Wrap-up
Technical Capability Needs

• Availability of computational platforms
• Usable, scalable, open source CAE software for commercial unclassified problems
• Turn-key tools for casting process
• Migrating models to HPC
• More friendly licensing and better cloud functionality
• Higher-fidelity, higher-physics, accurate models to fully replace reality
• Reduced-order for real-time modeling in line with operations
• Cheaper HPC access, compute time, and software applications
  o Consortium of small companies to share access HPC and software packages, including applications software
  o Trial packages for small companies and design teams
Technical Capability Needs

• Additional capabilities not currently available in software:
  o Expertise in the HPC utilization and software design
  o Magneto Hydrodynamics - movement of molten aluminum
  o Metal casting, HVAC
  o Ironmaking and Steelmaking and Rolling processes
  o Better models for non-Newtonian fluids
  o Microstructures, defect identification, turbulence, solidification
  o Composite material process modeling and simulation
  o Multiphase flow with chemical reaction
  o Comprehensive understanding of turbulence
Technical Capability Needs

• Greater readiness level of current SW for HPC systems:
  o Better scalability of software on HPC: FEA and CFD software that scales beyond 1000 cores
  o Improved scaled coupling: DEM and CFD, FEA and CFD
  o Manufacturing process modeling
  o Multiscale simulation software bridging the gap from mesoscale simulation to engineering scale
  o Better I/O buffering, e.g. through large NVMe on nodes
  o Programming tools
  o Better “story telling” visualizations
Human Capability Needs

• Additional collaborations:
  o With other HPC4Mfg project companies, on common challenges
  o With universities, for when analytical models used to simulate processes are insufficient
  o With software companies, to develop software workflows with manufacturers
  o With application-side (e.g., automotive and aerospace industry) researchers, who use structural and acoustic simulation
  o Between Lab and Company after project completion, for cost-effective use of HPC

• How to continue the work after the HPC4Mfg project ends

• Limited company-internal staffing
Human Capability Needs

• Translate industry challenges back into scientific problem statements
• More modeling/simulation expertise (in general and in HPC) for broad industry adoption
  o Local Engineering Service Providers to help translate HPC to manufacturing processes
• Culture change, so that manufacturers see simulations as having same validity as experimental results
  o Leadership engagement, story telling, and outreach