DOE Advanced Manufacturing Office

2016 R&D Peer Review

September 30, 2016

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**Department of Energy**

Washington, DC 20585



October 15, 2017

To Members of the AMO Community,

The Annual Program Merit Review for the Advanced Manufacturing Office (AMO) of the U.S. Department of Energy was held on June 14-16, 2016 for the Fiscal Year 2016. Please find a report of the merit review. Annual Program Merit Reviews are an important part of the technology research and development mission of the office. It is a time when researchers and leaders from the individual projects, consortia, technical partnerships and related R&D activities supported by the office gather, share goals and technical results, receive feedback and highlight successes supported by the office during the year. The merit review also provides important feedback to the office from third-party independent technical experts on both individual projects and importantly the overall portfolio supported by the office. With this feedback, the technical managers and managers of AMO are able to adjust and adapt to changing conditions around the office. With prior year feedback, the office has adopted a more systems-oriented, broadly thematic, and cross-cutting approach to the technology development work being supported by the office.

An important part of the 2016 merit review was it provided an opportunity to share a first draft of the AMO Multi-Year Program Plan (MYPP) and receive feedback from the manufacturing community. This provided feedback for the office to document and include a draft MYPP publication later in the year. Feedback from both the merit review committee and the broader manufacturing community was important input to identify and prioritize research and development for the office.

Thank you to the merit review team for their diligent and insightful feedback. This is a great service these individuals provide to the manufacturing community.

And thank you to the overall manufacturing community for your partnership with the Advanced Manufacturing Office. Technology innovation in manufacturing and energy remains a foundation for economic growth and jobs in the country. Keep up the great work.

With highest regards,



Mark Johnson

*Director, Advanced Manufacturing Office*

*Energy Efficiency and Renewable Energy*

*U.S. Department of Energy*

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# Executive Summary

The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) requires each program to conduct periodic peer reviews to enhance EERE program planning. The EERE Advanced Manufacturing Office (AMO) held a peer review of its R&D Projects in Arlington, Virginia on June 14-15, 2016. The purposes of the R&D Projects peer review were to learn from each other, provide feedback to AMO, baseline for comparison over time, and identify possible course correction and new direction. To the extent possible, the peer review process followed the guidelines set forth in the EERE Peer Review Guide (2004). An independent panel of experts attended the meeting and provided comments on AMO R&D Projects. Their findings are summarized in this report.

The AMO leadership has made significant progress this year in developing a long term strategic plan, called the Multi-Year Program Plan (MYPP), currently in its DRAFT stage. The draft MYPP presents a vision for the AMO, “U.S. global leadership in manufacturing for a sustainable clean energy economy”, and a mission, “Catalyze research, development and adoption of advanced manufacturing technologies and practices to drive U.S. economic competitiveness through energy productivity”. The panel felt that the vision and mission are appropriate for AMO and connects directly with the mission of EERE. The draft Strategic Goals succinctly cover the AMO mission and program areas. The goals to improve productivity as well as energy efficiency and to transition innovative technologies are particularly important to achieving success, as recognized by the AMO.

The Technology and Deployment Areas connect well to the 14 technology areas in the Quadrennial Technology Review (QTR). The draft MYPP technology areas have been mapped to the Quadrennial Technology Report (QTR) focus areas, thereby establishing synergy with other DOE offices and programs.

The review panel made a number of recommendations to AMO for strengthening the program, which included specific suggestions to:

* Expand the draft MYPP to cover cross-cutting technical themes, including increased use modeling and simulation, the strategic role of the NNMI institutes, the need for technical and business case analyses, and the AMO interface with the national labs and with other agency programs in technology (e.g. DoD) and practices (e.g. NIST MEP) for advanced manufacturing.
* Use the draft MYPP to shape the future AMO investment portfolio. It is apparent that many draft MYPP areas of emphasis are not reflected in the current portfolio. Future Funding Opportunity Announcements should be based on draft MYPP technical areas and priorities, although a category for “other” proposals should always be included.
* Use the draft MYPP as the organizing framework for the next AMO Peer Review. Limit panels to cross-cutting areas and require project presentations to map their presentations to draft MYPP goals, technical areas and success indicators.

# Introduction

The U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE) requires each program to conduct periodic peer reviews to enhance EERE program planning. The EERE Advanced Manufacturing Office (AMO) held a peer review of its R&D Projects activity in Arlington, Virginia on June 14-15, 2016. The purposes of the R&D Projects peer review were to learn from each other, provide feedback to AMO, baseline for comparison over time, and identify possible course correction and new direction. To the extent possible, the peer review process followed the guidelines set forth in the EERE Peer Review Guide (2004). An independent panel of experts attended the meeting and provided comments on the AMO R&D Projects element. Their findings are summarized in this report.

## EERE Peer Review Requirements

The EERE Peer Review Guide sets forth a number of guidelines for program and project peer reviews. EERE requires all programs to conduct a peer review, on average, every two years. Program reviews should consider budget, output generated, management structure and complexity, stakeholder participation, and information needed to support management decisions. Activities reviewed should typically cover 80-90% of the program’s funding, supporting business analysis, and management programs.

EERE Peer Review guidelines also require a minimum of three reviewers for each discrete program element or smallest unit that is assessed and reported on. Each reviewer should be independent, competent, and objective, selected by a transparent, credible process that involves external parties. Together, the reviewers cover the subject matter.

After the review, the peer review panel is expected to produce and submit a peer review report to AMO management of the findings, and obtain his or her feedback on the draft, including actions to be taken. After AMO’s review and comment, the report is finalized and submitted to senior EERE management, associated staff and researchers involved with the R&D program or project, and all persons involved in the review. The report is to be made available publicly.

## 2016 AMO R&D Projects Peer Review Process

The AMO R&D Projects Peer Review was held on June 14-15, 2016 in Arlington, Virginia. The agenda is listed in Appendix A. The review panel attended the opening session on Day 1 in which the AMO Office Director presented the purpose of AMO, AMO’s organizational structure, key Obama administration and EERE initiatives in manufacturing and clean energy manufacturing, and AMO programmatic elements. A briefing was also provided on the Multi-Year Program Plan (MYPP) development efforts in its DRAFT form. Afterwards on Day 1 and Day 2, presentations were provided on individual R&D Projects by the appropriate Principal Investigator. Each 20-minute time slot consisted of a 10-minute presentation by the Principal Investigator and 10 minutes of questions and answers. Panel sessions were also conducted on Covetic Materials, High Performance Computing for Manufacturing (HPC4Mfg), and Small Business Innovation Research (SBIR) activities. A poster session for several other R&D Projects was held at the end of Day 1. Additionally, a concurrent session was conducted on Day 1 with the morning session focused on AMO Analysis activities and the afternoon session focused on AMO R&D Facilities activities.

Prior to the meeting, the review panel was provided with the AMO’s Fiscal Year 2017 budget request and a link to AMO’s website for additional information. Appendix B lists the evaluation criteria for the overall AMO R&D Projects activity. The forms allowed reviewers to comment on the activity’s strengths, weaknesses, and recommendations. The reviewers also rated the activities on a scale of 1 to 4 (1 = disappointing; 4 = excellent). Separate sets of feedback responses were developed for the individual R&D activities (based on criteria in Appendix C); the observations on individual activities have been provided to AMO separately.

## Review Panel Membership

|  |  |  |
| --- | --- | --- |
| **Name** | **Email** | **Position** |
| Melur Ramasubramanian | [rammk@clemson.edu](mailto:rammk@clemson.edu) | D. W. Reynolds Distinguished Professor and Department Chair, Mechanical Engineering, Clemson University |
| Tom Kurfess | [kurfess@gatech.edu](mailto:kurfess@gatech.edu) | Professor, the George W. Woodruff School of Mechanical Engineering, Georgia Tech |
| Mike McGrath | [mfm@mcgrath-analytics-llc.com](mailto:mfm@mcgrath-analytics-llc.com) | Independent consultant; (former Vice President at Analytic Services Inc.) |
| Frank Pfefferkorn | [frank.pfefferkorn@wisc.edu](mailto:frank.pfefferkorn@wisc.edu) | Assistant Director for Research Partnerships, Advanced Manufacturing National Program Office; (on leave from Associate Professor of Mechanical Engineering, University of Wisconsin-Madison) |
| James Lyons | [jlyons@capricornllc.com](mailto:jlyons@capricornllc.com) | Principal, Farmington River Technologies; and Chief Technologist for venture investment teams at Capricorn Investment Group and Energy Innovation |
| Mike Simpson | [michael.simpson@nist.gov](mailto:michael.simpson@nist.gov) | On detail at the National Institute of Standards and Technology (NIST) Advanced Manufacturing Office; (serves as Director of System Operations, NIST Manufacturing Extension Partnership) |

Appendix D contains the biographies of each panel member.

# AMO Strategy, Mission, and Goals

The AMO leadership has made significant progress this year in developing a long term strategic plan, called the Multi-Year Program Plan (MYPP). The MYPP currently presents a DRAFT vision for the AMO, “*U.S. global leadership in manufacturing for a sustainable clean energy economy*”, and a mission, “*Catalyze research, development and adoption of advanced manufacturing technologies and practices to drive U.S. economic competitiveness through energy productivity*”. The panel felt that the vision and mission are appropriate for AMO and connect directly with the mission of EERE. The draft Strategic Goals succinctly cover the AMO mission and program areas. The goals to improve productivity as well as energy efficiency and to transition innovative technologies are particularly important to achieving success, as recognized by the AMO.

The Technology and Deployment Areas connect well to the 14 technology areas in the Quadrennial Technology Review (QTR). The draft MYPP technology areas have been mapped to the Quadrennial Technology Report (QTR) focus areas, thereby establishing synergy with other DOE offices and programs. Defining “practices” (technology assistance and workforce development) as a major topic along with the three technology categories (manufacturing systems/unit ops, Production/Facility Systems, and Supply chain systems), is a major step and gives programs in the area of technology assistance and workforce development the standing they deserve. The AMO team is commended for including explicit recognition of technology assistance and workforce development in their strategic plan. The AMO success indicators (draft) are well defined, quantitative, and appropriate. The objectives for each of the deployment area, targets/milestones, and timeframes are well organized.

The panel noted that use of the national labs capabilities for modeling and simulation to optimize processes is missing as a cross cutting theme, and should be emphasized. Another area not addressed is Analysis. The continuation of technical analyses, such as Bandwidth Chart development, is important to inform AMO goal setting. Growing the capability for cost and benefit analysis is important for both AMO and industry, and should be part of the plan. The panel also noted that some technical areas were described in great depth while others were not. For example, the composites area had fifteen targets/milestones whereas the smart manufacturing had two major milestones. The consensus of the panel, however, is that the draft MYPP provides a sound basis for focusing future investments.

An overarching observation is that the draft MYPP does not integrate or explain the role of the NNMI institutes in achieving AMO’s vision. We know that the AMO has stood up two NNMIs, awarded a new institute at the time of this writing, is soliciting two additional institutes, and plans to define additional institutes in the future. Similarly, the role of demonstration facilities in achieving the vision of AMO is not made explicit in the draft MYPP. It is important to include NNMI and demonstration facilities into the draft MYPP and discuss other relationships with the National Labs that have significant involvement in AMO’s projects.

Overall, the panel felt that the AMO’s strategic focus has never been sharper and is well aligned with the strategic direction of EERE. With some tweaking (see recommendations), the plan could become more complete capturing all activities and investments by AMO and connecting them all to the unifying vision and serve as a roadmap for guiding the future activities of AMO.

# AMO R&D Portfolio

As way of background, many projects in the current portfolio resulted from an open Funding Opportunity Announcement that did not emphasize specific AMO focus areas and priorities in the past. While current projects are individually aligned with AMO’s mission and goals, the overall balance of the portfolio is not optimized for those goals. The peer review team did an analysis of the projects in the current portfolio to see how they line up with the draft MYPP areas of emphasis.

Table 1 shows the technology and deployment presented in the draft MYPP. A category “other” was added as we sorted through the projects to place ones that did not quite fit in the draft MYPP topics.

Table 1. Draft MYPP Technology and Deployment Areas

|  |
| --- |
| **A. Manufacturing Systems/Unit Ops -- Equipment used for manufacturing process and non-process unit operations** |
| *A1. Additive Manufacturing* |
| *A2. Process Heating* |
| *A3. Process Intensification* |
| *A4. Roll-to-Roll Processing* |
| *A5. Other* |
| **B. Production/Facility Systems - Equipment, process flow and energy strategies that comprise a goods-producing facility** |
| *B1. Combined Heat and Power Systems* |
| *B2. Waste Heat Recovery Systems* |
| *B3. Smart Manufacturing* |
| *B4. Sustainable Manufacturing* |
| *B5. Other* |
| **C. Supply Chain Systems - Network of facilities and ops involved in moving materials through industry, from extraction of raw materials to finished goods** |
| *C1. Advanced Materials Manufacturing* |
| *C2. Composite Materials* |
| *C3. Critical Materials* |
| *C4. Direct Thermal Energy Conversion* |
| *C5. Materials for Harsh Service* |
| *C6. Wide Bandgap Semiconductors* |
| *C7. Other* |
| **D. Practices - Technology assistance and workforce development** |
| D1. Industrial End User Technical Assistance |
| D2. Workforce Development |
| E. Other Technology and Deployment |

Table 2 shows the initial mapping the peer review team came up with after listening to presentations during the review. It is apparent that many draft MYPP areas of emphasis are not reflected in the current portfolio, and many current projects do not fall within defined draft MYPP technology and deployment areas. Further investigation is needed on the part of the AMO team to use this as a starting point, include current resource allocations, project expiry dates, and other information to make plans for assigning future resources to areas that are currently missed, and make continuation decisions about areas that are active now but do not fit into a MYPP topic. Future FOAs should continue to include a category for “other” innovative ideas, but should be structured to gradually populate the future portfolio in the areas emphasized by the QTR and MYPP.

Table 2: R&D Projects, Posters, and Panel Discussion Topics mapped to draft MYPP Areas

|  |  |  |
| --- | --- | --- |
| **Category** | | **Project (Day-Track-Tab Number)** |
| A1 | | 1-B25 Manufacturing Demonstration Facility |
| A5 | | 1-A14 Sustaining Manufacturing via Multi-scale Physics-based Process Modeling and Manufacturing-informed Design |
| A5 | | 2-B24 No Heat Spray Drying Technology |
| A5 | | 2-B30 High Thermal Conductivity Polymer Composites for Low Cost Heat Exchangers |
| B2 | | 2-B27 Waste Heat-to-Power Using Scroll Expander for Organic Rankine Bottoming Cycle |
| B2,A1 | | 1-B21 Panel - Advanced Manufacturing Technologies |
| B3 | | 2-A20 Development of an Automatic Continuous Online Monitoring and Control Platform for Polymerization Reactions |
| B3 | | 2-B28 Industrial Scale Demonstration of Smart Manufacturing Achieving Transformational Energy Productivity Gains |
| B4 | 1-A8 Wear-resistant Surface Technologies of Low-Leakage NG Compressors |
| B4 | 1-B22 Panel - Water-Energy-Material Nexus |
| B4 | 2-A12 Advanced, Energy-efficient Hybrid Membrane System for Industrial Water Reuse |
| B4 | 2-A13 Novel Membranes and Systems for Industrial and Municipal Water Purification and Reuse |
| B4 | 2-A15 Bio-Oxo Technology |
| B4 | 2-A16 A Novel Unit Operation to Remove Hydrophobic Contaminants |
| B5 | 1-A6 High Fidelity Model for the Porous Paper Web |
| B5 | 1-A9 Coatings and Process Development - Reduced Energy Automotive OEM Manufacturing |
| B5 | 1-A17 In-line Quality and Process Control in Solar and Fuel Cell Manufacturing |
| B5 | 1-A18 Ultra Low Energy, Low Cost Industrial Nanomembrane Manufacturing for Desalination, Water Purification, and Remediation |
| B5 | 1-B20 Panel - Analysis Methodology & Tool development |
| C | 1-B23 Panel - Impacts at the Supply Chain Level |
| C1 | 1-A10 Development of Integrated Die Casting Process for Large Thin-wall Magnesium Application |
| C1 | 1-A11 Rapid Freeform Sheet Metal Forming: Technology Development and System Verification |
| C1 | 1-A12 Quenching and Partitioning Process Development to Replace Hot Stamping of High Strength Automotive Steel |
| C1 | 1-A13 High Metal Removal Rate Process for Machining Difficult Materials |
| C1 | 1-A15 New Method of Low Cost Production of Ti Alloys to Reduce Energy Consumption of Mechanical Systems |
| C1 | 2-A17 Low-Energy, Low Cost Production of Ethylene by Low Temperature Oxidative Coupling of Methane |
| C1 | 2-A18 New Design Methods and Algorithms for Energy Efficient Distillation Trains |
| C1 | 2-A19 One Step Hydrogen Generation through Sorption Enhanced Reforming |
| C1 | 2-A21 Conversion of Waste CO2 and Shale Gas to High Value Chemicals |
| C1 | 2-B26 Novel Flash Ironmaking Process |
| C1 | 2-B29 Continuous Processing of High Thermal Conductivity Polyethylene Fibers and Sheets |
| C2 | 1-A2 Panel on Covetic Materials |
| C2 | 1-A3 Synthesis and Characterization of Covetic Materials |
| C2 | 1-A4 Melt Processing of Covetic Materials |
| C2 | 1-B27 Institute for Advanced Composite Materials |
| C2 | 2-B22 Carbon Fiber Technology Facility |
| C2 | 2-B23 Low-Cost Bio-Based Carbon Fiber for High Temperature Processing |
| C2 | 2-B25 Energy Efficient Thermoplastic Composite Manufacturing |
| C3 | 1-B24 Critical materials Institute |
| C5 | 2-A14 Sacrificial Protective Coating Materials that can be Regenerated In-Situ to Enable High Performance Membranes |
| C6 | 1-A7 Computation Study of Flow and Growth Inside Ammonothermal Gallium Nitride Reactor |
| C6 | 1-B26 Power America |
| E | 1-A5 High Performance Computing for Manufacturing |
| E | 1-A16 Panel - Small Business Innovative Research Integrated DC-DC Converters Using Thin-Film Magnetic Power inductors |
| E | 1-B19 AMO Strategic Analysis Overview |
| A5,B1 | 1-P1 Crosscutting Manufacturing R&D-Natural gas IC Engines |
| B1 | 1-P2 Combined Heat and Power R&D |
| B5 | 1-P3 HPC4Mfg: High Fidelity Model for the Porous Paper Web |
| A2 | 1-P4 HPC4Mfg:Improving Steel Production with a Virtual Blast Furnace |
| C6 | 1-P5 HP4Mfg: Computation Study of Flow and Growth Inside Ammonothermal Gallium Nitride Reactor (1-A7) |
| B5 | 1-P6 Flash Processed Steel for Automotive Applications |
| E | 1-P7 Phase II SBIR Integrated DC-DC Converters Using Thin-Film Magnetic Power inductors |
| B3 | 1-P8 Phase II SBIR: In-Line Quality and Process Control in Solar and Fuel Cell Manufacturing |
| C1 | 1-P9 Phase II SBIR: Ultrahigh-Efficiency Capacitive Devices for Continuous Water Deionization |
| C1 | 1-P10 Phase II SBIR: CORE: Capability of Rolling Efficiency for 100 mm High Speed Rails |
| A5 | 1-P11 Phase II SBIR: Ultra Low Energy, Low Cost Industrial Nano-membrane Manufacturing for Desalination, Water Purification, and Remediation II |

# AMO R&D Project Level Observations

* High Performance Computing for Manufacturing (HPC4Mfg) is a good mechanism for connecting manufacturers with computational resources at National Labs and should be highlighted as a cross-cutting theme in the draft MYPP. Computational modeling should be used pervasively across all projects whenever appropriate to optimize products and processes. The demonstration projects on paper wet pressing, and fluid flow behavior inside an ammono-thermal GaN reactor using CFD, and the virtual blast furnace, presented in the poster session were impressive, but were standalone by themselves. Making HPC4Mfg resources accessible to proposers, and evaluating plans for their use during proposal reviews would be very effective in increasing the use of these national assets to achieve AMO goals.
* IACMI has developed a technology roadmap and has deployed several projects with industry. The institute seems to be operational and has selected a first cohort of projects that fit their roadmap. The roadmap seems comprehensive with respect to composites technology. This raises an issue of whether AMO will be open to composites technology related projects from other proposers and SBIR mechanisms when a very large investment and commitment has been made to ORNL. If it is open, AMO will need to provide leadership in connecting novel ideas and facilitate availing IACMI’s world class facilities for the project. A similar question about the role of the MDF in helping R&D project proposers arise. It is recommended that AMO clarify the roles of IMIs, MDFs, and other National Labs in achieving the vision articulated in draft MYPP.
* Covetic material development projects lacked justification given there are larger initiatives such as the Material Genome Initiative (MGI).
* The energy bandwidth studies were informative and useful based on the examples presented. The results should be used to set targets for the draft MYPP.
* Desalination and the water-material-energy nexus investments are not out of scope for AMO, but if this is a major focus area it needs to be added to the draft MYPP.
* Many projects did not have good understanding of key metrics or industry requirements. In the future, metrics for commercial success of projects and how the technology developers incorporate into their project planning may be used as a review criterion. This will also assist in categorizing project portfolio into groups at different TRL/MRL levels.

# AMO Strategic Recommendations

* The role of NNMIs in achieving the strategic vision of AMO should be articulated and the following questions should be addressed. Are these targets/milestones exclusively for AMO projects outside the Innovative Manufacturing Institutes (IMIs)? Are they targets set jointly by IMIs and AMO? For example, are AMO’s Additive Manufacturing targets, many of which overlap the objectives of America Makes and DoD, connected to or coordinated with the IMI agenda?
* In addition to the color coding to depict the strategic areas in the draft MYPP, the panel suggests some symbol be added to indicate targets/milestones that have the potential for R&D collaboration with the NNMI Institutes to accelerate or improve the chance of meeting the target timeline.
* Technology Development Facilities (including innovation consortia) is a major AMO program area that should be added to the MYPP. The overall plan for AMO-sponsored innovation consortia is strategically important, and the draft MYPP seems incomplete without such a section. A matrix showing the intersection of Facilities with AMO targets and milestones would be a useful addition.
* It appears that the Manufacturing Demonstration Facility (MDF) has its own objectives beyond AMO’s objectives. How does it fit with the draft MYPP? How does MDF and IACMI connect? Need to articulate clearly the relationship between the two and how AMO will support both without duplication.
* It will be helpful to both AMO and industry if the new MYPP guides the solicitation and selection of future projects to apply AMO’s budget for greatest overall mission impact. Energy efficiency and reduction in energy use are excellent metrics, the dimension of cost ($$) should also be linked to the energy metrics and needs to be messaged more strongly.
* The continuation of technical analyses, such as Bandwidth Chart development, is important to inform AMO program planning. Growing the capability for cost and benefit analysis is important for both AMO and industry, and should be part of the plan.
* The breadth of topics covered under the 14 technical areas and 2 practices areas cover a wide range. There was a concern if all the deployment areas clearly fit the scope of “advanced manufacturing”. The panel recommends developing a set of priorities for investment within the MYPP deployment areas and a plan for revising these priorities periodically through the peer review process.
* If water resource and technology is intended to be a big part of “advanced manufacturing” portfolio, it is recommended that AMO find explicit mention of an area rather than listing under “advanced materials” as it is now. The presentations on water-energy nexus (panel) discussion gave the impression of a bigger effort that that of a subtopic under advanced materials. Completion of an Energy-Water Bandwidth study is recommended to inform planning and set targets in this area.
* With AMO’s vision to strengthen the competitiveness of the U.S. industry, it was surprising to see a technology developed under the program was licensed to a Taiwanese manufacturer. It is recommended that AMO study this case to understand if it was a “market failure” issue or lack of incentives to manufacture in the U.S. and implement necessary measures. This understanding becomes increasingly important with the large investment in NNMIs, since similar challenges may arise when their technology development begins to mature. Proactive planning is recommended, both for the NNMIs and the AMO project portfolio. Tech transition plans and the business case for scale-up in the U.S. should be an explicit consideration for projects at TRL/MRL 5 and higher.
* The modeling capabilities of national laboratories should be well advertised to proposers of AMO R&D projects. Wherever possible, it is recommended that a lab PI work with the proposer while preparing the proposal coordinating the modeling effort with R&D ideas. Special attention should be paid to cost of HPC services and affordability by SMEs. In the current form, the industry writes a proposal to LLNL with their challenging problems, and an internal PI at LLNL is matched and he/she works on the problem with an award from LLNL and AMO. This is a cumbersome process and LLNL centric to create projects for LLNL PI with industry input and AMO support. This was evident at the poster sessions where the presentations were made by LLNL and there was a lack of understanding of the true problem and the history of attempts in the industry to solve the problem over several decades. The peer review team believes that the HPC capabilities should play a support role to the R&D projects by SMEs and individual PIs and not the other way around as it appears now. An allowable line item on the budget for national laboratory resources will accurately track the HPC costs and provide a mechanism for PIs to incorporate modeling activities easily.
* For national labs projects in the AMO portfolio, the proportions of intramural and extramural funding were not clear. National Labs have their own strategic plans and they are also funded by AMO. This raises the question of how the AMO strategic planning process and that of the National Labs dovetail. For example, the Manufacturing Demonstration Facility (MDF) has its own objectives beyond AMO’s objectives, and also intersects with the objectives of IACMI. The MYPP should clarify the linkage of national labs programs and NNMI programs to the MYPP technical areas and priorities when the draft MYPP is finalized.
* The Critical Materials Institute seems to be a high investment and fairly standalone with a small group of partners. It was not clear how they fund their partners and get new ideas to support the mission of the institute. Are there open calls for proposals, for instance? Will they be renewed after five years at the same funding level?
* PowerAmerica’s recent breakthrough with John Deere in deploying an electric bulldozer is remarkable. Deployment of a SiC foundry is another significant achievement. The Institute is serving its purpose very effectively by generating early and significant wins. The IP arrangement for such a breakthrough technology was not clear.
* The coordination between IAC and MEP was alluded to by the director in response to questions. Although these two have slightly different goals, coordination and leveraging each other’s network is highly recommended.

# AMO R&D Project Recommendations

Comments on individual projects and activities have been provided separately to AMO. While current projects are individually aligned with AMO’s mission and goals, the overall balance of the portfolio is not optimized for these goals. We recommend that the MYPP set investment priorities and that future FOAs be designed to shape the portfolio in accordance with those priorities. We also recommend that TRL/MRL levels be tracked for the projects, and additional attention be applied to developing explicit transition plans for projects in advance of reaching TRL/MRL 6.

# Feedback on the Peer Review Process

* The panel discussion format for discussing National Laboratory projects such as Analysis Methodologies and Tools Development, and specific technologies such as Industrial Process Heating, Industrial Waste Heat Recovery, etc. was not useful in communicating the goals and the progress made in a concise manner. The presentations were fragmented and were hard to follow. Individual presentations with Q&A are recommended for future meetings. The panel mode of presenting technology projects should be discontinued.
* The AMO overview and the MYPP discussion provided important context for the peer review, but were not well applied in structuring the briefings. In the next peer review, it would be a big step forward to use the MYPP as an “organizing feature” for presentations, with a DOE leader introducing each technical area and providing the AMO mission rationale for the following technical presentations. Presenters should include a slide mapping their project to the MYPP areas and success indicators, including metrics for commercialization. They should also indicate the progression through TRL and MRL levels in each review through the life of the project. Since the portfolio will need time to evolve to the MYPP areas of emphasis, AMO may need to create a few transitional areas to group current projects for the next peer review.

# Appendix A: Final Agenda

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Day 1 (June 14) Potomac Salon ABC** | | | | | | | |
| 8:00 – 8:45 am | | Peer Reviewer Briefing Breakfast  **Mark Johnson, Isaac Chan, Valri Lightner, and Jay Wrobel**, **DOE-AMO** | | | | | |
| 8:45 – 9:00 am | | BREAK | | | | | |
| 8:00 – 9:00 am | | REGISTRATION FOR ATTENDEES | | | | | |
| 9:00 – 9:30 am | | Welcome and AMO Overview | | | | **Mark Johnson**  AMO Director | |
| 9:30 – 10:00 am | | Overview of the AMO Multiyear Program Plan | | | | **Valri Lightner**  Senior Advisor | |
| 10:00 – 10:30 am | | Summary of Technical Assistance Activities | | | | **Jay Wrobel**  Technical Assistance Supervisor | |
| 10:30 – 10:45 am | | BREAK | | | | | |
| **TRACK A Potomac Salon ABC** | | | | | **TRACK B Potomac Salon D** | | |
| **Research and Development**  **Projects Review** | | | | | **Analysis Review** | | |
| 10:45 – 11:25 am | Panel on Covetic Materials  High Performance Electrical and Thermal  Conductors  Synthesis and Characterization of Covetic  Nanomaterial  Melt Processing of Covetic Materials | | **David Forrest**  DOE-AMO  **Balu Balachandran**  Argonne NL  **Xinghua Yu**  Oak Ridge NL  **Paul Jablonski**  National Energy Technology Lab, Albany, OR | | 10:45 – 10:55 am | | Overview of AMO Analysis Activities  **Joe Cresko – DOE/AMO** |
| 10:55 – 11:25 | | Panel on Advanced Manufacturing Technology Analysis  **Joe Cresko –** DOE/AMO  **Alberta Carpenter –** NREL  **William Morrow –** LBNL  **Sachin Nimbalkar -** ORNL |
| 11:25 am – 12:00 noon | Panel on HPC4Mfg  Advanced Innovation in Manufacturing | | **Peg Folta,** Lawrence Livermore NL   * **Jun Zu,** Xerium * **Rajeev Pakalapati,** Soraa * **Peg Folta,** LLNL | | 11:25 – 12:00 noon | | Panel on Resource Efficiency and Supply Chain/Value Chain  **Joe Cresko –** DOE/AMO  **William Morrow –** LBNL  **Sujit Das –** ORNl  **Diane Graziano -** ANL |
| **Day 1 (June 14) Continued** | | | | | | | |
| **TRACK A Potomac Salon ABC** | | | |  | **TRACK B Potomac Salon D** | | |
| 12:00 – 1:00 pm | LUNCH  (Private Lunch for Reviewers) | | | | | | |
| **Research and Development**  **Projects Review** | | | | | **R&D Facilities Review** | | |
| 1:00 – 1:20 pm | Wear-Resistant Surface Technologies for Low-Leakage NG Compressors | | Argonne National Laboratory | | 1:00 – 2:00 pm | | Critical Materials Institute  **Rod Eggert**  Colorado School of Mines |
| 1:20 – 1:40 pm | Coatings and Process Development Reduced Energy Automotive OEM Manufacturing | | PPG Industries, Inc. | |
| 1:40 – 2:00 pm | Development of Integrated Die Casting Process For Large Thin-Wall Magnesium Applications | | General Motors LLC | |
| 2:00 – 2:20 pm | Rapid Freeform Sheet Metal Forming: Technology Development and System Verification | | Ford Motor Company | | 2:00 – 3:00 pm | | Manufacturing Demonstration Facility  **Bill Peter**  Oak Ridge NL |
| 2:20 – 2:40 pm | Quenching and Partitioning Process Development to Replace Hot Stamping of High Strength Automotive Steel | | Colorado School of Mines | |
| 2:40 – 3:00 pm | High Metal Removal Rate Process for Machining Difficult Materials | | Microlution LLC | |
| 3:00 – 3:20 pm | BREAK | | | | | | |
| 3:20 – 3:40 pm | Sustainable Manufacturing via Multi-Scale Physics-Based Process Modeling and Manufacturing-Informed Design | | Third Wave Systems Inc. | | 3:20 – 4:10 pm | | PowerAmerica  **Nick Justice**  North Carolina State University |
| **Day 1 (June 14) Continued** | | | | | | | |
| **TRACK A Potomac Salon ABC** | | | | | **TRACK B Potomac Salon D** | | |
| **Research and Development**  **Projects Review** | | | | | **R&D Facilities Review** | | |
| 3:40 – 4:00 pm | A New Method of Low Cost Production of Ti Alloys to Reduce Energy Consumption of Mechanical Systems | | The University of Utah | | 4:10 – 5:00 pm | | Institute for Advanced Composite Materials Innovation  **Craig Blue**  CCS Corporation |
| 4:00 – 5:00 pm | SBIR Phase II Poster Preview Panel  Integrated DC-DC Converters Using Thin-Film Magnetic Power Inductors  In-Line Quality and Process Control in Solar and Fuel Cell Manufacturing  Ultra-Low Energy, Low Cost Industrial Nanomembrane Manufacturing for Desalination, Water Purification, and Remediation II | | **David Forrest**  DOE-AMO  Ferric Semiconductor, Inc.  Ultrasonic Technologies, Inc.  Covalent | |
| 5:00 – 6:00 pm | BREAK | | | | | | |
| 5:00 – 6:00 pm | Private Dinner and Discussion for Reviewers | | | | | | |

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| 5:30 – 7:30 pm | POSTER SESSION AND NO-HOST RECEPTION (12 Posters)  Georgetown Ballroom |

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| **Project Title** | **Performer** |
| Crosscutting Manufacturing R&D | Argonne National Laboratory |
| Combined Heat and Power R&D | Oak Ridge National Laboratory |
| HPC4Mfg: A Hi-fidelity model for coupling flow and mechanical deformation of the porous paper web in papermaking | Lawrence Livermore National Laboratory/LBNL/Agenda 2020 |
| HPC4Mfg: The Virtual Steel Blast Furnace | LLNL/Purdue U. Calumet |
| HPC4Mfg: Study of Fluid Behavior Inside an Ammonothermal Gallium Nitride Reactor Using Computational Fluid dynamics | LLNL/Soraa |
| Flash Processed Steel for Automotive Applications | SFP Works |
| Phase II SBIR: Integrated DC-DC Converters Using Thin-Film Magnetic Power Inductors | Ferric Semiconductor, Inc. |
| Phase II SBIR: In-Line Quality and Process Control in Solar and Fuel Cell Manufacturing | Ultrasonic Technologies, Inc. |
| Phase II SBIR: Ultrahigh-Efficiency Capacitive Devices for Continuous Water Desalination | Mainstream Engineering Corp. |
| Phase II SBIR: CORE: Capability of Rolling Efficiency for 100mm High Speed Rails | OG Technologies, Inc. |
| Phase II SBIR: Ultra Low Energy, Low Cost Industrial Nanomembrane Manufacturing for Desalination, Water Purification, and Remediation II | Covalent |

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| **Day 2 (June 15)**  **Research and Development Projects** | | | | |
|  | **TRACK A Potomac Salon ABC** | | **TRACK B Potomac Salon D** | |
| 8:00 – 9:00 am | REGISTRATION FOR ATTENDEES | | | |
| 9:00 – 9:05 am | Welcome, AMO R&D Staff | | Welcome, AMO R&D Staff | |
| 9:05 – 9:25 am | Advanced, Energy-Efficient Hybrid Membrane System for Industrial Water Reuse | Research Triangle Institute | Carbon Fiber Technology Facility | Oak Ridge National Laboratory |
| 9:25 – 9:45 am | Novel Membranes and Systems for Industrial and Municipal Water Purification and Reuse | GE Global Research | Low-Cost Bio-Based Carbon Fiber for High Temperature Processing | GrafTech International Holdings Inc. |
| 9:45 – 10:05 am | Sacrificial Protective Coating Materials that can be Regenerated In-Situ to Enable High Performance Membranes | Teledyne Scientific and Imaging | No Heat Spray Drying Technology | ZoomEssence |
| 10:05 – 10:20 am | BREAK | | | |
| 10:20 – 10:40 am | Bio-Oxo Technology | Easel Bio-technologies | Energy Efficient Thermoplastic Composite Manufacturing | The Boeing Company |
| 10:40 – 11:00 am | A Novel Unit Operation to Remove Hydrophobic Contaminants | Doshi & Associates | Novel Flash Ironmaking Process | American Iron and Steel Institute |
| 11:00 – 11:20 am | Low-Energy, Low Cost Production of Ethylene by Low Temperature Oxidative Coupling of Methane | Siluria | Waste Heat-to-Power Using Scroll Expander for Organic Rankine Bottoming Cycle | TIAX |
| **Day 2 (June 15) Continued**  **Research and Development Projects** | | | | |
|  | **TRACK A Potomac Salon ABC** | | **TRACK B Potomac Salon D** | |
| 11:20 – 11:40 am | New Design Methods and Algorithms for Energy Efficient Distillation Trains | Purdue University | Industrial Scale Demonstration of Smart Manufacturing Achieving Transformational Energy Productivity Gains | University of Texas at Austin |
| 11:40 – 12:00 pm | One Step Hydrogen Generation through Sorption Enhanced Reforming | Gas Technology Institute | Continuous Processing of High Thermal Conductivity Polyethylene Fibers and Sheets | Massachusetts Institute of Technology |
| 12:00 – 12:20 pm | Development of an Automatic Continuous Online Monitoring and Control Platform for Polymerization Reactions | Tulane University | High Thermal Conductivity Polymer Composites for Low Cost Heat Exchangers | UTRC |
| 12:20 – 12:40 pm | Conversion of Waste CO2 and Shale Gas to High Value Chemicals | Novomer |  |  |
| 12:40 pm | PEER REVIEW MEETING ADJOURNS | | | |
| 12:40 – 1:30 pm | LUNCH FOR PARTICIPANTS  PRIVATE LUNCH FOR REVIEW PANEL | | | |
| 1:30 – 4:00 pm | PRIVATE MEETING OF REVIEW PANEL*(including time with AMO management to address outstanding questions)*  Potomac Salon ABC | | | |

# Appendix B: Evaluation Criteria for R&D Program Overall Activity

**Relevance and Approach**

**Mission**

* How well does the AMO R&D Program fit within the EERE mission and the overall DOE mission?
* Is the justification for a federal program clear and compelling?

**Approach**

* Assess how well the overall AMO R&D Program approach, including goals and programs, addresses the AMO mission.
* Do activities address high impact areas and address appropriate markets and technical barriers?

**Resources**

* Are there adequate resources in terms of dollars for the current mission?
* Is the allocation of resources reasonable?

**Overall Assessment of Relevance**

* On a scale of 1-4, with 4 representing excellent, 3 representing good, 2 representing fair, and 1 representing disappointing, what is the your overall assessment of relevance and approach?
* What recommendations do you have on relevance and approach?

**Management**

**Execution**

* Are the R&D Projects likely to result in high quality products and outcomes? How can their impact be improved?
* How can AMO improve the way its new technologies are received and used by target audiences/stakeholders?
* How do you view the Office’s current activities with respect to balancing the level of risk, expected payoff/benefits, and timeframe for results?

**Resource Leveraging**

* How well is the program coordinating with and learning from other EERE, DOE, and federal activities?
* What other resources could be used or leveraged to meet AMO goals?

**Overall Assessment of Management**

* On a scale of 1-4, with 4 representing excellent, 3 representing good, 2 representing fair or adequate, and 1 representing disappointing, what is the panel’s overall assessment of the organization and management of the R&D Program?
* What recommendations does the panel have on program management?

**Overall Program Assessment**

* What are the best aspects of the AMO R&D Program? What area needs the most improvement?
* On a scale of 1-4, with 4 representing excellent, 3 representing good, 2 representing fair, and 1 representing disappointing, what is the panel’s overall assessment of the program?
* What recommendations does the panel have for the program?

# Appendix C: Evaluation Criteria for Individual Activities

**R&D Projects**

**Technical Merit and Innovation**

The degree to which the project has a high level of scientific and technical merit, has a high degree of innovation, and will be compatible with current or future U.S. manufacturing operations.

 4 - Outstanding

 3 - Good

 2 - Fair

 1 - Poor

**Energy and Market Impacts**

The degree to which the project expects to provide a high level of energy productivity improvements, addresses a significant market opportunity, and will provide attractive economics for end-users compared to existing technology.

 4 - Outstanding

 3 - Good

 2 - Fair

 1 - Poor

**Technical Approach**

Degree to which the technical approach appears reasonable, and the project team’s knowledge of the techno-economic issues specific to the technology.

 4 - Outstanding

 3 - Good

 2 - Fair

 1 - Poor

**Technology Transition Plan**

Degree to which the project staff has a sound approach for transitioning the technology forward, and collaborates or coordinates with industry or other relevant stakeholders to accelerate movement of technologies or practices into the market.

 4 - Outstanding

 3 - Good

 2 - Fair

 1 - Poor

For each criteria, provide comments about the project’s strengths and weaknesses to substantiate the scores.

Offer any additional comments or recommendations for the project.

**R&D Facilities**

**Technical Merit**

Degree to which the activities at the Hub/Facility/Institute align with the mission of AMO/EERE/DOE, and address appropriate technical barriers.

 4 - Outstanding

 3 - Good

 2 - Fair

 1 - Poor

**Energy and Market Impacts**

Degree to which the activities at the Hub/Facility/Institute address high impact areas.

 4 - Outstanding

 3 - Good

 2 - Fair

 1 - Poor

**Objectives and Approach**

Degree to which the objectives and approach of the Hub/Facility/Institute are clear, and degree to which the objectives, approach, and partnership models are well suited to address critical technology challenges.

 4 - Outstanding

 3 - Good

 2 - Fair

 1 - Poor

**Transition Plan**

Degree to which the Hub/Facility/Institute has a sound approach for addressing market barriers and accelerating movement of technologies or practices into the market.

 4 - Outstanding

 3 - Good

 2 - Fair

 1 - Poor

For each criteria, provide comments about the activity’s strengths and weaknesses to substantiate the scores.

Offer any additional comments or recommendations you have for the activity.

**Analysis**

**Framing - Objectives and Approach**

Degree to which the strategic framing of the objectives and approach appears reasonable, and whether key issues are identified and communicated.

 4 - Outstanding

 3 - Good

 2 - Fair

 1 - Poor

**Strategic Planning and Technology Analysis**

Degree to which the specific analysis activities help inform strategic planning and technology analysis for AMO.

 4 - Outstanding

 3 - Good

 2 - Fair

 1 - Poor

**Opportunity Assessment**

Degree to which the activities help identify or assess high impact opportunity areas.

 4 - Outstanding

 3 - Good

 2 - Fair

 1 - Poor

For each criteria, provide comments about the activity’s strengths and weaknesses to substantiate the scores.

Offer any additional comments or recommendations you have for the activity.

# Appendix D: Review Panel Member Biographies

**Melur “Ram” Ramasubramanian (Chair)**

Melur “Ram” Ramasubramanian joined the Clemson University Mechanical Engineering Department in 2012 as D. W. Reynolds Distinguished Professor and Department Chair. He also holds a joint appointment with Bioengineering. Currently, he is on an IPA assignment to the National Science Foundation, as the Program Director for the Engineering Research Centers Program.

Prior to arriving at Clemson, he was the lead program director for the IGERT program at the National Science Foundation from 2009-2012 as an IPA from NC State University, Department of Mechanical and Aerospace Engineering where he built his academic career rising through the ranks from 1994-2012. From 1987-1994, he was a Research Associate in Corporate R&D, James River Corporation (now Georgia-Pacific Corporation).

His research interests are strongly interdisciplinary to include mechanics of manufacturing processes and short fiber composites; bio-manufacturing and tissue engineering including microfluidics; biomimetic materials and systems; mechatronics; and biomedical devices. He is a Fellow of ASME, TAPPI, AIMBE, and a Senior Member of IEEE and EMBS. He earned a B.S. in Mechanical Engineering (National Institute of Technology, Durgapur India), a M.S. in Applied Sciences (Miami University), and a Ph.D. in Mechanical Engineering (Syracuse University).

**Tom Kurfess**

Tom Kurfess is a Professor of Mechanical Engineering and the HUSCO/Ramirez Distinguished Chair in Fluid Power and Motion Control at the Georgia Institute of Technology. Dr. Kurfess' research focuses on the design and development of advanced manufacturing systems targeting complex product production and optimization. Dr. Kurfess began his academic career at Carnegie Mellon University where he rose to the rank of Associate Professor. In 1994, he moved to the Georgia Institute of Technology where he rose to the rank of Professor. In 2005, he was named Professor and BMW Chair of Manufacturing in the Department of Mechanical Engineering at Clemson University’s International Center for Automotive Research. In 2012, Dr. Kurfess returned to Georgia Tech.

During 2012-2013, Dr. Kurfess served as the Assistant Director for Advanced Manufacturing at the Office of Science and Technology Policy (OSTP) within the Executive Office of the President. Professor Kurfess has served as a special consultant of the United Nations to the Government of Malaysia in the area of applied mechatronics and manufacturing, and as a participating guest at the Lawrence Livermore National Laboratory in their Precision Engineering Program. He currently serves on the Board of Directors for the Society of Manufacturing Engineers, the National Center for Manufacturing Sciences, and the National Center for Defense Manufacturing and Machining, and on the Board of Trustees of the MT Connect Institute. He has received numerous awards including a National Science Foundation (NSF) Young Investigator Award, an NSF Presidential Faculty Fellowship Award, the ASME Pi Tau Sigma Award, SME Young Manufacturing Engineer of the Year Award, the ASME Blackall Machine Tool and Gage Award, the ASME Gustus L. Larson Award, an ASME Swanson Federal Award, and the SME Education Award. He is a Fellow of the AAAS, the SME and the ASME. He earned a B.S., M.S., and Ph.D. in Mechanical Engineering, as well as a M.S. in Electrical Engineering and Computer Science, from MIT.

**James Lyons**

James (Jim) Lyons entered the venture capital business in 2008 after a 30-year technology career at General Electric. Jim is currently the principal at the Farmington River Technologies consulting firm and also serves as chief technologist for the venture investment teams at the Capricorn Investment Group and Energy Innovation focused on the creation and growth of clean/renewable energy companies. Formerly, Jim was Chief Engineer for Electrical Technologies at GE Research serving as technology leader and mentor for a 250-member global team. He was a leading advocate for renewables within GE and corporate champion behind the formation of GE Wind Energy in 2002 - which quickly grew to $8B annual revenues.

In 2000, Jim was the technology leader during the creation of GE’s Digital Energy business unit. While at GE, he served on the board of directors of Powerex, the Electric Drive Trade Association, and the US Offshore Wind Collaborative as well as becoming a principal company spokesperson for renewable energy. In 2006, Jim was co-chair of the American Wind Energy Conference, initiating the AWEA/DOE 20% wind energy roadmap. He has led many additional technology and business initiatives e.g. waste gasification, electric vehicles, advanced batteries, power electronics, solid-state lighting, solar PV, rural electrification, and nuclear fusion. He currently serves on a variety of technical board assignments including: Curent ERC, Servato, Encell, Sunpreme, Kinestral, and Norwegian Crystals. Jim is a reviewer for the DOE and the National Science Foundation. He holds 40 patents and has a B.S. in Electrical Engineering from Rensselaer Polytechnic Institute, an M.S. in Electrical Engineering from Virginia Polytechnic Institute and a Ph.D. from Cornell University.

**Michael McGrath**

Michael McGrath is an independent consultant. As a former Vice President at Analytic Services Inc. (ANSER), he led government services operations in Systems and Operations Analysis. He previously served as the Deputy Assistant Secretary of the Navy for Research, Development, Test and Evaluation, where he was a strong proponent for improvements in technology transition, modeling and simulation, and test and evaluation. In prior positions, he served as Vice President for Government Business at the Sarnoff Corporation (former RCA corporate lab), ADUSD for Dual Use and Commercial Programs in the Office of the Secretary of Defense (OSD), Assistant Director for Manufacturing at the Defense Systems Research Projects Agency (DARPA), and Director of the DoD Computer-aided Acquisition and Logistics Support (CALS) program. His early government career included positions in Logistics Management at Naval Air Systems Command and in Acquisition Management in OSD, where he was principal author of the policy on Integrated Logistics Support (DoD Directive 5000.39).

Michael has maintained research interests in information systems, systems engineering, logistics and manufacturing technologies. He has participated in Defense Science Board studies and studies by the National Research Council, where he is a member of the National Materials and Manufacturing Board and chairs the Defense Materials, Manufacturing and Infrastructure Committee. He is a Senior Fellow of the Potomac Institute for Policy Studies. Michael holds a B.S. in Space Science and Applied Physics, an M.S. in Aerospace Engineering from Catholic University, and a doctorate in Operations Research from George Washington University (where he also was an adjunct associate professor).

**Frank Pfefferkorn**

Frank Pfefferkorn is currently Assistant Director for Research Partnerships, Advanced Manufacturing National Program Office. He is currently on leave from being Associate Professor of Mechanical Engineering at the University of Wisconsin-Madison. His teaching and research have focused on manufacturing processes and heat transfer as it applies to manufacturing processes. His work goals are to: (1) educate/develop manufacturing and heat transfer engineers/workforce, and (2) help move laser polishing, friction stir welding, cryogenic machining, additive-subtractive manufacturing, and micro end milling from arts to science-based technologies that will help U.S. manufacturers. He also served as the Director of the Manufacturing Systems Engineering Program and on the Executive Committee of the Center for German and European Studies.

Frank is a member of the International Academy of Production Engineering, American Society of Mechanical Engineers, and Society of Manufacturing Engineers. He is also Technical Program Chair for the 2016 ASME Manufacturing Science and Engineering Conference. Frank holds a B.S. in Mechanical Engineering from the University of Illinois at Urbana-Champaign, and M.S. and Ph.D. degrees in Mechanical Engineering from Purdue University.

**Mike Simpson**

Mike Simpson is currently on detail to the Department of Commerce's (DOC) National Institute of Standards and Technology (NIST) Advanced Manufacturing Office (AMO), as the NNMI Institute Panel Chair for the first round of Open Topic Manufacturing Institutes. Following the completion of the NNMI competition, he will return to the NIST Manufacturing Extension Partnership (MEP) as the Director of System Operations for the MEP program. As the leader of System Operations, he and his team are responsible for engaging the Leadership and Staff of the MEP System of Centers in a strategic dialog as it relates to improving the competitiveness of U.S. manufacturers. His team engages regularly with MEP Center Leadership, including the Boards of Directors, providing them with knowledge and manufacturing best practices. Also, his team is responsible for deploying key strategic manufacturing competitiveness initiatives in areas such as Top Line Growth (e.g. ExporTech), Sustainability (e.g. E3 and GSN), Continuous Improvement (e.g. Lean and Quality) and Financing. Many of these initiatives are developed and deployed collaboratively with other public, private, and not-for-profit organizations.

Since Joining MEP in 1994, Mr. Simpson has led several other divisions in MEP, including Information Systems and Center Operations. Prior to joining the Department of Commerce, he was an Engineer and Information Technology consultant to the nuclear power industry, working with U.S. energy companies to develop systems to reconstitute the design basis of existing nuclear power plants as well as preparing documentation to relicense existing operations. Prior to that he served as an officer on-board the nuclear submarine USS John Adams, which was home based in Charleston, South Carolina. Mr. Simpson received an MBA focused on the Management of Innovation, Science and Technology from The George Washington University and a B.S. in Chemical Engineering from Pennsylvania State University.



For more information, visit:  
energy.gov/eere/amo/advanced-manufacturing-office

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