

Background

Accu-Precision, a manufacturer of aerospace components, is challenged by a tab removal process that is slow and produces inconsistent results. Our team is developing a faster, safer, and more precise solution that maintains tight tolerances across various materials.

Mission

Design a tooling assembly capable of **safely, quickly, and efficiently** removing work holding tabs from parts with complex geometries, ensuring no gouging and leaving no more than 0.002 inches of remaining tab material.

Procedure

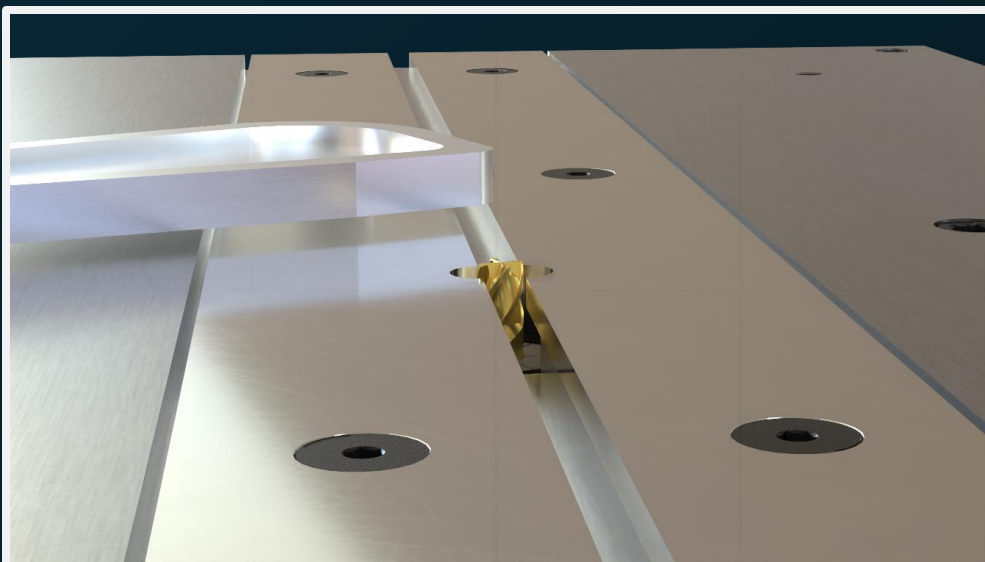


Requirements

✓	OSHA and ADA Compliance
✓	Remove No Material From Part
✓	≤0.002” Remaining Tab Material
✓	0.003”-0.020” Tab Width
✓	1⁄16”-3⁄4” Tab Height
✓	Straight & Curved Tabs
✓	Up to 80” Tab Length
✓	Plastic, Aluminum, Steel, Stainless
✓	0.25”-1.5” Tab Radii

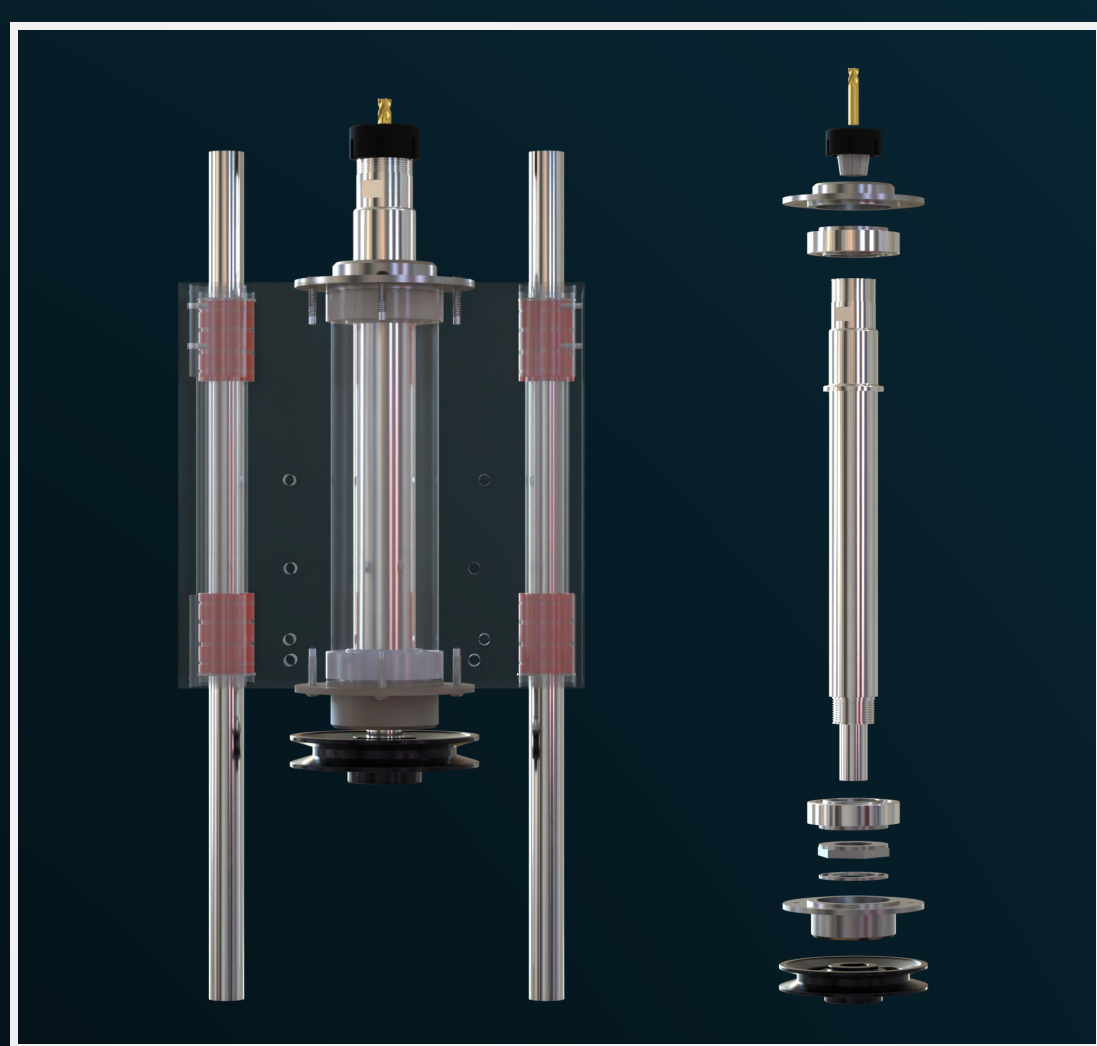
System Breakdown

End Mill



3/8" carbide roughing end mill mounted in an ER32 collet cuts tabs at 3450 RPM. Positioned at the top of the spindle, this tool handles all material removal during the tab trimming process.

Tight Tolerance Spindle



Holds preloaded spindle with tapered roller bearings for stable, high-speed cutting. Custom enclosure ensures minimal runout and handles lateral forces during tab removal.

End Mill Guard

Spring-loaded safety guard covers spinning end mill, swings aside when part is fed through.

Industrial Motor

1 horsepower motor drives spindle via belt up to 3450 RPM.

Emergency Stop

Brings spindle to a stop in under 2 seconds for operator safety.

Variable Frequency Drive

Drives motor with 3-phase power from wall outlet, spindle speed adjusted with dial.

Precision Lift System

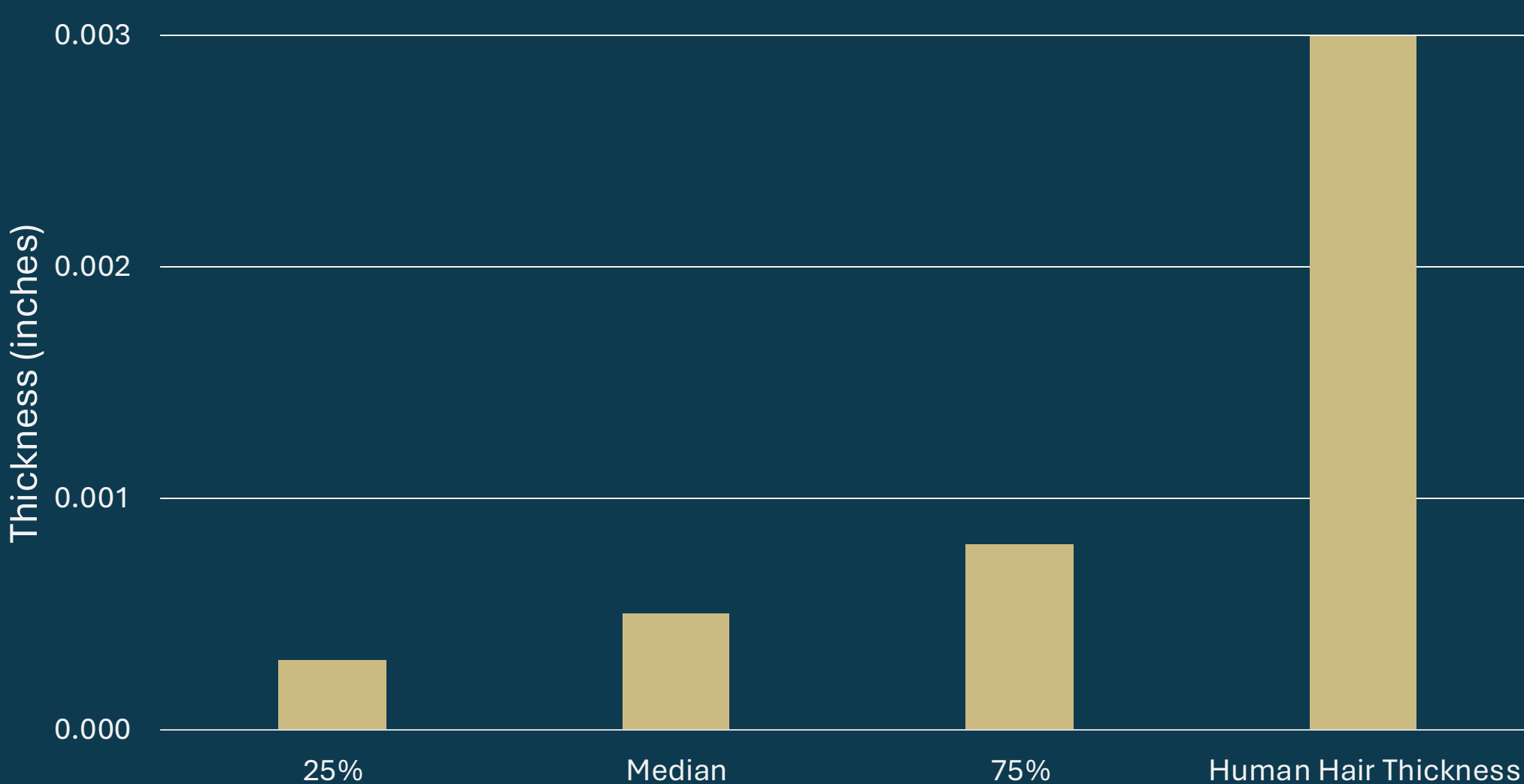
Crank driven ball screw delivers 0.005" of vertical travel per-turn for ultra fine adjustment.

Safety Features

Operator safety is a **top priority**, especially since our machine will be used by employees on the shop floor. An **industrial emergency stop** halts the spindle in under two seconds, allowing for rapid response in case of an incident. A **spring-loaded end mill guard** protects the operator from the fast-spinning cutter, automatically swinging into place when not actively cutting. The **motor belt is fully enclosed by a guard** that adheres to OSHA standards, shielding the user from the high-speed belt drive. **Adjustable tab guides** help keep hands clear of the cutting area, while the **all-metal construction** ensures long-term durability and structural integrity for safe, reliable use.

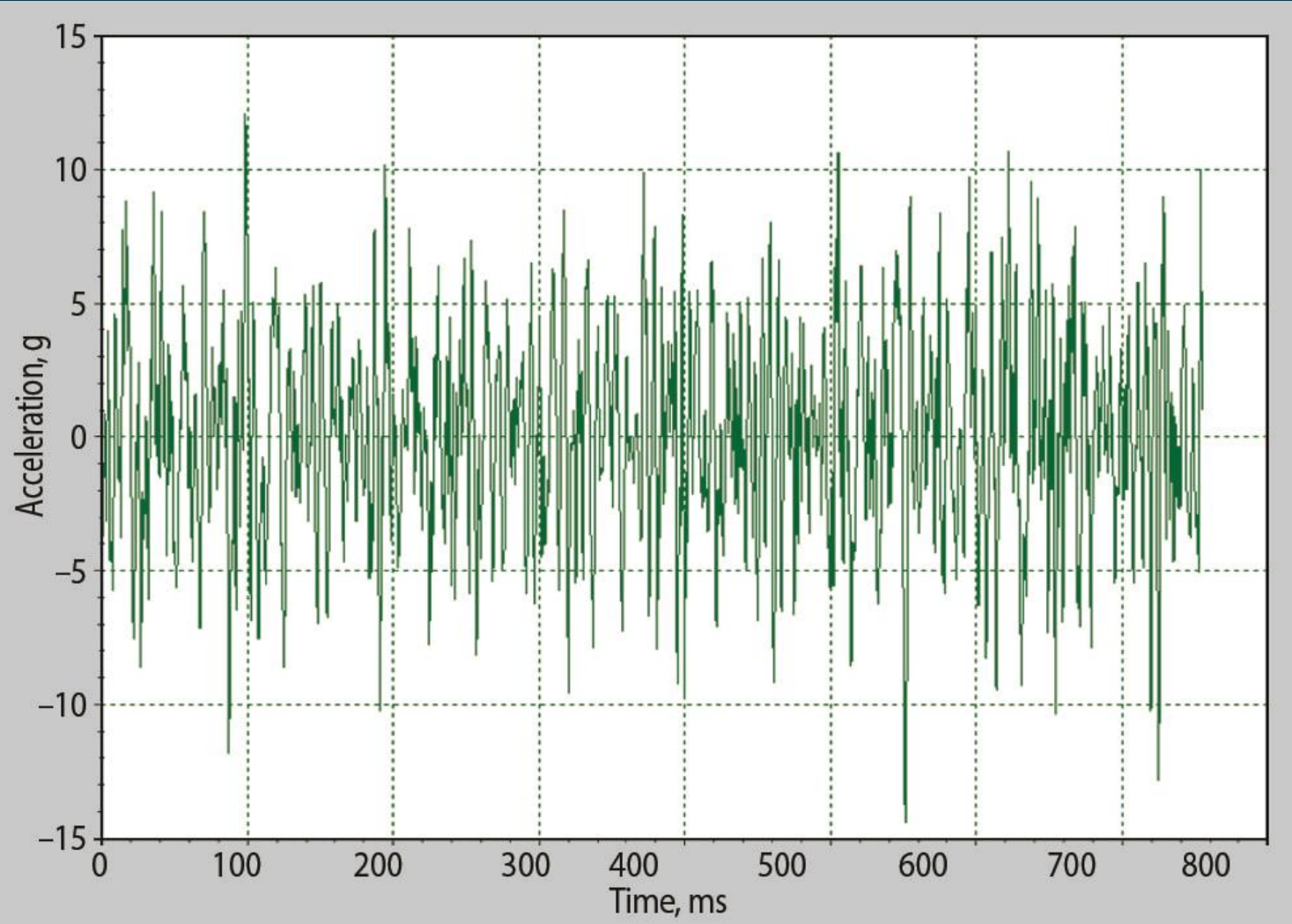
Testing & Analysis

Remaining Tab Material After Cut

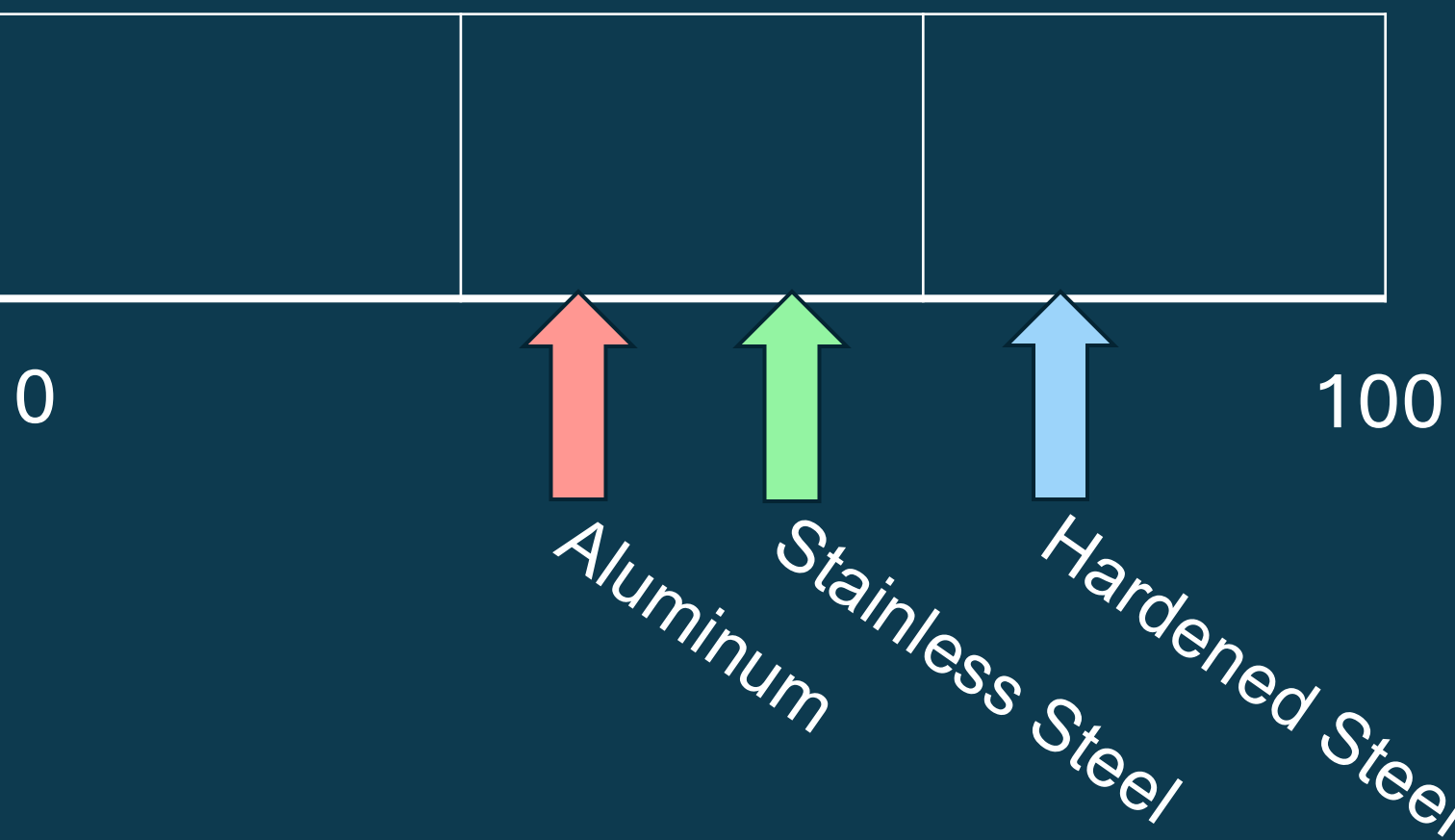


Tab cutting performance across 51 samples, showing 25th percentile, median, and 75th percentile tab thickness. Human hair thickness (~0.003") included for scale.

System Vibration Testing



Chip Collector Airflow Performance



Challenges

- Tight Tolerances & Stack-up Control
- Preventing Spindle Binding During Lift
- Spindle For Handling Lateral Forces
- Weight Reduction Strategies

Future Work

- Standardize Hardware
- Streamline Manufacturing Processes