

Group M1.01 – High Temperature 3D Printed Masks

Ian Sporn, Subash Panta, Mikhale Johnson, Jared McCash

Sponsor – Shelby Huff



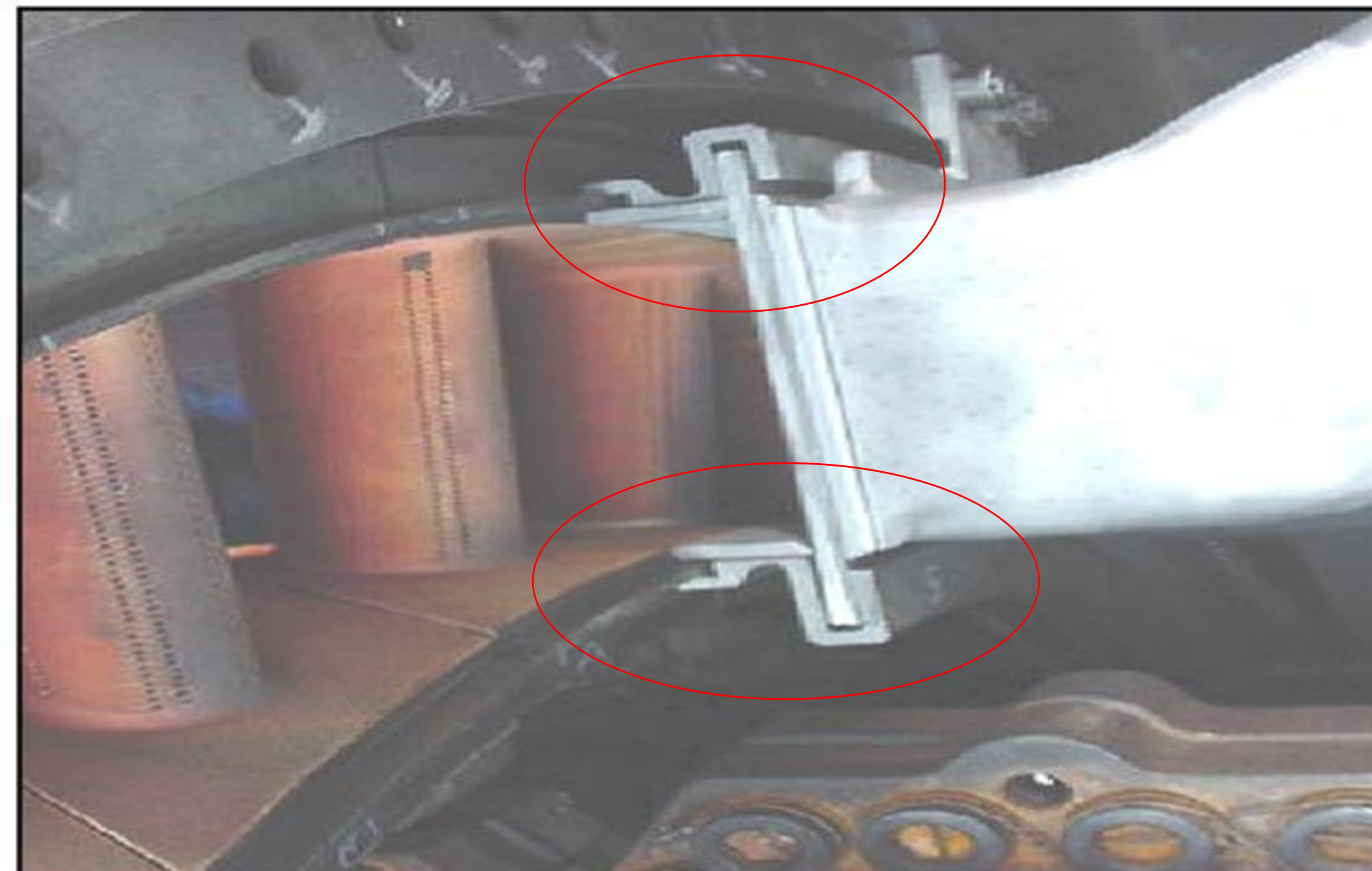
Introduction



- Curtiss-Wright manufactures products for a variety of industries; from aerospace to power and energy.
- Post processing for these parts requires a lot of preparation and materials, which means a high production cost.
- Processes include aluminum oxide grit-blasting, and high temperature thermal sprays. (HVOF, Plasma Arc, and Laser Cladding)

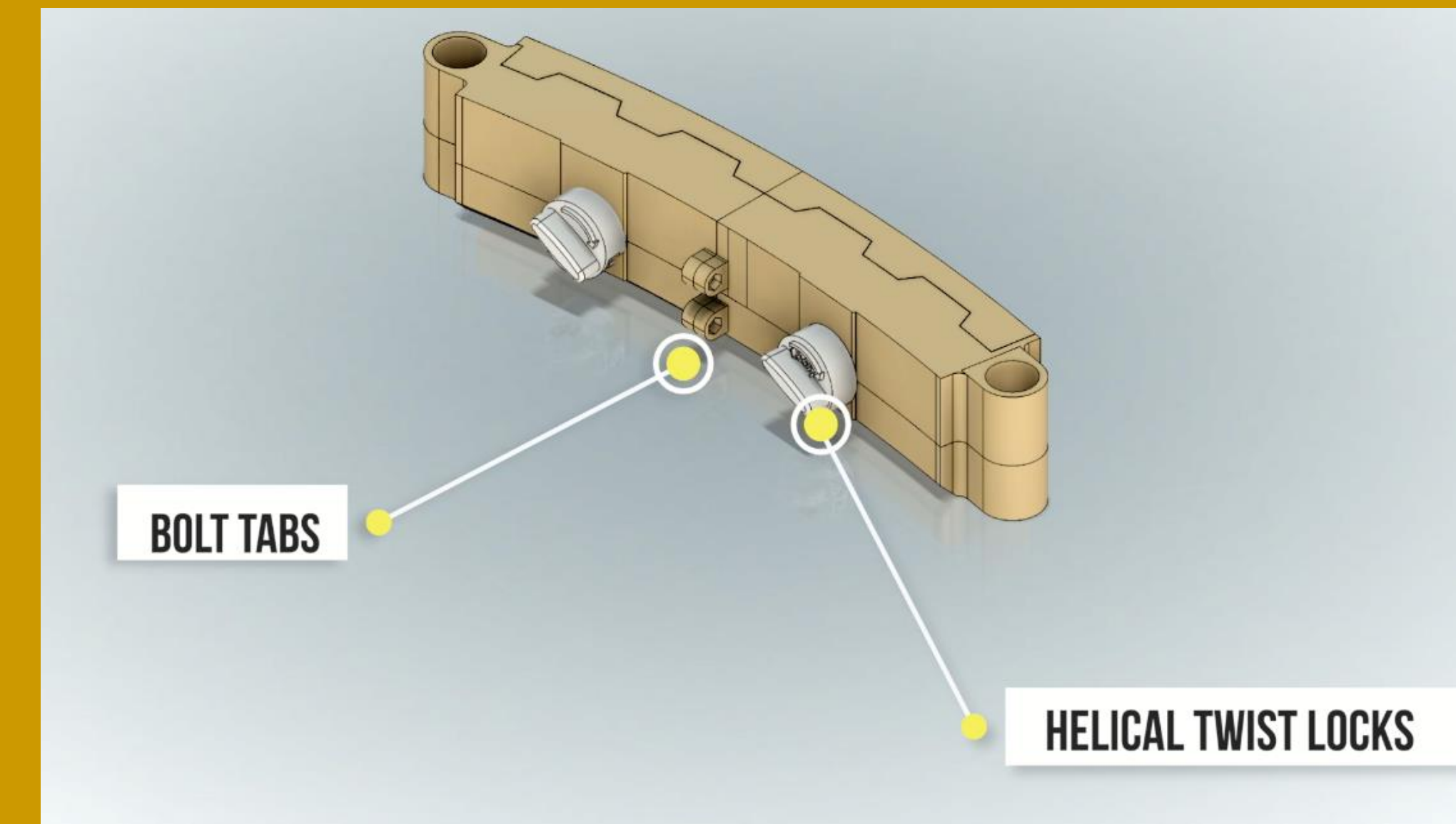
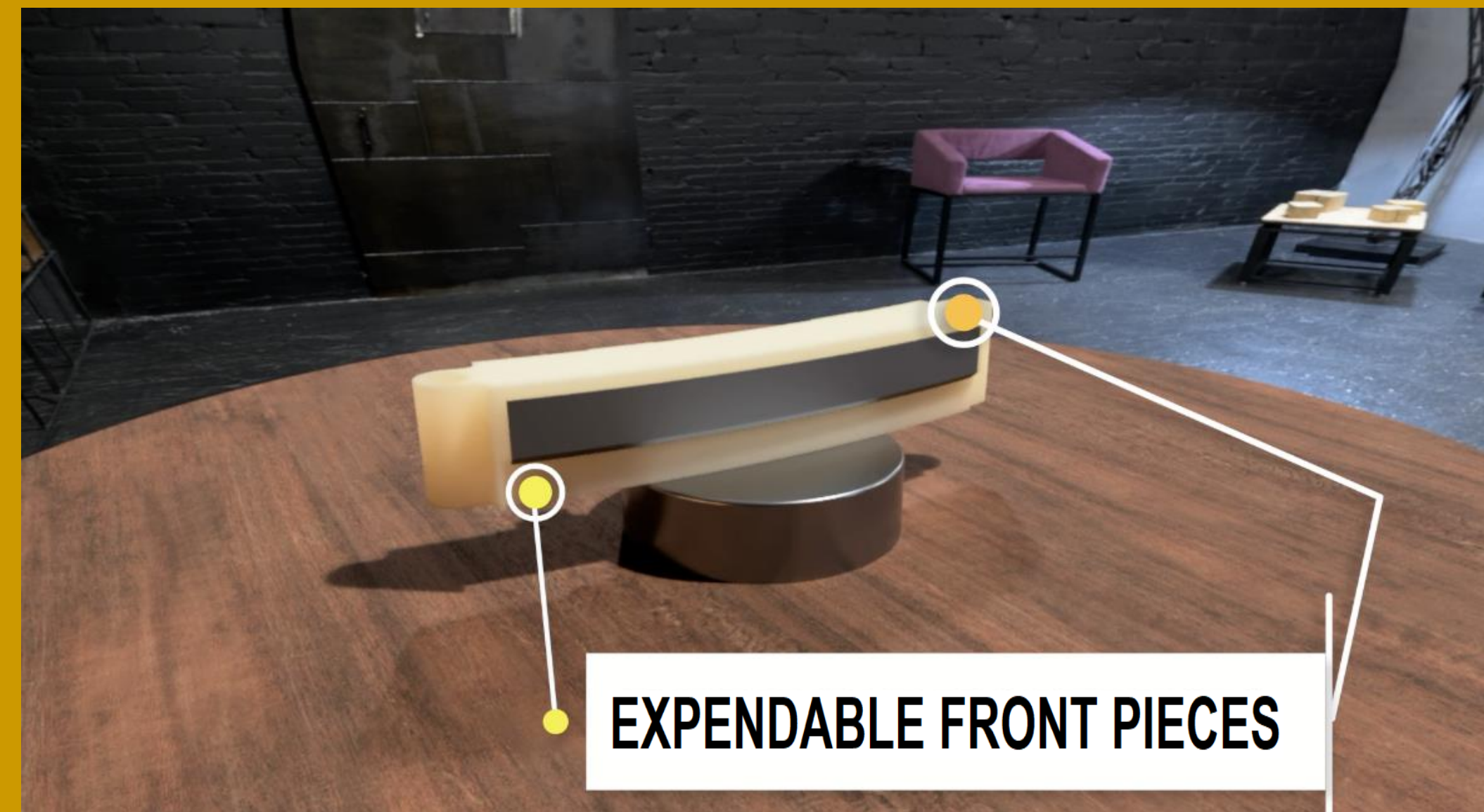
Initial Problem

501F TRANSITION-SEAL-VANE

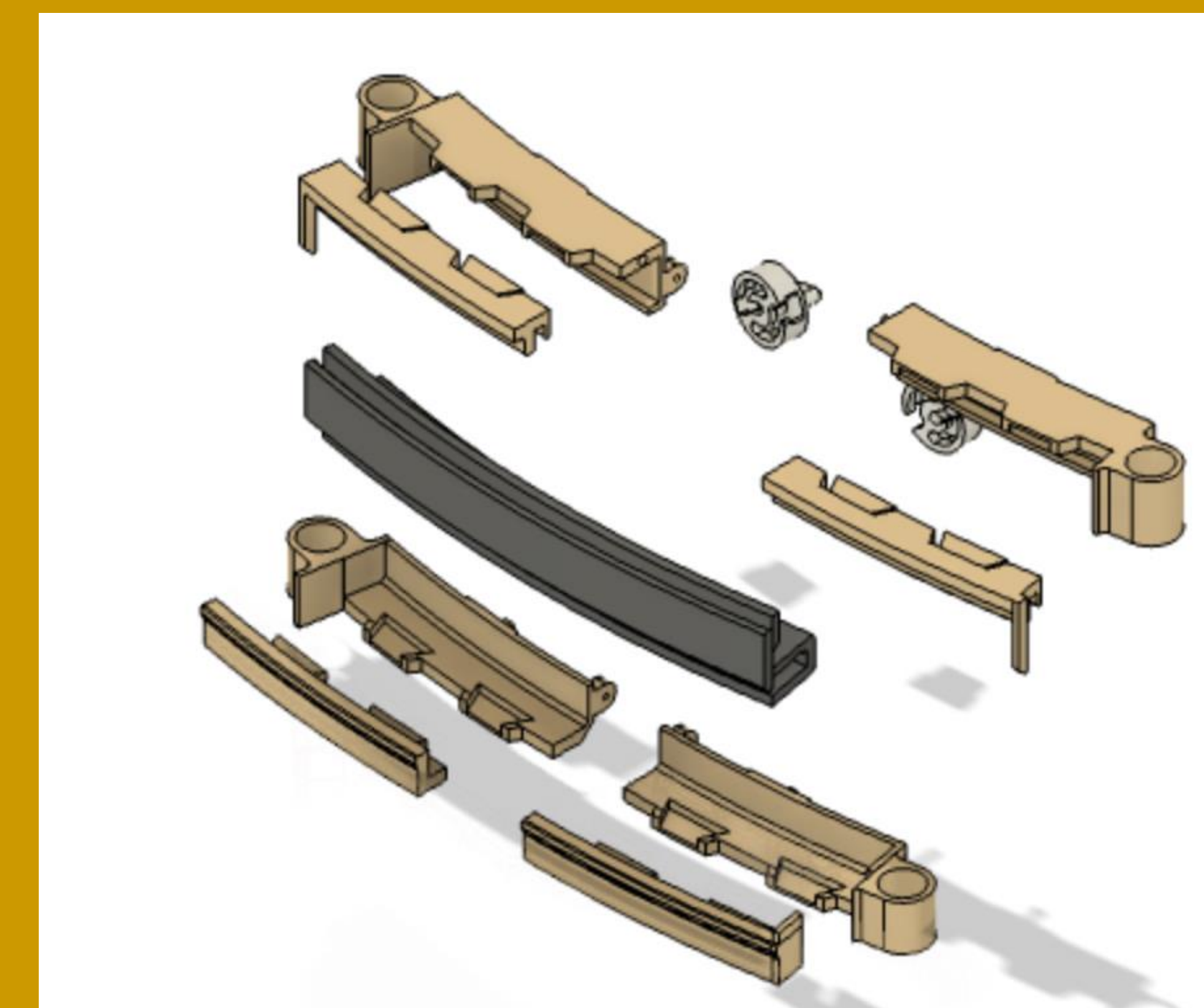
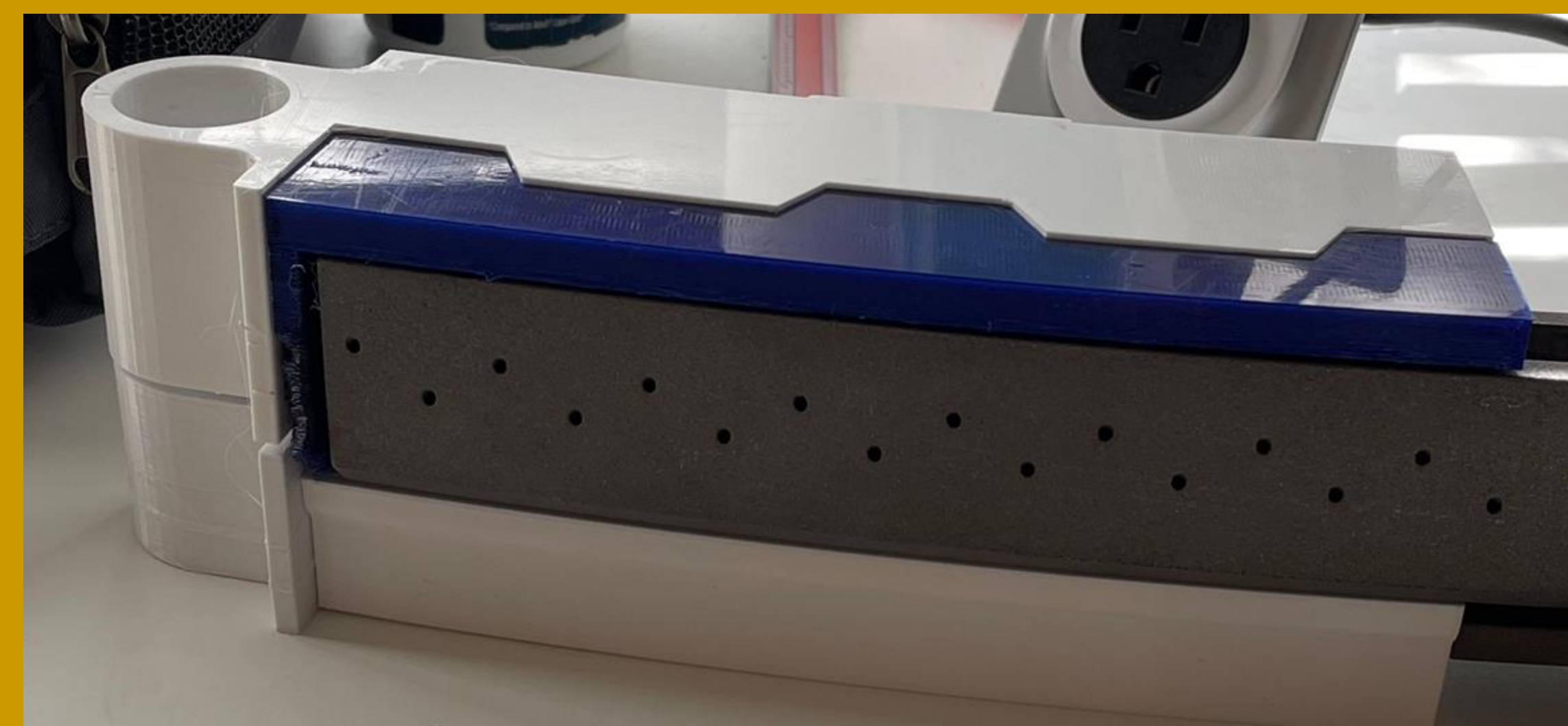


- One part produced is a floating seal for an aerospace exhaust.
- For Processing, the seal is currently hand masked with fiberglass tape.
- Our goal was to find an alternative to masking by hand that would be cost effective and of high tolerance.
- 3D printing offered the most versatility to survive both the grit blasting environment and the thermal spraying, while being reusable.

Mask Design

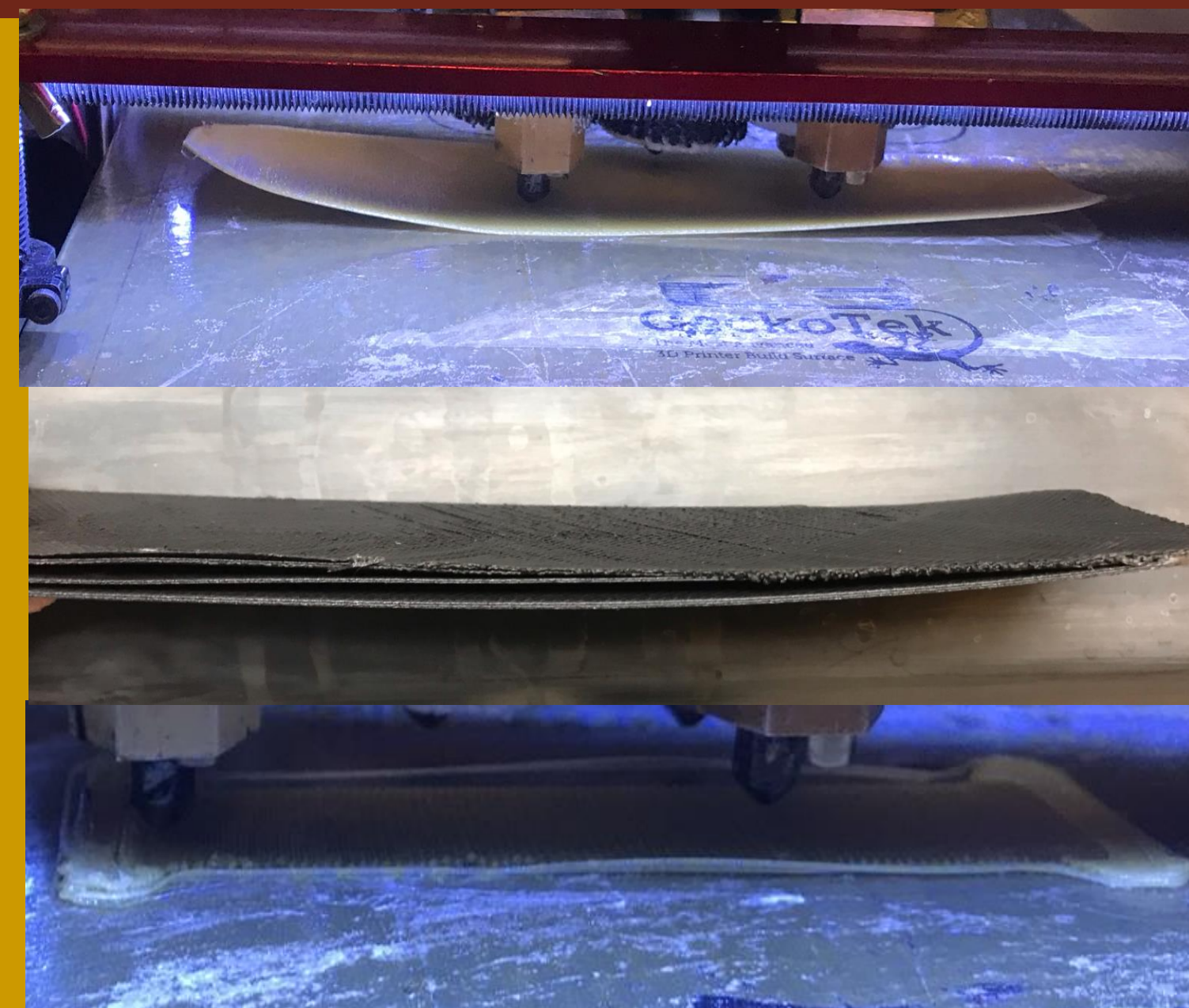


- Ten-piece design
- Expendable front portions, directly exposed to thermal spray process, small for ease of reprint
- Dovetails are used to attach the small front portion to their parent body
- Helical twist locks used to secure the mask to the part quickly by hand
- Outer tabs for mounting to round tube fixture
- Stackable to process parts in batches



Issues Encountered With Prints

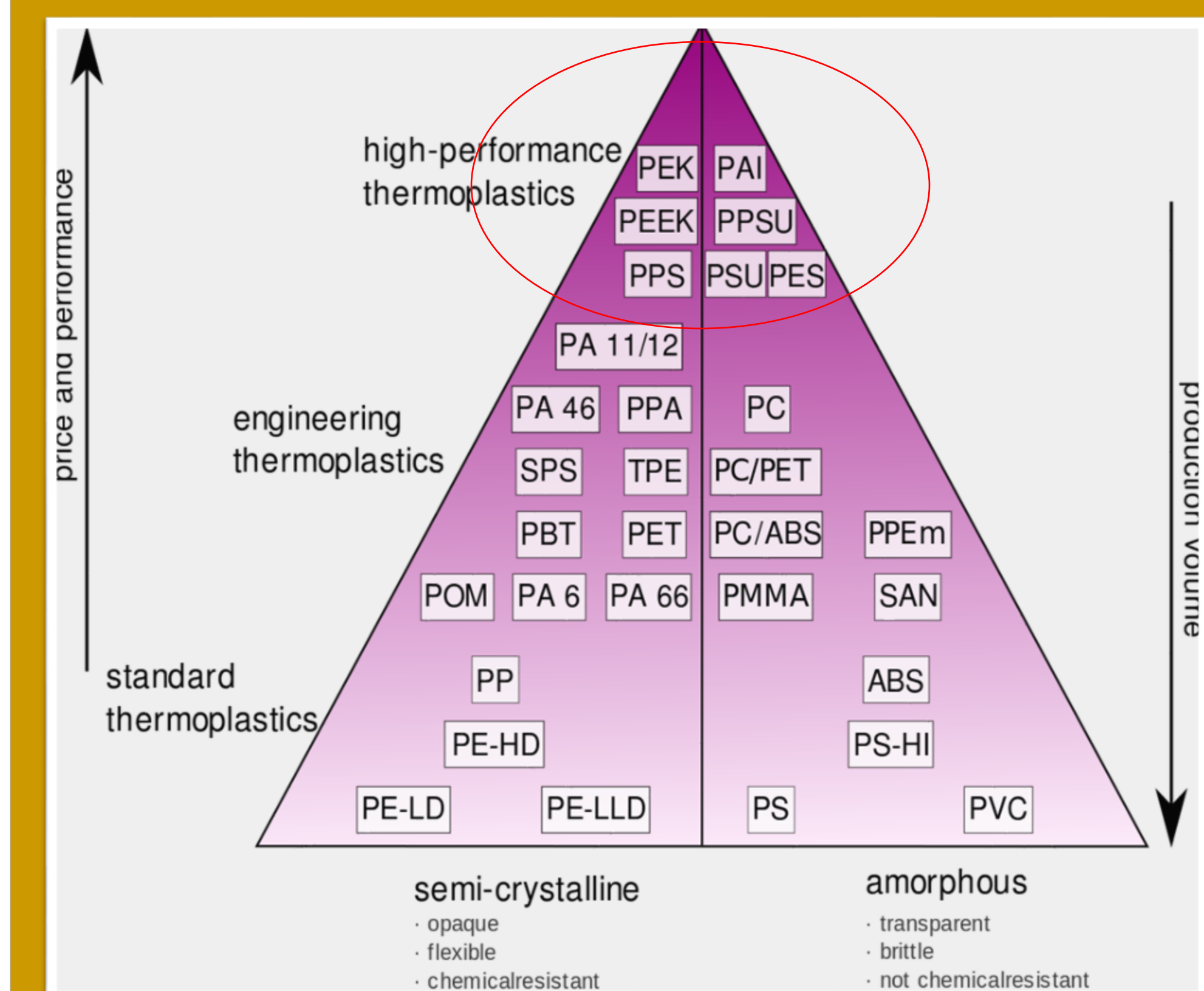
- Sharp Corners delaminate from print bed
- Curling of coupon follows initial layer pattern
- Delamination from previous layers due to thermal shrinkage
- Filaments require controlled environment
- Prints fail at full scale
- Test Coupons have since been outsourced to ensure quality



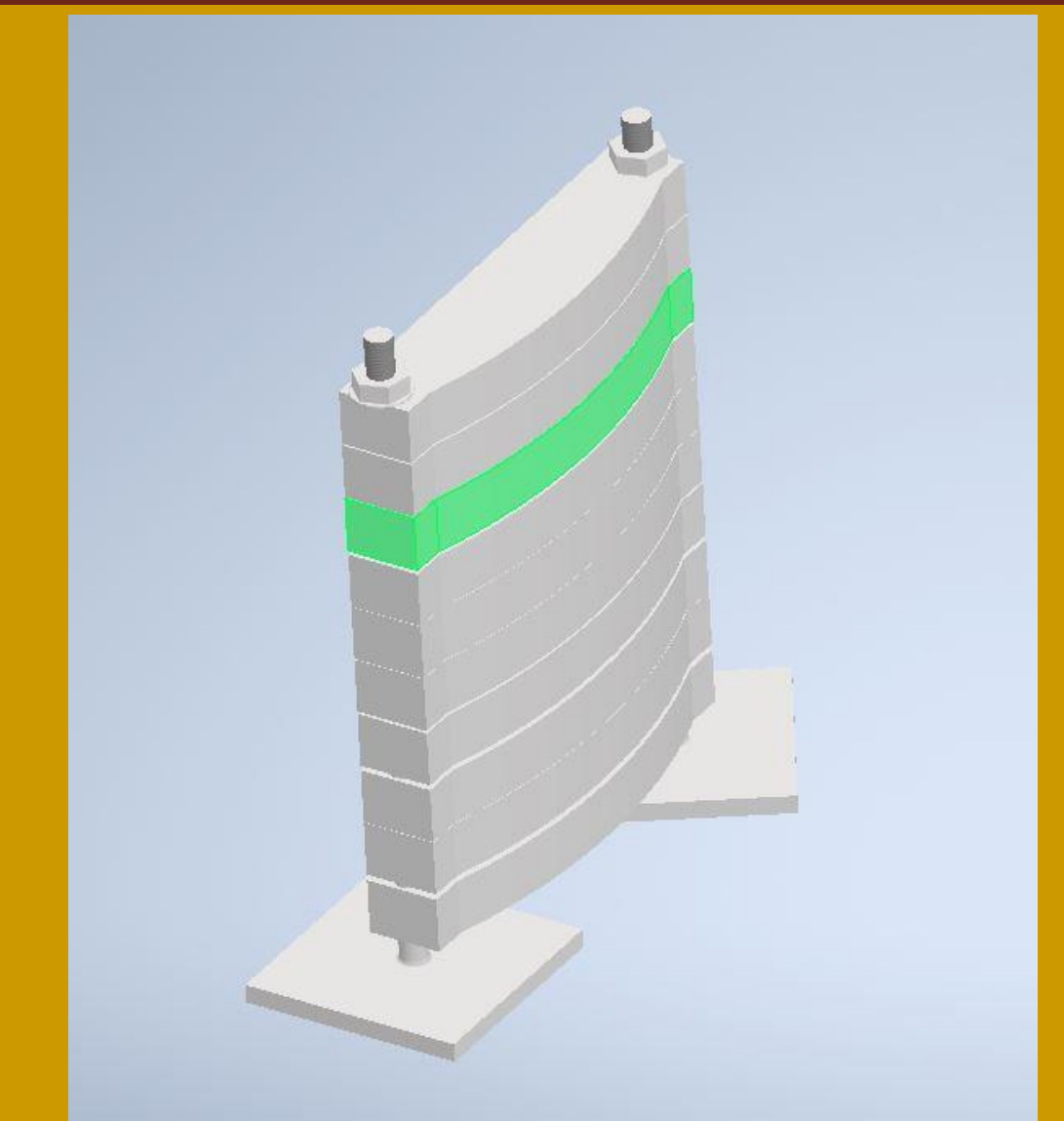
High Temperature Filament

Filaments were selected based on high temperature, chemical and impact resistance.

- ULTEM-1010
- ULTEM - 9085
- PPSU
- ONYX Carbon filled Nylon
- 3Dktop (PCTG)
- ULTEM – 1010 with Carbon



Moving Forward



- Continue mask design creation for outer seal
- Finalize fixture design to work with both hard mask iterations.
- Cost comparison and time study analysis with prototype
- Test to provide complete proof of concept