

Carnegie Mellon University

Manufacturing Futures Initiative 2019 Request for Proposals

I. Proposal Objectives

Carnegie Mellon University's Manufacturing Futures Initiative (MFI) is requesting research proposals from teams of two or more faculty members. MFI seeks to support multidisciplinary research that will enable the "digitalization" of manufacturing and enhance the requisite human workforce through integration of advanced cyberinformation technologies, including, but not limited to, augmented reality, artificial intelligence, cloud computing, cybersecurity, data analytics, internet-of-things, machine learning, simulation and virtual modeling. The appropriate infusion of these modern-era information technologies into manufacturing environments holds the potential to create new paradigms and policies when merged with advanced manufacturing technologies such as additive manufacturing, robotics and automation, micro/nanofabrication, and modular processing. Cutting across the advanced manufacturing landscape is the infusion of learning science to accelerate workforce development, technology-based policy to accelerate adoption, and ethics to provide a compass toward the future. MFI also seeks to support projects that incorporate these areas of social sciences to applications in the digitalization of manufacturing as appropriate. This initiative aims for Carnegie Mellon to lead in integrative multidisciplinary technology innovation to address the high-impact opportunities and associated challenges facing manufacturing.

Part of the mission of MFI and a specific intention of this research program is to incentivize collaboration among faculty members from across the University to contribute to the future of manufacturing by leveraging their combined research strengths. Projects should lead to growth of externally sponsored research. A specific emphasis is placed on the regional impact of the projects, for example measured in terms of connectivity to industry, potential for startup generation, and/or connectivity to activities in the Mill 19 at Hazelwood Green advanced manufacturing facility to open in late spring 2019. Sustainability and external partnership are drivers of the location that seeks to be a world class advanced manufacturing facility that exists at the intersection of industry, research, and education with strategic technology combinations that accelerate the development of technology to support the future of manufacturing.

In this next project call, MFI is seeking research project proposals that are one-year in duration and has plans to fund up to 10 projects with a combined program budget of up to \$2.0M. This amount represents the total amount available to projects and has already had administrative burden removed. MFI reserves the right to select fewer projects and commit less than the projected funding level, dependent on the number of proposals meeting objectives and availability of funds.

Proposed research must demonstrate a clear fit with the MFI objectives outlined above. The mission and topic areas of specific interest are described in more detail in **Section V** of this document. Preference will be given to proposals that integrate cyberinformation technologies with manufacturing technologies, and where this short-term investment from MFI may help increase the investigators' prospects of winning subsequent externally sponsored awards. Proposals including ethical, policy, and workforce development components of such technological integration are also of interest.

The goals of MFI will be best accomplished by promoting collaboration. Therefore, preference will also be given to proposals that involve multiple investigators and multidisciplinary interactions (cross-college and/or interdepartmental). Of specific interest are proposals with the capacity to nucleate entirely new activities that link cyberinformation technologies with manufacturing technologies and their corresponding experts.

In addition to seeding new projects, proposals for a next phase of existing MFI funded projects will be considered. Proposals that are simply requesting funding to continue an existing and/or mature line of work will receive lower priority. However, coalescing of individually existing and/or relatively mature areas into a new intellectually merged activity is encouraged when it meets the MFI objectives. Proposals for next phase of existing MFI funded projects must place the project narrative in the context of the current project effort, distinguishing between the current effort and the proposed new effort. To demonstrate fit with the mission of MFI, identify all details in the Proposal that apply such as the evolution of concepts and growth of the work, success in seed phase, implementation, industry connections/partnerships, maturity to transition to industry, Mill 19 at Hazelwood Green application, cost match availability, and/or support of external partners.

Research projects previously funded by MFI can be viewed here:

<https://engineering.cmu.edu/mfi/research/index.html>. This is the MFI website Research page.

A listing of funded faculty can be found here:

<https://engineering.cmu.edu/mfi/people/index.html>. This is the MFI website People page.

II. Application Process and Timeline

Investigators should prepare a brief proposal using template provided (1-inch margins, 11-point Times Roman type or equivalent, single spaced, three pages with an additional fourth page for budget using the budget template provided) following the format below. Submissions as Principal Investigator (PI) are limited to one per person (not precluding participation on other proposals).

Applications are due Friday, June 7, 2019 and the awards are expected to be announced Friday, July 19, 2019. Applications must be submitted using the JotForm: <https://form.jotform.com/90904370522149>

We look forward to assisting with proposals by convening an informational session on Wednesday, April 17, 2019 from 3:00 PM – 4:00 PM in Scott Hall 6142.

Proposals must be prepared according to the following Proposal format:

Proposal Title

PI Name, Department; Co-PI Names, Departments, Business Manager/Research Administrator

Project Summary: Provide a summary of the proposed activity that outlines the concept to be explored and/or problem to be addressed, and explain why it is important to the mission of MFI. The summary should include objectives and the plan to achieve those objectives.

Expected Outcomes: Provide a summary of the expected knowledge generated by the project and the corresponding outcomes. Explain how the expected outcomes demonstrate concept viability. For example, outline what might be presented to government and corporate leaders near the end of the project (e.g. for future funding or at a Manufacturing Futures Initiative Forum).

Impact: Describe the metrics of success for the project. Describe its potential for social and economic impact, broadly for U.S. manufacturing and, if applicable, for the Greater Pittsburgh Region.

Leverage: Discuss how MFI funding can lay the foundation, or continue support, for an expanded activity, including specific sources that will be sought for future support and indication of the long-term potential for growth of this activity. Describe the closest related work currently underway at CMU by the team (clarifying the

uniqueness of the proposed project). Also, describe the prospects for matching or in-kind support that can amplify the impact of the grant.

Mill 19 at Hazelwood Green: CMU has invested in Mill 19 at Hazelwood Green, an off-campus advanced manufacturing research facility. The facility space includes high bay area, large contiguous and agile project cell spaces, space for large manufacturing equipment, embedded personnel dedicated office space, dedicated collaborative project space, and a shared infrastructure incubation space and conferencing space. The opportunities exist to collaborate side-by-side with industry on sponsored R&D projects, to showcase innovations (e.g. technologies and equipment), to de-risk technology through maturation, to integrate technologies with partners, to provide workforce training, and to recruit students. If applicable, describe what aspects of your proposed project outcomes, if successful, would positively impact and/or leverage potential activities at the Mill 19 facilities.

Expertise: Describe the partitioning of work among the team aligned to and justified by specific expertise. Include identification of intended cross-college and/or cross-department collaboration.

Budget: Provide a budget and justification appropriate for the proposed scope of work using the provided budget template to be uploaded separately. The period of performance should be approximately one year and start on/after September 1, 2019 and end by August 31, 2020. Describe any committed cost share from partners (e.g., industry) if applicable.

III. Proposal Evaluation

Proposals will be evaluated by ad-hoc reviewers, primarily CMU faculty members without a conflict of interest. Final approval of grant awardees will be made by MFI Leadership. Please contact Sandra DeVincent Wolf at sandradevincentwolf@cmu.edu with questions.

While all proposals will be treated as confidential with respect to protecting investigator ideas, we reserve the right to be proactive with facilitating development. For example, depending on the ideas we receive, we may approach investigators to explore possible alternative or additional collaborations when it might add valuable new perspectives to a project. We may also ask investigators to revise proposals prior to funding, based on reviewer feedback.

Review criteria are:

- Extent to which project integrates cyberinformation technologies with manufacturing technologies and/or social sciences toward an innovative objective
- Extent to which project, as applicable, seeks to incorporate areas of learning science to accelerate workforce development, technology-based policy to accelerate adoption, and ethics to provide a compass toward the future.
- Clear indication of expected outcomes and demonstration of concept viability
- Extent to which the short-term investment from MFI may help increase the investigators' prospects of winning subsequent externally sponsored awards from the federal government, industry or elsewhere
- Involvement of at least two investigators interacting across different disciplines (cross-college and/or interdepartmental)
- Quality and fit of the expertise of the team to the project

- Extent of regional impact of the projects, for example as measured in terms of connectivity to regional industry and/or potential for startup generation
- Extent of potential for impact to future activities at the Mill 19 at Hazelwood Green facility
- Budget reasonableness (e.g. Can the proposed work and outcomes be accomplished within the budget?)
- Next Phase projects review criteria will be the above plus demonstration of success in seed phase, evolution of concepts, implementation options, maturity to transition to industry, cost match, and/or external partners.

IV. Awarded Project Requirements

If accepting an award, PI award recipients will be required to:

- Attend monthly MFI meetings
- Submit brief quarterly reports outlining the progress of the project and its financial status
- Include a project overview Power Point slide with the quarterly report. This slide highlights the project aspects from a marketing standpoint
- Provide summary and presentation information upon occasional request for reporting to the Richard King Mellon Foundation

Additionally, PIs will also be required to present demonstration of projects at the MFI Forum involving industry executives and government leaders. The first Forum will be in April 2019. Additional Forums may occur every 12-24 months depending upon future program plans. PIs may also be called upon to present their work on an as-needed basis throughout the year.

Note that intellectual property (IP) developed under the projects remains under the default, standard terms of the university, unless otherwise waived by the university.

V. MFI Background and Topic Areas of Interest

Carnegie Mellon University's Manufacturing Futures Initiative (MFI) is a campus-wide initiative that seeks to enable the future of manufacturing through the convergence of cyberinformation technologies and advanced manufacturing technologies. MFI website can be viewed here: <https://engineering.cmu.edu/mfi/index.html>. MFI creates a highly collaborative advanced manufacturing ecosystem that:

- Connects multidisciplinary expertise tapping into CMU's strengths in advanced manufacturing,
- Fosters research thrusts, including advanced workforce training methodologies, that attract federal funding by raising awareness and providing support for new opportunities,
- Builds partnerships with stakeholders at the regional and national level,
- Generates high-impact research results with national visibility,
- Catalyzes robust activity, regionally, and in the Mill 19 at Hazelwood Green facility,
- Identifies critical needs for strategic growth in the region and informs policy,
- Accelerates translation of research into commercialization through industry sponsored research, startup generation and support, and technology licensing, and
- Promotes sustainable manufacturing innovation.

While any proposal that fits within the MFI mission and objectives is encouraged and welcomed, MFI especially encourages proposals in the following areas that exemplify merging of cyberinformation technology and manufacturing technologies and that integrate ethics, policy, and workforce development components of such technological integration:

1. Robotics to advance manufacturing integration in production environments, particularly additive manufacturing
2. Artificial intelligence and machine learning applied to advanced manufacturing
3. Science of learning, augmented reality, and other areas accelerating workforce skill development
4. Internet-of-things-informed virtual modeling of advanced manufacturing work cells and/or workflows