Request for Proposal

DMDII-18-01
AI Design Advisor

Technology Thrust Area: Design, Product Development & Systems Engineering

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1 Record of Change

Version	Date	Sections	Description
1.0	26 June 2018		Original

2 Project Call Purpose

Digital Manufacturing and Design Innovation Institute (DMDII) Request for Proposals 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) and directly support the Institute's vision of developing digital manufacturing systems that make every part better than the last. This Request for Proposal (RFP) is a description of a specific technology objective. A separate document, the Proposal Preparation Kit (PPK), offers detailed instructions on how to respond to this RFP. The Proposal Preparation Kit (DMDII_18-01_Proposal_Preparation_Kit_(PPK)_1.0_6.26.2018) can be found here.

2.1 Key Dates

Phase One Key Event Dates	
Project call released	6/26/2018
Webinar	7/09/2018
Pitch session signup deadline (sign-up process found in PPK)	7/16/2018
Group pitch session & teaming opportunity	7/23/2018
Executive summaries due	8/13/2018
Phase Two Key Event Dates	
Advancing teams notified	8/20/2018
Full technical proposals and cost proposals due	9/14/2018
Teams notified of final selections	10/05/2018
Initial review of Enterprise Award Agreement	11/01/2018
All clarifications/negotiations on SOW and cost proposal complete	12/01/2018
Project awarded	12/15/2018
Project kickoff meeting	01/07/2019

Phase Two Dates are Estimates

2.2 Submission Information

The selection process for DMDII 18-01 has been redesigned to include more touchpoints for submitting teams to get feedback on their ideas. For a full overview of the changes, please see the Proposal Preparation Kit.

Teams planning to participate in the pitch session must email charlie.tokowitz@uilabs.orgby **12:00PM Central Time, July 16, 2018**. Teams will be assigned a slot in the pitch session, in which they will share a 10-minute overview of their proposed response to the project call. Teams are encouraged but not required to attend the entire event in order to hear other project pitches and take advantage of the teaming opportunity to condense on similar ideas.

Each project team planning to submit a proposal must first submit an Executive Summary to outline their solution's technical and strategic approach. Instructions for the Executive summary can be found in the

PPK. Executive Summaries must be submitted by **12:00PM Central Time August 13, 2018**. All teams are invited to submit Executive Summaries, which will then be evaluated based on criteria presented below. Only the top-scoring teams will be invited to submit full technical and cost proposals.

Each project team which is planning on submitting a full technical and cost proposal must submit their Technical Proposal and Cost Proposal no later than **12:00PM Central Time, September 14, 2018**.

All Submissions should be made electronically to Charlie.tokowitz@uilabs.org. Please include the RFP designation (e.g., "DMDII-18-<xx> – <RFP Title> - <Offeror Name> - <Proposal Title>") in the subject line of the email.

3 Project Evaluation Criteria

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. Proposals should provide a clear explanation of the problems that are to be solved, and how the project success will benefit the manufacturing organizations.

Each Proposal is evaluated by a specific set of criteria. The PPK defines a general list of Technical Proposal evaluation criteria, all of which are applicable to this RFP. Below are the specific criteria for each phase of the evaluation process:

Executive Summary Grading

Evaluation Criteria	Points Available
Executive summary demonstrates vision for use-case-driven solution	1-4
Fills a gap for which there are no suitable market alternatives within the initiative time horizon	1-4
Fills a gap that any one entity from industry, academia, government cannot do alone (because of the need for collaboration/multiple perspectives, economics, legal contracting impediments, etc.)	1-4
Has line of sight to a transition plan that will create quantifiable value/ROI for a broad, cross-industry set of our members	1-4
Total Points Possible	**16 Points**

Technical Proposal Grading

Evaluation Criteria	Points Available
Requirements Compliance	0-5
Problem Statement and DMDII Relevance	0-20
Methodology	0-30
Technology Transition Plan and Impact to Industrial Base	0-15
Team Qualifications	0-10
Program Management Plan	0-15
Cost Factors	0-5
Total Points Possible	**100 Points**

4 Request for Proposal Summary

Decisions made by a design engineer at a CAD workstation have implications downstream of the initial concept design through every aspect of the product lifecycle. These decisions are typically made based on the designer's level of experience, the capabilities of the existing CAD software and the data that has been made available to the designer. Any of these decisions may impact the design of a part or assembly and can have major downstream repercussions on the part's cost and ability to be tested, procured, manufactured, assembled, inspected, packaged, shipped, installed, maintained and disposed of.

While organizations strive to "move manufacturing left" to better incorporate these downstream considerations into product design, formal methods to represent any of these multiple attributes to facilitate feedback to design remain elusive. Additionally, the effort to move manufacturing leftwards in the design process means that design engineers are increasingly burdened with the responsibilities of manufacturing engineers, supply chain planners and more. In *The Future of Product Design*, Jonathan Follett concurs that individual designers working within these leftward-shifting product development cycles "must be concerned with the myriad of development and production considerations" that typically befall large cross-enterprise teams.

Meanwhile, end-item complexity continues to increase with the introduction of sensors and processors into products that generate data from production equipment, quality assurance processes and fielded products. Still, systems engineering practice remains mostly unchanged over the last several decades. Multiple integration-test-redesign loops, followed by exhaustive system-level verification and testing are often used to discover designed-in producibility and supportability problems. This in turn results in enormously expensive engineering change costs for complex items as well as hidden factory costs (scrap, rework, etc.).

In the computing realm, artificial intelligence (AI) and machine learning technology continue to see increasing maturity and expanded implementation, enabling more informed and data-driven decisions. A fundamental premise of the "Internet of Things" is to utilize data from products to enhance future offerings; combing and determining how to best leverage industrial IoT (IIOT) data would facilitate

deeper understanding of the impacts of design decisions on a range of factors, including producibility, supportability and correlation of process variability with key performance parameters. If design engineers had more sophisticated insights into data describing downstream product development activity, they could make better decision choices up front and reduce the number of iteration cycles throughout internal business units and external business partners that are required to successfully design, build, ship and maintain parts and assemblies.

The current state of the art focuses on using predictive physics-centric algorithms to optimize design constraints like strain and density, and to generate designs in the solution space. This RFP is distinct from the current approach in that it seeks to leverage *historical* data sets from sources including manufacturing, inspection and maintenance to inform design choices, while also building on current predictive generative design tools. Rudimentary capabilities of this nature already exist in other business sectors, leveraging historical data in customer relationship management (CRM) systems to generate sales and marketing insights for account managers. Extending similar functionality throughout engineering and design will require more technical complexity and integration, but orders-of-magnitude productivity benefits stand to be reaped by enabling humans to collaborate with AI systems and utilize AI techniques to bridge design with these large data sets.

In previous efforts, DMDII projects have yielded frameworks that enable stronger and more consistent multi-directional data flows to break down the silos within an organization as well as within their supply chain. This project call is seeking solutions that will build on these existing project learnings to develop solutions that utilize artificial intelligence to either generate recommendations for a design engineer or automate portions of the design process based on data from downstream activities like manufacturing, assembly, quality, service and repair.

Project Requirements

Projects funded are expected to take place in two phases. The first phase will focus on research, requirements definition, and use case refinement. After successful completion of Phase One, the project team will begin Phase Two which will focus on commercial development and the integration and implementation effort. Refer to the information below for additional details.

Phase One (3 months)

- Examine and define the current state of competing design assist technologies;
- Perform a gap analysis to determine the best course of action for driving data and AI-based design feedback capabilities;
- Define – for at least one gap identified – the type of feedback to be provided to the designer, including format (e.g., producibility score, probabilistic certificate of correctness, yield estimate, warning or alert, etc.), and the data source(s) to be incorporated into the analysis;
- Identify any “trade-space” considerations that arise from addressing multiple gaps in the design process; i.e., how will the design function resolve conflicts between producibility, supportability, cost, etc.?

- Identify how to best make use of downstream data (i.e. manufacturing, assembly, etc.) from a design perspective;
- Define strategies for linking design feedback to evaluation of requirements;
- Define measures of effectiveness, e.g. number of engineering changes, warrantee performance, etc.;
- Generate a set of software requirements and business rules that must be followed;
- Develop the software architecture required to enable the artificially intelligent design feedback tools;
- Define at least one demonstration use-case for the Phase Two effort;
- Anticipate and plan for companies' cultural and organizational inertia regarding workflow innovation;
- Develop a go-to-market strategy.

Phase Two (9 months)

- Employing an agile methodology, integrate solutions, generate the machine learning algorithms, and develop software prototype;
- Demonstrate the full capabilities of software prototype in one or more working environments;
- Develop vendor-agnostic and part family/type-agnostic guidelines and lessons-learned content that will enable members of the broader DMDII community to sharpen their own digital design strategies;
- Develop a playbook to aid organizations in the adoption of the technology developed based on technical, cultural and organizational considerations;
- Provide training materials on the benefits of the new software and how to utilize the new tool(s) developed.

DMDII requires that each project team generates a go-to market strategy that will be reviewed and updated throughout the project. This plan must account for real barriers-to-adoption of the design feedback tools being generated. DMDII expects that the project team will have a committed go-to-market plan developed by the conclusion of the Phase One in order to start Phase Two.

It is important that the efforts funded are developing ready-to-use tools that will create order-of-magnitude productivity improvements which are validated via testing at design and manufacturing organizations. Additional successful project requirements are detailed below:

- Main project outcome must be software solution that will be commercially ready in 2020. (Assumes a project kickoff by 1/7/19);
- Tool(s) should focus on aiding design engineers during the early concept design phase or modifying an existing part for a new purpose;
- Tool(s) must provide automated solutions or recommendations based on real time or near real time data;
- Software tool must interface with various enterprise systems (CAD, CAM, ERP, MRO, etc.), analyze relevant data, and generate/deliver design engineering feedback;

- Tool developed can be a new standalone tool or a plug-in for existing CAD environments, if it is a standalone tool, proposals should identify how the new tool integrates within the existing design process.

Project teams may be composed of industry, academic, government, solution providers, and relevant research organizations. However, it is imperative that teams include adequate industry involvement and input. Solutions generated should seek to solve problems within the industry partners on the team as well as the broader industry environment. Therefore, a team can have an academic or industry overall project lead but DMDII is requiring the Technical Principal Investigator to be an industry partner employee. It is not required that the Technical Principal Investigator be an employee of the project lead organization. DMDII anticipates working directly with each of the team members to manage scope, timeline, contracting, etc.

DMDII anticipates choosing one team to complete this project, however, we reserve the right to work with the proposing teams to modify scope and readjust the project teams to best suit this effort. DMDII anticipates working directly with each of the team members to manage scope, timeline, contracting, etc.

5 Program Requirements

5.1 Travel Requirements

Proposals should include funding for three trips per year for two people for presenting to the DMDII membership. 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.). For estimation purposes, use Chicago, IL as the destination.

5.2 Period of Performance Requirements

Proposed projects should be no more than twelve months in duration. Please note that projects are initiated once an Enterprise Award Agreement is signed, therefore, the project duration must include the subcontracting of all project participants between the Lead Organization and the Project Participants.

5.3 Funding Requirements

The DMDII anticipates awarding one project for $500,000-$750,000, not inclusive of expected cost share, under the DMDII-18-01 RFP. Final award amounts will be adjusted accordingly based on Proposals received and subsequent evaluations. This project requires a minimum 1-to-1 Cost Share in aggregate by each Offeror team.

6 Request for Proposal Questions & Answers

Interested parties may submit questions to Charlie.tokowitz@uilabs.org. All new questions and answers received may be posted here.