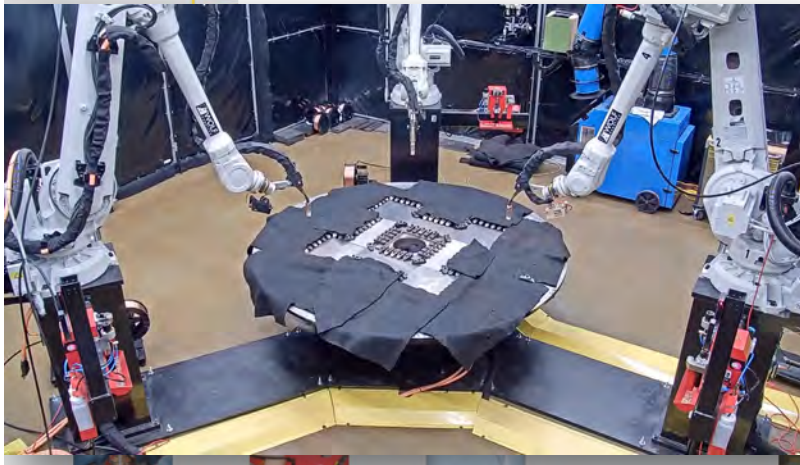


From Prototype to Production Tooling for Casting, Molding, and Thermoforming Using Additive Manufacturing

Sudarsanam Suresh Babu
Clark Distinguished Chair Professor
Department of Materials Science and Engineering
October 8, 2025; 1:00 PM



**Acknowledgement: Collaboration
with ORNL-MDF for the last 15 years**

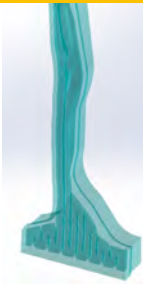
Bottom line upfront: Large-scale metal additive manufacturing shortens tooling lead times by 80–90% and enables conformal cooling, graded properties, and rapid design iteration.

CRADA Based on Industry Demand (2017)

Report on Additive Manufacturing for Large-Scale Metals Workshop



CAD Design



Print Design



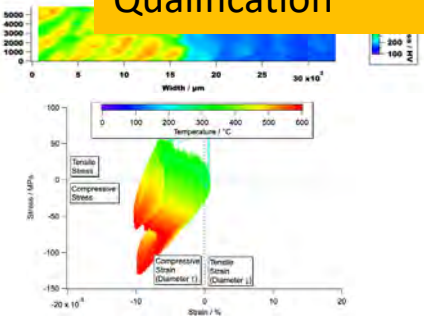
A. Nycz et al (2023)

Oak Ridge National Laboratory
Large Scale Metal Additive
Manufacturing for Stamping Dies

Print Part



Metallurgical Qualification

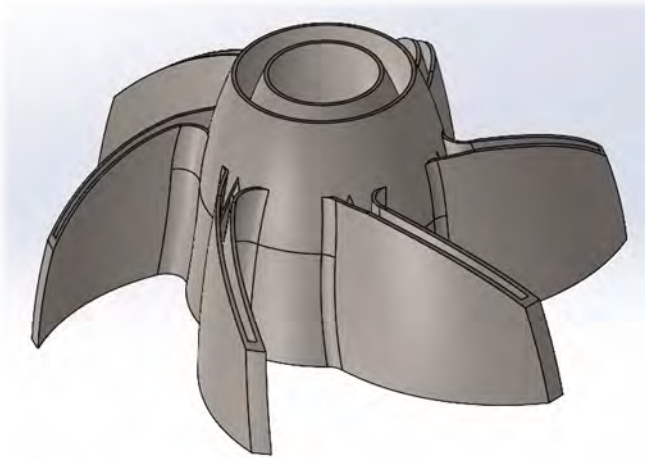


- **Large scale metal additive manufacturing started as a dream, and it is a new technology offering from welding companies.**

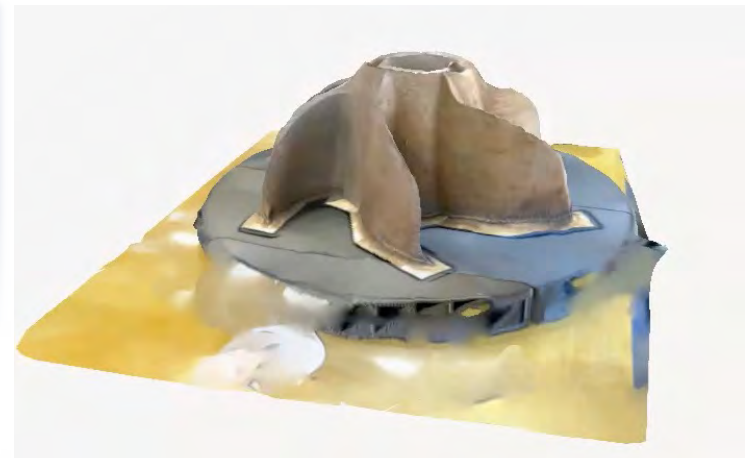
Key capabilities: Make, Monitor & Model



Ref:
<https://arstechnica.com/cars/2020/10/the-technology-behind-the-iphone-lidar-may-be-coming-soon-to-cars/>



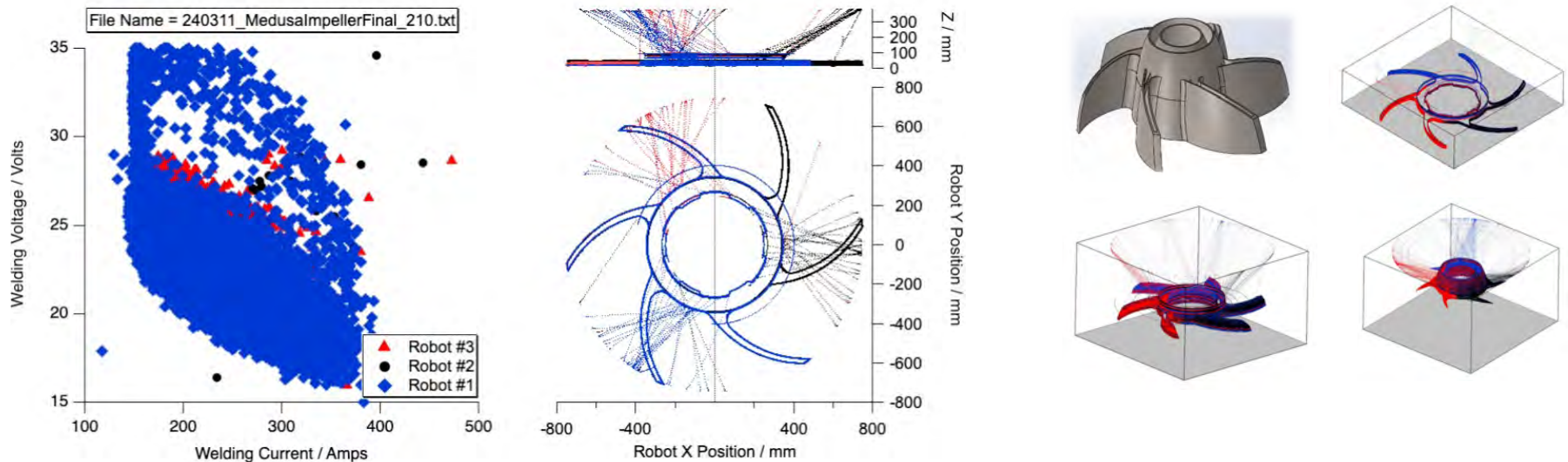
CAD FILE



iPhone13 Pro Measurements

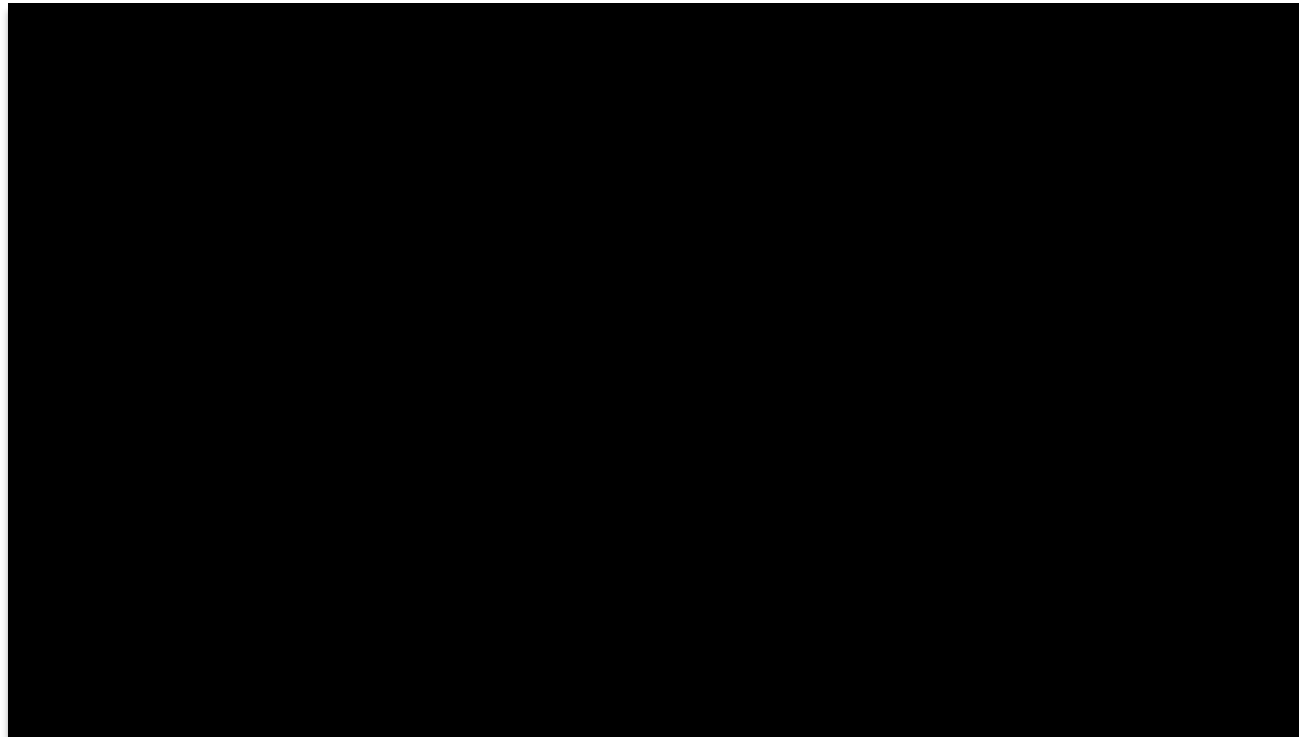
- **In-situ process monitoring and physics-based modeling are key capabilities for achieving precision and repeatability.**

During fabrication, adaptive controls dynamically adjust welding voltage, current, & travel speed based on geometry and heat input.



- **AI and machine learning can accelerate part qualification—but are these tools widely accessible to the community?**

Demo (accessed as private citizen)



- I am not endorsing or promoting this application or web service.
- However, we should ask: Is this good or not? How can we shape emerging technologies to align with our vision, mission, and values?