Project Planning Document
Call for White Papers

DMDII-15-15
Agile Manufacturing to Compensate for Production Variability

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1 Record of Change

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<td>16-Jul-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>
<thead>
<tr>
<th>Event</th>
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<tr>
<td>Call for White Papers released</td>
<td>16-Jul-2015</td>
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<tr>
<td>Workshop</td>
<td>10-Sep-2015</td>
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<tr>
<td>White Papers due</td>
<td>8-Oct-2015</td>
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<td>Selection / Cost Proposal solicitations released</td>
<td>29-Oct-2015</td>
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<td>Cost Proposals due</td>
<td>Est. 3-Dec-2015</td>
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<td>Project kickoff meetings</td>
<td>Est. 3-Feb-2016</td>
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2.3 Submission Information

White Paper submissions in response to Project Call DMDII-15-15 are due no later than 12:00PM Central Time, October 8, 2015. Submissions should be made electronically to [DMDII@uilabs.org](mailto:DMDII@uilabs.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

Every manufactured component is imperfect. Some imperfections are within acceptable limits, while other imperfections require the component to be reworked or cause the component to be rejected. Variations in component geometry and composition are managed through quality processes, and through engineering design practices that result in intended performance even when imperfections exist. Digital manufacturing technologies allow for new ways to manage the variability within a batch of manufactured components. The goal of this topic is to demonstrate revolutionary new approaches to measuring the geometry and composition of manufactured components, and to use this data in other parts of the digital
3 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 provide a crystal clear explanation of the problems that are to be solved, and how the project success will benefit the 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 business benefit that is being created in the project. They should also 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>
<tr>
<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>
<td>0-10 Points</td>
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<tr>
<td>Program Management Plan</td>
<td>0-15 Points</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>
<td>0-5 Points</td>
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<td>Team Qualifications</td>
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<tr>
<td>Cost Factors</td>
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<tr>
<td>Total Points Possible</td>
<td>100 Points</td>
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3.2 Problem Background

Traditionally, agile manufacturing is defined to be the tools, processes, and training to be able to respond quickly to product or process requirements. This topic extends this concept of manufacturing agility to agile production, which allows for real-time changes in fabrication or assembly. Data about manufacturing variability also enables improvements in other parts of the value chain.

Production variability exists for all manufactured components regardless of manufacturing process. Some imperfections are within acceptable limits, while other imperfections require the component to be
reworked or cause the component to be rejected. For acceptable components, variability often imposes costs over the lifecycle of the component, and may affect the component performance.

Digital manufacturing technologies allow for new ways to manage manufacturing variability. For example, high resolution measurements of the geometry or composition of a manufactured component can be used to inform subsequent assembly processes. Some components may offer better performance or longer lifetime than others. In another example, sensors integrated into networked production equipment can monitor changes in the status of the factory, machine tool, or product, which could be used to inform later stages of production.

Digital manufacturing allows for data to be shared across the manufacturing value chain. Data about manufacturing variability could be used to improve product design, sourcing, assembly, or qualification. Data about manufacturing variability could also be used to inform the maintenance or products while they are in service, resulting in lower lifecycle costs. Data about manufacturing variability can also be used to predict the performance of manufactured products while they are in service. A broad goal of this topic is to use data about production variability to reduce costs or create new capabilities in other parts of the value chain.

Consider the specific example of an engine having a hundred or more components sourced from dozens of suppliers. Data about the specific three-dimensional shape of each component flowing through the supply chain would allow for the original equipment manufacturer to select specific components for optimally assembled engines. This data could further be used to predict the engine performance and a schedule for preventative maintenance on the engine while in service. Further, the data could be used to understand and manage supply chain risks such as when the components from different suppliers exhibit more or less variations over time, or specific variations that are each benign but when combined, present problems. Data about production variability can be used by designers to predict systems performance using validated probabilistic models of manufactured components and systems.

The goal of this topic is to demonstrate revolutionary new approaches to measuring the geometry and composition of manufactured components, and to exploit this data in other parts of the manufacturing value chain. The ultimate goal is to use digital manufacturing technologies to reduce the time and cost to develop and maintain manufactured products.

### 3.3 Specific Requirements

DMDII is seeking White Papers that propose the development and demonstration of Agile Manufacturing to Compensate for Production Variability.

Projects selected under this topic should identify a product or product family, where production variability affects in-service performance or total lifecycle costs of the product or product family. White Papers should explain what the product or product family is, and how its production variability affects performance or cost. The proposed project should focus on maturing and demonstrating a digital
manufacturing technology that monitors, manages, and responds to production variability in a way that improves product performance or reduces product cost.

DMDII has intentionally defined this topic broadly, to allow for proposing teams to propose innovative solutions. Digital manufacturing technologies allow for data about production variability to improve design, sourcing, assembly, or qualification, as well as in-service performance and maintenance. White Papers may address any or all of these opportunities. A key tenet of this topic is agility, where monitoring and analysis of production data allows for the manufacturing enterprise to quickly respond in a manner that reduces cost, increases speed, and improves product performance.

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 expects that successful projects will create knowledge and specific technical products that can be used broadly by the members of DMDII. This knowledge and specific technical products should create a business benefit for the broad membership of DMDII. White Papers should clearly explain the knowledge being created, the specific technical products, and the corresponding business benefit that will accrue to the members of DMDII.

White Papers should describe one or more industry problems or opportunities that can be addressed through the use of agile manufacturing practices as well as specific product(s), process(es) or system(s) whose design or manufacture will be improved through the development of the proposed technology.

DMDII encourages the participation of small manufacturing businesses on project teams, and especially encourages the development of technologies that can benefit these small manufacturing businesses as small businesses can provide an excellent test bed for digital manufacturing technologies. Furthermore, technical solutions that can be disseminated across many small businesses have the potential for broad-based impact for the DMDII membership as well as the Unites States industrial base.

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.

Offerors shall identify the project deliverables. White Papers should also explain how the deliverables will benefit the DMDII Membership and how those benefits will be realized.

**Travel:** At a minimum, White Papers should include funding for two trips per year for two people. These trips may be for travel to UI LABS or to another location at the request of DMDII (e.g. a conference, workshop, showcase, etc.).
4 Period of Performance
The Period of Performance may range between 12-24 months.

5 Award Information
The DMDII anticipates awarding up to $2,000,000 total to fund 2 to 4 projects under Project Call DMDII-15-15. This $2,000,000 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
The proposing teams may be led by either industry or academia. DMDII strongly encourages the participation of small businesses. 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/r/FGM5ZXD. This survey is also accessible from the DMDII Projects website page. Interested parties are requested to complete this survey by August 8, 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@uilabs.org will be posted on the DMDII webpage. 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 Projects webpage. 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 Chicago, IL on September 10, 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.