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
• ADDITIVE MANUFACTURING
• MACHINING SIMULATION
• 3D LASER SCANNING
• LASER MARKING

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

- **SolidWorks**
  - 3D Model Parts from 2D
  - 3D Model Patterns from 2D

- **Solidification Simulation**
  - Complex Pattern Components
  - Complete Patterns
  - Verify Casting Process
  - Verify Heat Treat Process
  - Verify Material Stress
  - Rough and Finish Machining of Castings
  - Machining of New Patterns

- **3D Printed Plastic**
  - Complex Pattern Components
  - Complete Patterns

- **CAM**
  - Create Machine Tool G-Code
  - Rough and Finish Machining of Castings
  - Machining of New Patterns
Laser Marking Technology Flowchart

- Laser Marker
  - Rough Machined
  - Finish Machined

- Customer
  - Permanent Part Identification
  - Completely Customizable Per Customer Requirements

- Effort Foundry
  - In-house Part Verification
  - Part #
  - Heat #
  - Pattern #
  - Material

- EFI Vendor
  - Part ID for Outside Processing
  - Part #
  - Heat #
  - Pattern #
  - Material
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

1. Measure Pattern 3D Scan
2. Model in Solidworks
3. Import to ProCast
4. Simulate
   - Pass
   - Fail
      - Modify Model in Solidworks
      - Ready to Mold
3D SCANNING WORKFLOW
3D SCANNING WORKFLOW

3D Scanning For Inspection
3D Printing Workflow

3D Printing → In Effort → Foundry
CASTING WORKFLOW

New Pattern

Model Casting in Solidworks
Model Rigging in Solidworks
Import to ProCast
Simulate

Ready to Mold
Pass
Fail
Modify Model in Solidworks
MACHINING WORKFLOW

Machined Part Preparation

1. Model Finished Machined Part in Solidworks
2. Model Adding .06 to Finished Surfaces
3. Model the As-Cast for Material Removal
4. In-house Drawings made and checked
5. Create Toolpath for Rough and Finish

Ready for Machine Shop
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
Create Toolpath for Rough and Finish
MACHINING WORKFLOW

Machining Sequence

1. Validate Casting "Baseline"
2. Rough Machine to Drawing
3. NDT and Upgrade
4. Finish Machining Required?
   - Yes: Finish Machine to Drawing
   - No: Final Dimensional Verification
5. Ready to Ship

Finish Machining Required?
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!