

IPD 5010

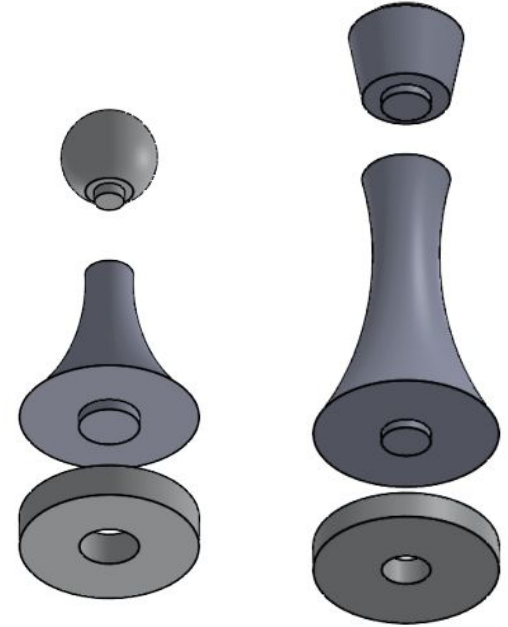
Check

Adam, Jason, Jyotiraditya, Theo



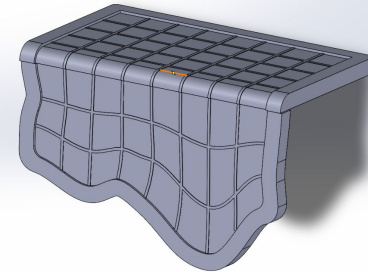
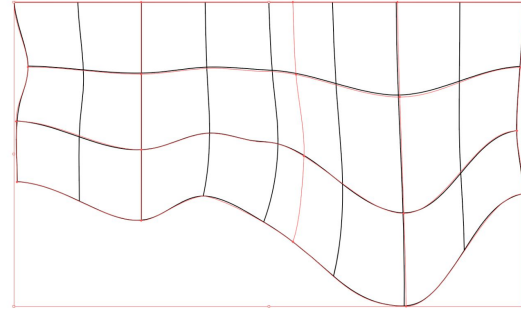
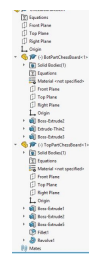
Designing the Pieces

- Sleek and minimal
 - Board is the standout piece
- Pieces were designed as a 3 part assembly
 - Aesthetics, freedom to experiment with various materials and manufacturing methods
- Axial symmetry
 - All except the knight have axial symmetry
- Designed for streamlined manufacturing process
 - All parts only required one holding (no flips)
 - All bases were done in three CAM files
 - Drilling, turning and parting off several times



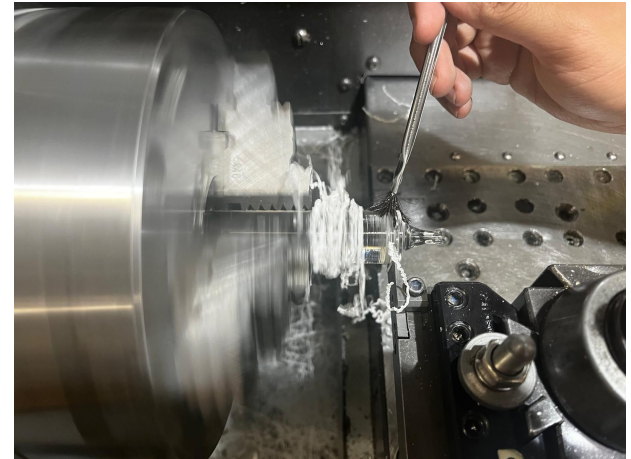
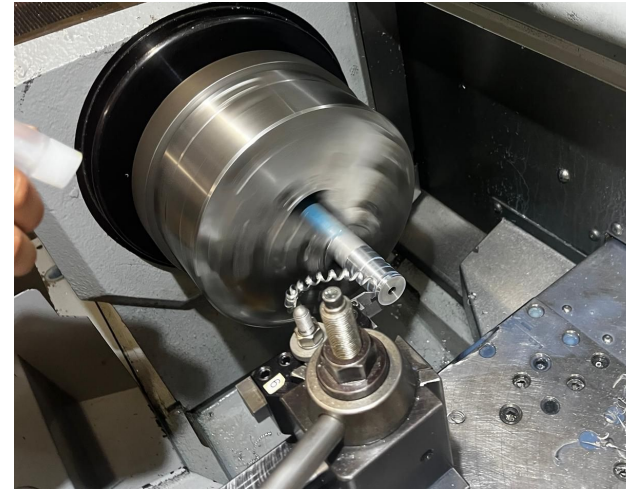
Exploded view: pawn (left)
and queen (right)

Designing the Board



Manufacturing the Pieces

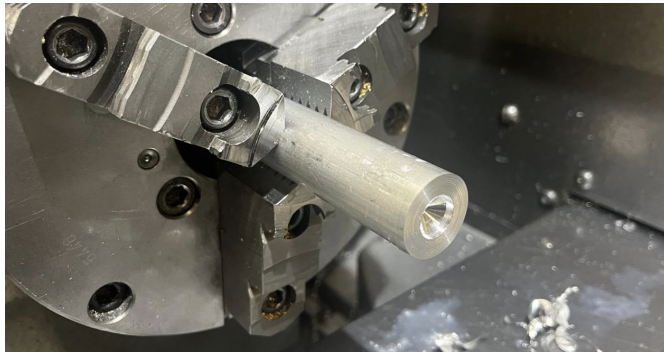
- Base (using 1" aluminum rod):
 - Pilot hole, then drilled 0.25" hole (w/ lathe tailstock). Turn down diameter to 0.75" (pawn), 0.85" (bishop, rook, knight), 0.95" (queen, king) and part off
- Body (1" clear and black polycarbonate):
 - Pilot hole and drill hole for head stub (w/ lathe tailstock). Run profile CNC code - applying oil every pass. Reducing spindle speed to 600 rpm for rough/finish pass. Max spindle speed of 800 rpm for grooves/parting off



Manufacturing the Pieces (continued)

- Head

- Used 0.625" aluminum rod for pawn, knight, bishop and queen. 1" aluminum rod for king and rook. Profiles achieved w/ rough and finish pass, followed by groove (for head stubs) and part off
- Rook: Pilot hole and 0.5" drill using lathe tailstock
- Knight: Bandsaw + sandbelt + finishing wheel



Pieces Assembly



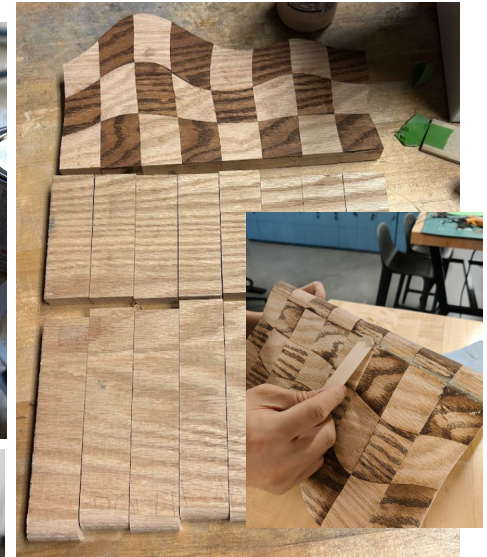
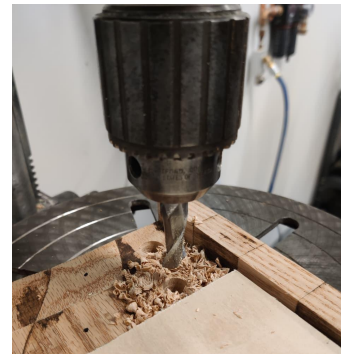
Manufacturing the Board

- Made from one 0.75 x 12 x 48" piece of red oak
- We essentially followed the manufacturing method shown in [this Instagram post](#)
 - Used laser-cut templates and simultaneously ran two pieces of oak in a wavy path through the vertical bandsaw
 - Stained alternating strips and glued them together, creating inverses
 - Simultaneously ran both strip assemblies through the bandsaw in the transverse direction
 - Switched every other checkered strip to achieve checkered pattern

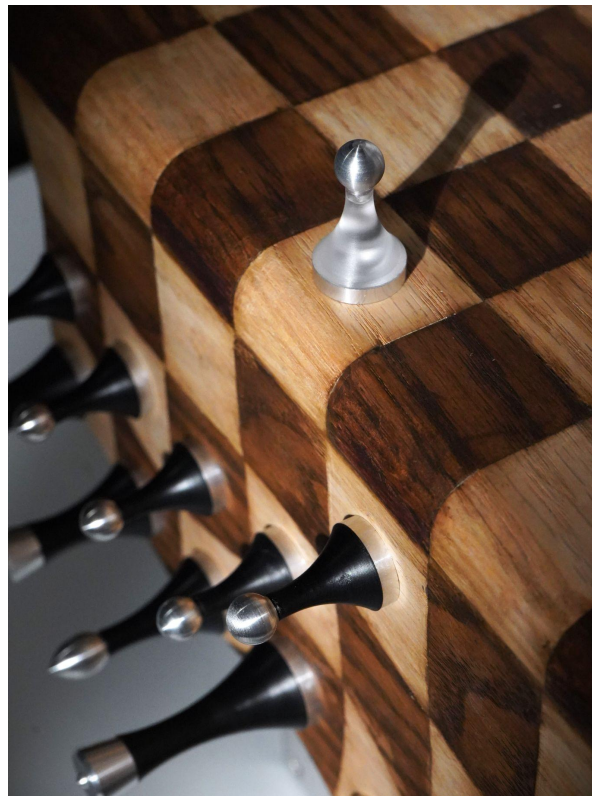


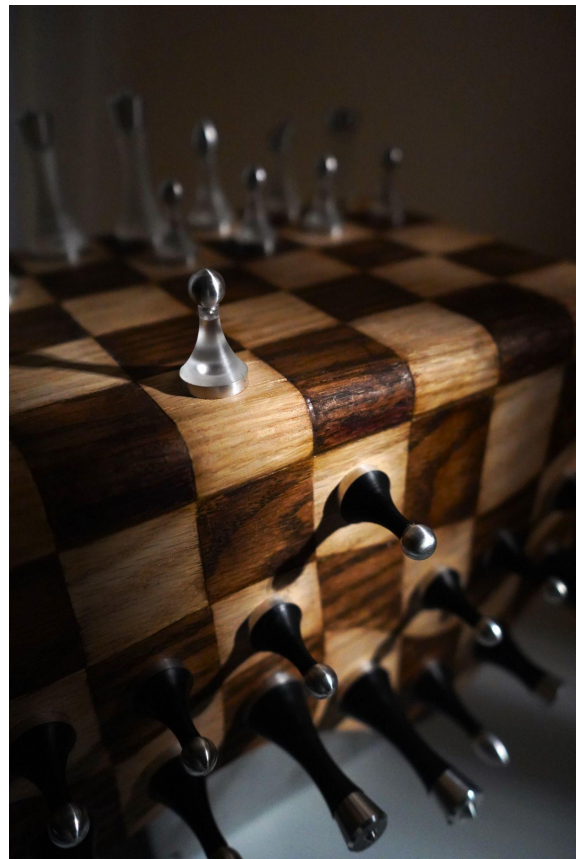
Manufacturing the Board (continued)

- Filleted edge of “normal” side on the belt sander
- Followed similar steps as wavy side
 - Ran the oak through the bandsaw in a straight line using a stop
 - Had to be precise to avoid tolerance stackup issues
- Drilled holes on underside to house magnets
- Hand-sanded imperfect spots to level and remove stain from light squares
 - Stain came off very easily
 - Used markers to touch up dark squares



Final results





Challenges, Learnings, and Key Takeaways

- Initial rough/finishing passes of acrylic achieved poor surface finish - likely due to high rpm (melting?) and oil not applied
 - Switched to polycarbonate rod stock and adjusted Mastercam settings
- Wood stain bleeding issues
 - Stain combined with glue and bled into light squares
 - Stain inhibited wood glue from reaching full strength
- Combination square tool saves a lot of time from having to zero the lathe tools continuously
- Magnets were weaker than we initially thought

