
HPC 4 MANUFACTURING
Industry Engagement Day
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Lawrence Livermore National Laboratory
BERKELEY LAB
OAK RIDGE National Laboratory
U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy
ADVANCED MANUFACTURING OFFICE
U.S. DEPARTMENT OF ENERGY
Office of Science

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
  - Consortium of small companies to share access HPC and software packages, including applications software
  - Trial packages for small companies and design teams

Technical Capability Needs

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

Technical Capability Needs

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

Human Capability Needs

- Additional collaborations:
  - With other HPC4Mfg project companies, on common challenges
  - With universities, for when analytical models used to simulate processes are insufficient
  - With software companies, to develop software workflows with manufacturers
  - With application-side (e.g., automotive and aerospace industry) researchers, who use structural and acoustic simulation
  - 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
  - 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
  - Leadership engagement, story telling, and outreach