

ME, ECE, IE Capstone Design Programs

Team #15: Arc Welding 3D Printer

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Objective Statement

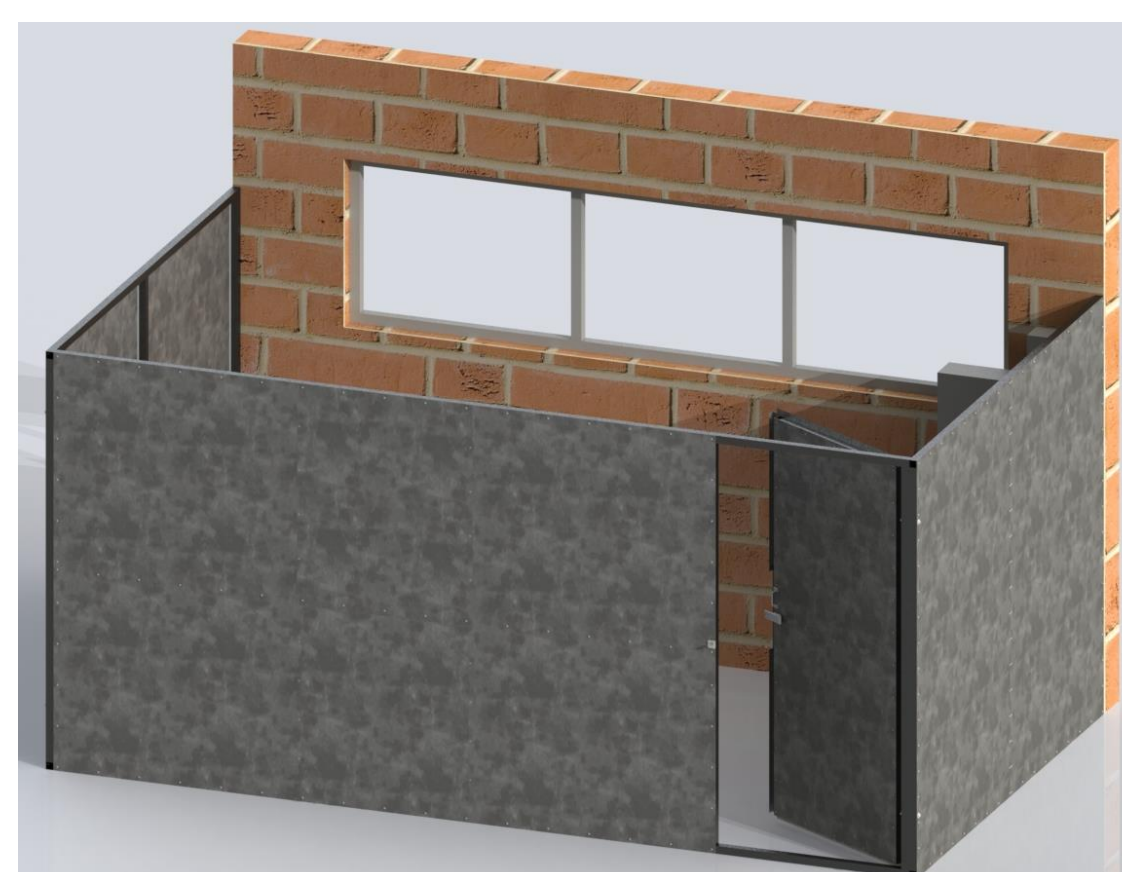
To design and manufacture a 3D printer that utilizes arc welding technology to create metal objects from computer aided design software. The printer shall be capable of producing parts with features such as overhangs, inclines, and cavities within a 3 ft x 2 ft x 2 ft printing envelope.

Engineering Specifications

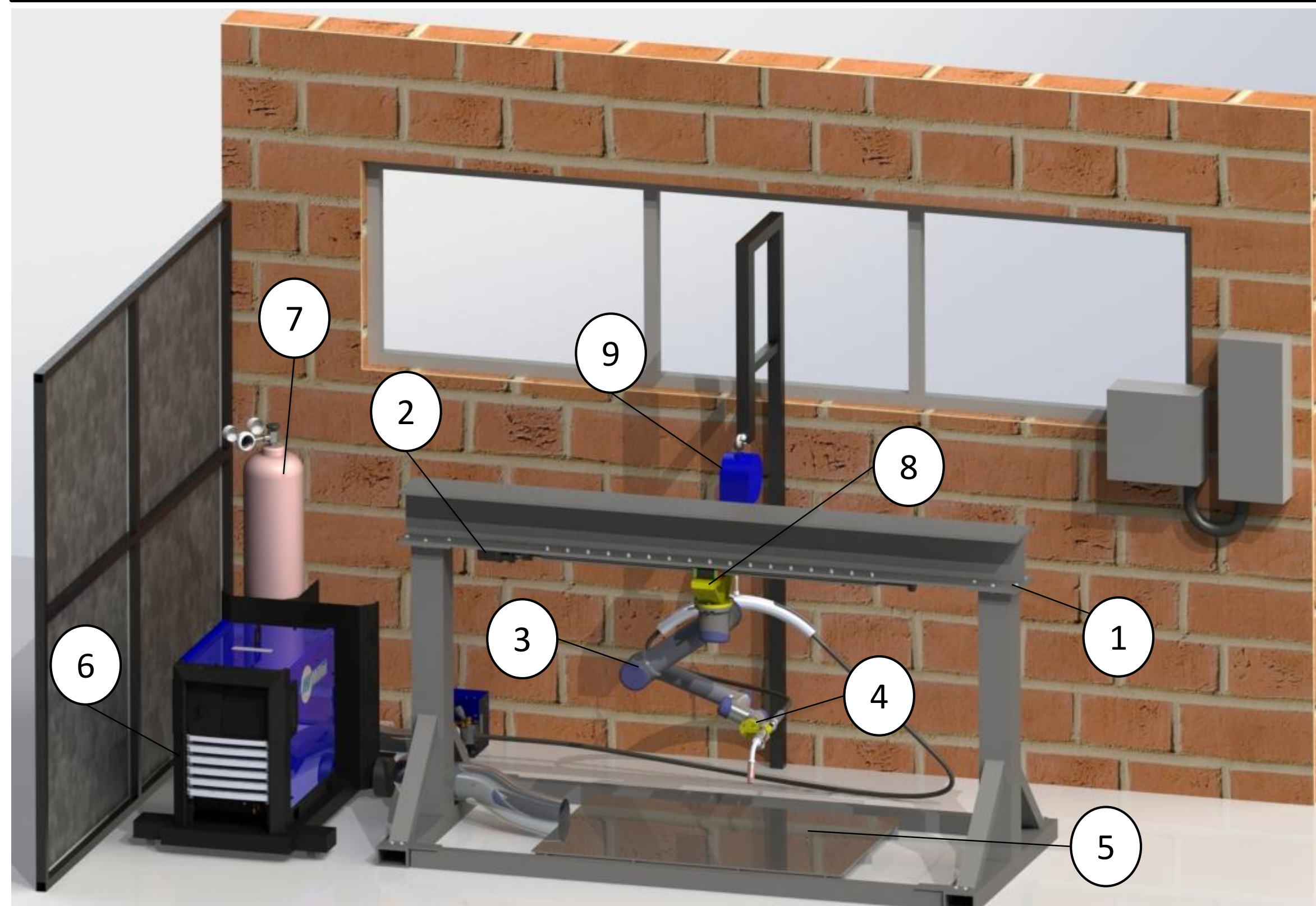
Quantitative Constraint	Target	Achieved
Deposition Rate	4.0 lbm/hr	4.7 lbm/hr
Material Properties	85.0% of parent material	96.1% of gross tensile strength 90.0% of local tensile strength
Print Resolution	Width = 0.375 in Height = 0.25 in	Width = 0.204 in Height = 0.094 in
Print Repeatability	± 10% of resolution	9.9% of resolution

Safety Considerations

- Risk assessment performed in accordance with ANSI/RIA R15.06-2012
- High voltage equipment signs and awareness
- Ventilation of welding fumes in accordance with IMC Table 4.4
- Emergency stops for operator safety
- Safety enclosure (seen below) designed in accordance with ISO/TS 15066 for robot containment and arc flash mitigation



Embodiment



Assembly Number	Part Name	Assembly Number	Part Name	Assembly Number	Part Name
1	Gantry	4	Torch Holder	7	Shielding Gas Tank
2	Linear Drive Assembly	5	Base Plate Holder	8	Carriage
3	UR-5 Six Axis Manipulator	6	Miller Continuum 350	9	Cable Management

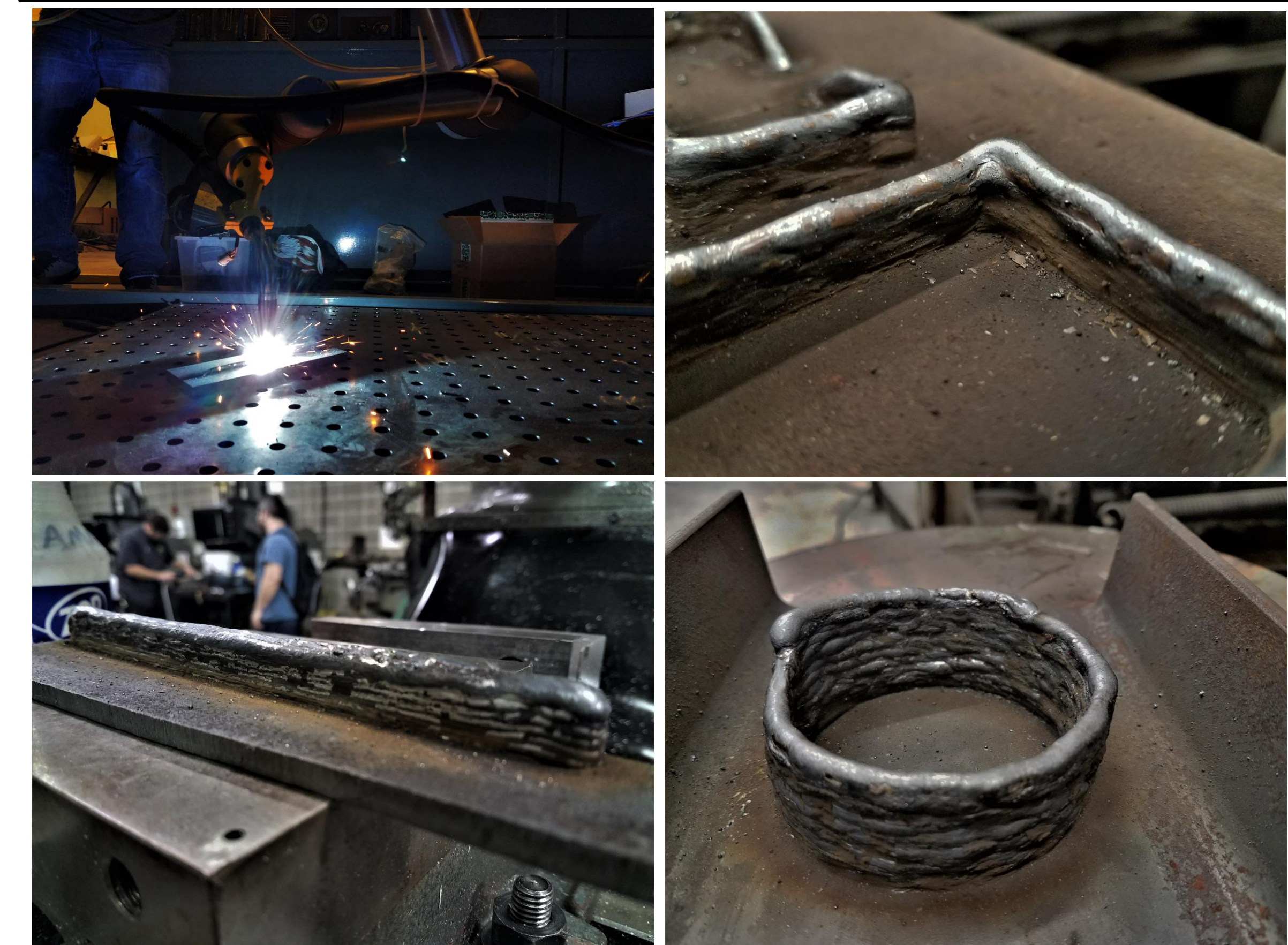
Key Features

- Xiris welding camera
- Weld data acquisition
- Live video stream
- Remote operation

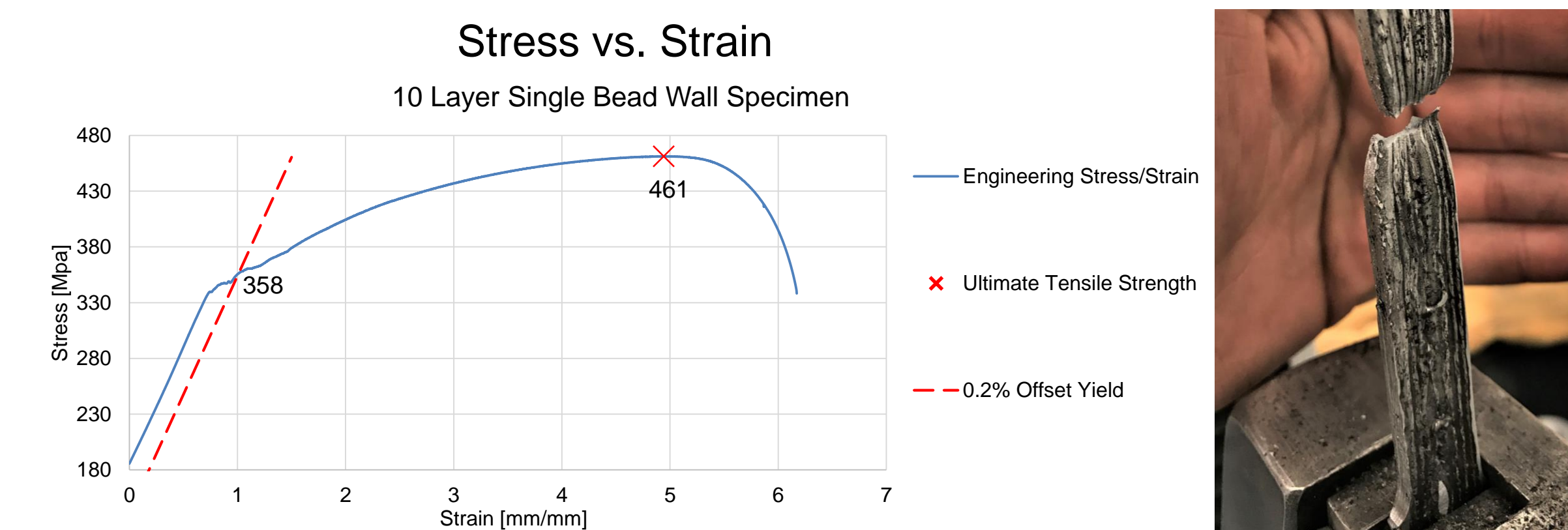
Expenses \$62,395.81

Component	Cost
Gantry Structure	\$3,306.02
Electronics	\$12,490.77
Safety Equipment	\$1,070.00
Labor Services	\$2,300.00
Linear Drive Assembly	\$1,303.57
Robot	\$31,500.00
Welder	\$10,075.45
Printing Materials	\$350.00

Printed Parts



Material Testing



Conclusion

This printer can produce near net shape low carbon steel parts for use in rapid prototyping or as active service parts after minimal machining. These parts are seamless layer based metal structures which can exhibit complex features such as extrusions, holes, and inclined surfaces.

