Effort Foundry Inc

Technology is the buzzword heard around the foundry today

NEW TECHNOLOGY OVERVIEW

EFFORT FOUNDRY IS MAKING HUGE INVESTMENTS INTO NEW TECHNOLOGY AS A PART OF OUR CONTINUOUS IMPROVEMENT PROGRAM TO BETTER SERVE OUR CUSTOMERS

- PRECISION MACHINING
- SOLID MODELING
- SOLIDIFICATION SIMULATION
- MACHINING SIMULATION
- 3D LASER SCANNING
- LASER MARKING
- ADDITIVE MANUFACTURING

3D printing is currently outsourced with plans in place for it to be added to in-house capability

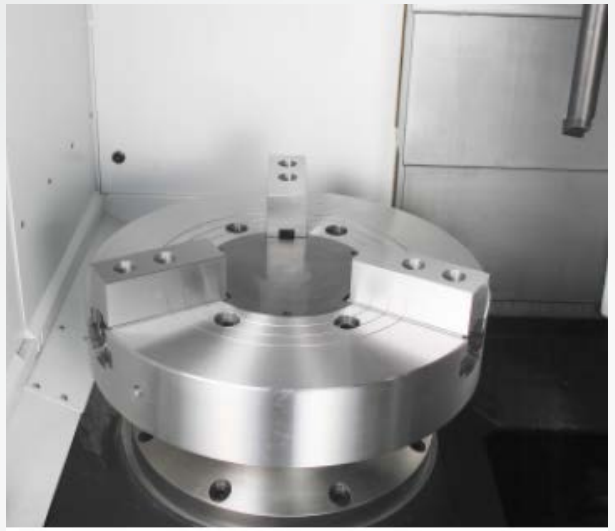
IN-HOUSE MACHINING TECHNOLOGY OVERVIEW

- VERTICAL TURNING
- HORIZONTAL TURNING
- HORIZONTAL MILLING
- VERTICAL MILLING
- KEYWAY CUTTER

- COMPETENCIES
  - ROUGH MACHINING CASTINGS
  - FINISH MACHINING CASTINGS
  - PATTERNS AND PATTERN COMPONENTS
- BENEFITS
  - VALIDATE CASTING QUALITY
    - LOCATE AND UPGRADE SHRINK, INCLUSIONS, CRACKS, ECT…
  - VALUE ADDED SERVICE TO CUSTOMER
    - ONE STOP SUPPLIER
  - DELIVERY
    - FASTER REACTION TIME
    - MACHINING ON CUSTOMERS SCHEDULE

VERTICAL TURNING WITH MILLING

- ROUGH & FINISH MACHINING
- PART DIAMETERS UP TO 40”
- PART LENGTHS TO 35”
- MILLING ON TOP AND SIDE
- TOLERANCES TO .0002”
- AUTOMATIC TOOL CHANGER

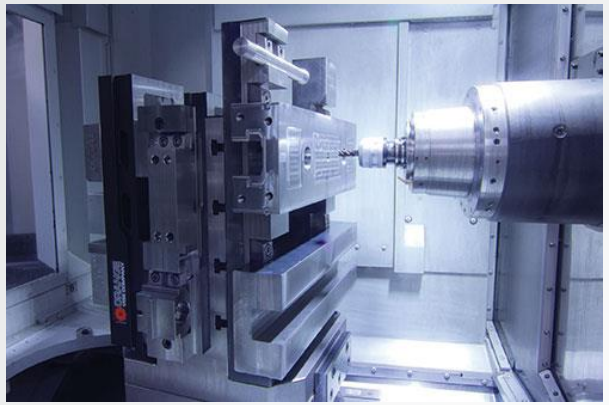


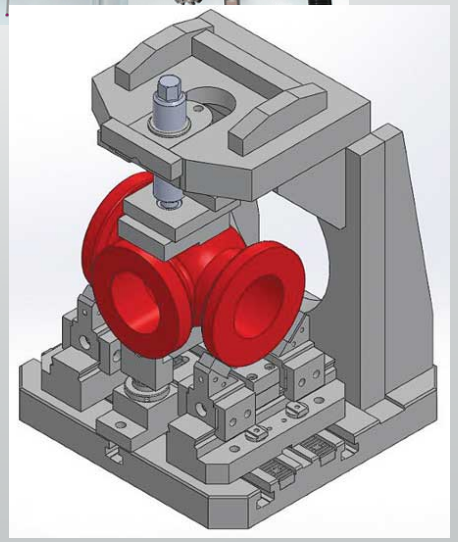
VERTICAL TURNING WITH MILLING

- TURNING
- MILLING
- DRILLING
- TAPPING
- TOP FEATURES
- SIDE FEATURES

HORIZONTAL MILLING

- ROUGH & FINISH MACHINING
- (2) ROTARY DEVICES FULL 5 AXIS
- X TRAVEL 40”
- Y TRAVEL 30”
- Z TRAVEL 25”
- TOLERANCES TO .0002”
- AUTOMATIC TOOL CHANGER



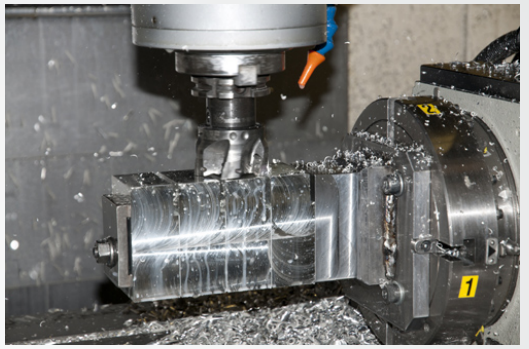


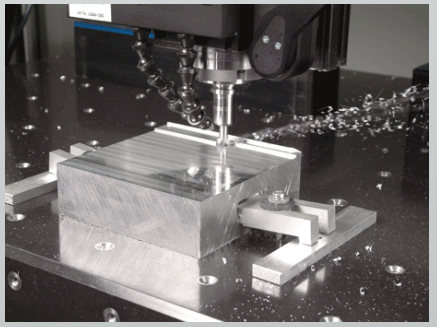
HORIZONTAL MILLING

- MILLING
- DRILLING
- TAPPING
- MACHINING ON 5 SIDES IN ONE HOLDING

VERTICAL MILLING

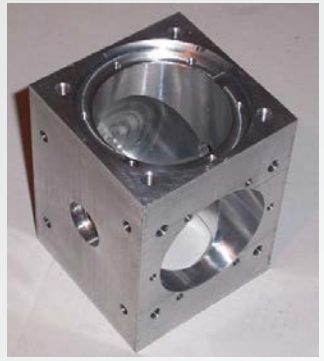
- ROUGH & FINISH MACHINING
- X TRAVEL 30”
- Y TRAVEL 20”
- Z TRAVEL 20”
- TOLERANCES TO .0002”
- AUTOMATIC TOOL CHANGER

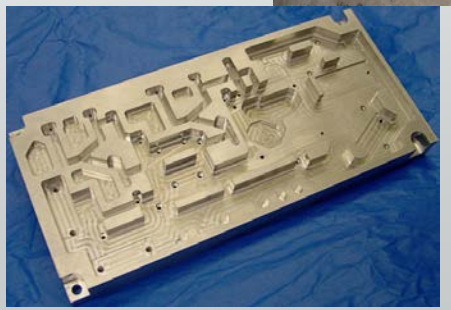




VERTICAL MILLING

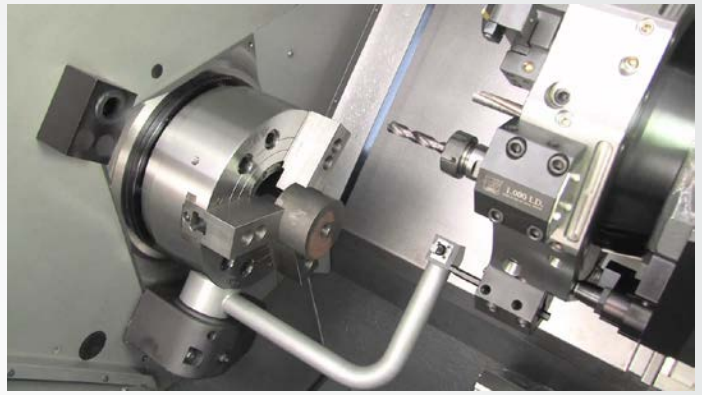
- MILLING
- DRILLING
- TAPPING

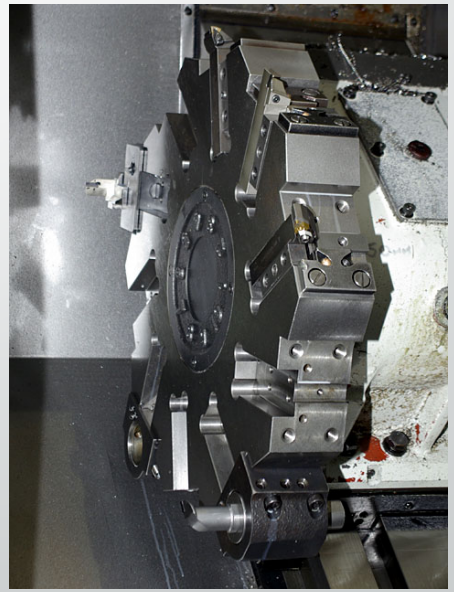




HORIZONTAL TURNING

- ROUGH & FINISH MACHINING
- PART DIAMETERS UP TO 40”
- PART LENGTHS TO 60”
- MILLING ON FRONT AND SIDE
- TOLERANCES TO .0002”
- AUTOMATIC TOOL CHANGER





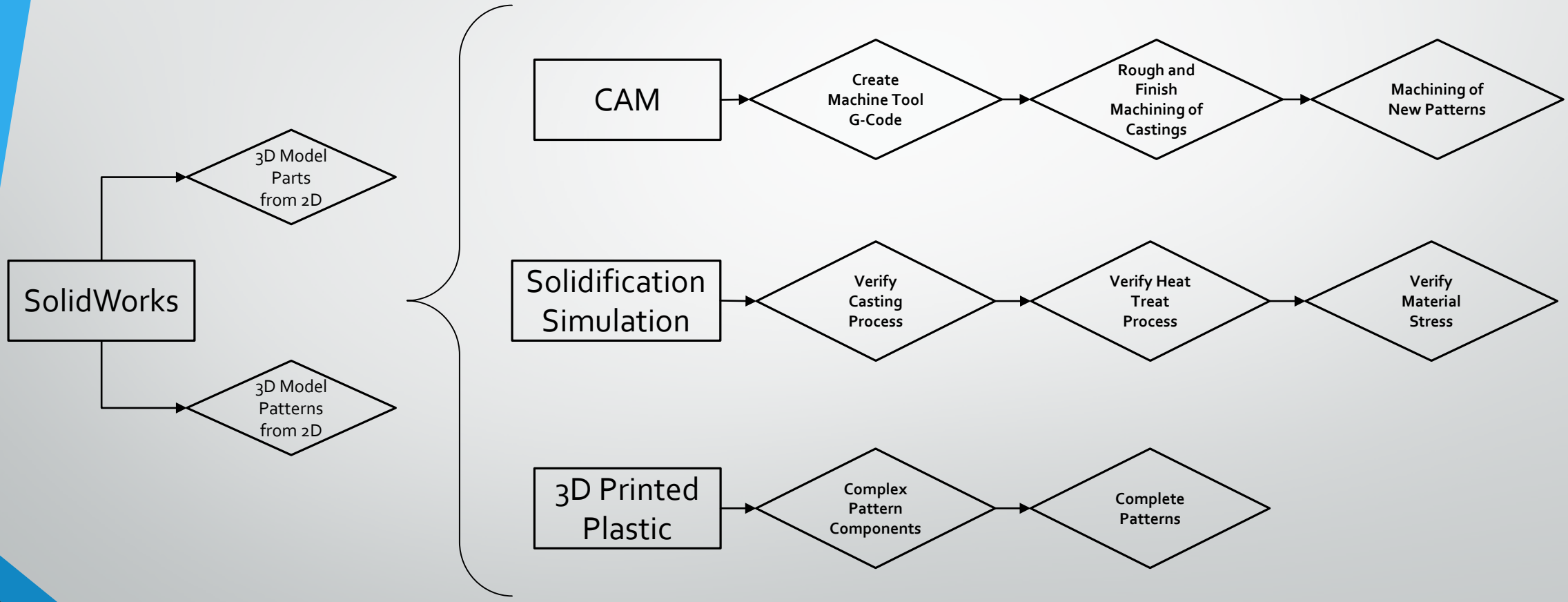
HORIZONTAL TURNING

- TURNING
- MILLING
- DRILLING
- TAPPING
- FRONT FEATURES
- SIDE FEATURES

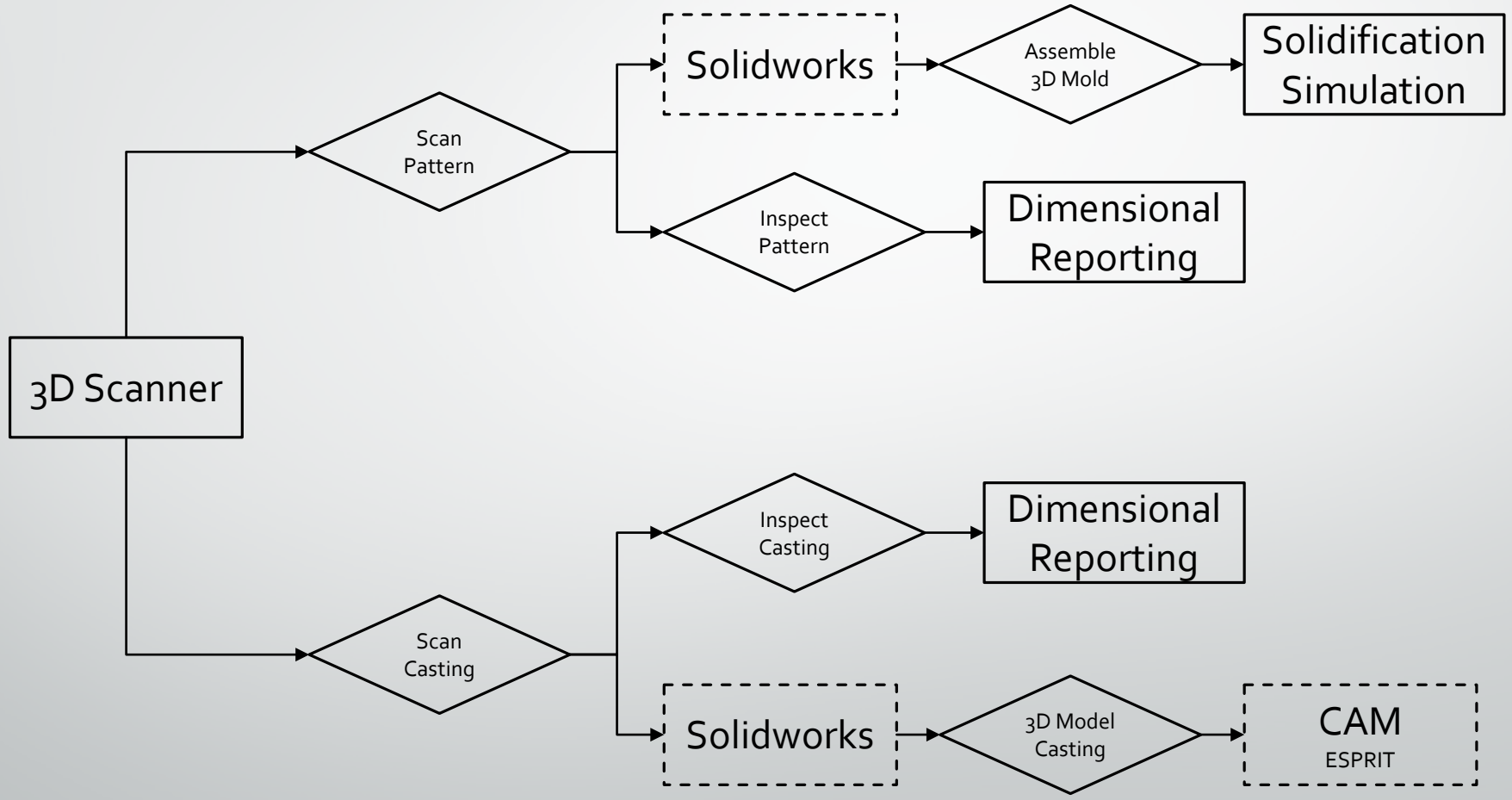
KEYSEATER

- KEYWAYS FROM 1/16" TO 1-1/2" WIDE
- UP TO 12" LONG

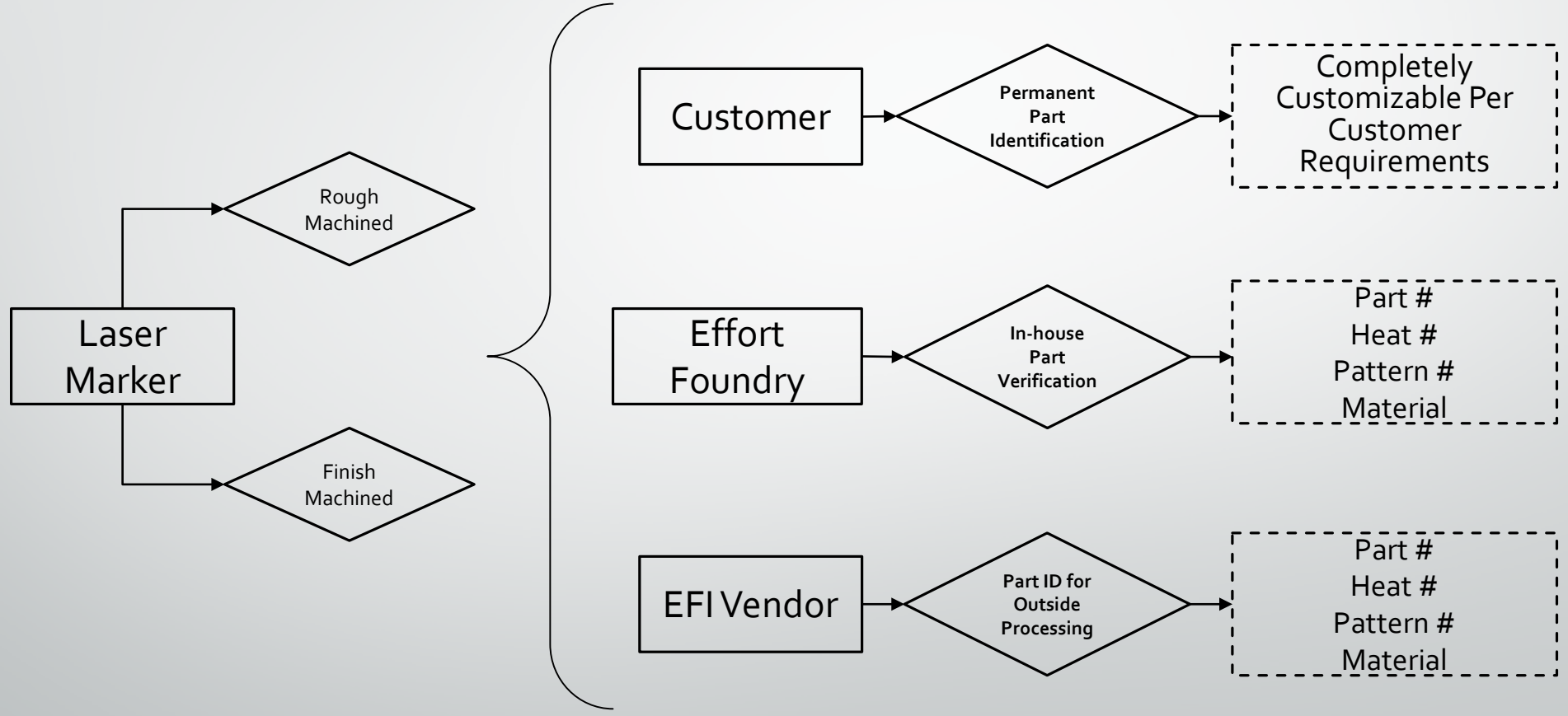
Solid Modeling and Simulation Technology Flowchart



3D Scanning Technology Flowchart

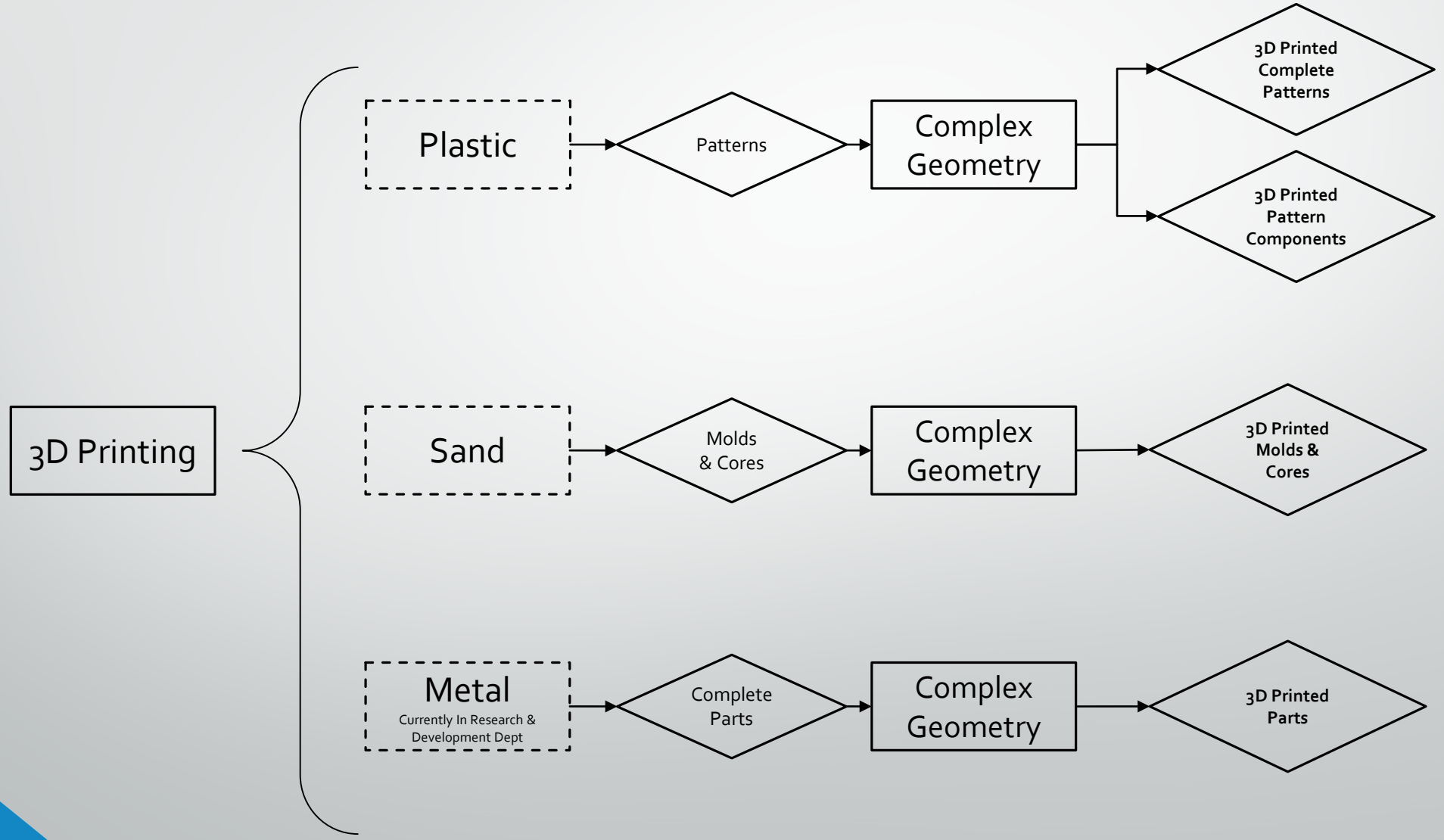


Laser Marking Technology Flowchart



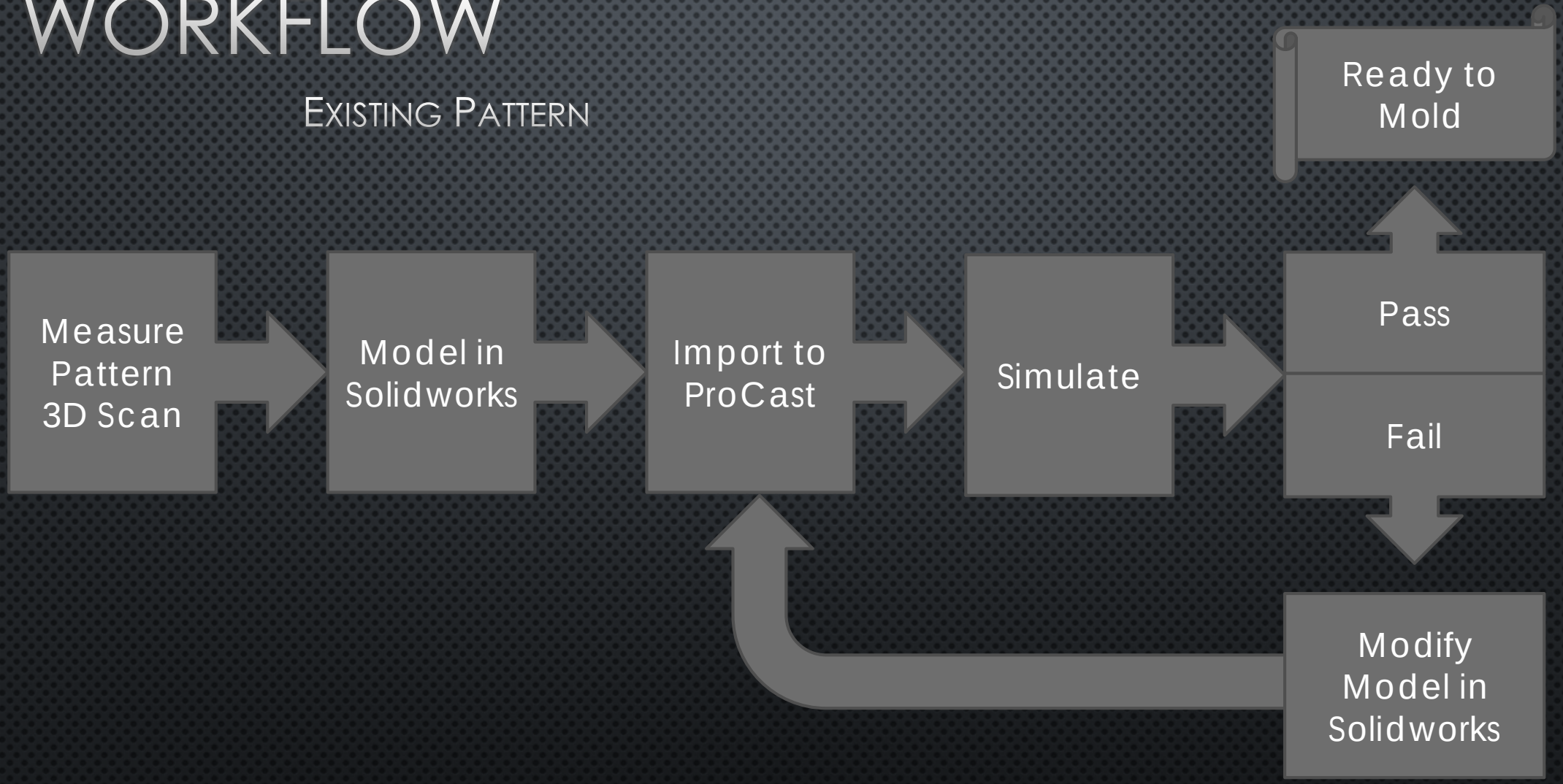
Additive Manufacturing (3D Printing) Technology Flowchart

3D printing is currently outsourced with plans in place for it to be added to in-house capability

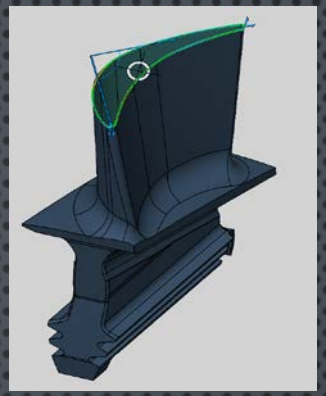


CASTING WORKFLOW

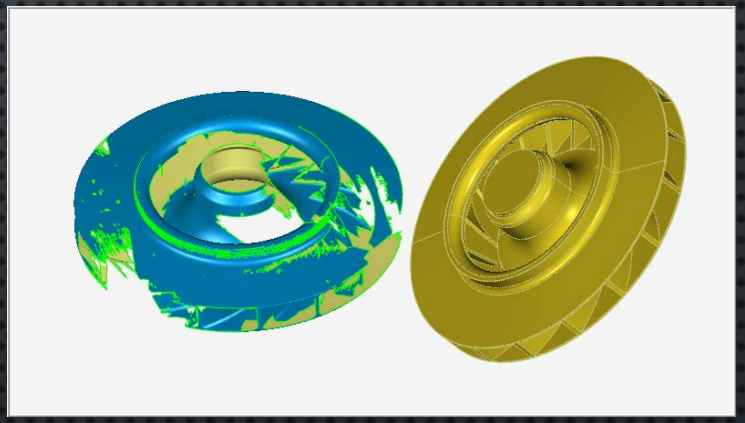
EXISTING PATTERN

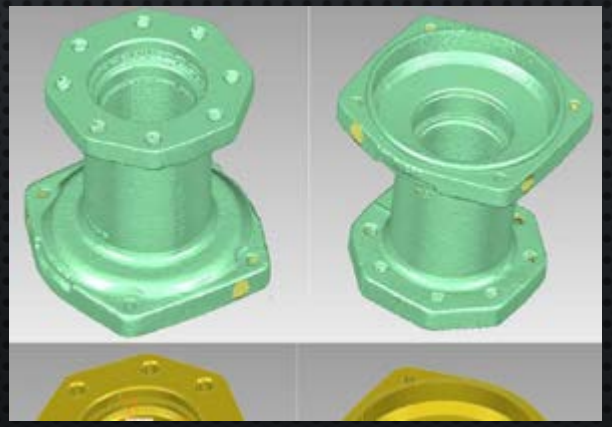


3D SCANNING WORKFLOW



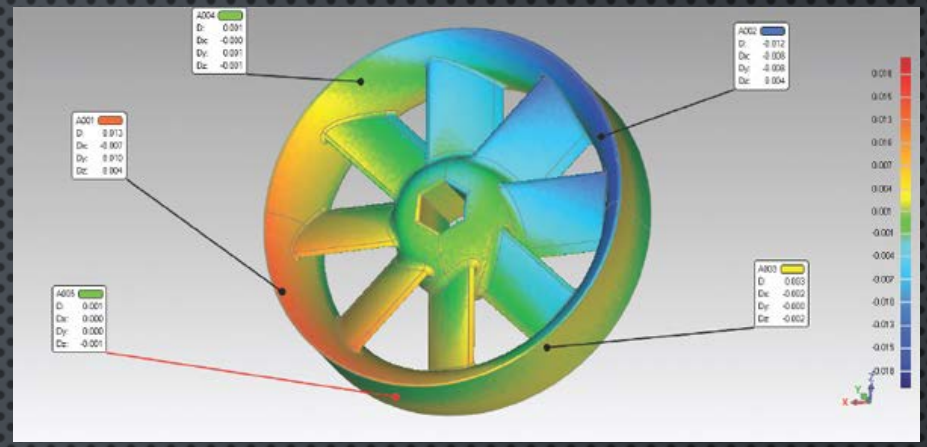
3D Scanning

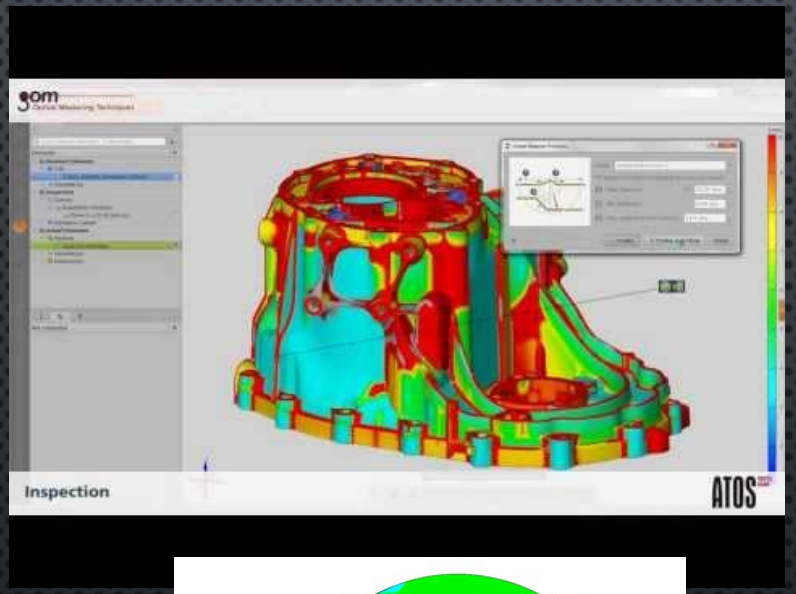


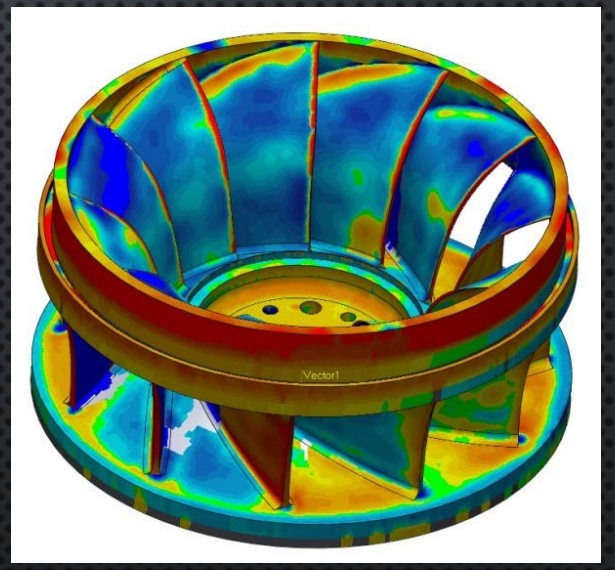


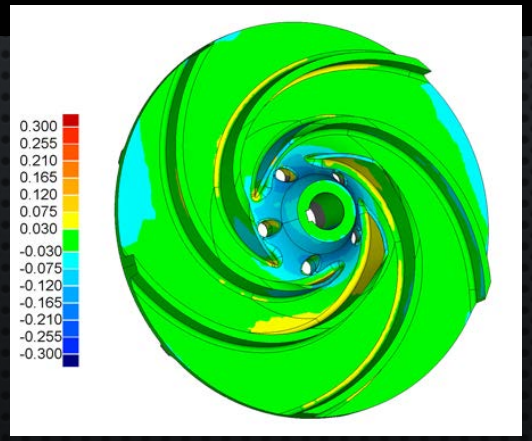
3D SCANNING WORKFLOW

3D Scanning For Inspection







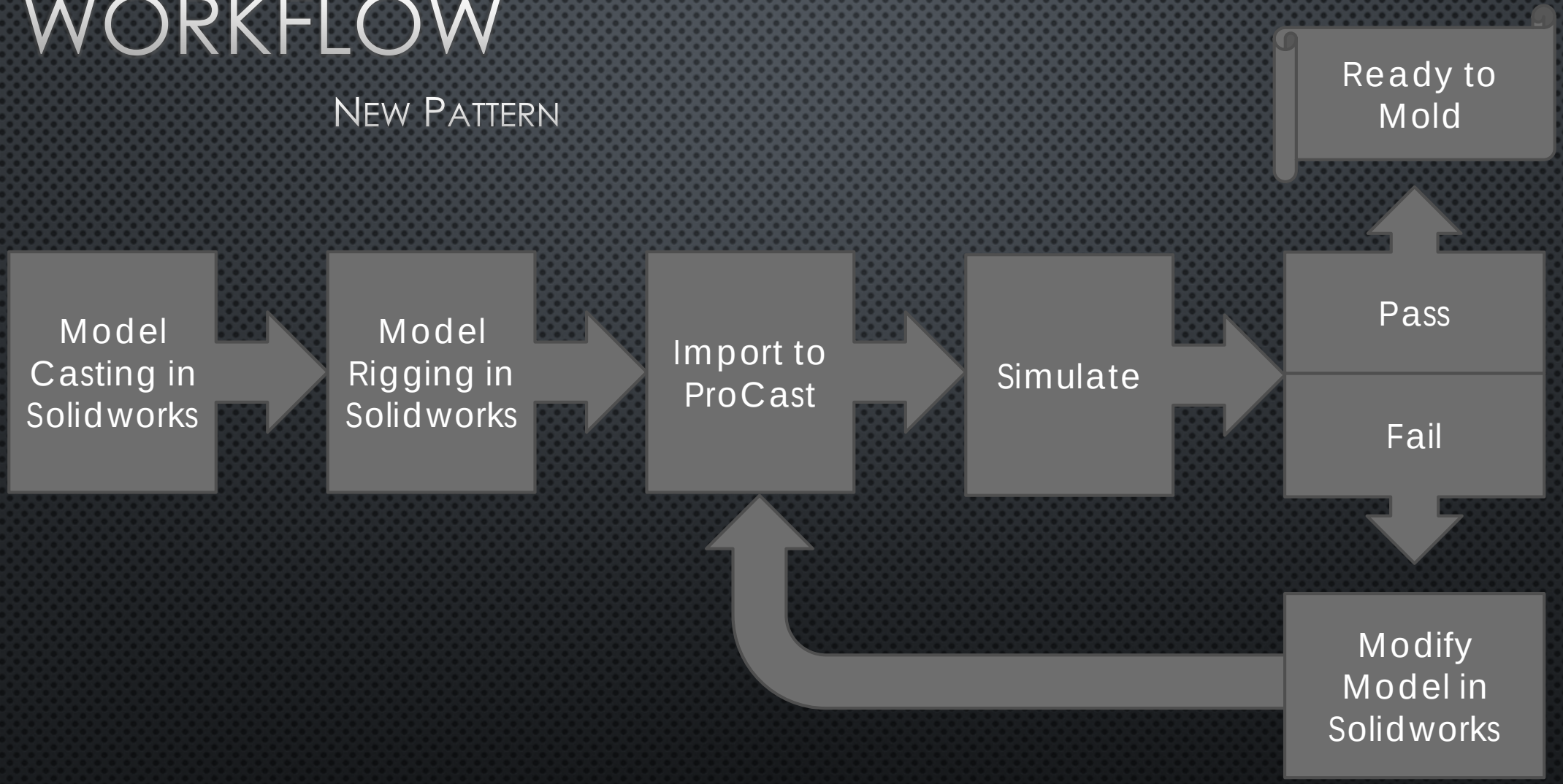


3D PRINTING WORKFLOW

3D Printing
In
Effort
Foundry

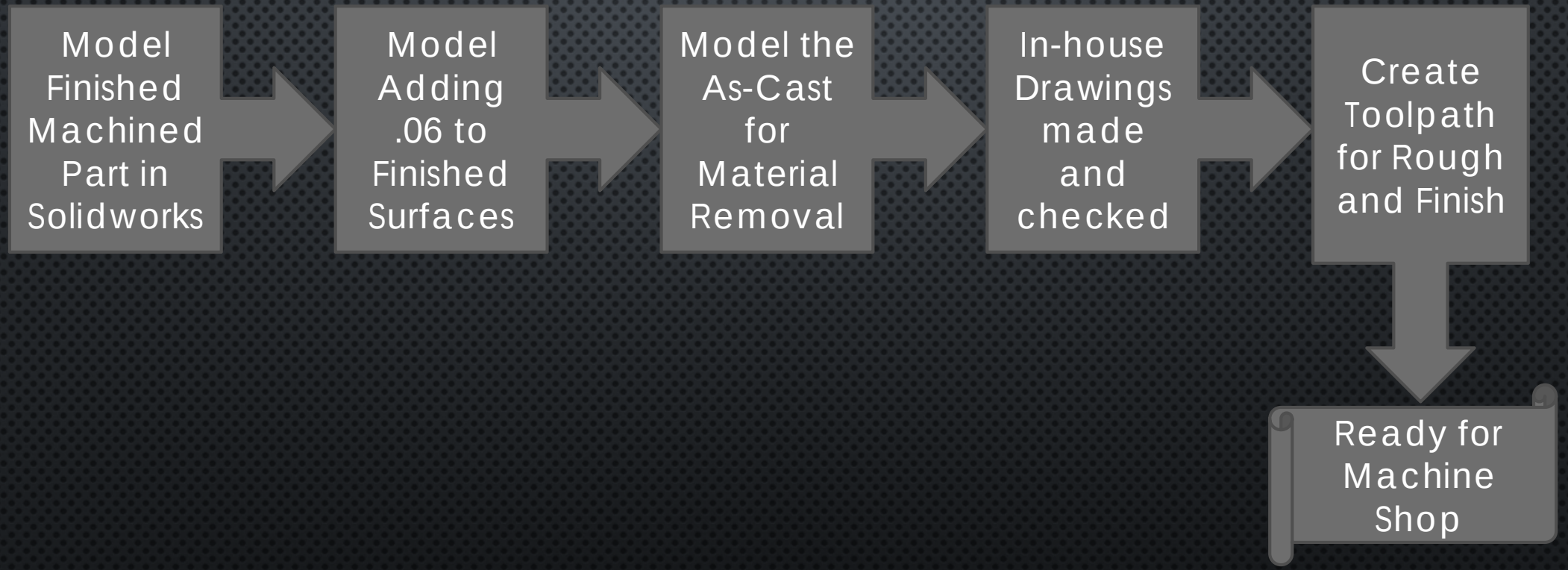
CASTING WORKFLOW

NEW PATTERN



MACHINING WORKFLOW

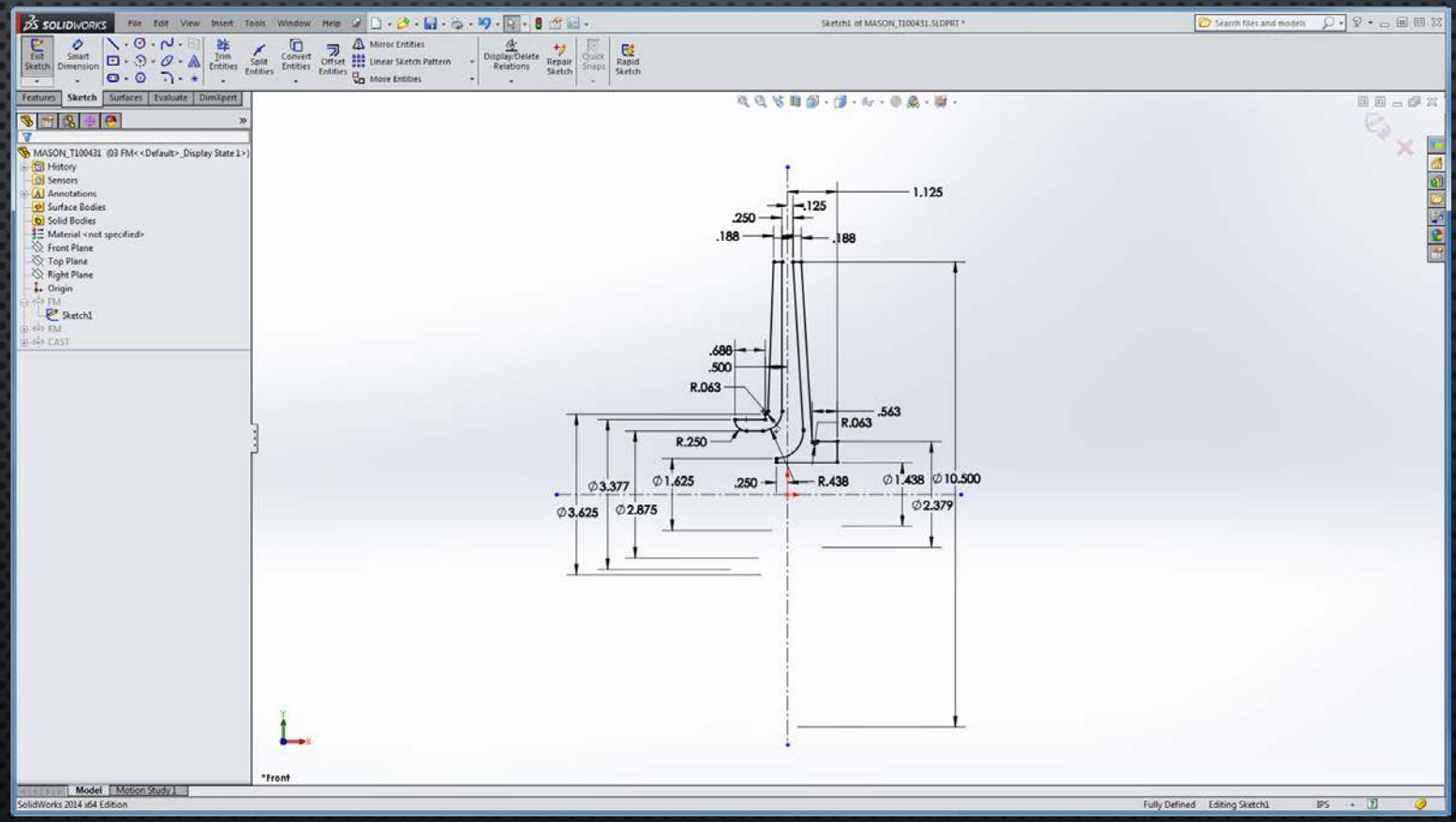
MACHINED PART PREPARATION



MACHINING WORKFLOW

MACHINED PART PREPARATION

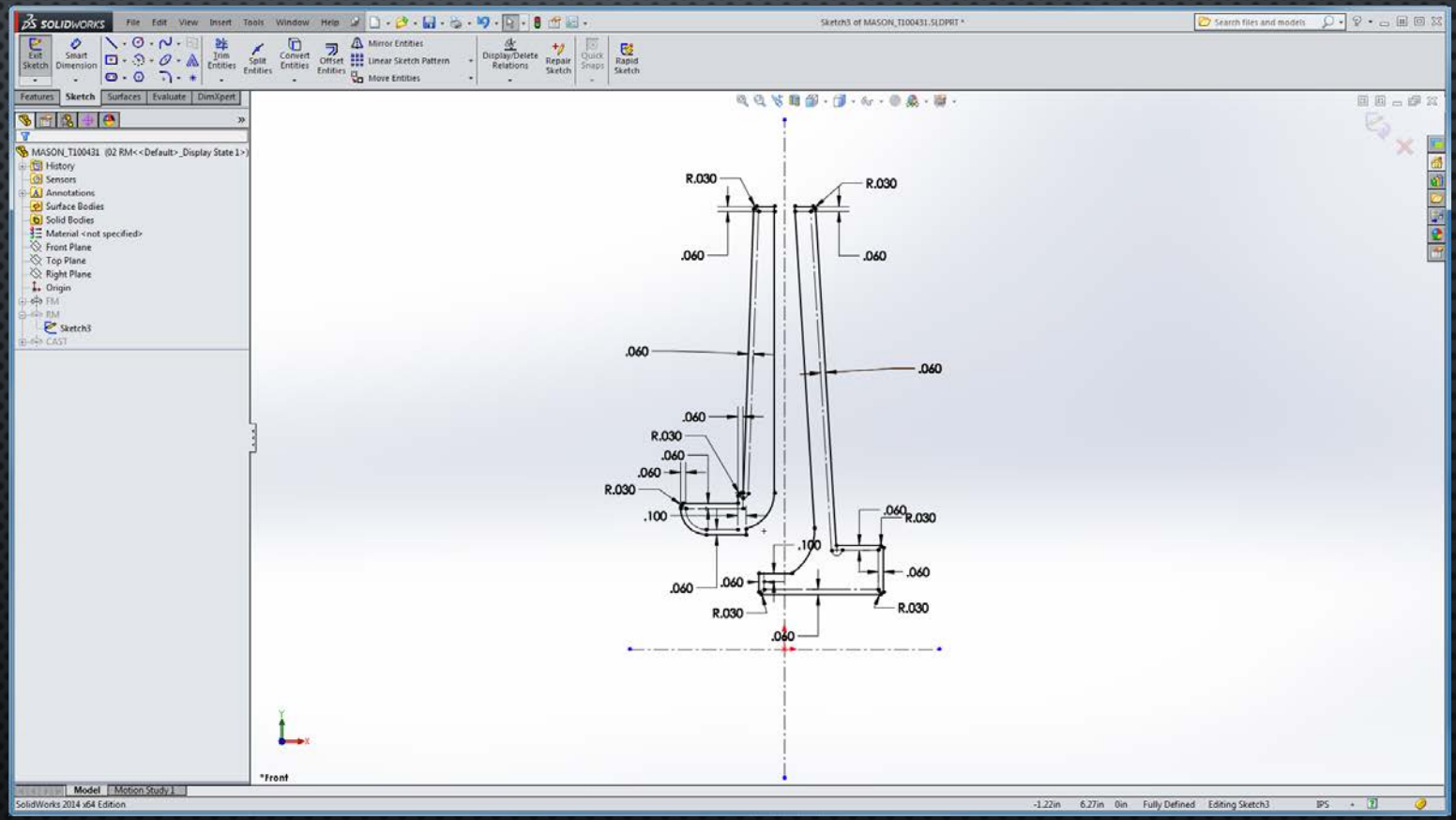
Model Finished Machined Part in Solidworks



MACHINING WORKFLOW

MACHINED PART PREPARATION

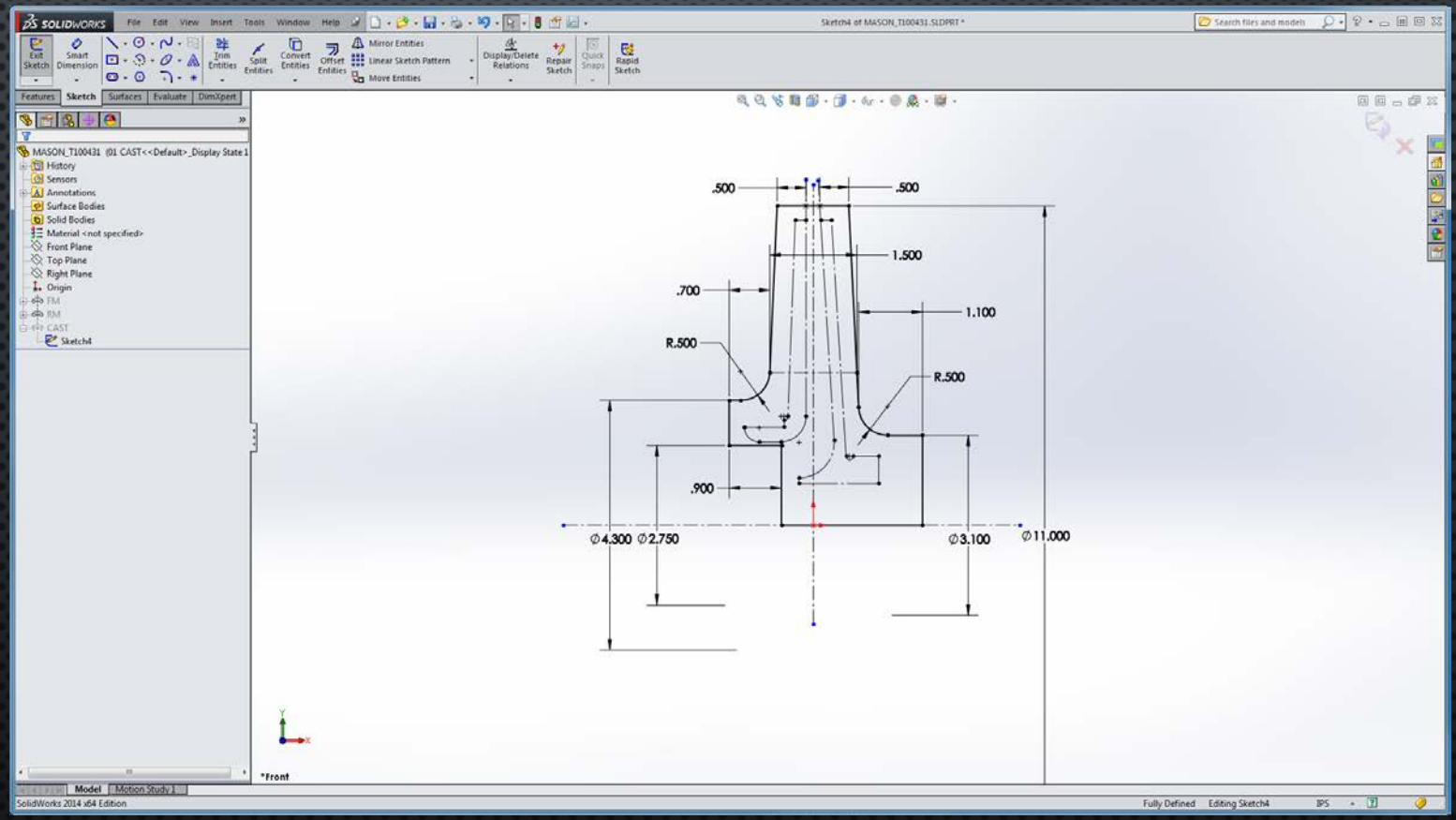
Model Adding .06 to Finished Surfaces



MACHINING WORKFLOW

MACHINED PART PREPARATION

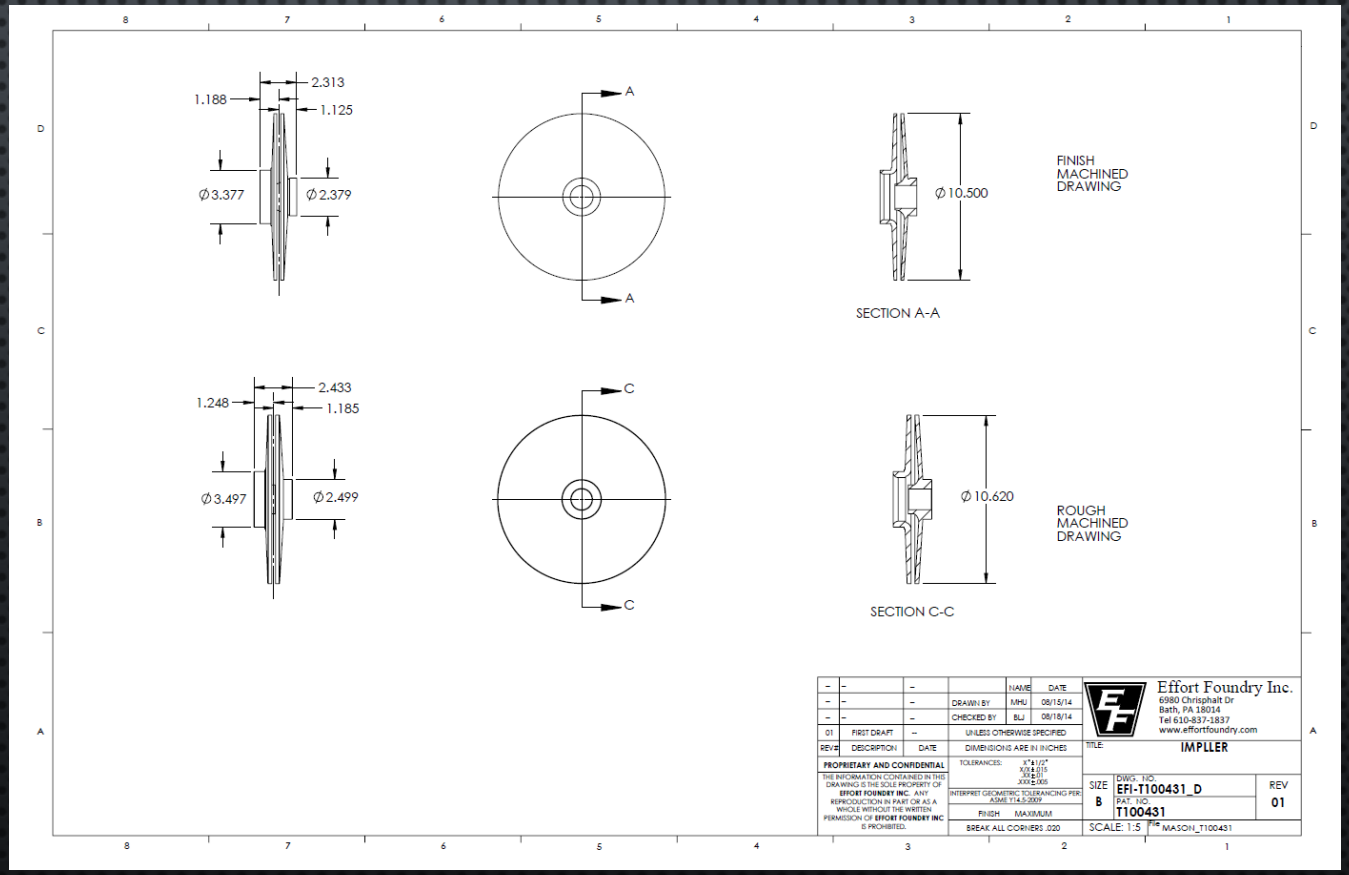
Model the As-Cast for Material Removal



MACHINING WORKFLOW

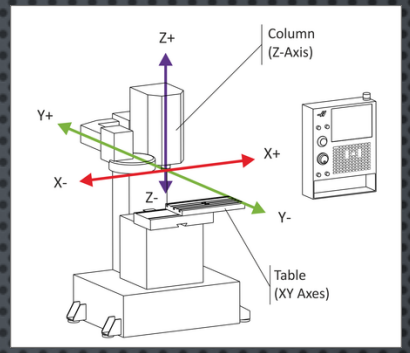
MACHINED PART PREPARATION

In-house Drawings made and checked

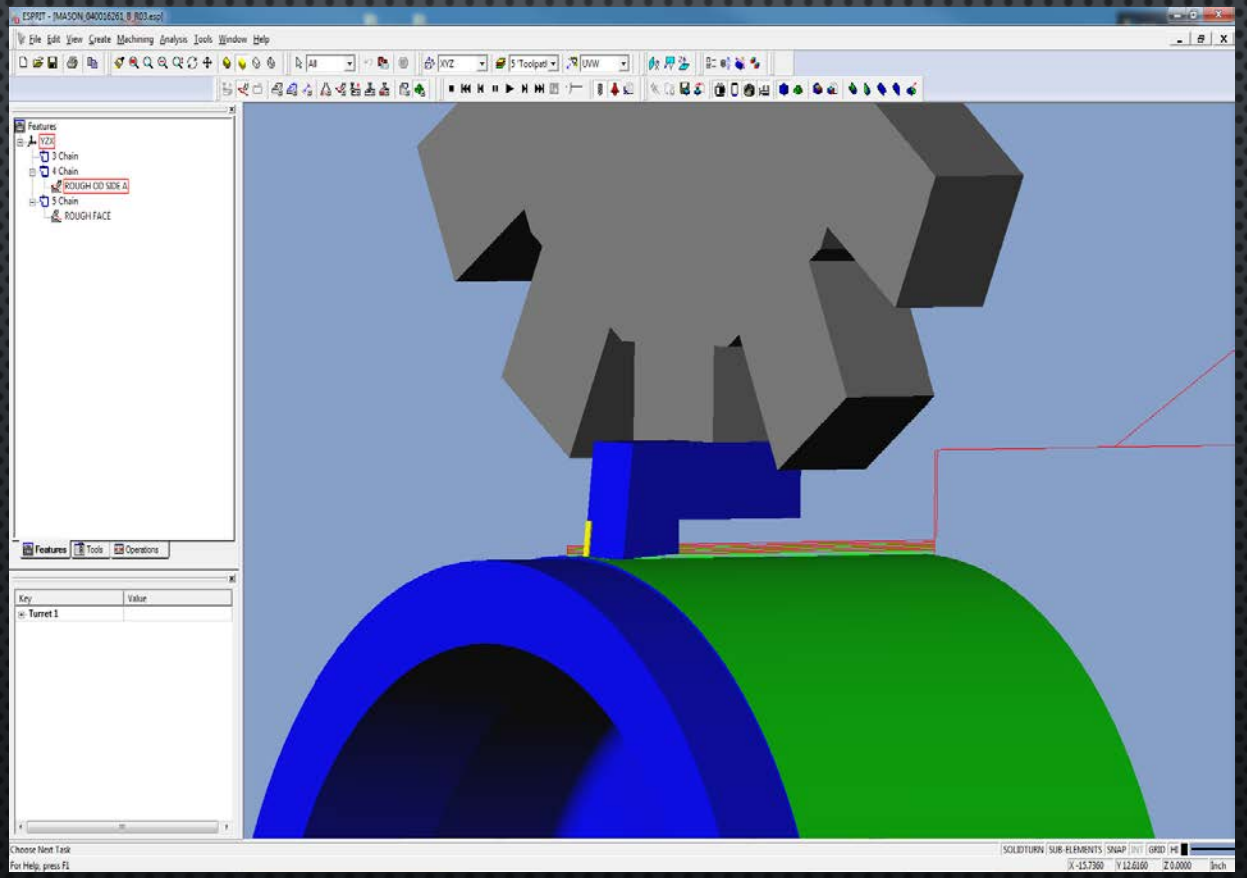


MACHINING WORKFLOW

MACHINED PART PREPARATION



Create Toolpath for Rough and Finish



ESPRIT NC Editor

File Edit View Tools Window Help

10 ROUGH SIDE A.nc

```
%
O0010
(10 ROUGH SIDE A)
(PART # - MASON_040012261_D)
(MATERIAL - STEEL inch - 1030 - 200 BHN)
(JUL 25 2014 -- 12:31 PM)
G20
N1 (ROUGH FACE)
(TOOL - 3 OFFSET - 3)
(DWLNR 164D  INSERT - WNMG 432-PM)
M98 P1
T303
M41
G97 S107 M03
G0 G54 X16. Z1.
M88
M31
G50 S500
G96 S450
Z.5115
X1.93
G99 G1 Z.4615 F.04
X-.0625
X.0082 Z.4969
G0 X1.93
Z.4731
G1 Z.4231
X-.0625
X.0082 Z.4584
G0 X1.93
Z.4346
G1 Z.3846
X-.0625
X.0082 Z.42
G0 X1.93
Z.3962
G1 Z.3462
X-.0625
X.0082 Z.3815
G0 X1.93
Z.3577
G1 Z.3077
X-.0625
X.0082 Z.343
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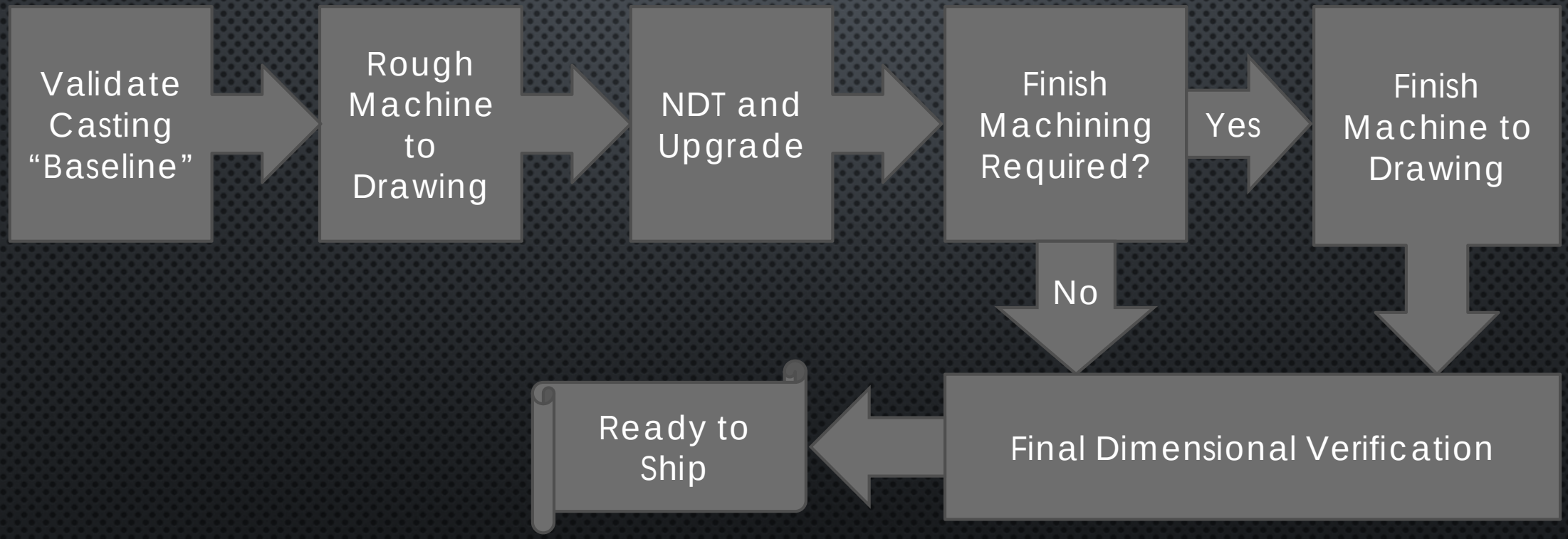
MACHINING WORKFLOW

MACHINING SEQUENCE



MACHINING WORKFLOW

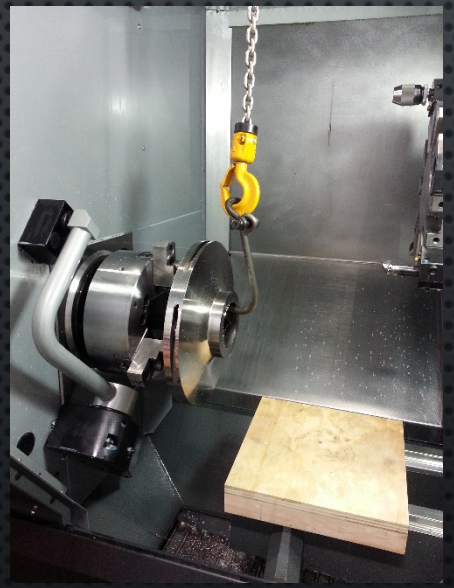
MACHINED PART PREPARATION

Validate Casting "Baseline"

MACHINING WORKFLOW

MACHINED PART PREPARATION

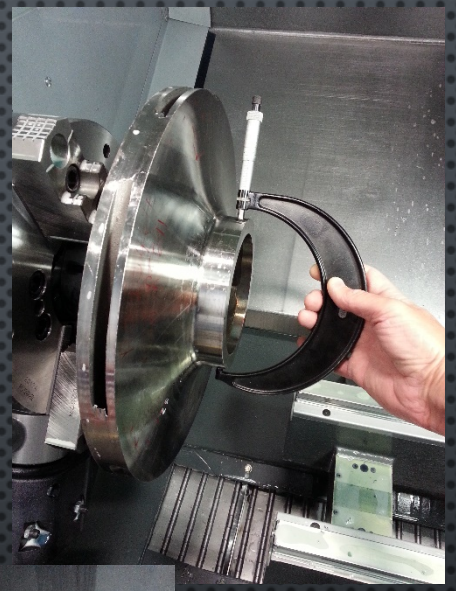
Rough Machine to Drawing



MACHINING WORKFLOW

MACHINED PART PREPARATION

Finish Machine to Drawing



MACHINING WORKFLOW

MACHINED PART PREPARATION

Patterns Too!