Program Webinar: National Laboratories partner with US Manufacturers to Increase Innovation and Energy Efficiency

Lori Diachin, HPC4Mfg Program Director
Robin Miles, HPC4Mfg Project Manager

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.
LLNL-PRES-733244
Today’s Agenda

12:00 – 12:05 EDT Welcome and webinar instructions

12:05 – 12:20 EDT Overview of program

12:20 – 1:00 EDT Q&A

Participant instructions

- Please turn off video and mute your phone

- Questions will be answered at the end of the briefing
  • Send to ”Everyone” via Chat
The HPC4Mfg program is designed to bring the many benefits of high-performance computing benefits brings many benefits to US Industry:

- Accelerate innovation
- Optimize design
- Reduce testing cycles
- Shorten the time to market
- Quality processes and Pre-qualify
- Reduce waste/reduce rejected parts
- Lower energy costs
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
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
Program Details: Eligibility and Funding

- Eligibility for call
  - Companies manufacturing in the US
  - Manufacturing-supporting organization
  - US Universities with strong tie to industry

- Who can be funded from the program
  - National Laboratories
  - In limited amounts, US Universities, via sub-contract

- Industry participant cost share
  - At least 20% of project funding
  - Can be used to support internal staff
  - Source can not be other federal funding
  - Waiver available for qualified universities

Required!
Program Details: DOE Model Short Form CRADA

- Used for accelerated placement and execution
- Scope and IP protection defined
- Industry awardees required to sign DOE Model Short Form CRADA
- Objections to terms and conditions can be stated in concept paper, however this could lead to delays and rejection of proposal
- Standard DOE Short Form CRADA available on the web site
  - Individual labs may have some variances
  - If concept paper is selected to go forward; the specific CRADA for your laboratory will be sent to you

ATTACHMENT 5

This Attachment provides information and/or requirements associated with DOE O 483.1 A as well as information and/or requirements applicable to contracts in which the associated CRADA (Attachment 1 to DOE O 483.1A) is inserted.

MODEL SHORT FORM CRADA

This Model Short form CRADA is designed to be offered to entities as means for streamlining and simplifying the CRADA process for certain circumstances. In order to ensure expedited CRADA development and approval, this document shall be adopted in its entirety, as written, by both/all parties and, at the same time, advise the alternative to use the DOE Model CRADA if the total terms of the Short Form CRADA are not acceptable.

a) The Participant shall be clearly advised that this CRADA must be adopted in its entirety, as written, by both all parties and, at the same time, advise the alternative to use the DOE Model CRADA if the total terms of the Short Form CRADA are not acceptable.

b) The dollar value of the entire project (including amendments) does not exceed $500,000. This dollar value may be periodically adjusted by the HQ Office of Procurement Policy (MA).

The Short Form CRADA package will be subject to the same process used for DOE Model CRADA package review and approval at the local DOE Field Offices.

Guidance for the DOE Model CRADA applies to clauses unchanged in the Short Form CRADA.

For each project, a Statement of Work (SOW) is required that details the nature, scope, roles, responsibilities, and costs of activities to be conducted by both parties together with an estimated timeline for completion of identified tasks. The SOW will be incorporated into the CRADA as Annex A.
The spring 2017 solicitation focuses on three areas:

**Broad impact on energy efficiency and/or productivity:**
- existing process optimization
- advanced product design
- predicting performance and failure rates

**Accelerating adoption of clean energy technologies:**
- new design and discovery on products or processes that impact energy use
- new materials that lower carbon release into atmosphere during use
- lower energy during manufacturing
- lower energy use during product life-cycle

**Additional emphasis area: development and qualification of new energy materials:**
- emphasis on nuclear and fossil energy
- predict behavior in specific severe environments
- scale up from grams to kilograms
- detailed processes such as oxidation, corrosion, matter-matter interactions, irradiation damage, etc.
Concept papers are the first step:

- Two-pages; single spaced; 12 pt font – Use the template at http://hcp4mfg.org!

- Key Elements
  - **Title page**
  - **Abstract** (150 words or less) - must be non-proprietary, publishable summary
  - **Background**
    - Technical challenge to be addressed
    - State-of-the-art in manufacturing in this area; how this program advances that; why national lab HPC resources are required; expertise of industry partners, etc
  - **Project Plan and Objectives**
    - Technical scope of the work and how this project fits into the overall solution strategy
    - How results will be validated including availability of data;
    - Specific simulation codes that will be used if known
  - **Impact**
    - How this effort results in long-term energy savings or
    - Development/production of clean energy technologies or
    - Ability to accelerate innovative energy-efficient manufacturing
    - Metrics include cost savings, energy savings, improvement in energy intensity

**You do not need to identify a laboratory partner up front!**
*Just an interesting and hard problem that HPC can help address!*
Full proposals provide much more detail

- Six-pages; single spaced; 12 pt font – Use the template at http://hcp4mfg.org!

- Key Elements
  - **Title page**
  - **Abstract** (150 words or less) - must be non-proprietary, publishable summary
  - **Background**
    - Similar to concept paper
  - **Project Plan and Objectives**
    - Similar to but more detailed than concept paper with specific tasks; specific simulation codes; modifications to the software needed etc.
  - **Tasks, Milestones, Deliverables and schedules**
    - Goals, timelines and due dates of milestones and deliverables from all partners; responsible party, communication from one partner to another
  - **Impact**
    - Similar to concept paper but more detailed; is this transformational for an industrial sector; what is the enduring impact; how will results be disseminated
  - **Implementation and adoption**
    - How will this be incorporated into company and industry-wide operations; follow on activities to extend this effort to solve the broader problem being addressed
  - Various appendices (see next slide)
Appendices provide additional information

- Used in the review process; CRADA development process; compute resource determination, etc..
- Not included in the 6 page limit
- **Appendix A**: Project summary of Tasks and Schedule (similar to project tasks in main proposal, but used for CRADA development)
- **Appendix B**: Project budget: costs, amount and source for participants, cost share (in-kind or cash); how funding makes a difference relative to existing funding
- **Appendix C**: Computational resources: computational approach, performance of the codes, resources requested (platform and core hours)
- **Appendix D**: Pictures for publication (please don’t ignore this!)
- **Appendix E**: How the work benefits the laboratory
- **Appendix F**: Resumes of key participants
Program Details: Evaluation criteria (or how to maximize your score)

- **Advances the current “State of the Art” in the industrial sector**: takes the industrial sector to a new level; provides a wholly new capability; or makes an existing technology obsolete

- **Technical feasibility**: clearly stated technical approach; description of the software including needed modifications; clearly stated roles and responsibilities; realistic timeframes; available validation data

- **Relevance to high performance computing**: utilizes unique expertise and facilities at DOE labs; solves a problem that could not be solved otherwise; can use large fractions of the HPC facility to solve a large-scale problem; clear estimates of the compute cycles needed

- **Impact, including Lifecycle Energy Impact**: clear, evidence-based energy savings with broad (national scale) impact; impact on employment and manufacturing; clear statement of the deployment plan

- **Project management and team**: team expertise matches the problem to be solved; modeling expertise on both lab and industry side; experts for model validation if necessary; clearly stated roles and responsibilities; evidence for strong collaboration through joint milestones
Historically, concept paper participation has been diverse in both geographic location and topic.

- Aerospace
- Automotive
- Clean Energy
- Machinery
- Steel
- CFD
- Atomistic Materials
- Microstructure Materials
- Thermo-fluid-structural
- Additive Manufacturing
- Casting
- Chemicals
- Metal Refining
- Semi-conductor Fabrication
Creating new lightweight alloys

**Goal:** Predict the strength of lightweight aluminum-lithium alloys produced under different process conditions; could save millions of fuel costs if used in aircraft design

**Results to date:** Developed new dislocation mobility laws for Al-Li alloys; examining influence of different precipitate density; predicting yield strength for differing particle sizes

**Team:** LIFT with LLNL and Univ Mich.

Dendritic Growth in AM Parts

**Goal:** Use HPC to model multi-scale morphology of solidification microstructure of Nickel base 718

**Results to date:** Predicting crystal growth over large domains from multi-component alloys using phase field approaches; moving to new alloy systems and 3D

**Team:** UTRC with ORNL/LLNL

Examples: HPC4Mfg is extending our scientific knowledge in different industrial sectors.
Examples: HPC4Mfg is improving industrial workflows and speeding up modeling time using HPC

**Weld Predictor Tool**

**Goal:** Develop an improved online welding software modeling application using advanced 3D models, more material hardening laws, and open source parallel codes

**Images courtesy of EWI**

**Results to date:** Developed new front end interface and automated meshing tools; working on new parallel simulation tools for thermal analysis, microstructure prediction, and mechanical analysis

**Team:** Edison Welding Institute with ORNL/OSU

**Paper Towel Design**

**Goal:** Use HPC to evaluate different microfiber configurations to optimize drying time while maintaining user experience

**Results to date:** New mesh tool reduces product design cycle by 2X cycle; additional cores by another 8X; largest non benchmark run of Paradyn code at LLNL

**Team:** Procter and Gamble with LLNL

**Examples:** HPC4Mfg is improving industrial workflows and speeding up modeling time using HPC
### More efficient LED lightbulb

**Goal:** Model ammono-thermal crystal growth of GaN to scale up the process; reduce production costs of LED lighting by 20%

**Results to date:** HPC allows higher fidelity simulations showing more complicated flow structure, improved predictions of temperature and flow velocity in the reactor; now optimizing uniform growth of crystals

**Team:** SORAA with LLNL

---

### Energy savings in paper making

**Goal:** Use multi-physics models to reduce paper rewetting in the pressing process; reduce 3rd most intense energy consumer in paper making; save 80 trillion BTU’s per year

**Results to date:** Using both continuum and pore-scale approaches to determine how water flows through porous paper pulp; simulations can be used to optimize drying

**Team:** Agenda2020 with LBNL/LLNL

---

**Examples:** HPC4Mfg is leading to significant energy savings in new products or processes
For more information on the HPC4Mfg Program

Additional information at http://HPC4Mfg.org

Questions can be sent to HPC4Mfg@llnl.gov

Join the hpc4mfg-info@llnl.gov distribution list via the web to receive program announcements

Lori Diachin, Director, HPC4Mfg diachin2@llnl.gov

Robin Miles, Project Manager, HPC4Mfg miles7@llnl.gov
Q & A

- Please mute your phone when not speaking
- Questions: Send to "Everyone" via Chat