Project Planning Document
Call for White Papers

DMDII-15-04
Shop Floor Augmented Reality and Wearable Computing

Project Call Release Date: 20 January 2015

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1 Record of Change

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<td>Original</td>
<td>20-Jan-2015</td>
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2 Summary

2.1 Purpose

Digital Manufacturing and Design Innovation Institute (DMDII) Project Calls are issued to address research and development needs in digital design and manufacturing technology that are aligned with the technical objectives of the DMDII (also referred to as the Institute). This Project Planning Document (PPD) is a description of a specific technology objective. A separate document, the Proposal Preparation Kit (PPK), offers detailed instructions on the White Paper and Cost Proposal organization, format and submission instructions. The PPK can be found at [http://dmdii.org](http://dmdii.org).

2.2 Key Dates

<table>
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<th>Event</th>
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<tr>
<td>Call for White Papers released</td>
<td>20-Jan-2015</td>
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<tr>
<td>Workshop</td>
<td>25/26-Feb-2015</td>
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<td>White Papers due</td>
<td>1-Apr-2015</td>
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<td>Selection / Proposal solicitations released</td>
<td>est. 8-May-2015</td>
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<td>Cost Proposals due</td>
<td>est. 8-Jun-2015</td>
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<td>Selection notifications</td>
<td>est. 8-Jul-2015</td>
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<td>Project kickoff meetings</td>
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2.3 Submission Information

White Paper submissions in response to Project Call DMDII-15-04 are due no later 12:00PM Eastern Daylight Time, 1 April 2015. Submissions should be made electronically to [DMDII@scra.org](mailto:DMDII@scra.org). Please include the Project Call designation (e.g., “DMDII-15-<xx> – <Project Call Title> - <Offeror Name> - WP”) in the subject line of the email.

2.4 Project Summary

This topic aims to form new digital connections between the manufacturing shop floor worker and the digital thread, through the application of wearable computing, mobile computing and data visualization. Wearable computing can capture data about both product and process, and can also facilitate knowledge capture. Similarly, mobile computing and visualization tools can transmit work instructions to shop floor technicians. Today, there is a significant opportunity gap for manufacturing organizations, as these technologies are widely available but have not been proven out in a manufacturing environment. The largest opportunities for manufacturing productivity improvements involve complex, non-routine tasks
including machine maintenance and product re-work, as well as training and re-training of the workforce. Natural, convenient, and relevant information provided to the technician could lead to higher resource utilization, operational effectiveness, and product quality.

The goal of this project “Shop Floor Augmented Reality and Wearable Computing” is to demonstrate technologies that integrate the shop floor workforce into the digital thread, using wearable computing, mobile computing and advanced data visualization.

3 Technical Requirements

3.1 General Requirements

DMDII’s primary goal is to apply digital manufacturing technologies to solve business problems. To this end, successful proposers must demonstrate an understanding of both the business needs as well as the technology solutions. White Papers should clearly explain how project success will benefit manufacturing organizations.

DMDII is interested in supporting projects that offer a significant advancement over state-of-the-art. Successful White Papers will clearly explain the present state of the technology as well as the desired future state of the technology. This technology advance must create a clear business benefit. White Papers should explain the metrics to be used – both technical and business – that can measure project success.

If the proposed project were to be successful and eventually implemented at scale, it should have the potential to impact the manufacturing competitiveness of the United States. Projects that demonstrate benefits to small manufacturing businesses are particularly encouraged.

Each White Paper is evaluated by a specific set of criteria. The PPK defines a general list of project call evaluation criteria, all of which are applicable to this project call.

<table>
<thead>
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<th>Evaluation Criteria</th>
<th>Points Available</th>
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<tr>
<td>Problem Statement and DMDII Relevance</td>
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<tr>
<td>Methodology</td>
<td>0-25 Points</td>
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<tr>
<td>Innovation</td>
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<td>Program Management Plan</td>
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<tr>
<td>Technology Transition and Impact to Industrial Base</td>
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<tr>
<td>Workforce Development and Education</td>
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<tr>
<td>Team Qualifications</td>
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<td>Cost Factors</td>
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<tr>
<td><strong>Total Points Possible</strong></td>
<td><strong>100 Points</strong></td>
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3.2 Problem Background

Recent innovations in human-computer interfaces have unlocked significant new opportunities for digital integration of the manufacturing workforce. Using wearable computing and mobile computing, the shop floor technician can capture data about both product and process, which can be integrated into the digital thread. Such data capture also facilitates knowledge capture and knowledge management. Similarly, data visualization technologies can provide new ways to display information from the digital thread and the output of digital analysis tools.

The information flow to and from the manufacturing shop floor workforce is often characterized by high labor content and the required participation of experts having tribal knowledge or specialized information. The performance of non-routine tasks such as re-work can require significant consultations and remote assistance. Information required by shop floor technicians to perform tasks is often stored on paper or with experienced experts in an undocumented state. The challenge faced by the technician is to access the relevant data when it is needed. This is most effectively done at the point of service. Very seldom are the data and knowledge resources in the same location as the shop floor activity. Often an expert consultation or data lookup requires the technician to leave the work location. Furthermore, the reporting of problems and issues is often unsupported by three-dimensional data or video.

Capture of digital product, process and facility data is rapidly expanding within organizations, but still has not fully deployed. While in the past, 2D physical drawings and expertise were often on-site, globally distributed manufacturing and service activities are becoming more commonplace. Product lifecycle management systems can help to collect and organize institutional knowledge, but rapid, natural and remote access to the information is yet untapped.

In today’s shop floor environment, technicians often access information from printed information or text on a screen. Instructions often use two-dimensional drawings. DMDII is interested in technologies that can present three-dimensional models or video, including smart displays that can interact with technicians and their environment. An example of this is a smart display that overlays three-dimensional work instructions onto the video image of physical part. Such technologies may also enhance collaboration between technicians, or digitally capture information about the manufacturing product or process.

DMDII anticipates that augmented reality and wearable computing will result in higher digital integration of the manufacturing workforce, and will result in increased product quality, lower service costs, and higher manufacturing productivity. Augmented reality and wearable computing can accelerate the delivery of on-demand procedures, knowledge base for plant issues, operator training, remote diagnostics and observation and training by remote experts.
3.3 Specific Requirements

DMDII is seeking White Papers that demonstrate the use of wearable computing and/or mobile computing that enables data capture on the shop floor, and that can increase manufacturing productivity through knowledge management and digital collaboration.

White Papers should describe one or more industry problems or opportunities that can be addressed through the use wearable and/or mobile computing on the shop floor. White Papers should describe a specific product(s), process(es) or system(s) whose design or manufacture will be improved through the development of the proposed technology.

The technology should be demonstrated on at least one application that has the potential for a broad-based impact to industry. The demonstration must be realized in an industry-relevant physical test bed and quantitatively assessed using both technical and business criteria.

DMDII is interested in projects that will demonstrate novel computing technologies in the manufacturing environment. Examples include, but are not limited to, mobile computing, wearable computing, head mounted displays and data capture devices, position tracking technology, data displayed as overlay to the physical environment, and object recognition and matching. The information that is captured and/or used can be visual, auditory or tactile.

DMDII is interested in technology demonstrations that demonstrate the promise of digital manufacturing technologies to the general public, and thus encourages White Papers that include exciting shop floor technology demonstrations.

White Papers can focus on how the wearable or mobile computing technology generates data that is included in the digital thread, or how the wearable or mobile computing technology pulls data from the digital thread and provides it to the shop floor technician. White Papers can include all of these aspects if desired. The overriding requirement is that the proposed projects apply digital technologies on the manufacturing shop floor in order to solve a business problem.

Wearable computing and augmented reality offer new opportunities for the workforce, including digital collaboration and leveraging digital tools for productivity improvements. White Papers shall describe plans for training the workforce on the technology that is developed.

DMDII is interested in projects that significantly exceed current state-of-the-art solutions and capabilities, as assessed on a global-scale, with the long-range prospect of developing and maintaining U.S. leadership in the field. Proposed projects that describe incremental advances will be considered nonresponsive.

4 Period of Performance

The Period of Performance may range between 12-24 months, with a preference for 12-18 months.
5 Award Information

The DMDII anticipates awarding up to $1,500,000 total to fund six projects under Project Call DMDII-15-04. This $1,500,000 is a target total award amount for this Project Call not inclusive of expected cost share commitments. Final award amounts will be adjusted accordingly based on White Papers received and subsequent evaluations. This project requires a minimum 1-to-1 Cost Share in aggregate by each Offeror team.

6 Team Composition

DMDII is interested in supporting diverse project teams that include both industry and academic partners. Projects can be led by a company, a university or a nonprofit organization of any size or specialty. The contributions of the different team members do not need to be equal. Regardless of the specific team composition, the proposed project must have meaningful participation from industry. Additionally, the requirement of at least 1-to-1 Cost Share does not need to match the individual contributions of each team member. Only the aggregate cost share value across the entire proposal team needs to meet or surpass the requested funding amount from DMDII.

To facilitate the formation of project teams, DMDII encourages manufacturing businesses, manufacturing services providers, and academic institutions to register their capabilities and interests on an online survey at https://www.surveymonkey.com/s/CBCMVTY. This survey is also accessible from the DMDII website page for this project call. Interested parties are requested to complete this survey by February 11, 2015. DMDII will provide a summary of the collected information via email one week after the requested completion date to all individuals who provide input. Survey completion is not required to submit a proposal to this project call. Please note that answers to questions submitted to DMDII@scra.org will be posted on the DMDII webpage associated with this project call. Individuals interested in received updates related to this project call (e.g., PPD amendments, PPK amendments, Q&A postings, etc.) should submit their email address on the DMDII webpage associated with this project call. Additional information regarding DMDII can be found at http://dmdii.org.

7 Workshop

In order to facilitate a common understanding of this technology and digital manufacturing in general, the DMDII will host a Project Call workshop in Atlanta, GA on February 25 and 26, 2015. This event will allow participants to familiarize themselves with the DMDII mission, gather information on current state of the technology, and prepare for teaming arrangements. Attendees will hear from the DMDII leadership about our mission, vision, and goals, as well as how to do business with the Institute. Attendees will have the opportunity to interact with the members of the Advanced Analysis (AA) technology thrust team and learn more about the project objectives and requirements. There will also be opportunity for Offerors to discuss their technology development ideas, their suitability for the project, and partnering arrangements. Membership in the DMDII consortium is not required to attend this workshop. Information on workshop attendance is available at http://dmdii.org.