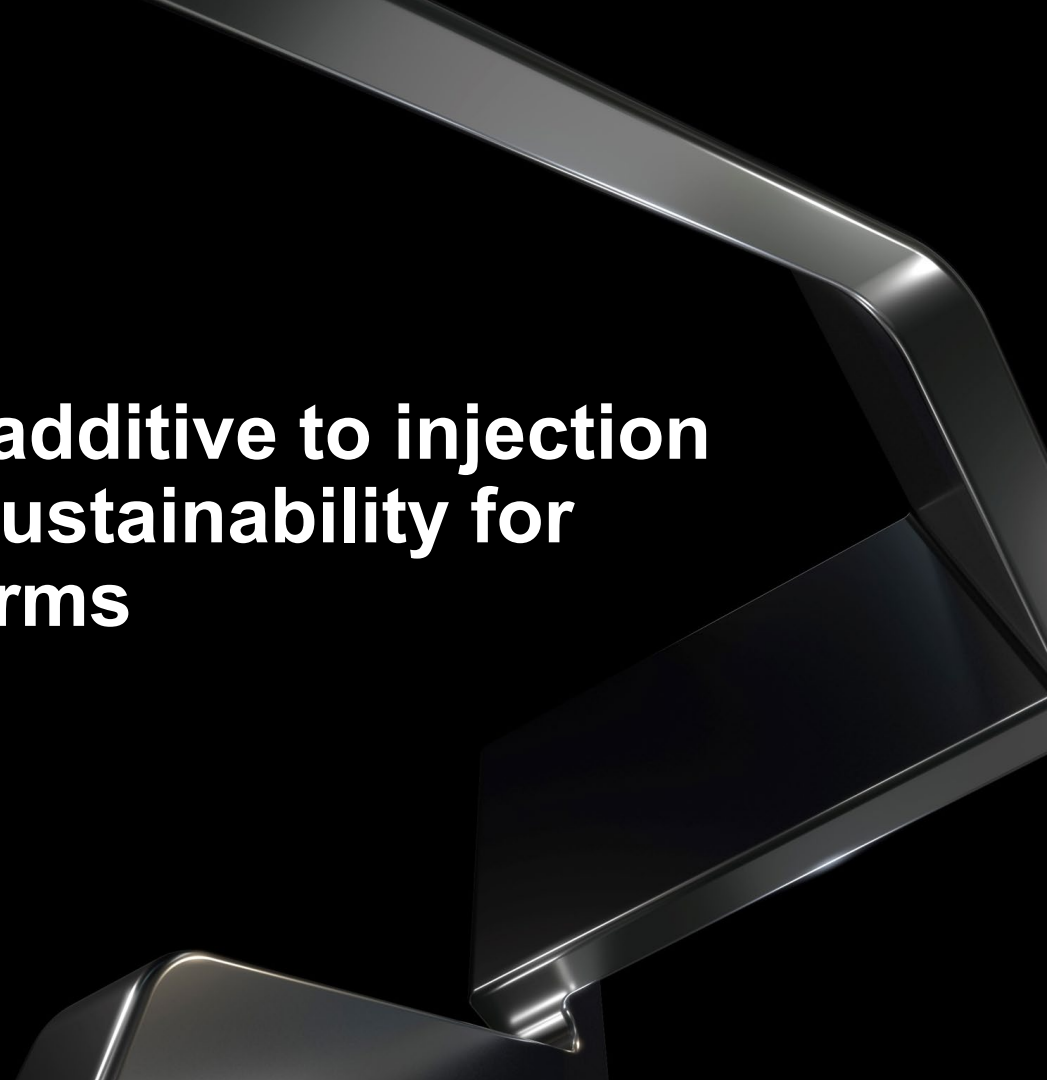
AUTODESK

limbitless SOLUTIONS®

Transformation from additive to injection molding to increase sustainability for personalized bionic arms



John Sparkman
Albert Manero

UCF

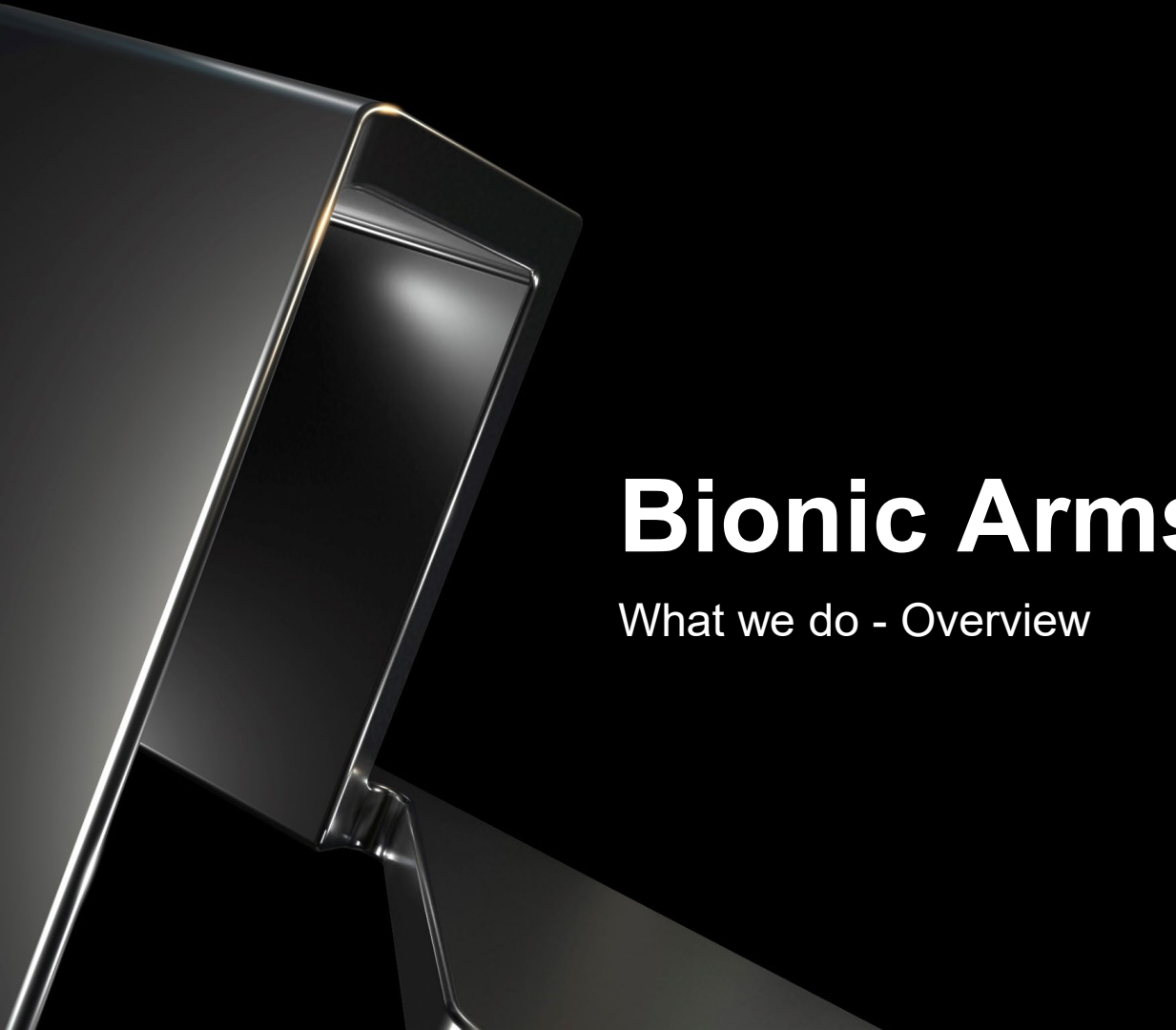
Limbitless Solutions | University of Central Florida
@Limbitless3D

John Sparkman
Manufacturing Director
Limbitless Solutions

Albert Manero, PhD
Executive Director
Limbitless Solutions

Bradley Ribaric

Engineering Scholar
Junior Status
Limbitless Solutions



Bionic Arms

What we do - Overview


100
limbitless
SOLUTIONS
Receiving
Suite #100

In 2005, an estimated 1.6 million people in the US had a limb difference: 541,000 people had an upper-arm limb difference.

This value was projected to double by 2050.

Adams et al (1999)
Ziegler-Graham et al (2008)

More than 32,500 children in the US have experienced a major pediatric amputation

Cignini et al (2012)

5 in 10,000 children are born with congenital limb difference

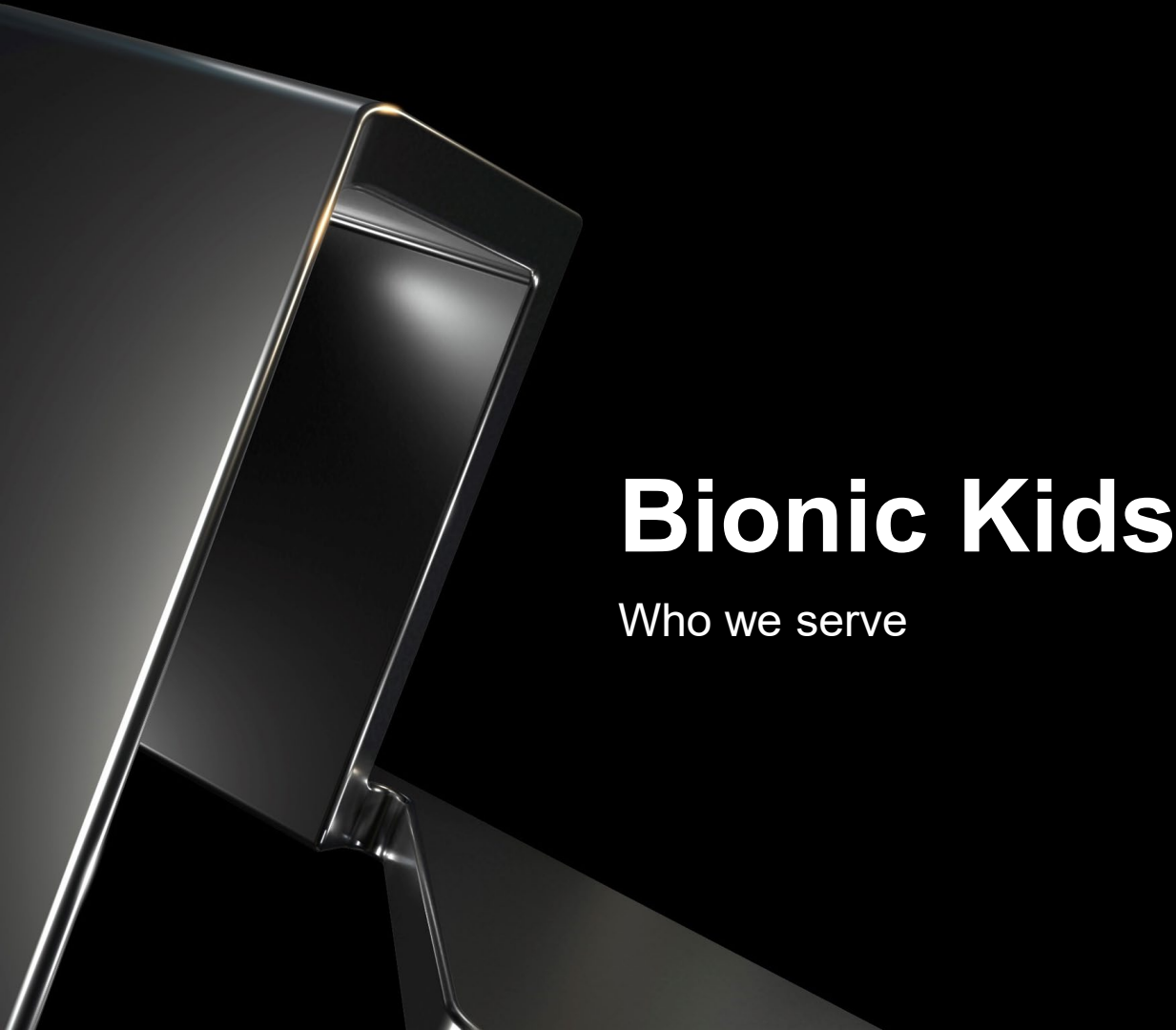
Parker et al (2010)

Cosmetically realistic myoelectric hands that open and close may cost $20,000 to $30,000 or more, while a neuroprosthetic arm may cost as much as $100,000.

McGimpsey et al (2010)

Usage rates reported for upper limb devices are as low as 37%.

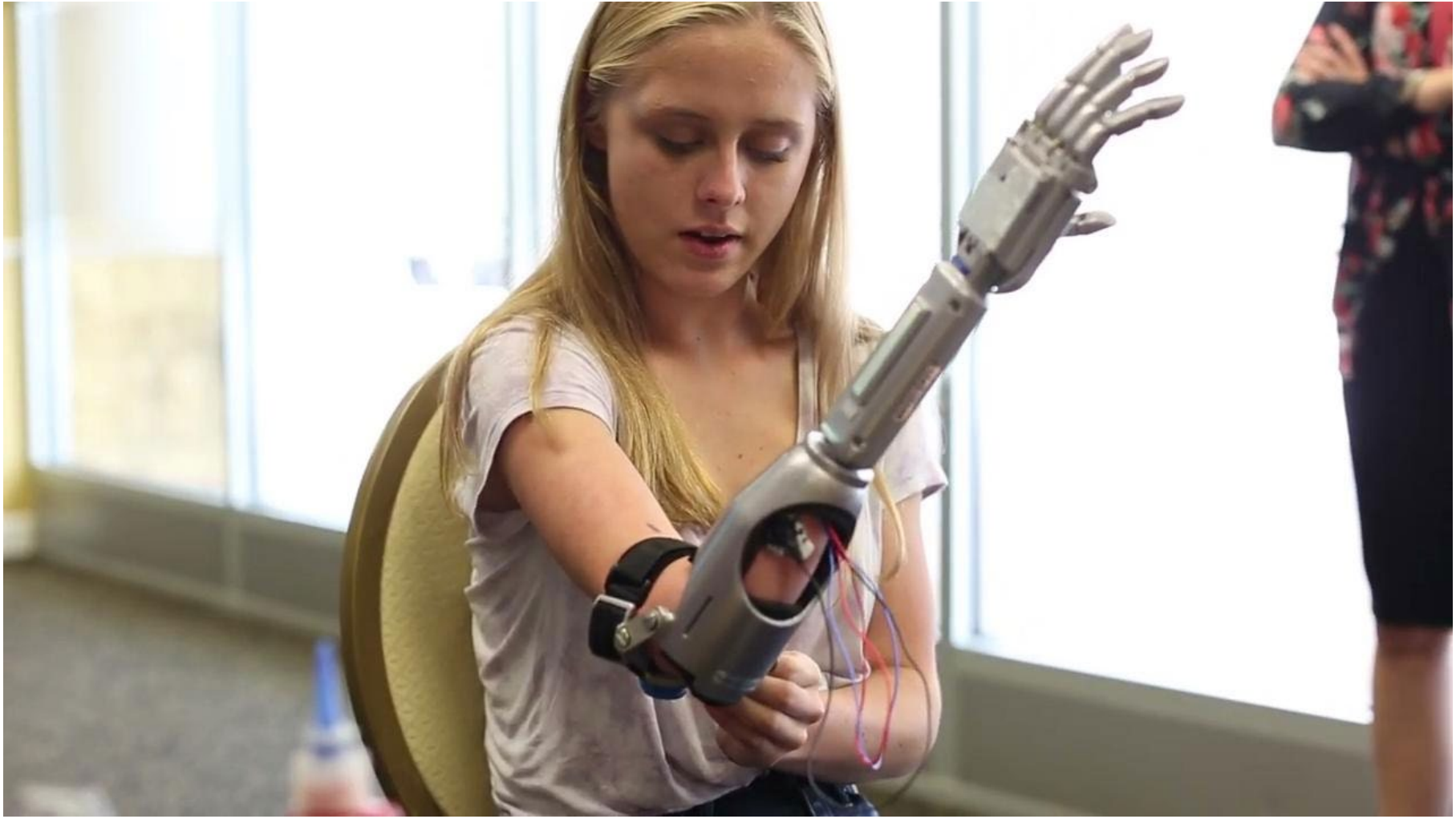
Wright et al (1995)

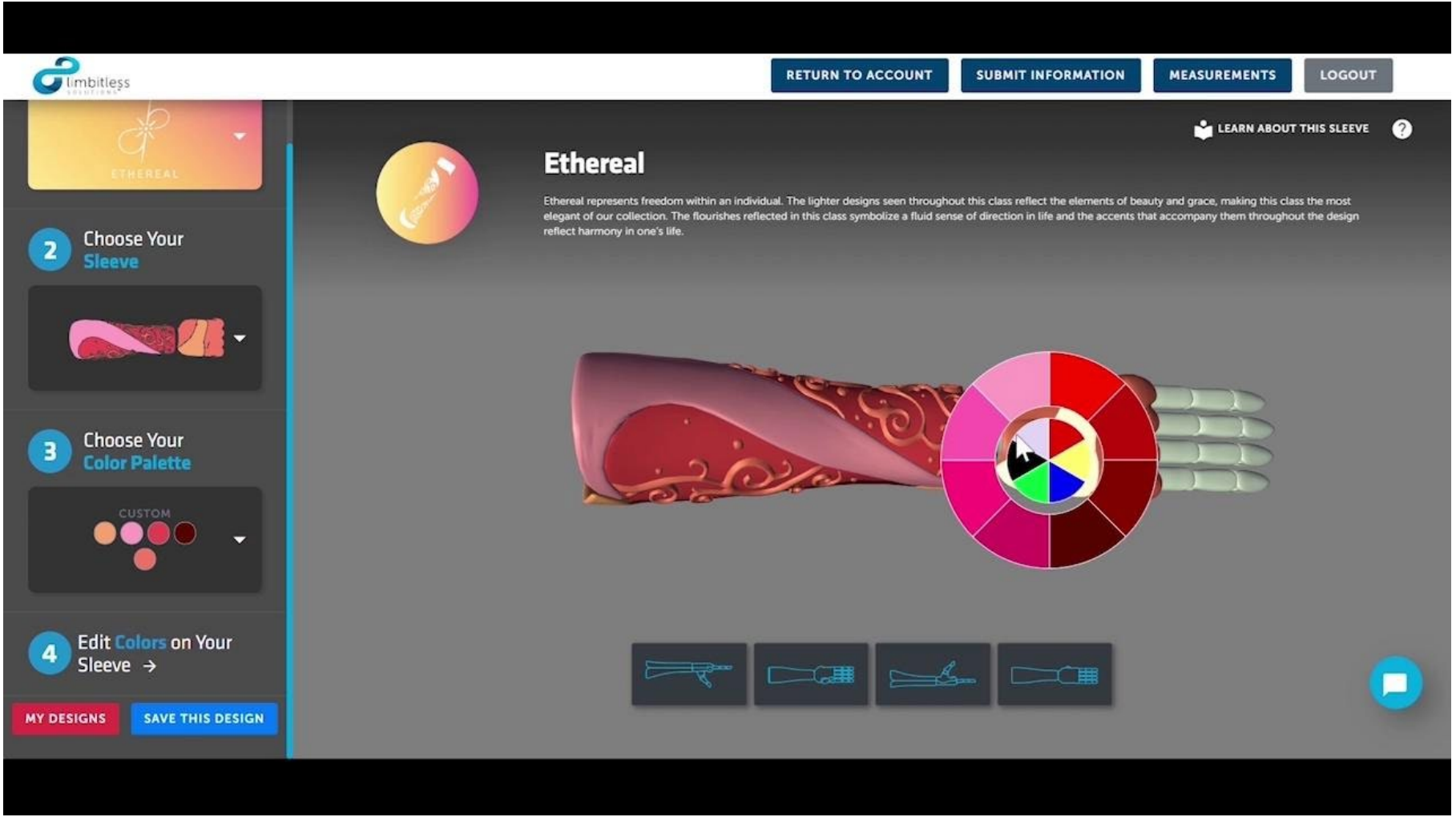


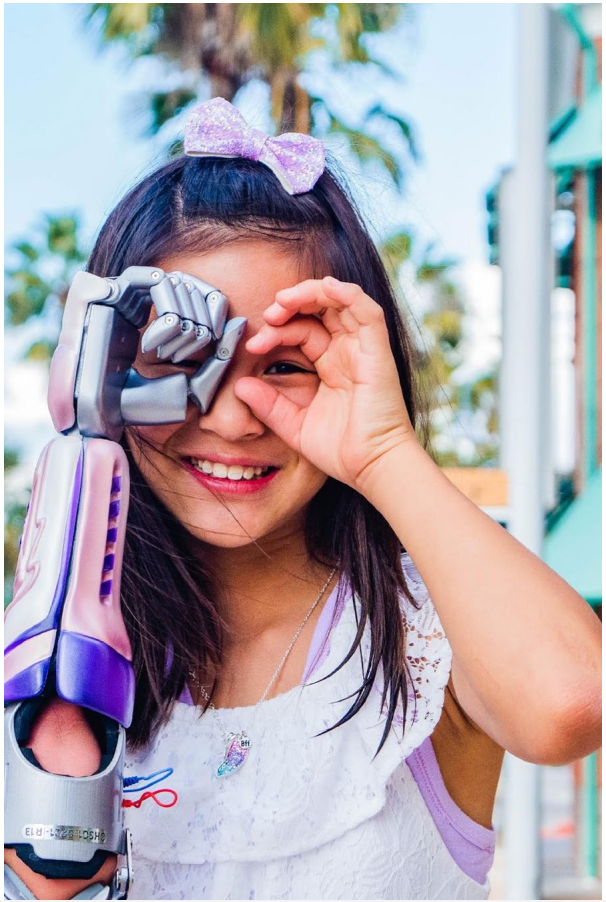
Bionic Kids

Who we serve

Impact for our community

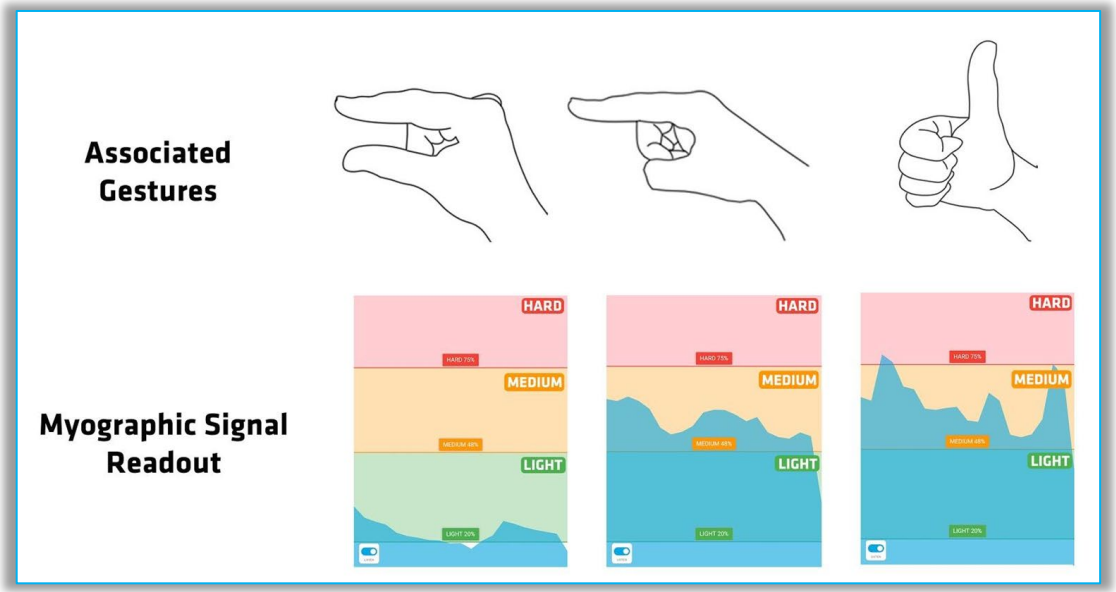



limbitless
RETURN TO ACCOUNT
SUBMIT INFORMATION
MEASUREMENTS
LOGOUT
ETHEREAL
2 Choose Your Sleeve
3 Choose Your Color Palette
CUSTOM
4 Edit Colors on Your Sleeve →
MY DESIGNS
SAVE THIS DESIGN
LEARN ABOUT THIS SLEEVE
Ethereal
Ethereal represents freedom within an individual. The lighter designs seen throughout this class reflect the elements of beauty and grace, making this class the most elegant of our collection. The flourishes reflected in this class symbolize a fluid sense of direction in life and the accents that accompany them throughout the design reflect harmony in one's life.




Chase Your
Dreams

Electromyographic Control



Single-sensor multi-gesture controls has been prioritized for ease of use and training in pediatric patients. Magnitude and time domain inputs can be leveraged to establish multiple controls for a variety of hand gestures.

Customization of the activation states improves the human machine interface.

Additive to Molding Conversion

Design changes and new manufacturing process

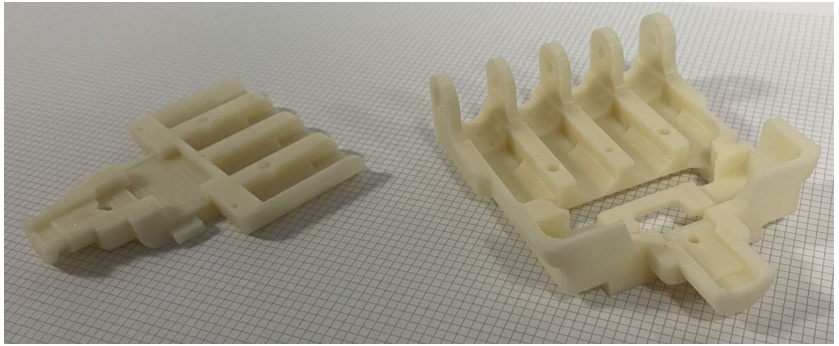
Objectives

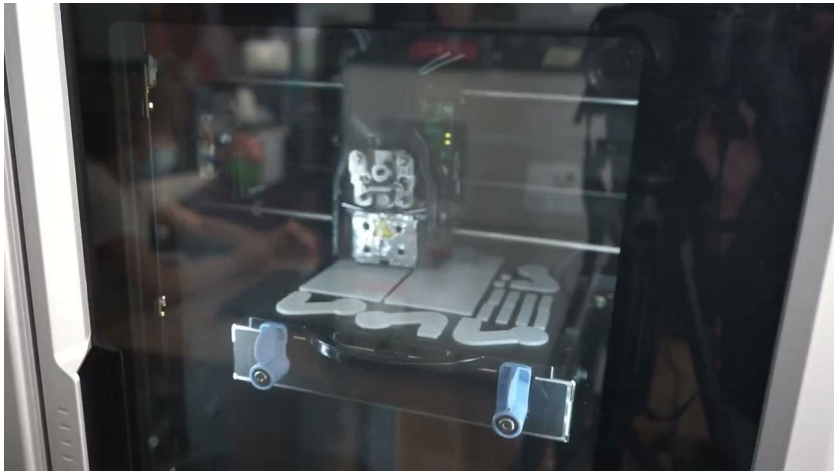
- Increase strength and robustness while decreasing weight of subcomponents to minimize maintenance and downtime
- Increase production speed and repeatability

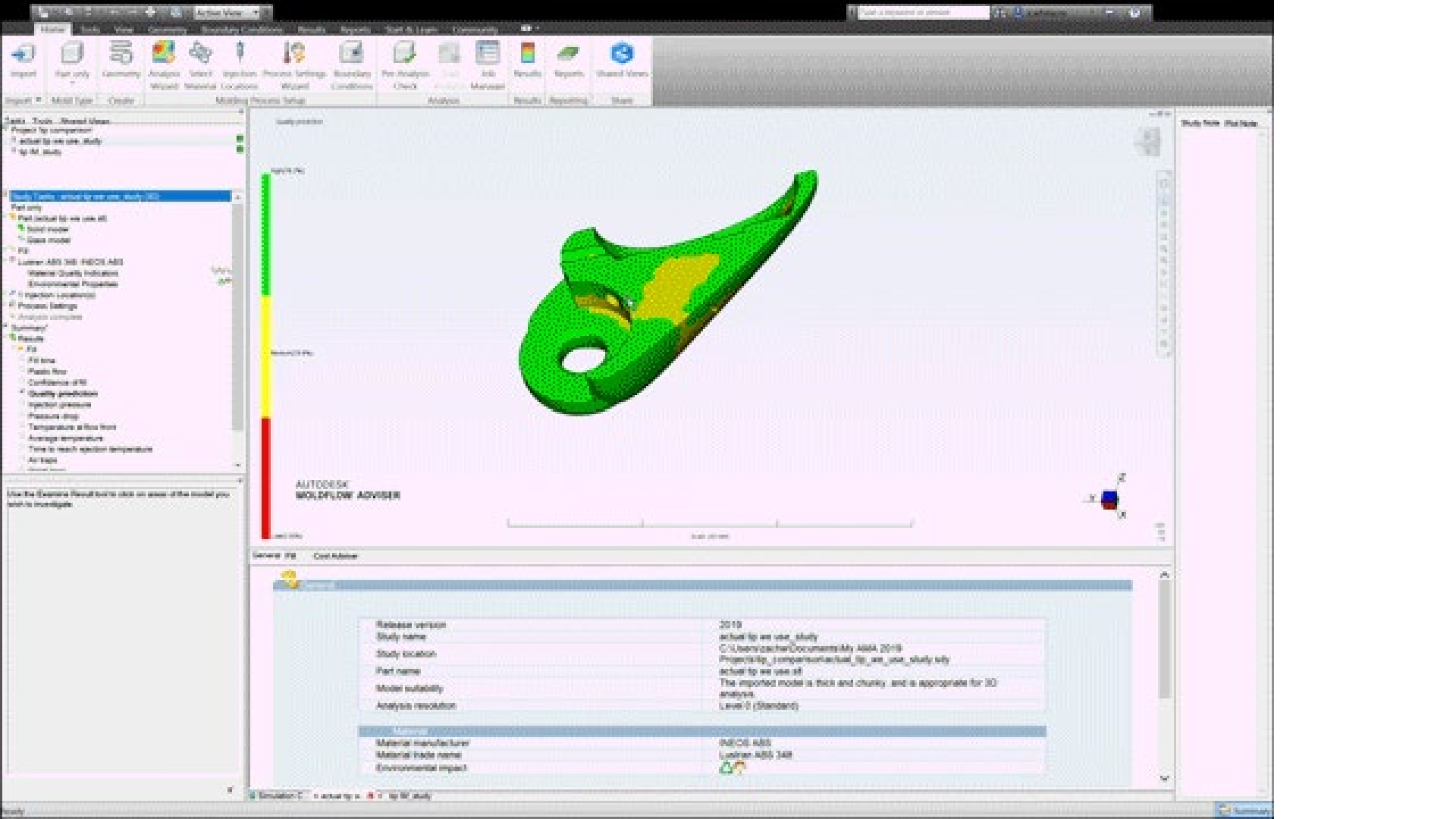
Convert design from 3D printing optimization to injection molding

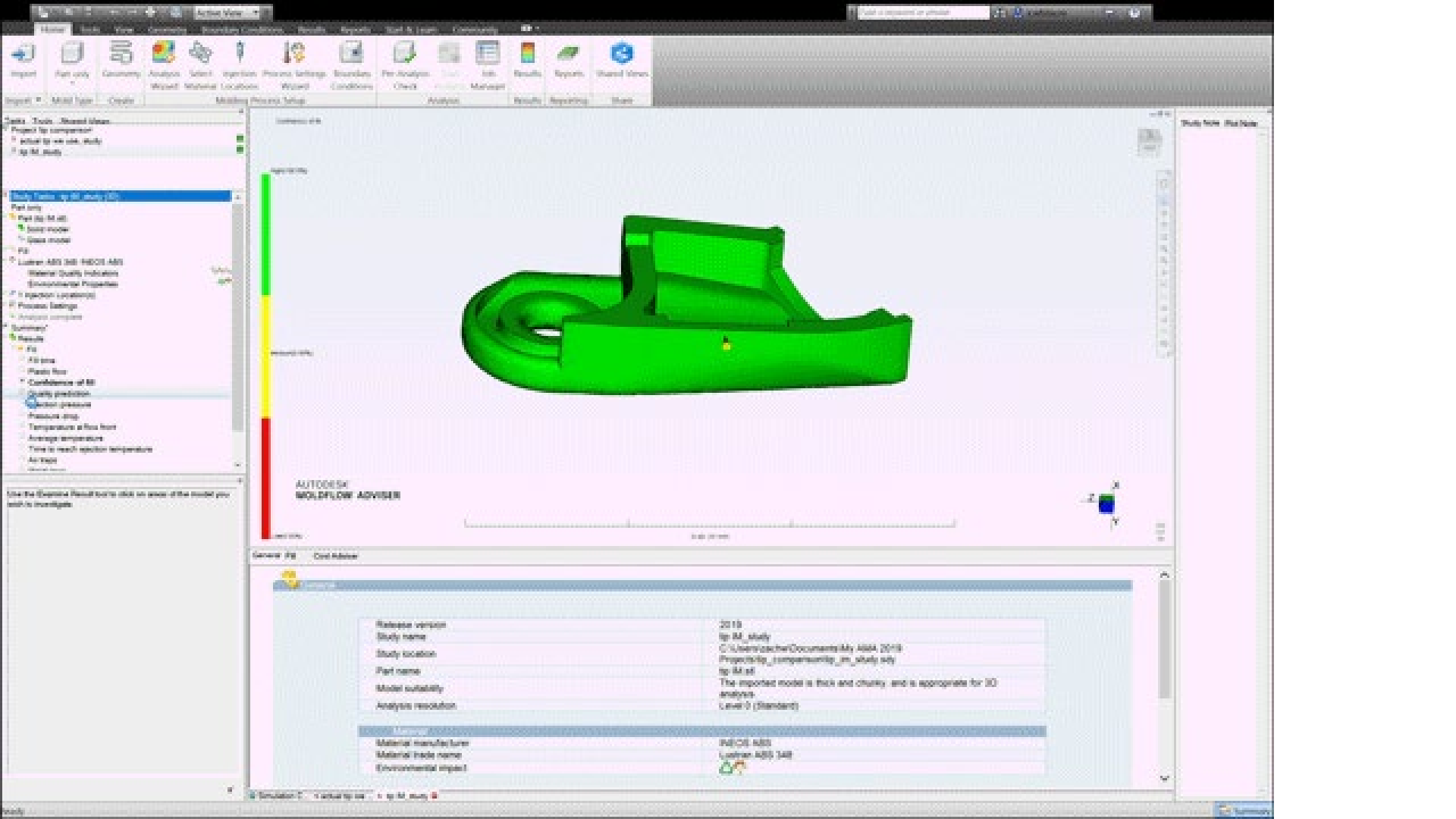
Challenges with Additive

1. Too easy to make “impossible” geometries
2. Difficult part analysis/ simulation (anisotropic)
3. Linear costs- increase scale, increase cost
4. Time Limiting
5. Limited materials






AUTODESK
MOLDFLOW ADVISER
Release version 2019
Study name actual tip we use_study
Study location C:\Users\zacha\Documents\My ABS\ 2019 Projects\tip_comparison\actual_tip_we_use_study.sdy
Part name actual tip we use.stl
Model suitability The imported model is thick and chunky, and is appropriate for 3D analysis.
Analysis resolution Level-1 (Standard)
Material manufacturer INEOS ABS
Material trade name Lustran ABS 348
Environmental impact


AUTODESK
MOLDFLOW ADVISER

AUTODESK. FOUNDATION

Limbitless is an Autodesk Foundation grantee and receives additional sponsorship support

Initial Concepts 3D Design, & Electronics Design

Design Validation & Simulation

Generation of Complex Core/Cavity & Parting Line Geometries

CNC Toolpaths for Injection Molding & 3D Printing

Previous Setup

Tormach PCNC 440

Morgan-press G55 molding machine (modified)

New Equipment

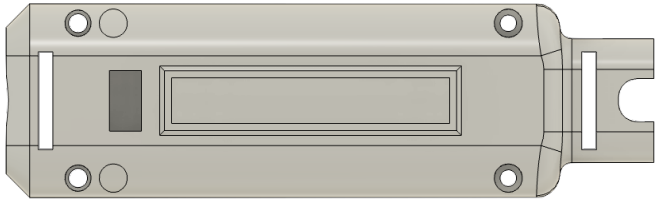
Tormach Bandsaw

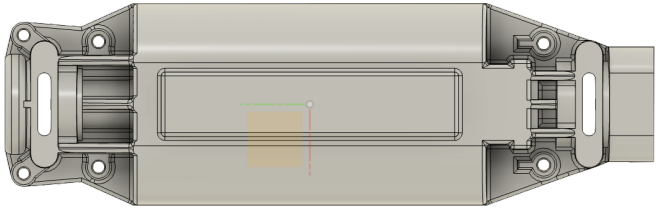
Tormach 770

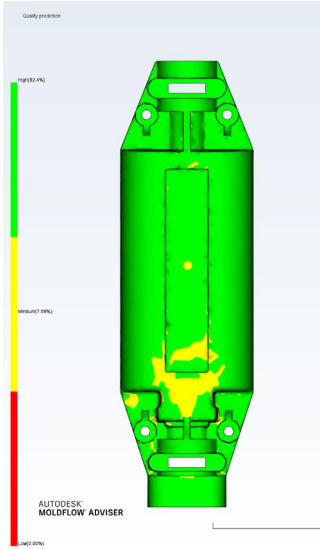
RobotDigg Injection Molding Machine

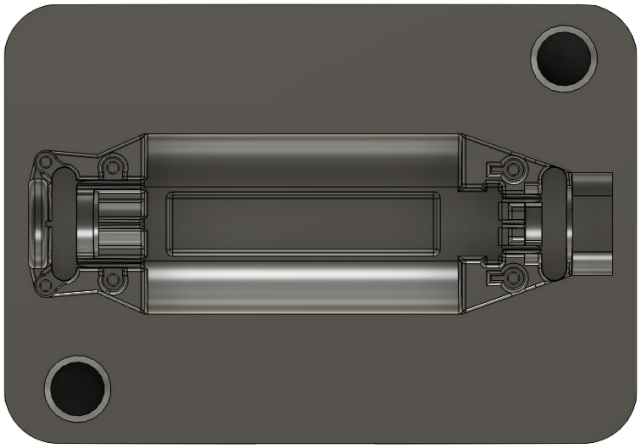
Design Process

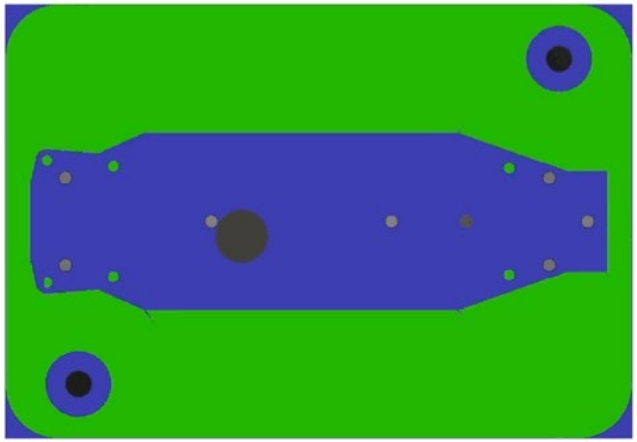
Battery Core design for molding





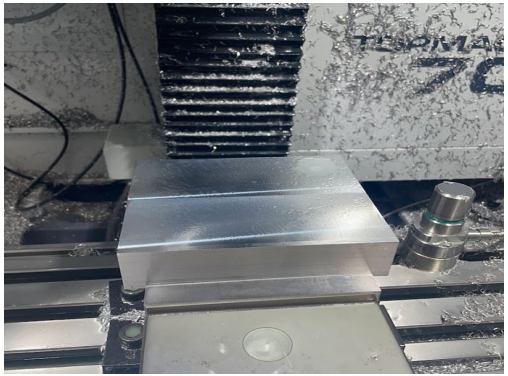


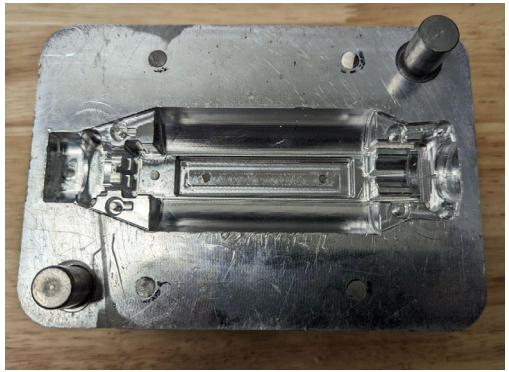




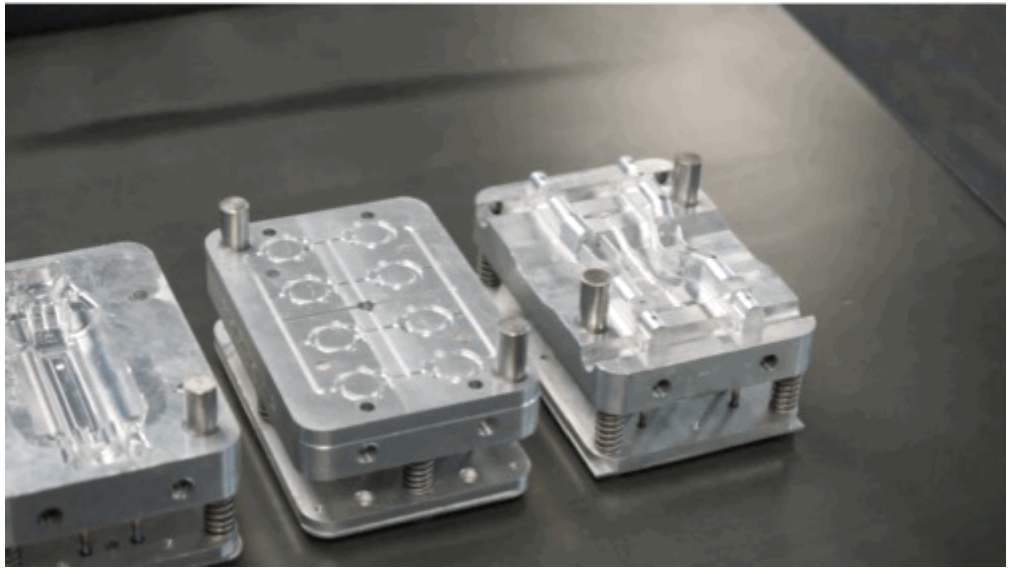
Manufacturing Process

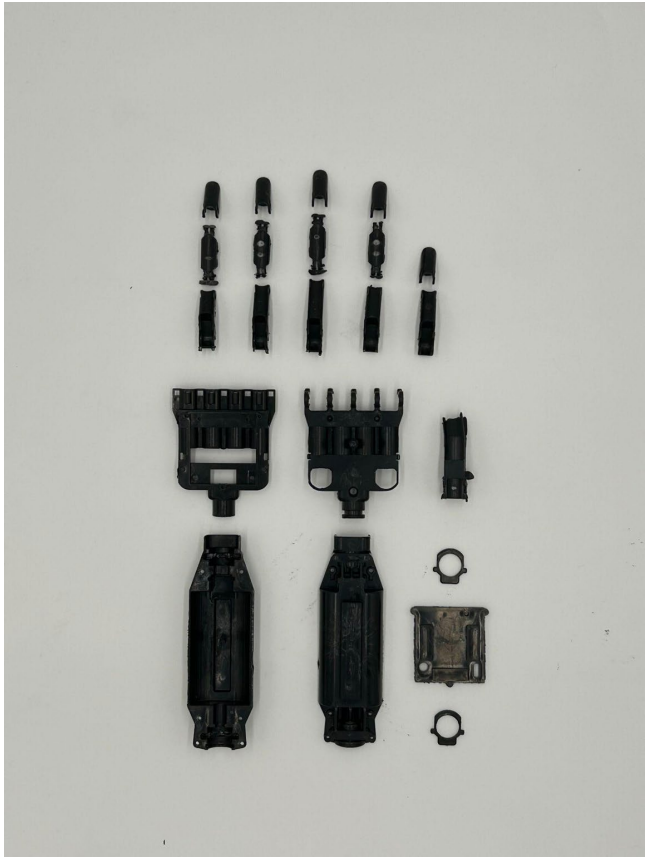
Battery Core design for molding



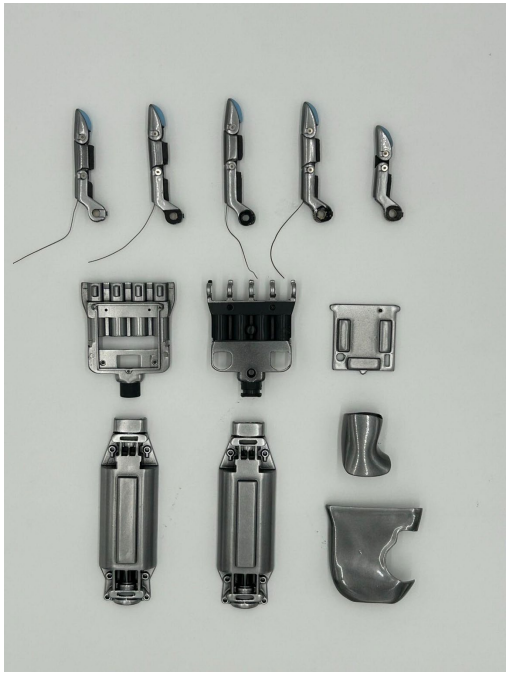


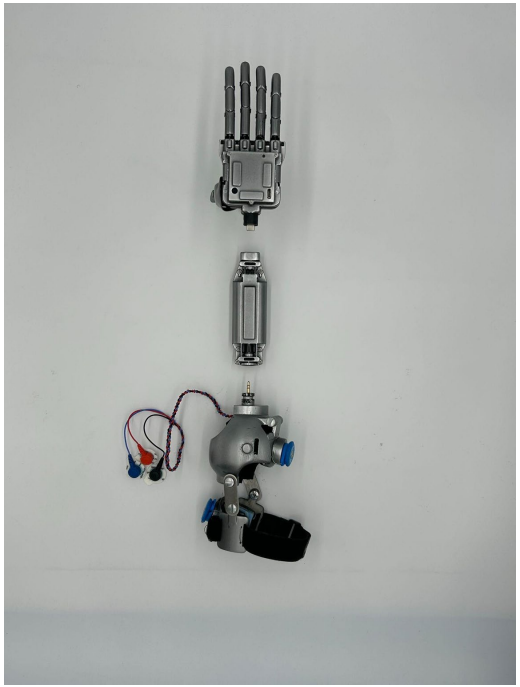
Completed Molds





Assembly

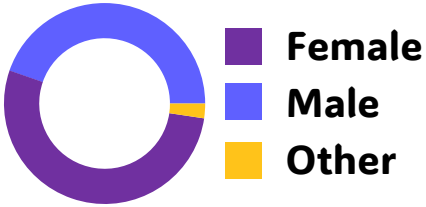


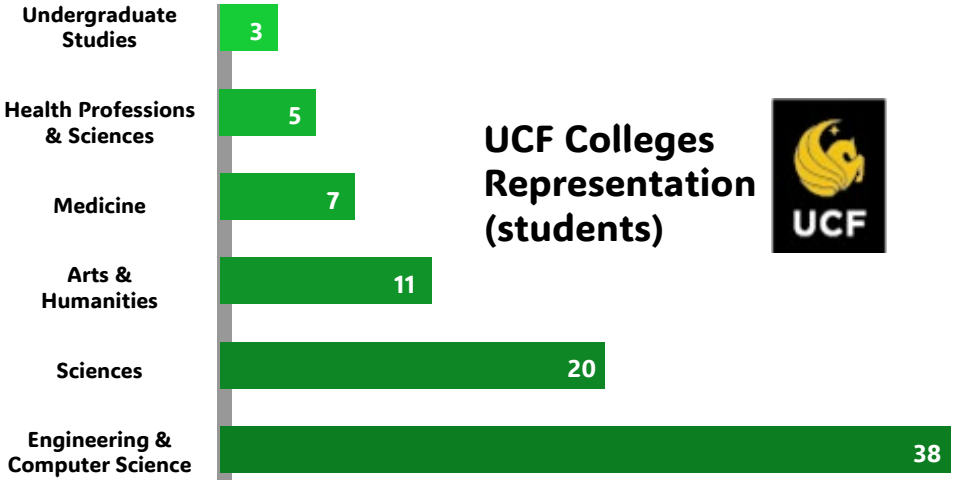


Student Experience

Providing hands-on experiences for undergraduate students to learn manufacturing

85
Total Interns

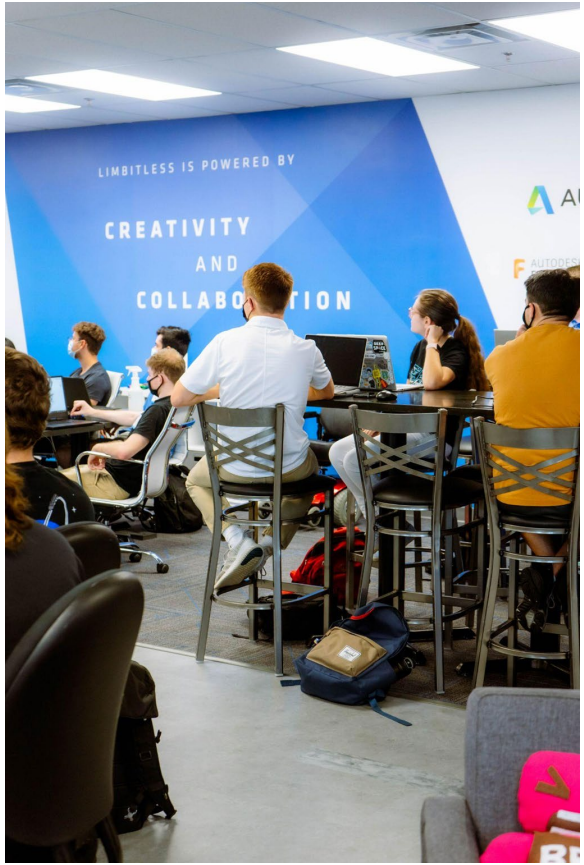


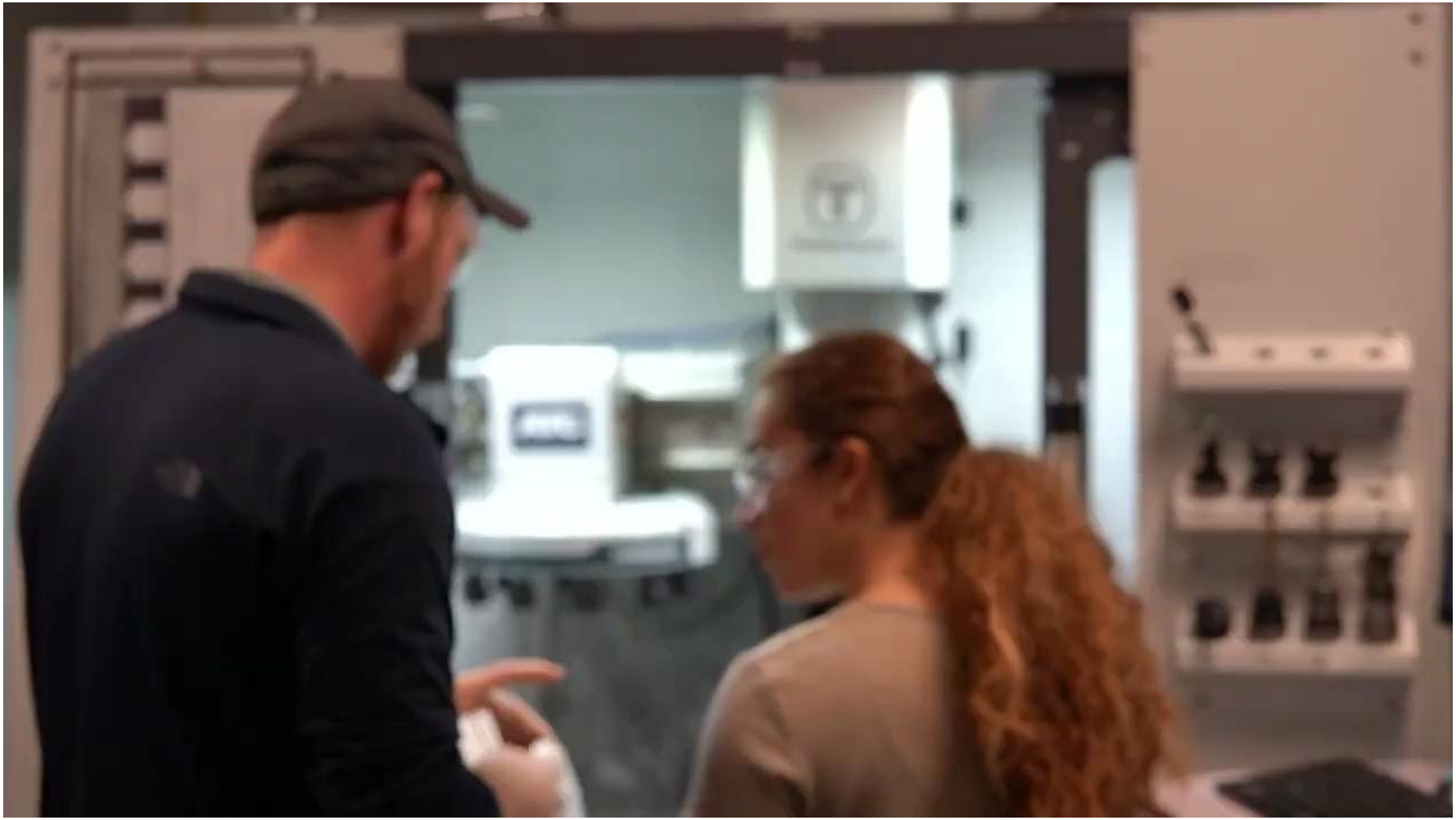


UCF Colleges Representation (students)

UCF

Fiscal Year 2023 Reporting


LIMBITLESS IS POWERED BY
CREATIVITY
AND



Future Casting

Improving readiness and scale

Next Steps

1. Convert to steel molds
2. Add textures to parts
3. Finalize conversion of remaining 3D printed parts
4. Increase strength in weld areas
5. Evaluate Alternative Materials

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