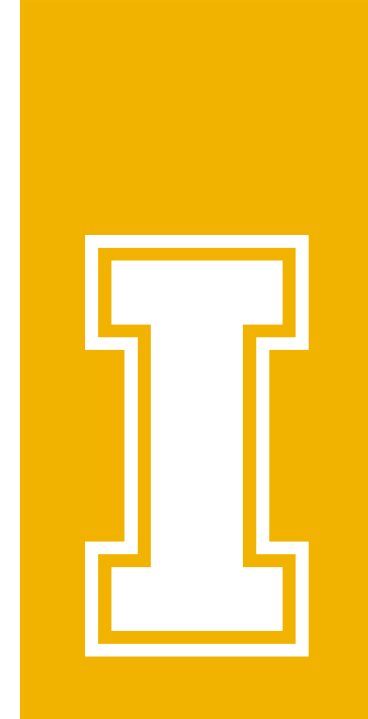




RECIPROCATING SAW ATTACHMENT FOR ROBOTIC ARM



Bennett Schlect, Blake Hansen, Cameron Summerfield, Kyle Monaghan

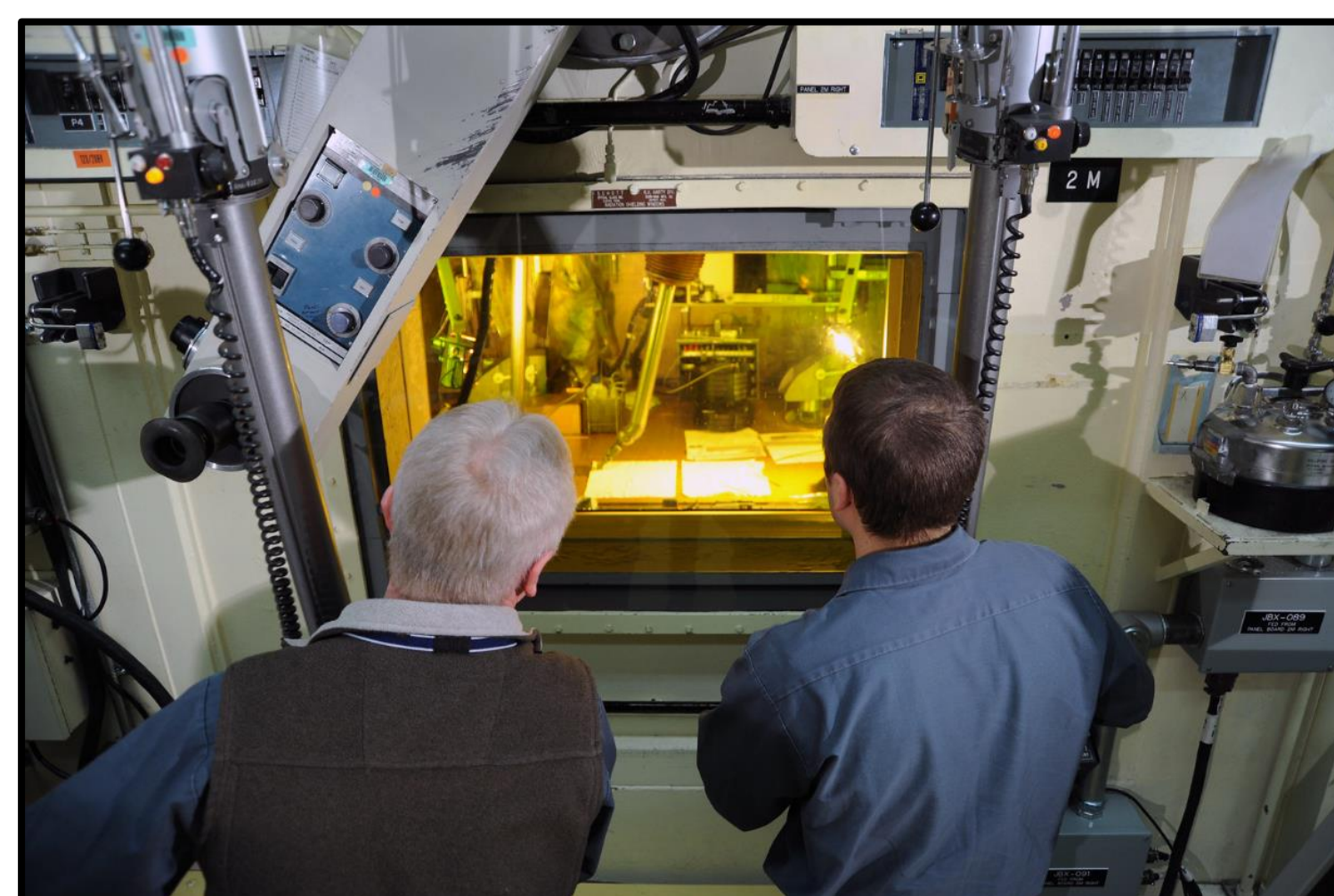


OBJECTIVE

Design and build a reciprocating saw attachment that will replace a claw attachment on a robotic arm.

BACKGROUND

- Client: Idaho National Laboratory (INL)
- INL uses a hot cell (protective room for handling radioactive material remotely)
- A gantry-mounted robotic arm with claw attachment will be placed in hot cell
- INL needs a way to cut radioactive material inside the hot cell (shown below)



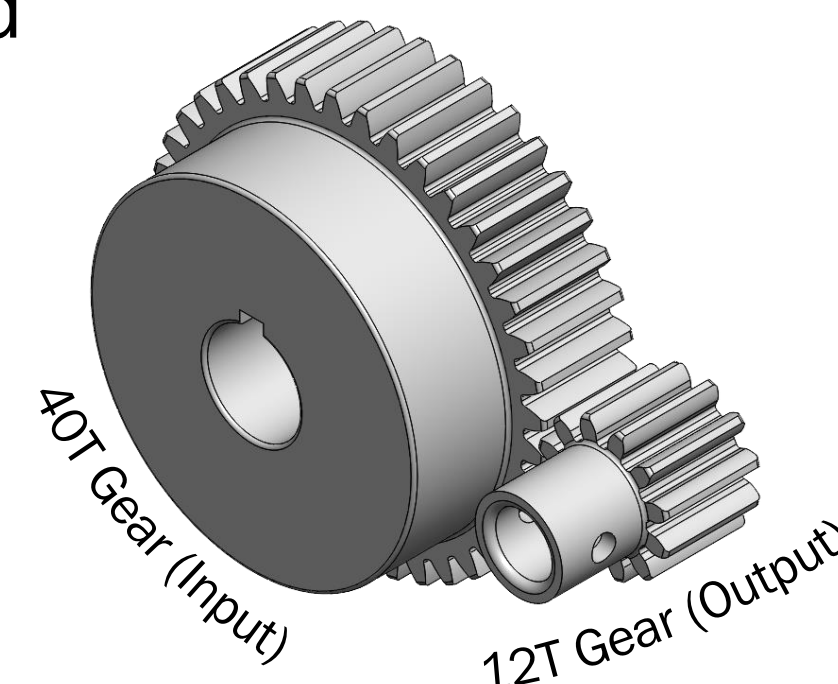
KEY REQUIREMENTS

- Contain only steel and aluminum components; no plastics or electronics
- Required to cut up to 4" diameter, 1/4" wall thickness stainless and aluminum tube
- Fit into the hot cell's 2'x2'x3' air lock
- Weigh less than 50 pounds
- Must be accessed and worked on by tele-manipulators inside the hot cell (shown above)

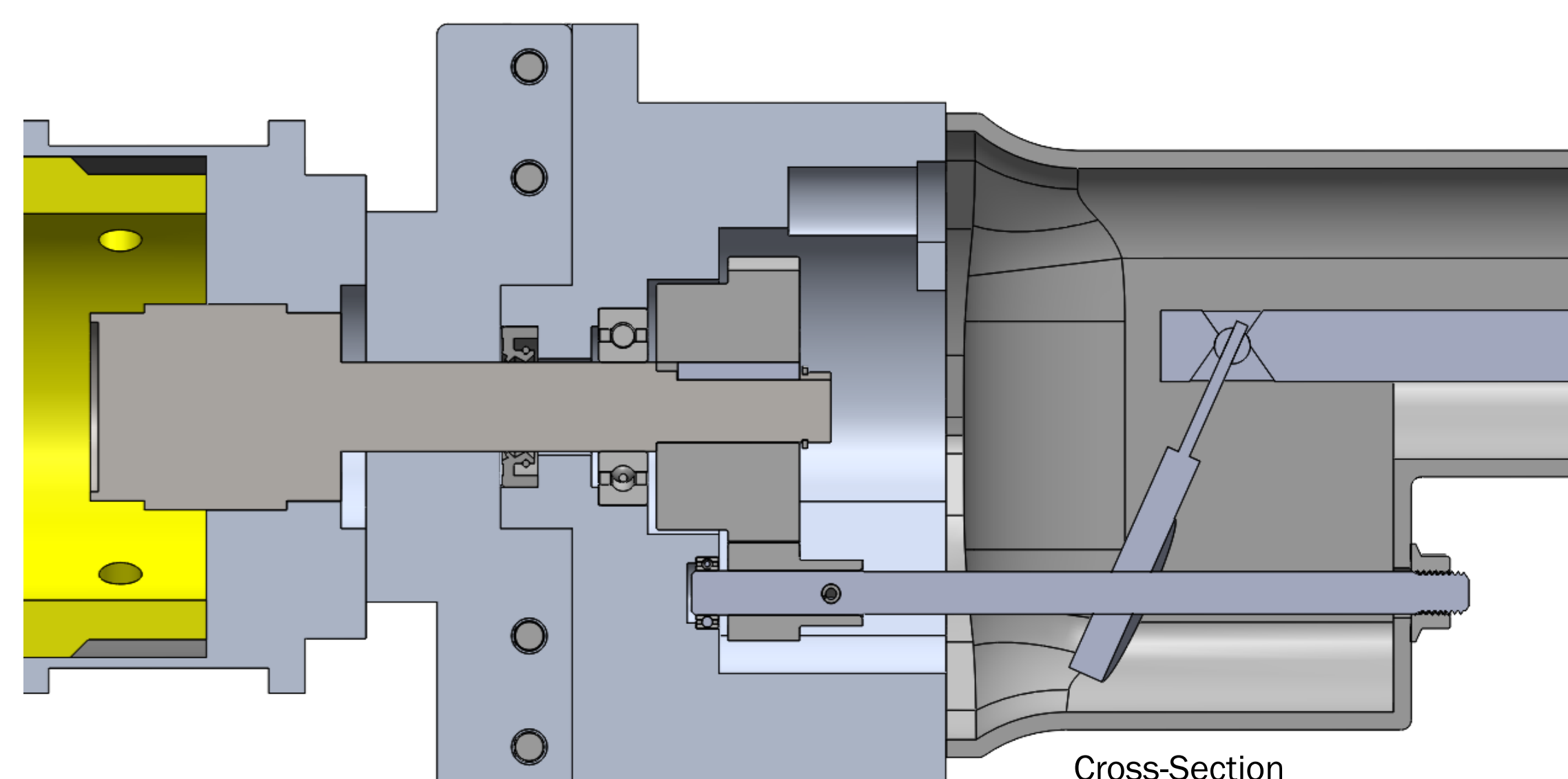


CONCEPT DEVELOPMENT

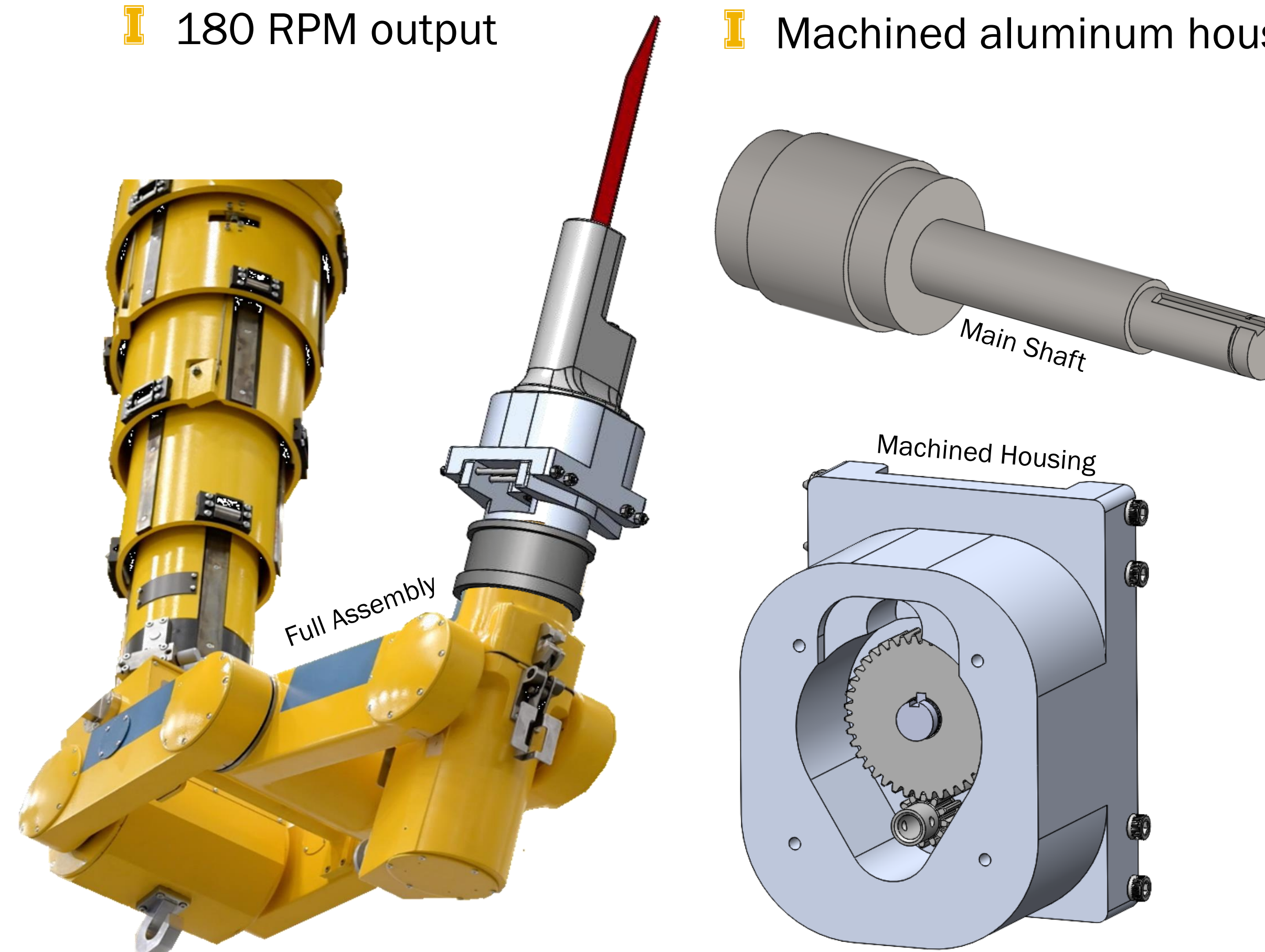
- Robotic arm only provides 50 RPM maximum motor speed
- Gear increase would be necessary for adequate cutting speed



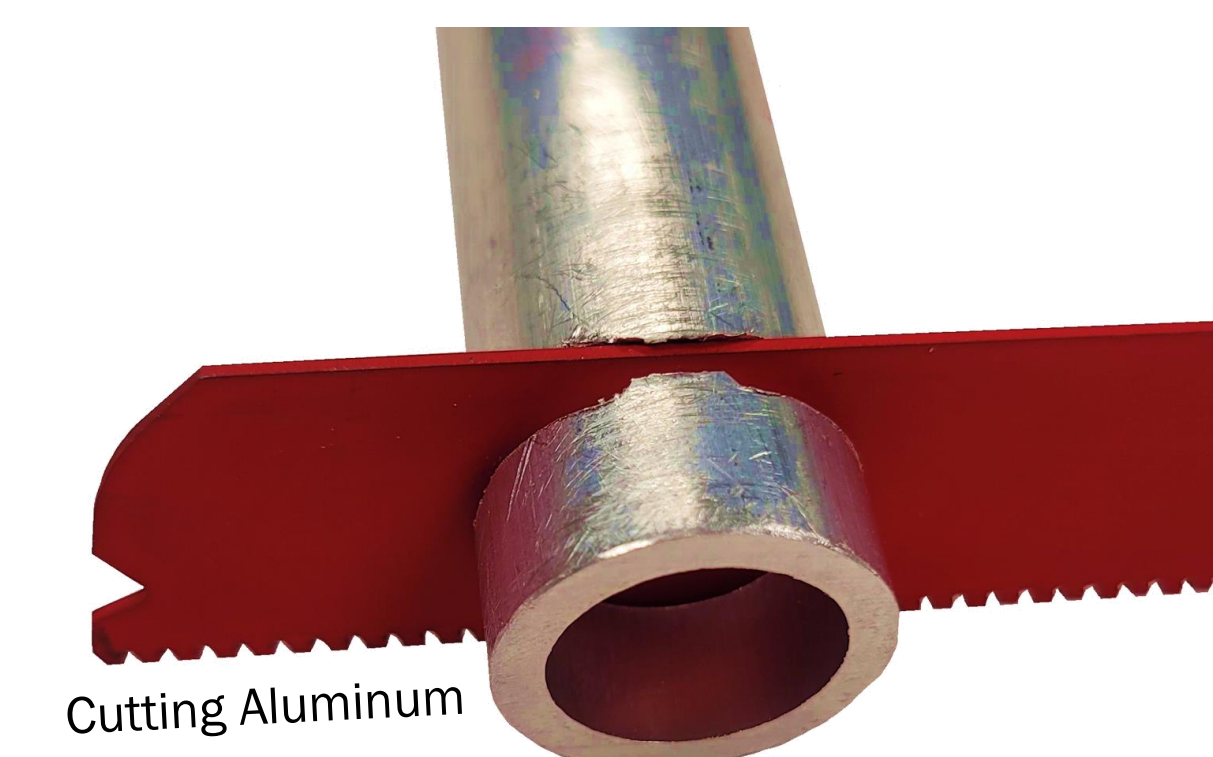
FINAL DESIGN



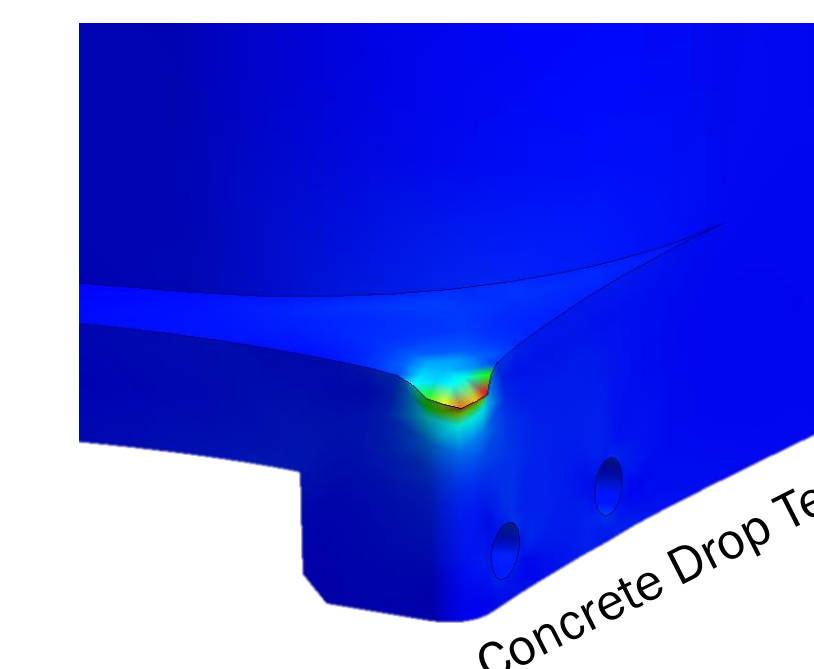
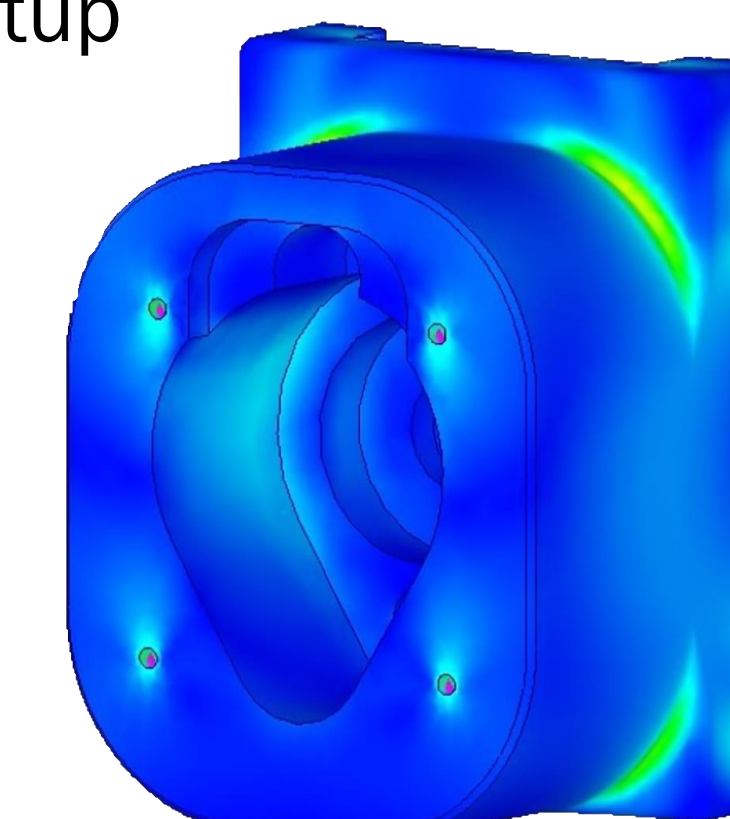
- 1:3.33 gear increase
- 180 RPM output
- All steel hardware
- Machined aluminum housing



VALIDATION



- Cut through aluminum in 8 minutes
- Can not cut through stainless steel reliably given our setup



- Finite Element Analysis (FEA) shows that housing will not fail due to loading
- Simulated drop onto concrete from 3' confirms durability

SUMMARY & CONCLUSIONS

- Meets all requirements besides stainless steel
- Good for aluminum
- The robotic arm motor is the limiting factor – needs more speed
- Despite conditions, our design performs flawlessly

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INL Representatives: Jesse Kappmeyer & Tom Pfeiffer



2023 Capstone Project