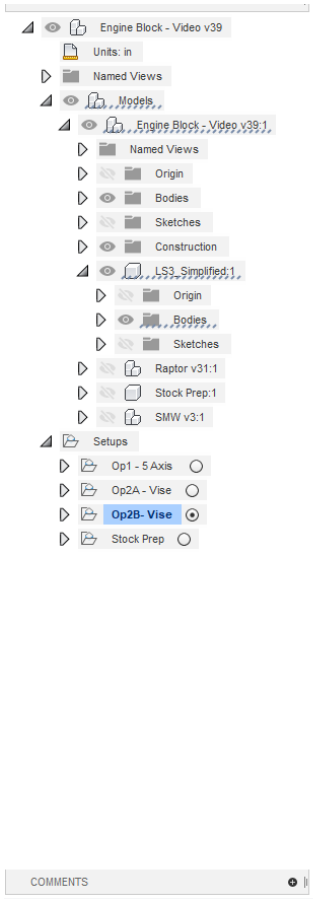


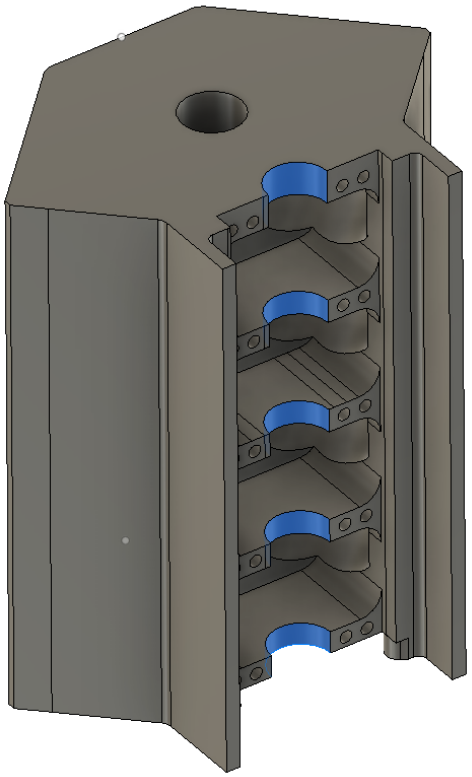
Johnny 5 Wrist



- CAM Program Demonstration: Positional (Tool Orientation)

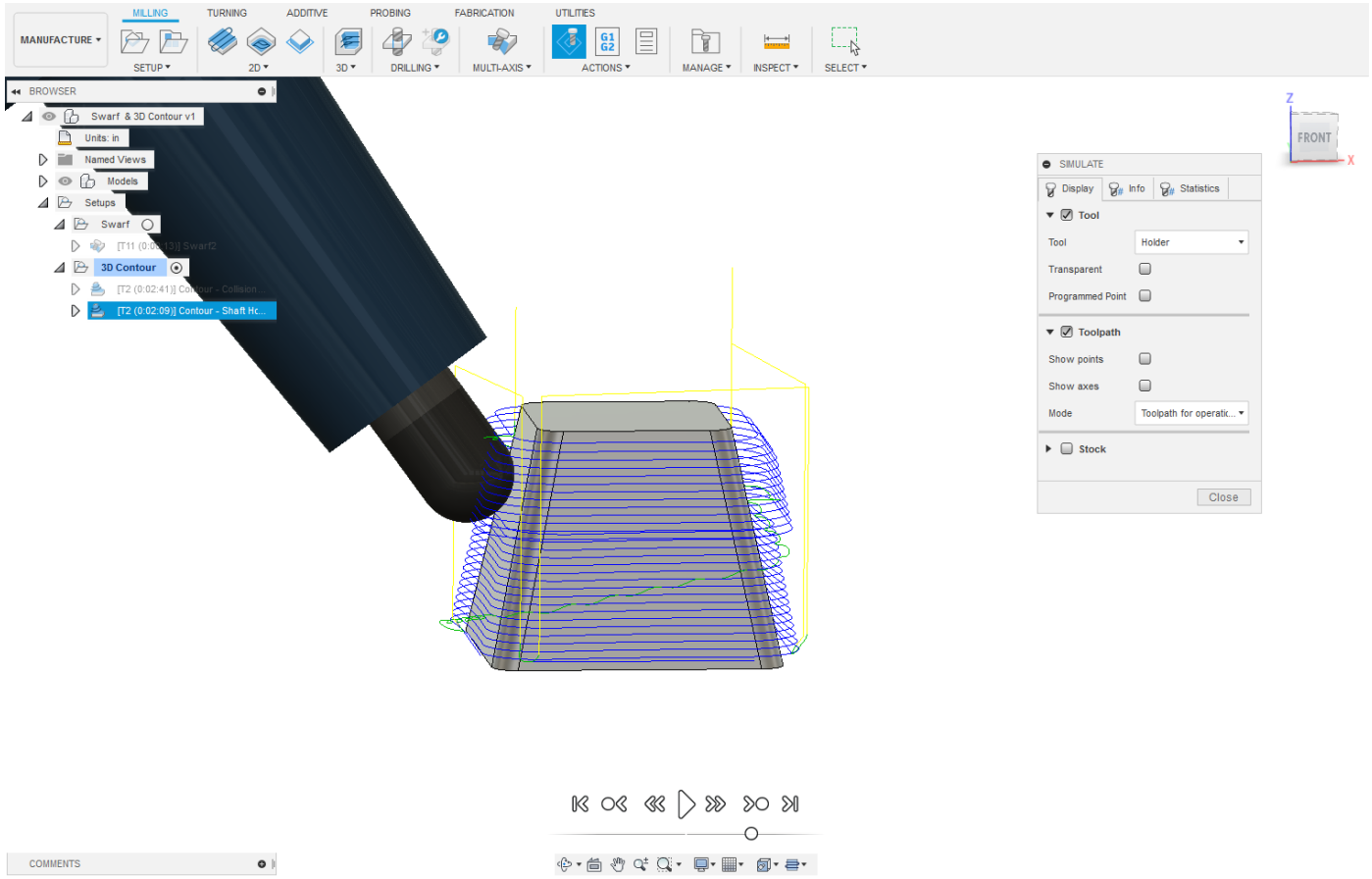
V8 Block



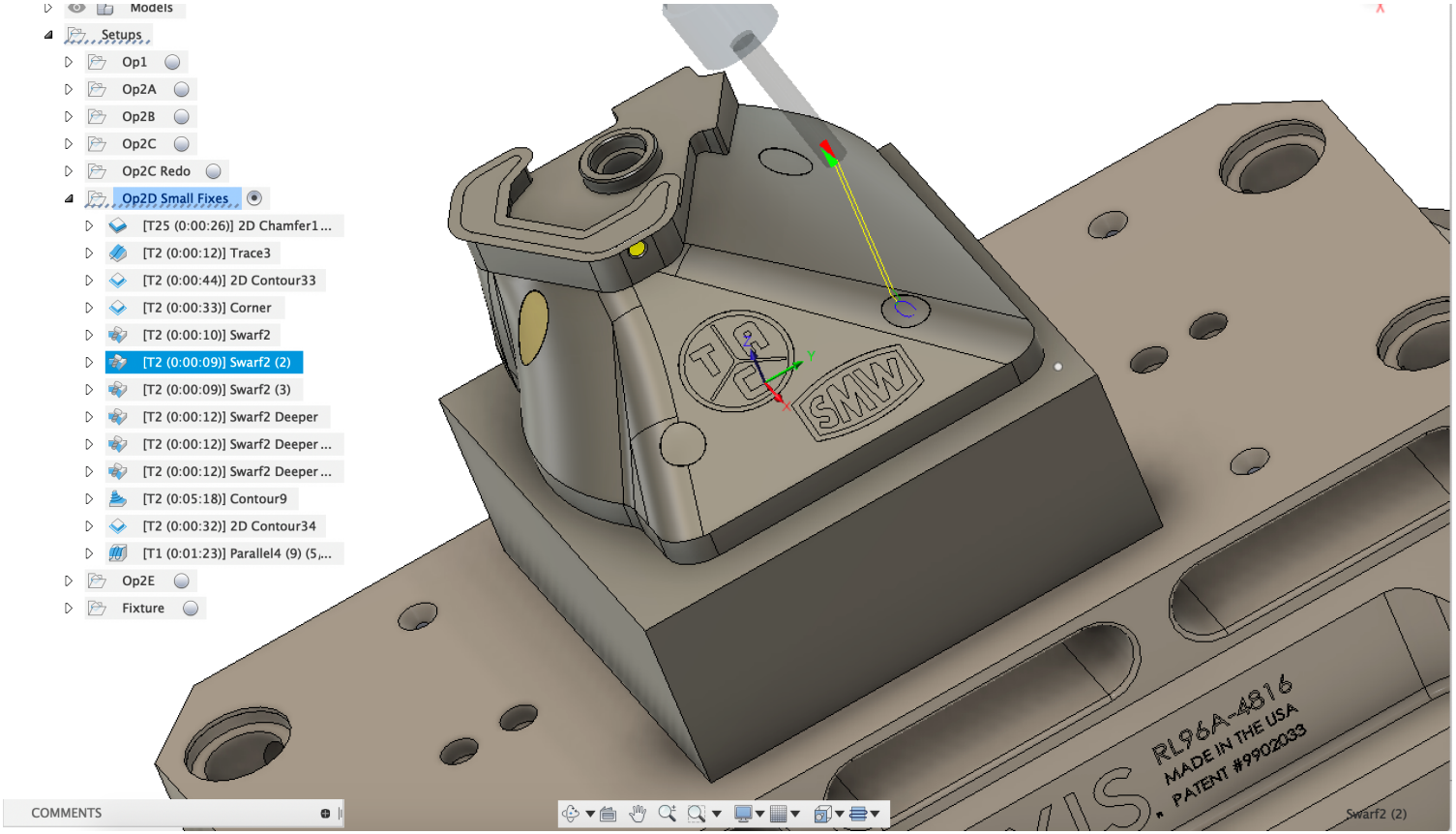


- CAM Program Demonstration: 3D Contour

Reducing Stickout

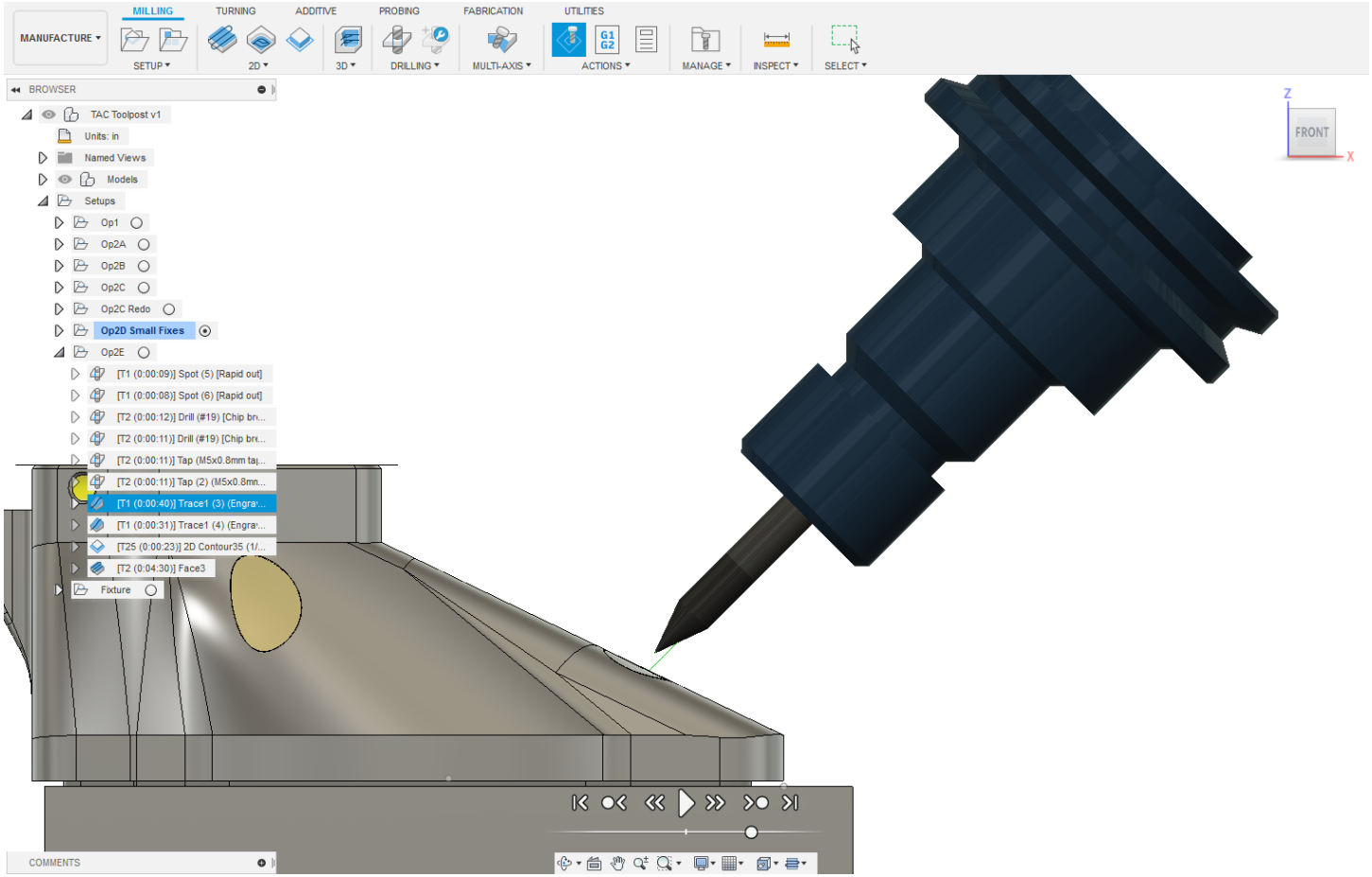


Lathe Toolpost Riser



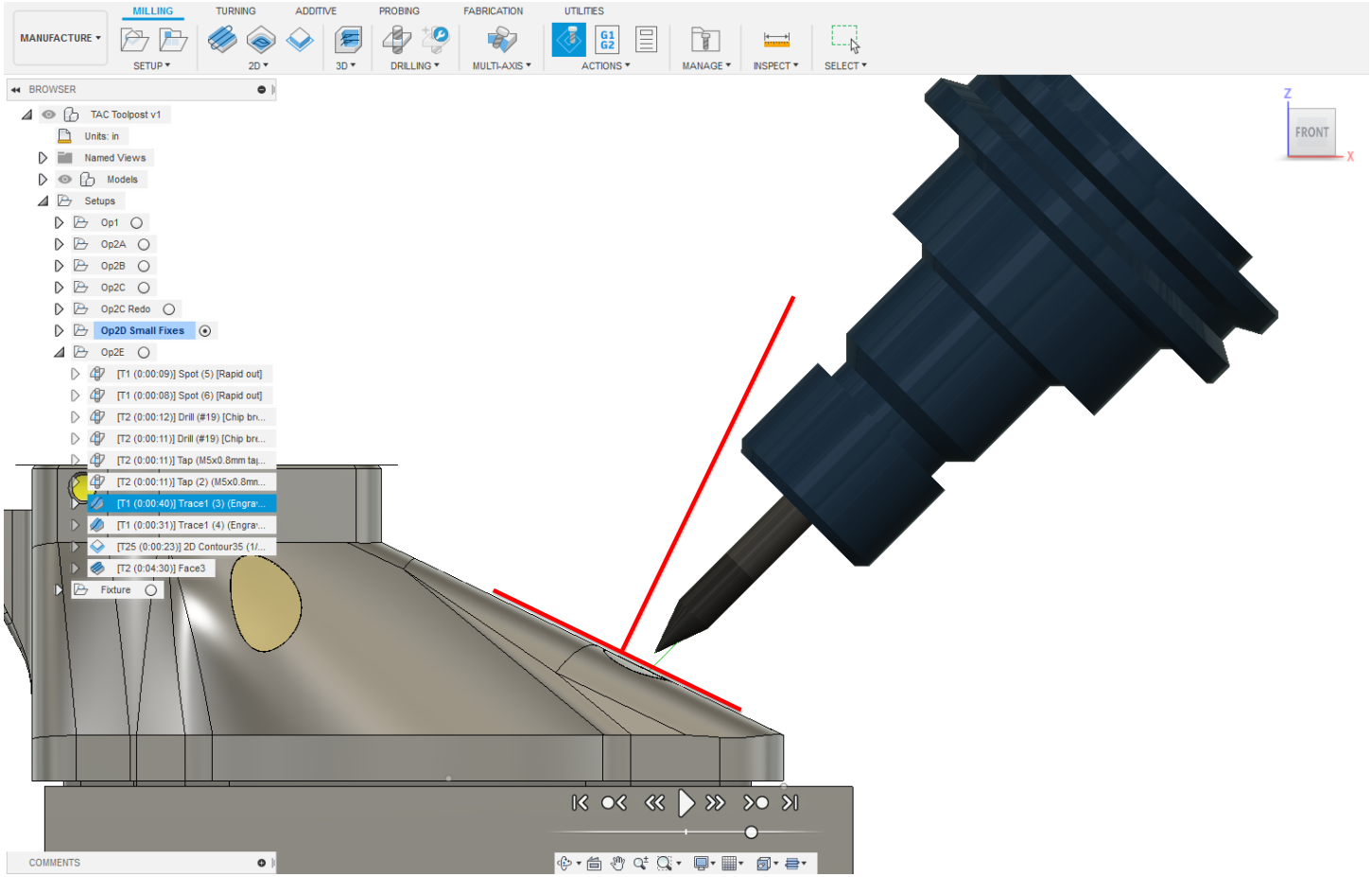
- CAM Program Demonstration: Swarf

Lathe Toolpost Riser



- CAM Program Demonstration: Engrave != Normal to Surface

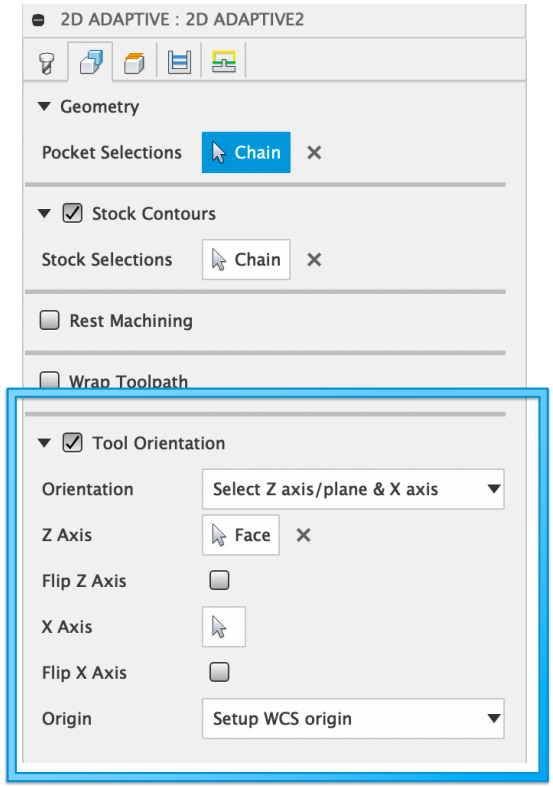
Lathe Toolpost Riser



- CAM Program Demonstration: Engrave != Normal to Surface

Programming Tips!

- Tool Orientation: set Z [*X and Y (generally) do not matter]*
- Improvements coming to automatically set Z – e.g. hole wizard
- Templates are your friend
- Sketch geometry to contain Adaptive toolpaths (to avoid fixtures, vises)
- PRO TIP: Re-name your sketches!

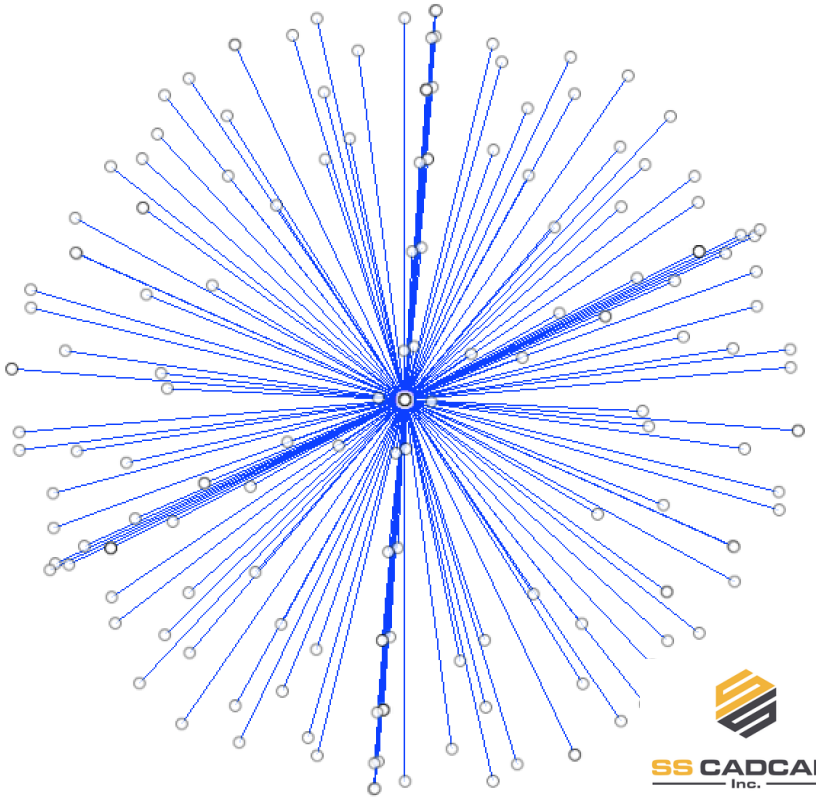


- *CAM Program Demonstration: Adaptive Roughing (avoid 5th axis vise)*

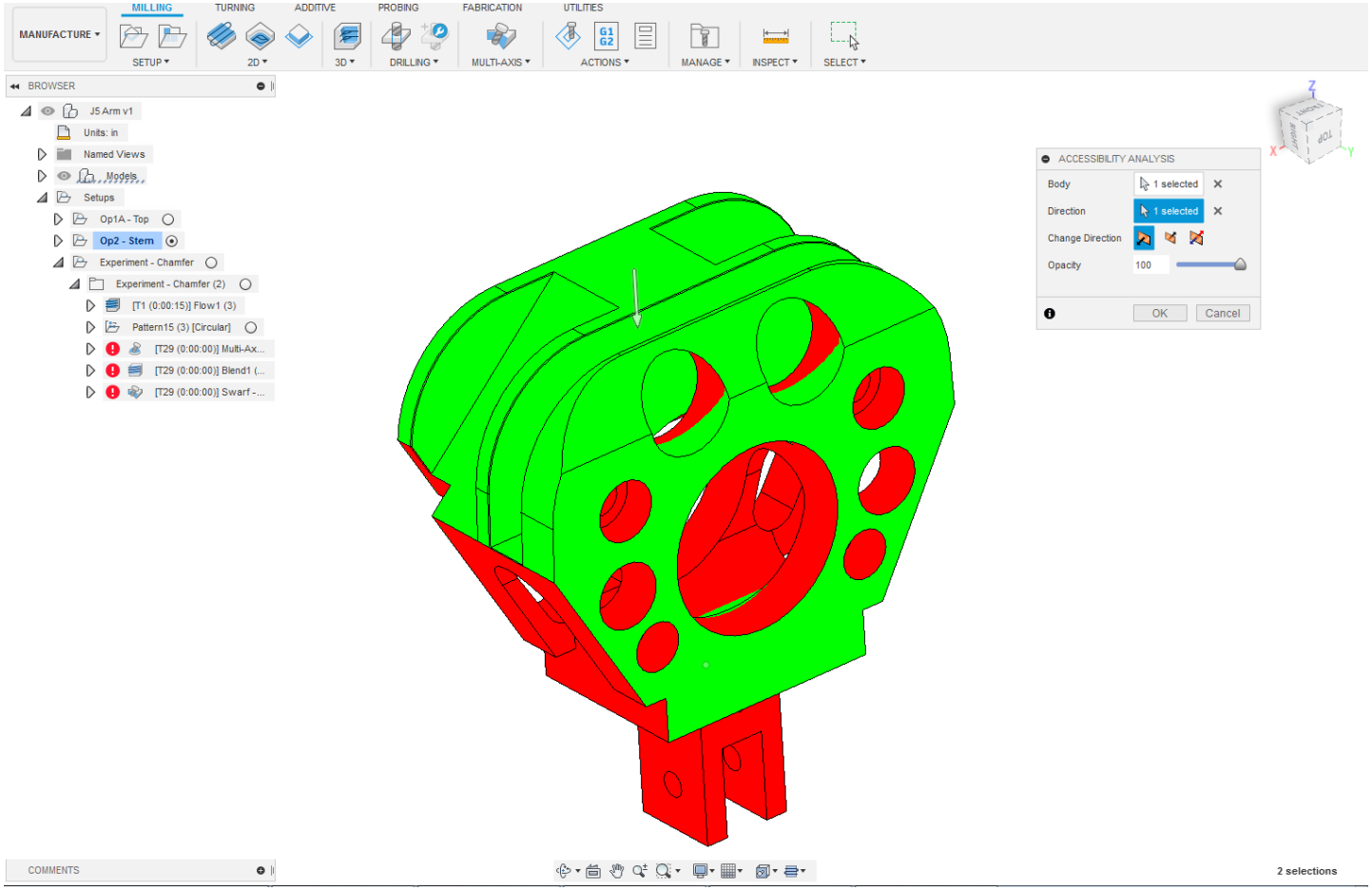
Star Globe

- Set Tool Orientation to an existing sketch (axis)

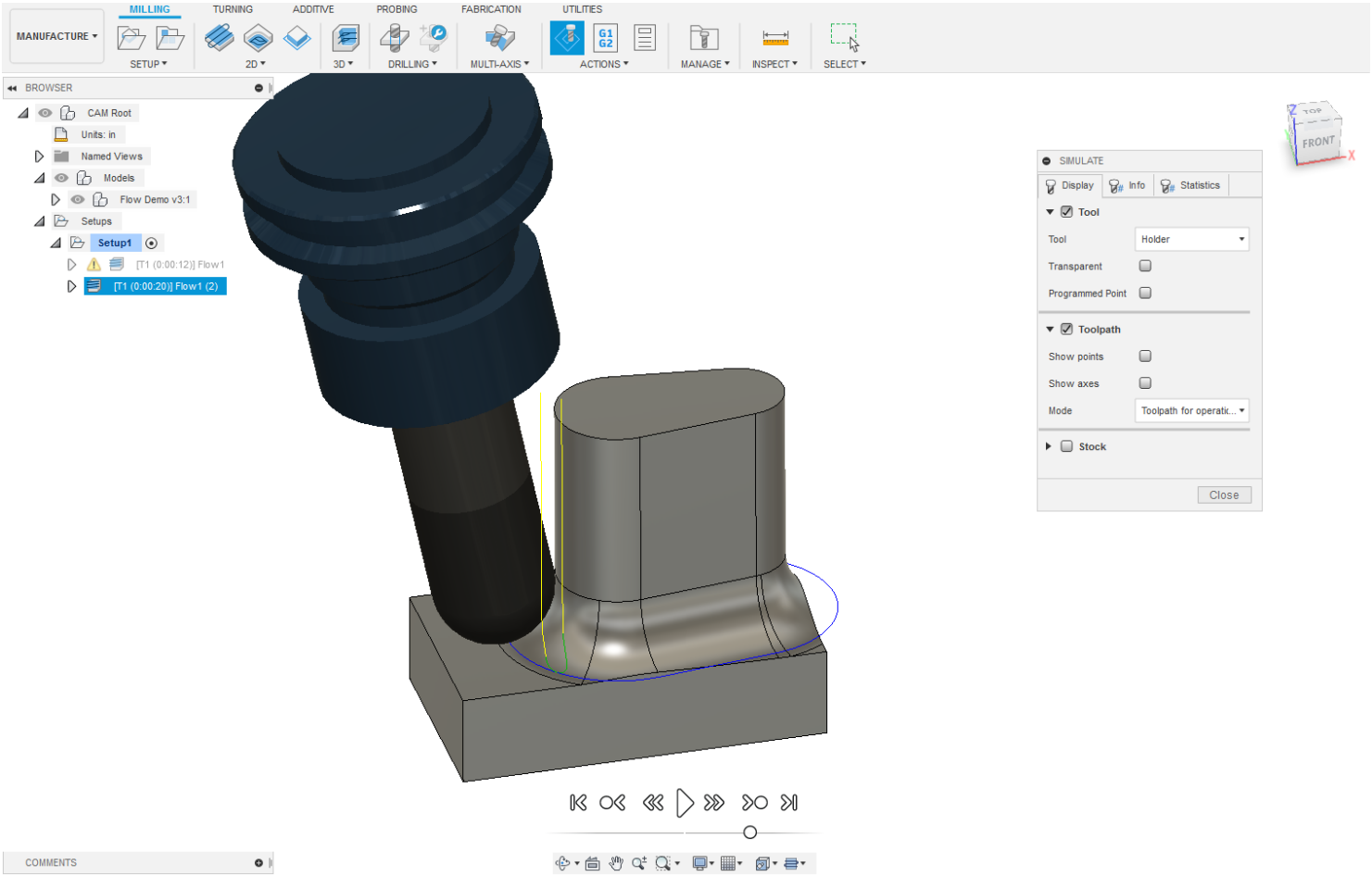
- Saves the time and hassle of creating individual sketches, planes, construction geometry



Accessibility Analysis

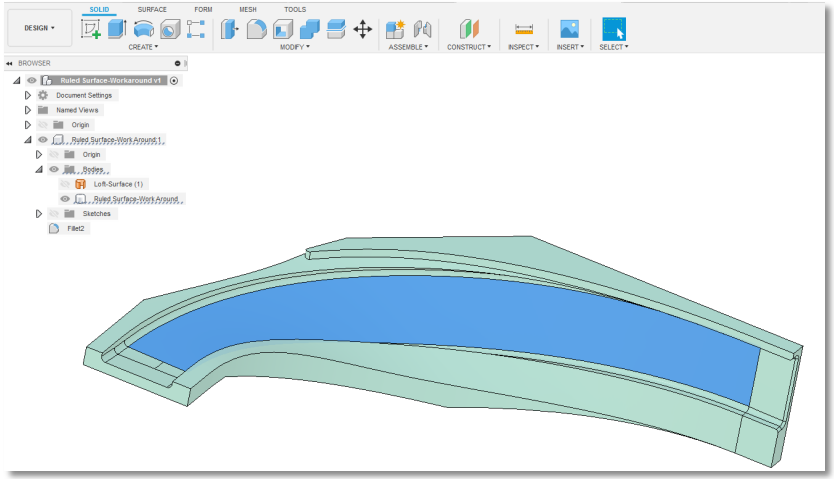


Flow


MANUFACTURE
MILLING
TURNING
ADDITIVE
PROBING
FABRICATION
UTILITIES
SETUP
2D
3D
DRILLING
MULTI-AXIS
ACTIONS
MANAGE
INSPECT
SELECT
BROWSER
CAM Root
Units: in
Named Views
Models
Flow Demo v3:1
Setups
Setup1
[T1 (0:00:12)] Flow1
[T1 (0:00:20)] Flow1 (2)
SIMULATE
Display
Info
Statistics
Tool
Tool
Holder
Transparent
Programmed Point
Toolpath
Show points
Show axes
Mode
Toolpath for operatic...
Stock
Close
FRONT
COMMENTS

When do I *need* 5-axis?

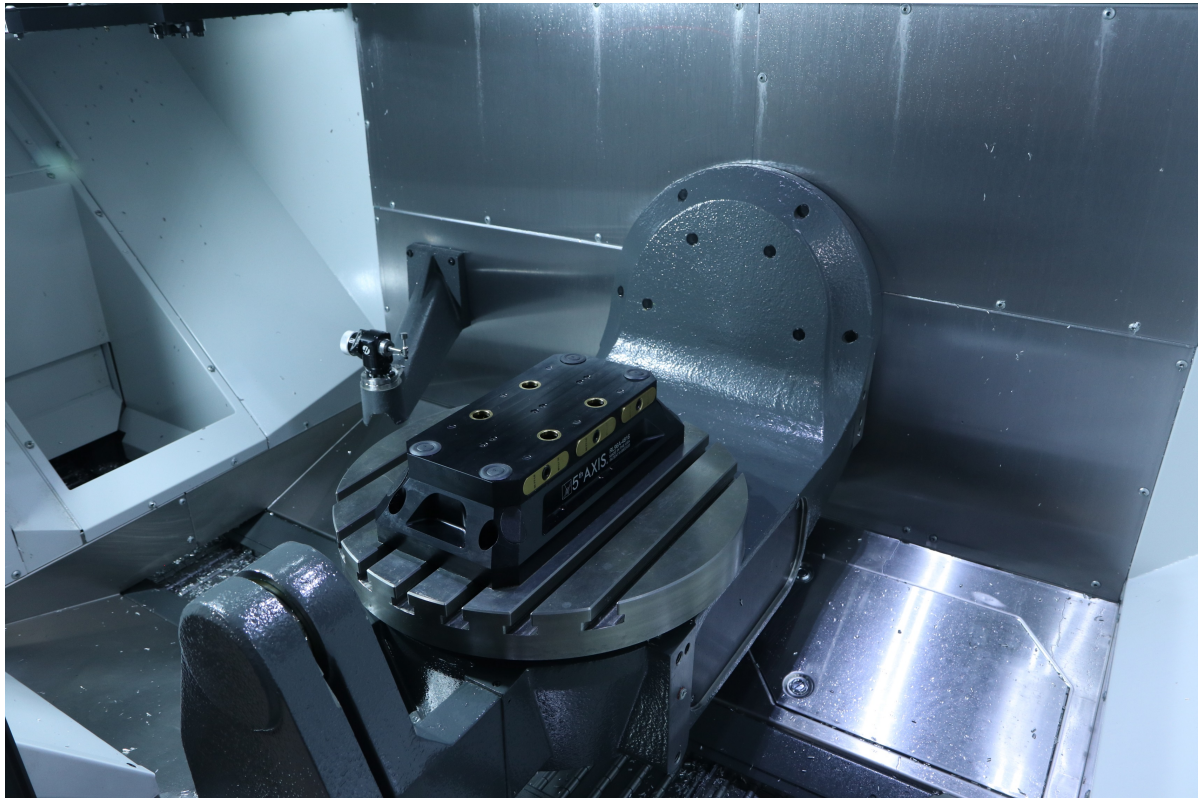
- Features that require additional setups
- 5 (even 6!) sides of prismatic part
- Angled features
- Tool path where projected toolpath could not see/reach
- Deep Geometry (prohibitive tool length)



When can I *benefit* from 5-axis?

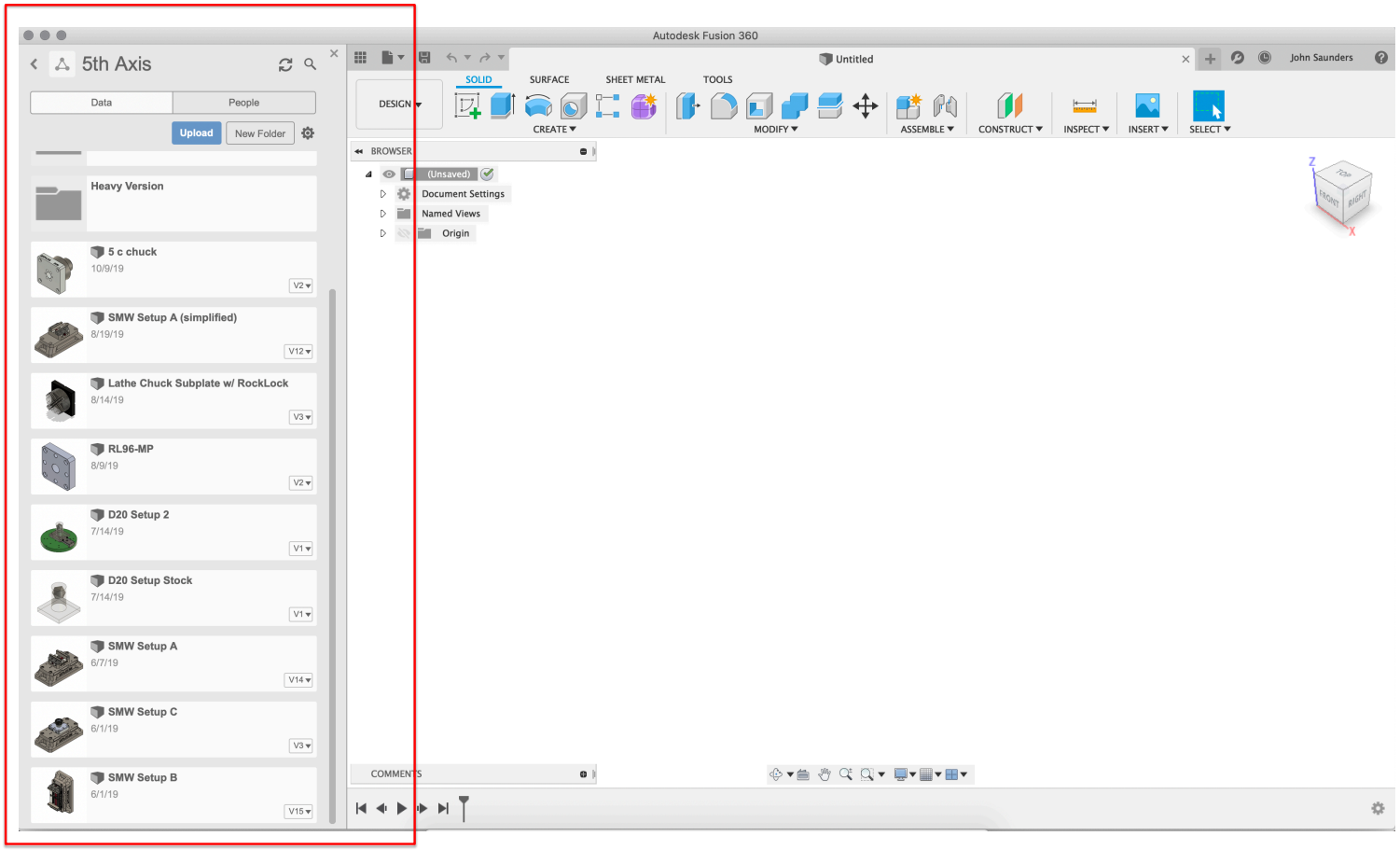
- Engrave & surface without using tip of tool
- “Work” the part – rough at multiple positions, then come back to finish machine
- Mistake when almost done? Just re-run part!
- Probe machined features (e.g. B90): easier, better.
- CNC chamfer (chamfer tool or swarf with end mill)

WORKHOLDING

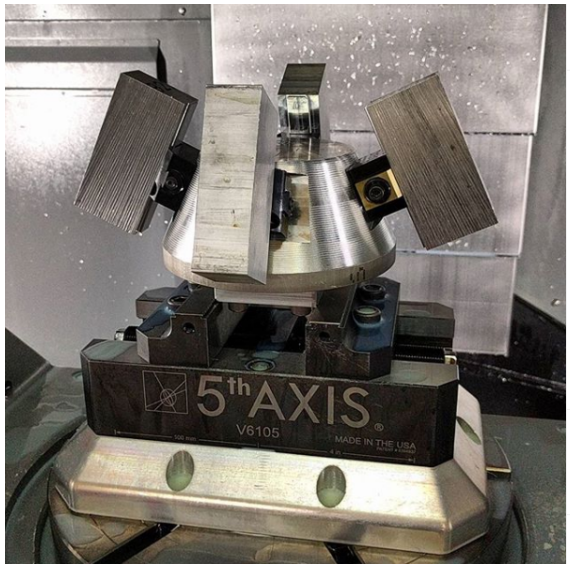


WORKHOLDING

Workholding Templates



Production Workholding Examples



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#instamachinist #fusion360 #5axis #5axismilling #workholding #cnc #machinist #engineering #smallbusiness

102w

maskayllc Thing looks like a satellite!

102w Reply

motioncell This is crazy

102w Reply

mister_keefey @gaz8590

102w Reply

Liked by **imperial_machine_co** and **260 others**

SEPTEMBER 28, 2017

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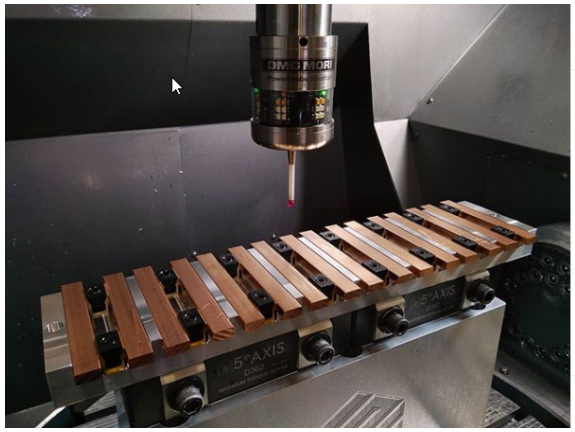

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71w

kalpay Xylophone?!

71w 8 likes Reply

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themachiningcenter That's what I saw. Nice setup!

71w Reply

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MAY 3, 2018

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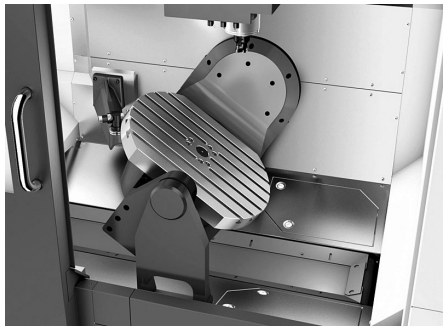
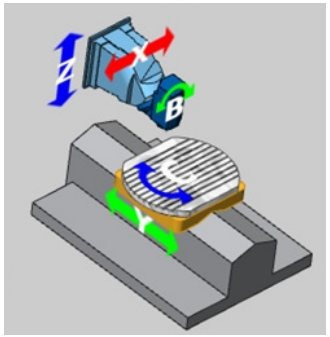
Machine Designs

TABLE / TABLE

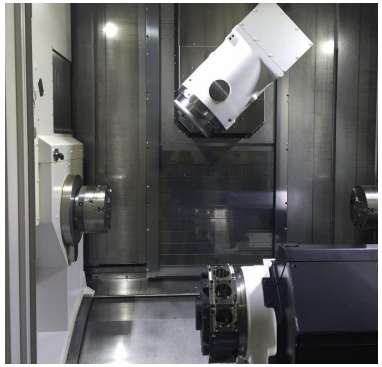


HEAD / HEAD

HEAD / TABLE



MULTI-TASK



Move whichever weighs less: head or workpiece

Buying a 5 Axis Machine Tool

- Emphasis: **Total Manufacturing Solution**
- Quality, Capability, Technical Specs, Service, Control….
- What happens if/when you crash?
- Verification Software (Camplete TruePath)
- More than just brand or model of the Machine Tool
- Post Processor, support, control, machine features, automation / automation-ready, price, service

Machine Specs

- Match machine to part size
- ATC: as large as possible!
- Probing
- Chip removal (washdown, conveyor)
- Air/Hydraulic through table
- Thru-Spindle, Thu-Air
- Buy options that cannot be field upgraded
- Training

Process Reliability

- Tool Break Detection
- TSC (Thru-Spindle Coolant / Air)
- Breaking Chips: corn rob, rougher, pecking
- Wash Down System
- Chip Removal (conveyor)

TOOL HOLDERS

MARITOOL

ER16-5.0M

MARITOOL

ER20-4.5MT

MARITOOL

SHRINK

YG

HYDRAULIC

Core tool library

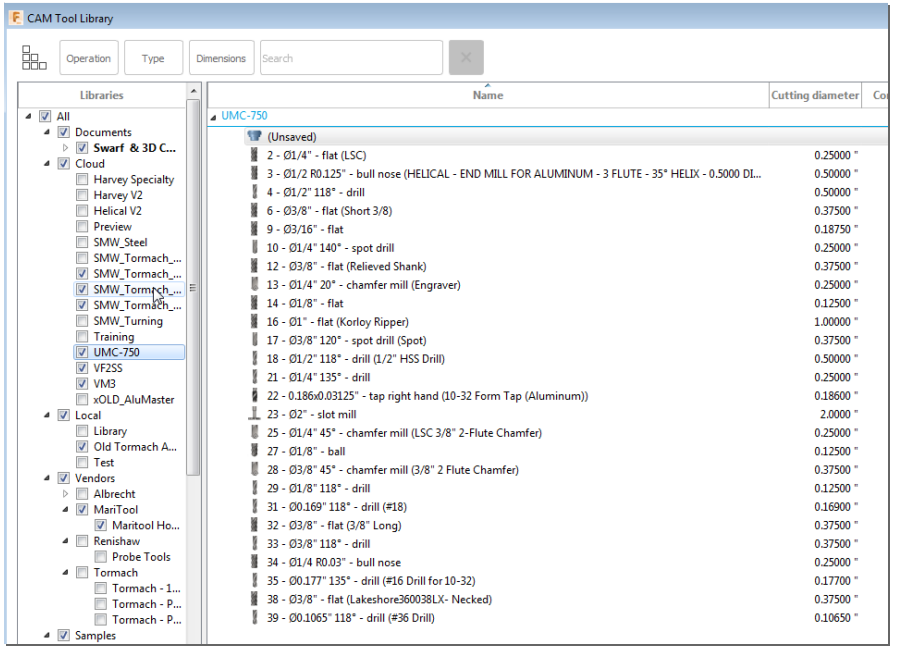
Yellow Tags: MSC P/N 58283474

Core tool library

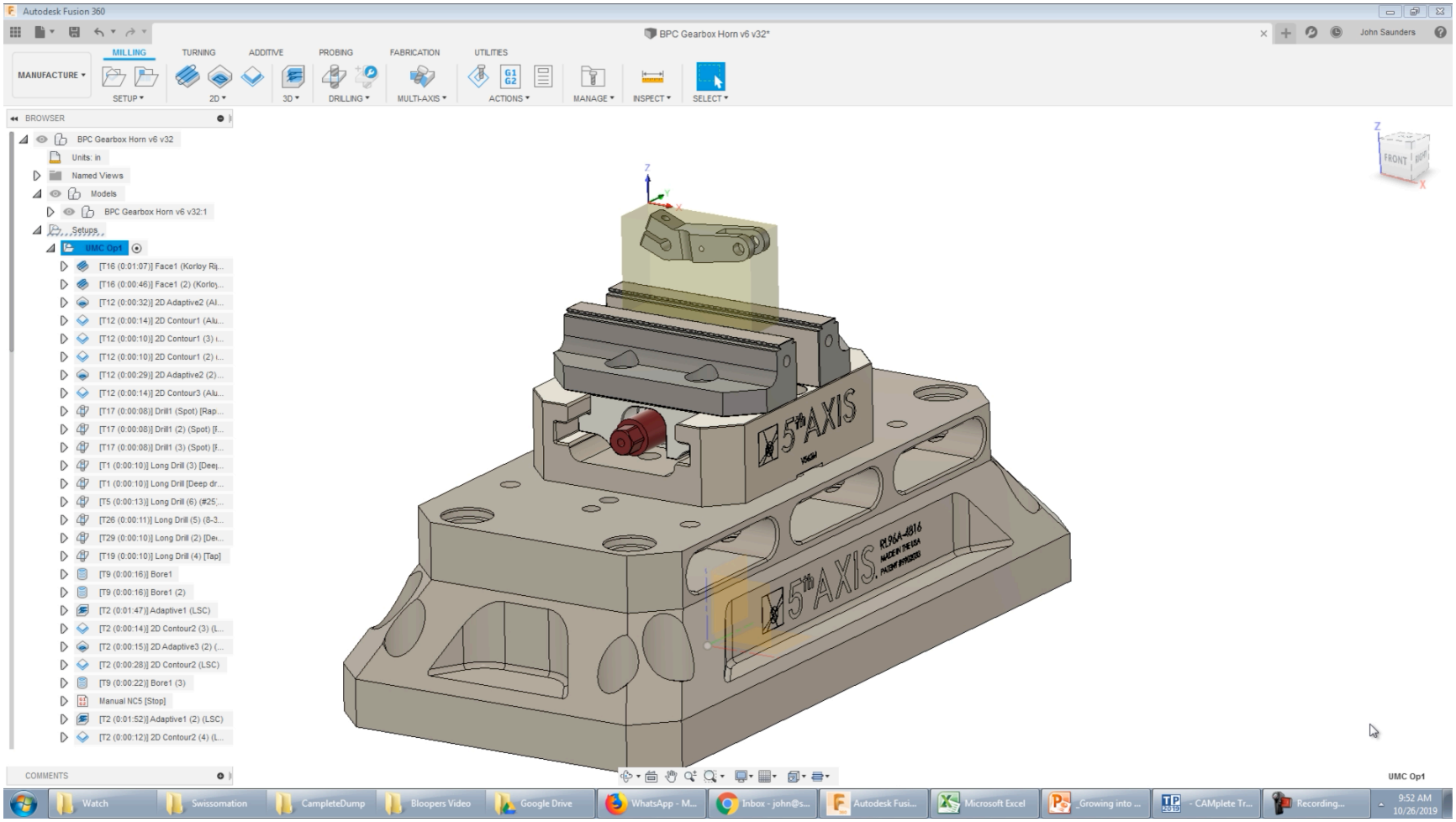
- Program offline / remote
- Learn recipes for certain tools
- Tool setups take time
- Searching for new [holder, collet, etc]

Benefits:

- Less stress
- Confidence in workflows
- Better machining decisions
- Programmed & saved stickouts
- Avoid hunting holders, wrenches, collets, etc
- Cost of first crash = ~$5k. That's a lot of holders.



Camplete Truepath



Resources

- NYCCNC.com & YouTube
- NYC CNC Training Classes
- ProvenCut: Pre-created toolpaths
- Fusion 360 CAM Samples
- Autodesk Forums
- Autodesk / YouTube Webinars

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