Methodology for Repair Using Hybrid Manufacturing

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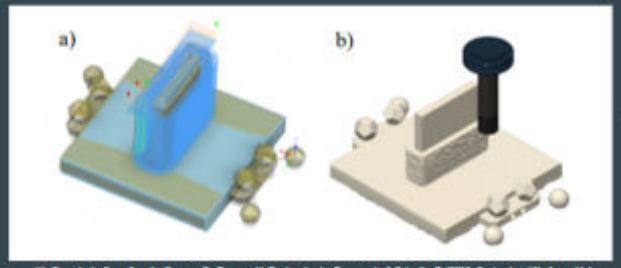
Introduction

- Hybrid manufacturing combines additive (AM) and subtractive (SM) manufacturing techniques
- The AM process creates a near-net shape of the part, which is then finished using SM techniques, such as milling or turning, to achieve the final dimensions and surface quality.



(1) Dvorak, J., Cornelius, A., Corson, G., Zanwisell, R., Jacobs, L., Penney, J., & Schmitz, T. (2022, September 16). *A machining digital twin for hybrid manufacturing*. Manufacturing Letters. Retrieved April 3, 2023, from https://www.osti.gov/servlets/purl/1822035

Main Goals of Our Project

- This research aims to create a method to restore damaged parts or tools to their original state using a 3D scanner.
- The objective is to improve efficiency in part fabrication and enable repair of valuable parts with complicated geometries.

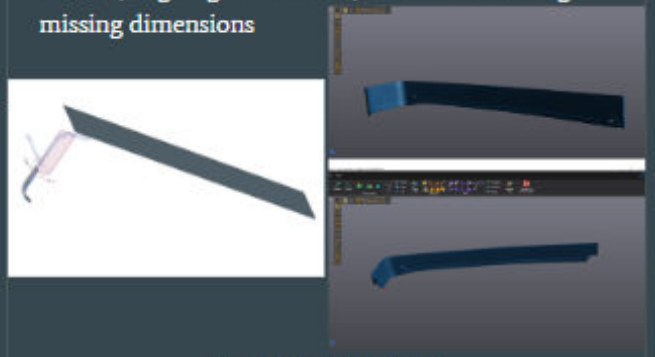
Approach

This research mainly focuses on creating a methodology and documentation for the full process of:

- Data Collection
- Machining
- Efficient Data Usage
- Data Analysis

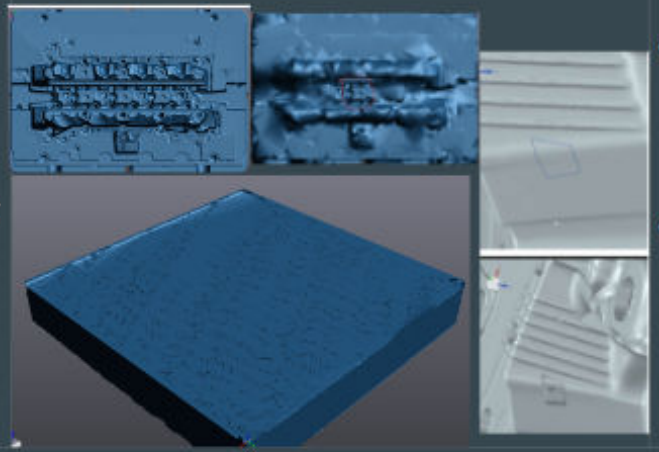
Data Collection

- Created methodology for 3-D scanning, cleaning meshes, aligning coordinates, and reconstructing missing dimensions



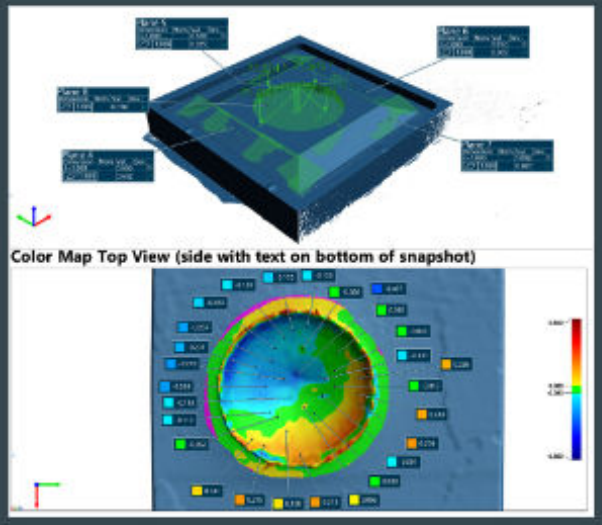
Efficient Data Usage

- Created methods to reduce data post processing. This includes:
  - Selective Data Reduction
  - Changing to efficient file types
  - Mesh Boolean Data Selection



Data Analysis

- After machining, the finished product will need to be compared to a reference cad model or scan. Documentation was created to show various methods.



Conclusions

- In conclusion, once the DMG Mori machine is mechanically functioning smoothly, the tools and documentation developed within this research can aid in repairing Toyota engine die parts with a hybrid machining workflow.
- Ultimately, the aim is to create a comprehensive program for Missouri S&T to instruct other universities on operating a hybrid additive and subtractive machine.