

SURFACE FINISHING &  
ENHANCEMENT FOR  
**ADDITIVE**  
**MANUFACTURED**  
**PARTS**

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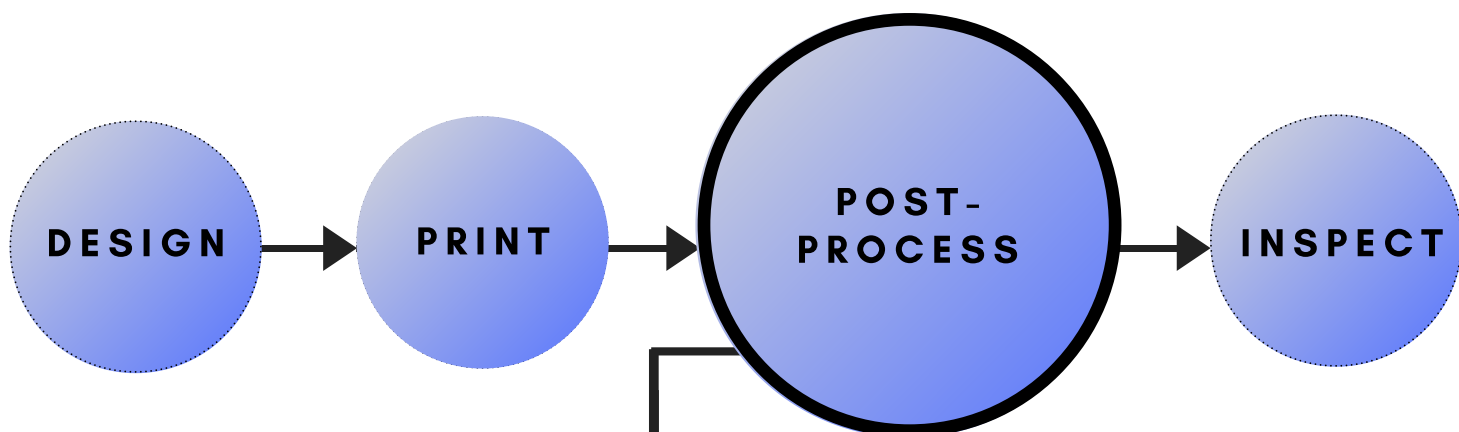
APR 2020



Advanced  
Remanufacturing and  
Technology Centre

ARTC

# THE AM VALUE CHAIN: ARTC'S CORE COMPETENCY



General Post-Processing

- Powder Removal
- Support Structure Removal
- Heat Treatment
- Abrasive Blasting

Surface Finishing

- Internal Channel Finishing by *Abrasive Flow Machining*
- External Surface Finishing by *Stream Finishing*  
by *Vibratory Finishing*  
by *Dry Electropolishing (Dlyte)*

Surface Enhancement

- Fatigue life improvement by *Peening (Shot, Hammer, Laser)*  
by *Deep Cold Rolling*

**Data-Driven Surface Enhancement Team's Core Competency**



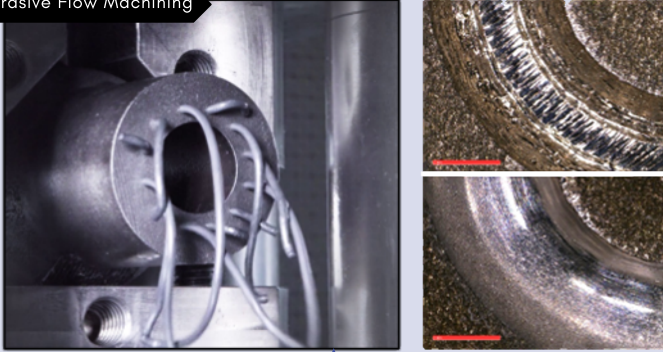
Advanced Remanufacturing and Technology Centre  
ARTC

# AM POST-PROCESSING: CAPABILITIES IN ARTC

## SURFACE FINISHING

FOCUSES ON IMPROVING SURFACE ROUGHNESS OF INTERNAL AND EXTERNAL GEOMETRY FOR ADDITIVE COMPONENTS.

Abrasive Flow Machining



Finishing of Complex Geometry

Stream Finishing



Polishing of L-PBF component

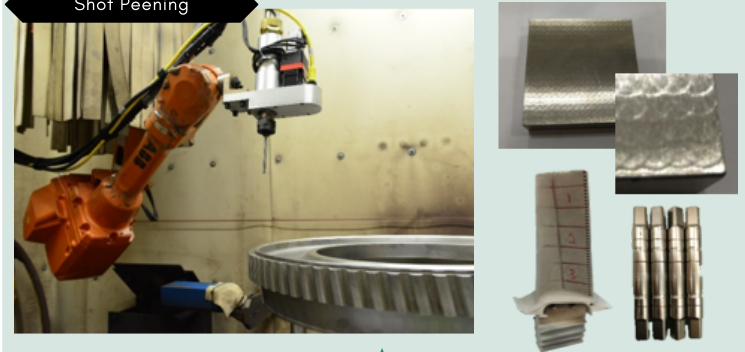
Polishing of EBM component

Finishing of Freeform External Geometry

## SURFACE ENHANCEMENT

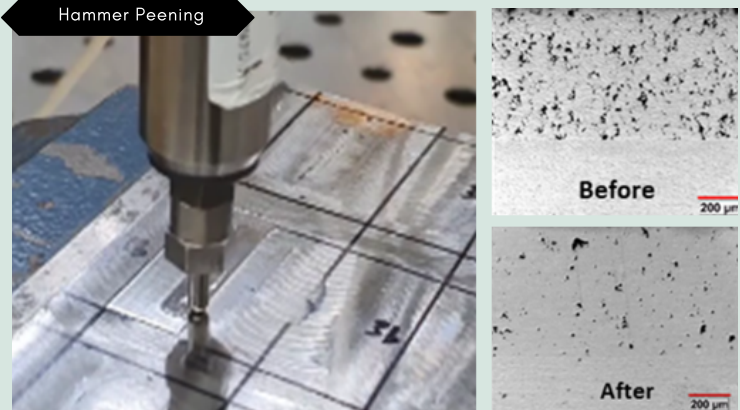
FOCUSES ON INCREASING FATIGUE LIFE OF ADDITIVE COMPONENTS, BY IMPARTING COMPRESSIVE RESIDUAL STRESS AND REDUCING POROSITY.

Shot Peening



Extending Fatigue Life of Parts

Hammer Peening



Reducing the Porosity of Components

## DO GET IN TOUCH IF...

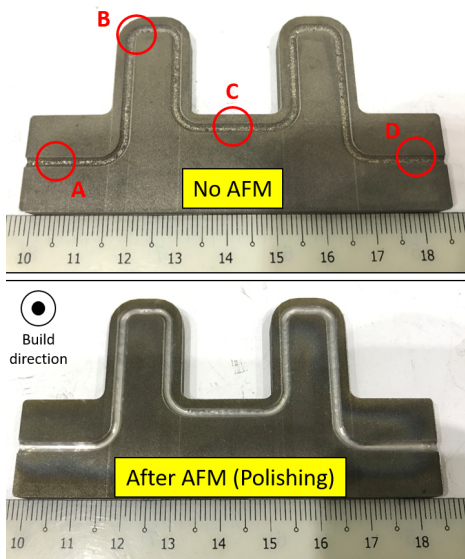
1. You are sourcing for post-processing solutions for your AM components
2. You are unsure if your AM components require post-processing
3. You would like to know more about post-processing or AM in general

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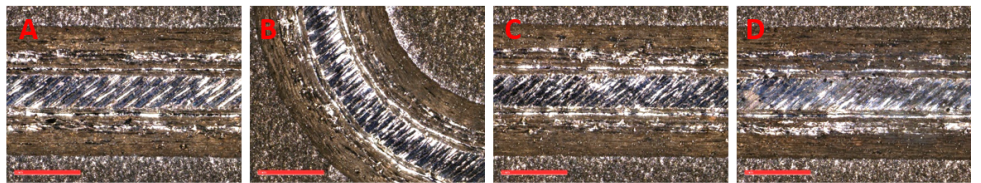
**ADDITIONAL MATERIALS  
ON PAGE 5**

# CASE STUDIES: ABRASIVE FLOW MACHINING

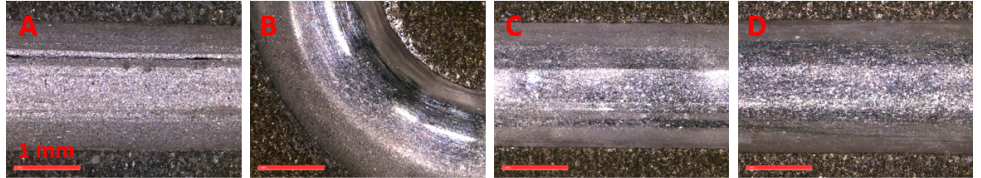
## EXAMPLE OF CHANNEL POLISHING #1 (ID Ø2MM)



Before AFM:



After AFM (Polishing):



## EXAMPLE OF CHANNEL POLISHING #2 (ID Ø2.5MM, Ø5MM)



Sectioning by wire-EDM

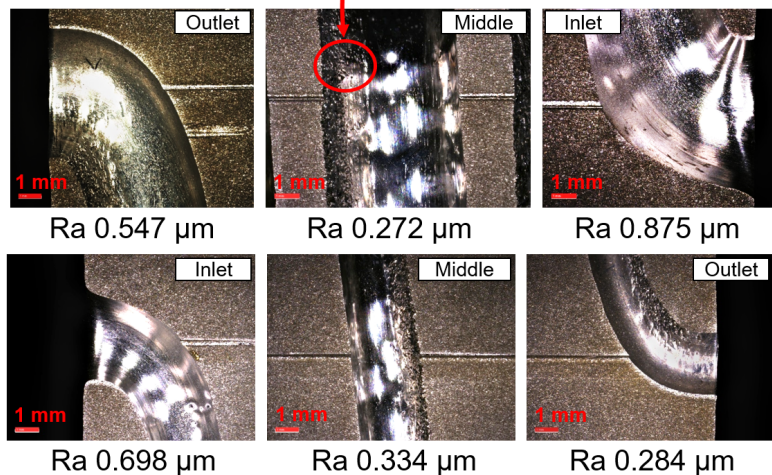
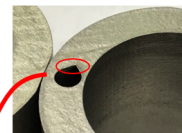
Ø5mm × 380mm spiral



Ø2.5mm × 190mm spiral

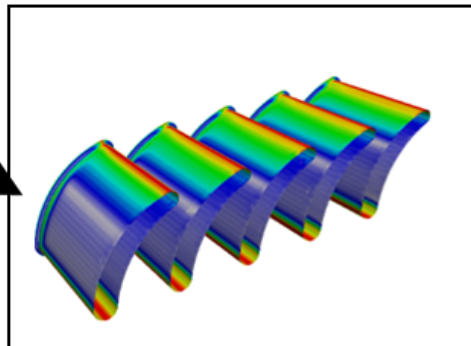
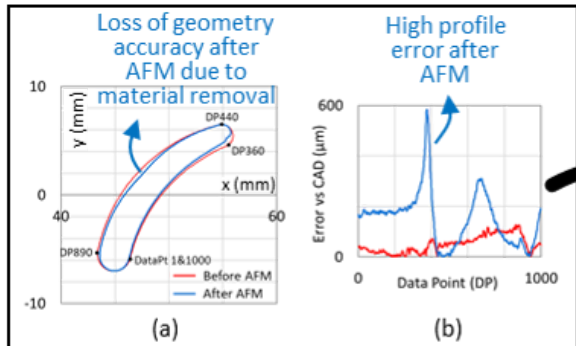
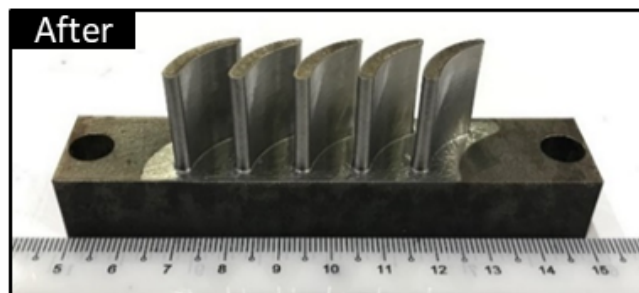
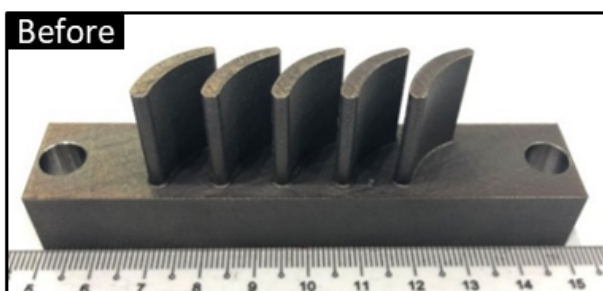


Difficulty to polish sharp corners – recommend to avoid during design



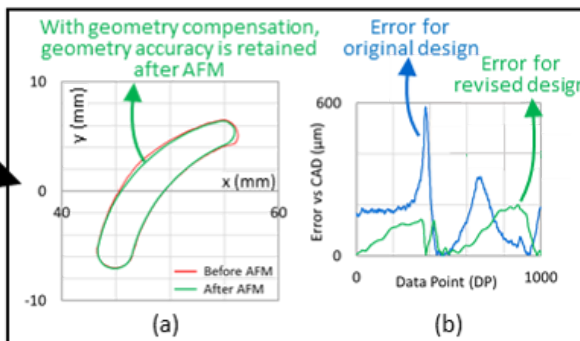
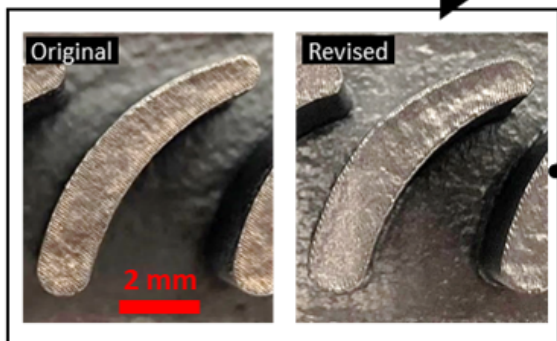
# CASE STUDIES: ABRASIVE FLOW MACHINING

## GEOMETRY COMPENSATION TO ACHIEVE DIMENSIONAL ACCURACY



1 Without geometry compensation, there is high profile error after AFM

2 Material removal distribution is predicted by process simulation

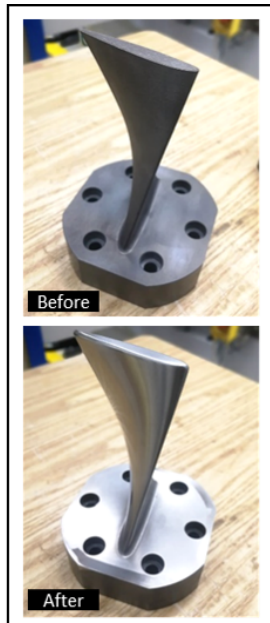


3 Based on predicted material removal, geometry is compensated

4 With geometry compensation, profile error after AFM is significantly reduced

# CASE STUDIES: STREAM FINISHING

## POLISHING OF FREEFORM EXTERNAL SURFACES

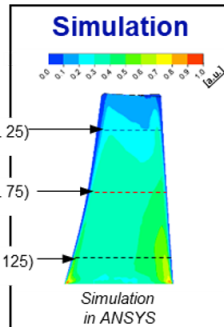
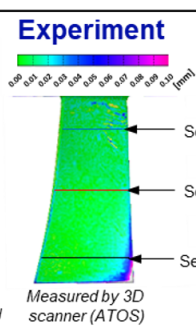
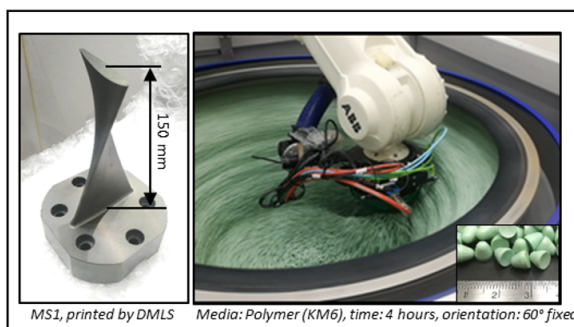
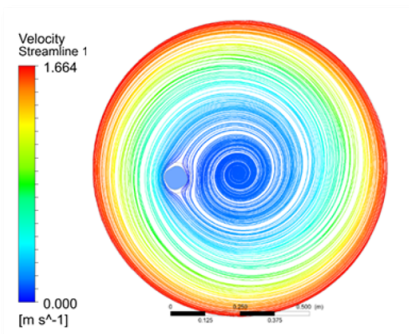


Polishing of L-PBF component



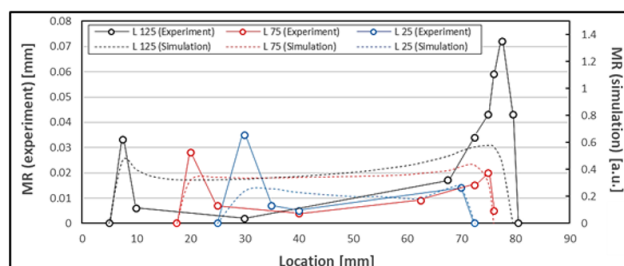
Polishing of EBM component

## MODELLING & SIMULATION TO PREDICT MATERIAL REMOVAL



1 Experiments were conducted to obtain material removal distribution

2 Media flow was simulated and material removal was calculated using a model



3 Comparison showed reasonable agreement, with underestimation when small radius of curvature is encountered