



MANUFACTURING

High Performance Computing for Manufacturing—The HPC4Mfg Program

Lawrence Livermore National Laboratory, Lead
Sept 2015 - Present

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The HPC4Mfg program lowers the barriers to bringing the power of HPC to the manufacturing community

- **Industry Status:**

- Some larger companies use HPC, but struggle to stay current
- Few small to medium companies use HPC



- **DOE Status:**

- DOE labs possess 5 of the top 10 HPC systems worldwide; 2 of top 4 in Graph500
- Broad expertise in the application HPC
- Can be a challenge for industry to understand the best way to partner with DOE



HPC4Mfg creates partnerships that leverage DOE lab expertise and compute resources to address critical problems in the manufacturing sector

Program Approach

The HPC4Mfg program is building an ecosystem to support HPC adoption by industry

- Showing what is possible with HPC through demonstration projects
 - AMO funds < \$300k to laboratories
 - Industry funds at least 20% in-kind support w/ optional cash contribution
 - Project duration < 1 year
- Encouraging the adoption of HPC through capability projects
 - Execution mechanisms and funding source varies
 - Project duration: multiple year
- Building the HPC Manufacturing community
 - Industry Engagement Day
 - Student intern programs



Program Approach

Our unique approach to building teams helps ensure each project's success



**Engage
industry**

Industry
submits
challenges

**Match
challenge
to PI**

AMO
approval;
Feedback to
industry

Sign
agreements

**Inform
industry**

Concept paper

Full proposal

Award

Technical Review Committee

Technical Merit Review Committee

- Partner labs and AMO representatives
- Heavy focus on **nation-wide** impact to energy efficiency and clean energy technology industry-wide

Execution streamlined through the required use of the DOE short form

Status: The HPC₄Mfg Program is in steady state

March – September 2015

Launch program with seedling projects

- LLNL established the program
- \$1.5M: 5 seedling projects
- Industry outreach



September 2015–March 2016

Inaugural solicitation

- LBNL, ORNL join as partner labs
- \$3M solicitation: 10 demonstration projects to 8 companies

March 2016 -

Steady state

- Solicitation twice a year
- Demonstration/Capability projects
- Summer internships
- Workshops, Industry Engagement Day
- Added participating laboratories: ANL, NREL, NETL

- *Compute resources from across the DOE complex*
- *Launched annual Industry Day*
- *Student internship programs*

The HPC4Mfg program has a diverse portfolio

- \$>13M technical portfolio
 - Executing on 41 projects with 33 industry partners and 5 labs
 - 40 demonstration; 1 capability
 - 2 projects funded by Office of Transportation, Fossil Energy
- Spring 2017 Solicitation announced yesterday
 - \$3M available
 - New area of materials in severe environments
 - Other DOE offices informally involved

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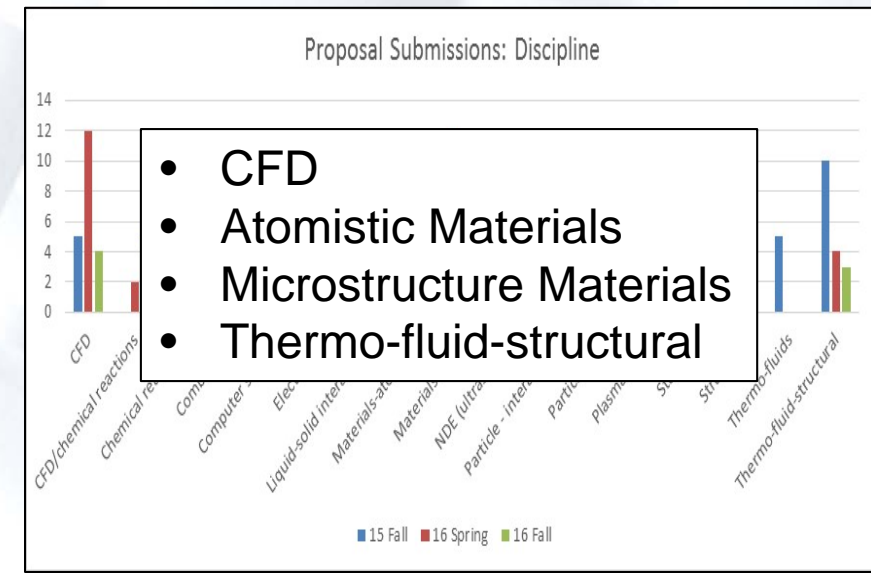
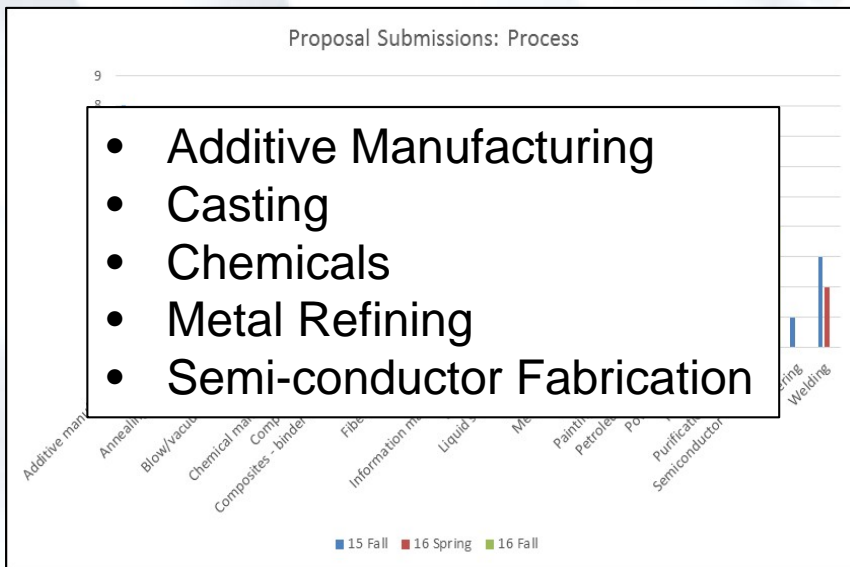
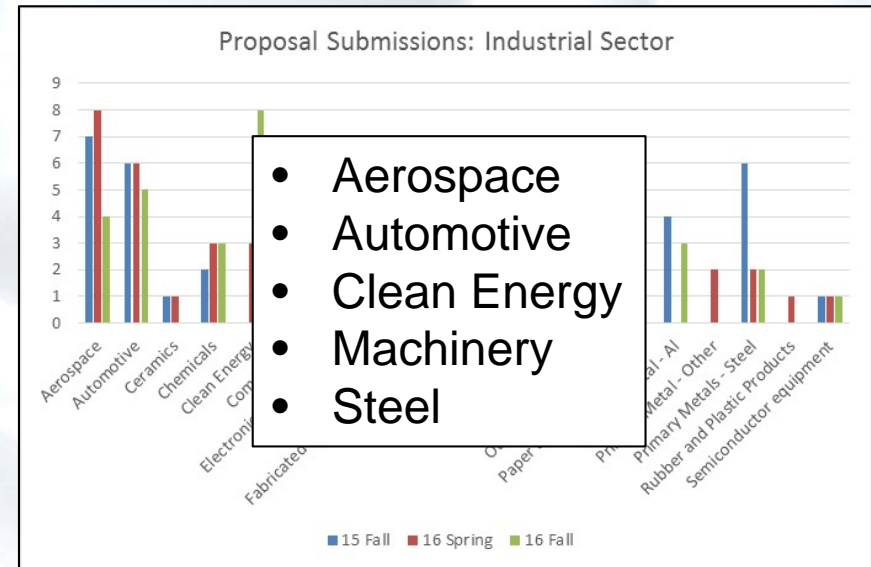
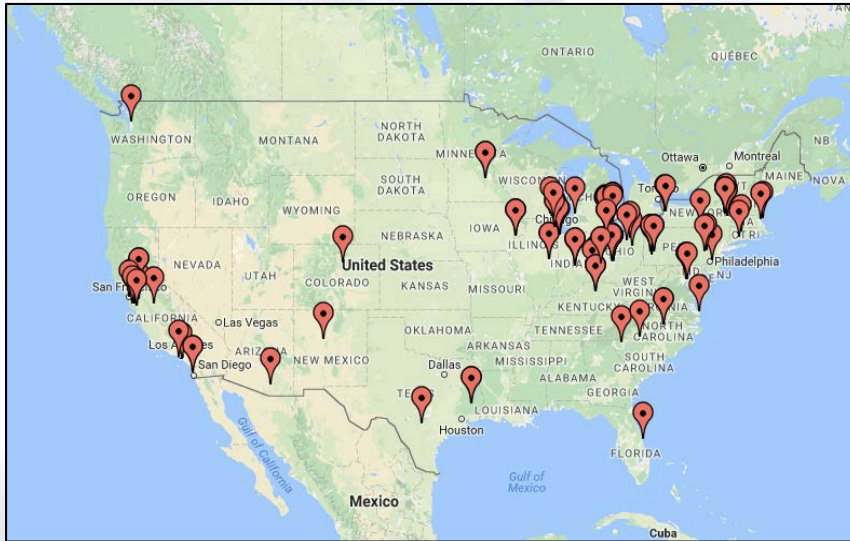
ALZETA CORPORATION

lift

GM

GE

The concept paper participation has been diverse in both geographic location and topic



HPC4Mfg outreach activities build community

- Industry Engagement Day brought together industrial leaders, lab researchers and government officials
- Conference/Meeting participation
 - TMS (March, July)
 - Manufacturing USA Networking Meeting
 - Council on Competitiveness Regional Forum
 - FabTECH (Nov)
- Topical Workshops
 - Powder bed spreading processes in AM
 - Performance and characterization of AM parts
- Workforce
 - Large summer student population planned this year
 - Booth planned at 2017 Computational Science Graduate Fellowship program review



If HPC₄Mfg is successful...

- The development and deployment of energy-efficient manufacturing is accelerated through funded projects
- The production or adoption of clean tech is enabled through funded projects
- HPC becomes a useful tool to a broad array of small, medium, and large companies in designing new products, reducing cost and energy consumption, accelerating time to market
- More collaborations between DOE labs and U.S. manufacturers are enabled increasing competitiveness
- Simulation capabilities at the DOE laboratories are improved

HPC4Mfg Program Management & Budget

- Program is led by Lawrence Livermore National Lab in conjunction with principal labs: Oak Ridge and Lawrence Berkeley
 - Bi-annual solicitation process
 - Technical review of concept papers and proposals
 - Process definition and governance
 - Funding and projects
- Budget
 - Defined by number of demonstration, capability and implementation projects
 - Additional support for summer students, industry day, workshops
 - Program and project management costs across three labs varies from 10-15% year over year

Results and Accomplishments

- The HPC4Mfg program is in steady state
 - Managing two solicitations per year
 - Starting up approximately 20 new demonstration projects/year
- Seedling projects are now coming to an end and demonstrate success
- Outreach activities are building community
- The HPC4Mfg program is well positioned for growth
 - New area in materials in severe environments added to Spring 2017 solicitation
 - Recently added three participating labs (ANL, NREL, NETL)
 - Projects co-funded by VTO or FE