The Digital Manufacturing Institute

MxD REQUEST FOR PROPOSAL

TECHNICAL SUMMARY, PROGRAM OVERVIEW and PROPOSAL PREPARATION INFORMATION

MxD-21-01:
AI Design Advisor

Revision 1.0 Release Date: March 30, 2021

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I. RECORD OF CHANGE

Revision	Date	Sections	Description
1.0	30 March, 2021	N/A	Original

II. PROJECT OVERVIEW

RFP Released	30 March, 2021
Deadline to be included in Initial Teaming List (Optional)	6 April, 2021
Pitch Session (Optional)	20 April, 2021
Technical and Cost Proposal Due	10 June, 2021
Anticipated MxD Funding	$500,000
Period of Performance	12 Months

III. INTRODUCTION

MxD: The Digital Manufacturing Institute is where innovative manufacturers go to forge their futures. In partnership with the Department of Defense, MxD (also referred to as the Institute) equips U.S. factories with the digital tools and expertise they need to begin building every part better than the last. MxD's core mission is to transform American manufacturing, by fully integrating the digital thread across the manufacturing enterprise to reduce overall manufacturing costs, stabilize and grow the manufacturing industrial base and improve US competitiveness through the world.

MxD has invested over $115 million in more than 80 applied research and development projects in areas including design, product development, systems engineering, future factories, agile and resilient supply chains, and cybersecurity.

MxD operates from a nearly 75,000-square-foot innovation center near downtown Chicago. Its future factory floor features some of the most advanced manufacturing equipment in the world, which partners can use for experimentation and training on everything from augmented reality to advanced simulation techniques.

MxD uses a broad and collaborative process to develop the Strategic Investment Plan (SIP) and Technology Roadmap to ensure its technology, outreach, and education investments provide U.S. manufacturing with the right skills, solutions, and tools to compete globally. A Request for Proposal (RFP) is initiated when MxD desires new and creative solutions to problems and/or advances in knowledge, understanding and technology for digital manufacturing and design. Once the RFP topic is developed and approved, the MxD RFP will be posted to the MxD website and represents the official notification to Proposal Teams of a request to submit the required documents.

This RFP contains the following elements:

1. Technical Summary: description of a specific technology objective
2. Program Overview: description of technical and program requirements

3. Proposal Preparation Information: background and guidance for the preparation of required forms and instructions needed to submit a proposal to MxD

The RFP is available on the MxD website at https://mxdusa.org/projects/. Amendments to a MxD RFP may be used to extend due dates, clarify procedural requirements, or modify technical requirements. If an updated RFP is issued, the previous RFP will be rescinded. Proposal Teams should carefully monitor the MxD website after an original posting of an RFP, up to the time of the Technical Proposal and Cost Proposal submission date. Any revisions, amendments or updates will appear in the same section of the website as the original solicitation. It is the responsibility of the Proposal Team to monitor the MxD RFP updates and ensure their proposal meets the solicitation requirements. MxD welcomes any comments or suggestions for improving the contents of this guide. Please address them to projects@mxdusa.org.

MxD refers to the Proposal Team Lead as the non-Federal organization that submits a proposal in response to a Request for Proposals. Proposal Team members are other participants on the proposal and are further broken down into Recipient/Subrecipient relationships similar to a prime/subcontractor relationship in traditional contracting.

Any questions regarding this solicitation must be provided to projects@mxdusa.org. The questions will be sent to the appropriate MxD and/or Government POC, and answers will be published on the MxD website, if appropriate. Questions submitted within one week prior to a deadline may not be answered.

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TECHNICAL SUMMARY

IV. TECHNICAL SUMMARY

PROBLEM STATEMENT

The decisions made during the design process have significant implications at all downstream stages of the product life cycle through manufacturing, assembly, quality inspection, sustainment, and end-of-life. It is a commonly cited guideline that 70 to 80% of the life-cycle costs of a product are determined by decisions taken during the design phase. The ability of a design engineer to proactively account for these factors in their design is based on their individual level of experience in these disparate areas. This cross-functional experience can take years to develop, is often process-specific, and is retained within the individual rather than the organization. This leads to inconsistency in the degree to which designs are receptive to downstream factors.

Simultaneously, more data are being generated during all stages of the product life cycle than ever before. A connected digital manufacturing enterprise often collects data relating to yield, efficiency, cost, scrap rate, rework, process parameters, field failure rate, and customer experience. These data are used to improve intra-departmental efficiency, such as manufacturing data being continuously monitored to predict when a part is drifting out of specification to enable early intervention. However, linking these data to specific choices made during the design phase is often done on an ad-hoc basis which relies on expert personnel. It is also generally reactionary rather than proactive, with feedback coming only after issues arise. It is difficult for organizations to socialize those learnings to inform and improve similar future designs as they are limited to their specific context. Organizational expertise in downstream areas such as quality is therefore not systematically leveraged in the early stages where it could provide the most value. Leveraging this data across phases of the product life cycle provides a compelling value proposition to organizations seeking clear ROI to the sometimes challenging process of integrating their data into one digital thread.

Product performance and production modeling have advanced greatly with the use of physics-based or statistical simulation approaches, accelerating product design cycles. These tools have enabled a tremendous increase in confidence that a design will meet required performance specifications prior to entering full production. These tools, however, do not often incorporate an organization's core competence and experience (in the form of their existing data) and are generally much more sophisticated at performance modeling than process or cost modeling. There is a need in industry for integrated frameworks that can enable the other half of this approach: utilizing real and as-observed data in the life cycle and correlating that back to individual design choices. The connections between as-designed products and experienced life cycle impacts can then be generalized and have analytics performed on them to surface relationships and outcomes that drive design improvements.

To address these industry needs, MxD is funding the development on an AI design advisor tool that will provide data-driven guidance to design engineers at the early stage of the product life cycle. Through this investment, MxD seeks to advance the state-of-the art towards a future goal of integrating the realms of design, production, manufacturing, quality, and sustainment. The successful project proposal will ideally provide one vertically integrated component of this solution, developing tools and methods of correlating in-process designs, similar-product life cycle data, and analytical insight to drive improvements in key performance metrics.

OBJECTIVES

The following objectives outline the key activities that MxD considers applicable for a successful project. MxD's recommended set of requirements are included under each objective, but the team is encouraged to make value-added changes to the requirements as they see fit. These changes should be justified in their proposal. The objectives below are listed in a rough chronological order based on a general concept of project execution, but accomplishing tasks in this specific order is not a requirement. MxD encourages agile development on its projects to ensure that the deliverables are shaped and validated by customers and key stakeholders throughout the period of performance.

Additionally, teams are not expected to provide an all-encompassing solution that covers the entirety of the product life cycle and all the downstream impacts that are made during the design process. This is unrealistic. **While it is MxD's larger vision that a single system could integrate data from all phases of the life cycle along a robust, flexible, and continuous digital thread, our expectation for this project is to provide one specific portion of that vision which is stand-alone and demonstrably scalable.** Teams are expected to focus their proposals to a scope that is realistic, achievable, and aligned with their unique subject matter expertise. A wider range of expertise is preferable to MxD, but teams will be evaluated based on their proposed approach and its potential impact in the development of an AI design advisor tool that will have the potential to make a broad impact on industry.

Because the objectives are listed chronologically, they are not listed in order of importance to MxD. **Objective 1 "Understand the Data Landscape" and Objective 5 "Transition the Outcomes" are minimally required for any proposal. The proposing team must select at least one of Objectives 2 through 4. Each of these objectives is desirable but not absolutely required if the resultant proposal makes meaningful progress towards MxD's larger vision.** For example, a team could develop artificial intelligence algorithms on manually staged data. The proposal must justify the team's choice(s) of objectives and explain how they advance a future state system where all objectives are accomplished. Teams are encouraged to maximize the impact of MxD funding by targeting research areas where team members have performed prior work, already possess components of the end solution, or where prior MxD research can be leveraged.

The key objectives are defined below:

1. **Understand the Data Landscape (Required):** Conduct mapping, review, and prepare processing approach for the underlying data that will drive the AI advisor's output.

   All projects with an AI component are intrinsically linked to the data that informs their insights. Data sparsity, noise, availability, and labeling are all primary challenges to a successful implementation. This is further complicated by the need to protect sensitive data and IP.

   The requirements for this objective are as follows:

   - Team should target use cases and manufacturers where sufficient data is present to provide meaningful insights and for which that data is sufficiently well-posed that it can be utilized during the project period of performance

- Evaluate data silos and methods to bridge these challenges, including technical and cultural within an organization
- Identify how to best make use of downstream data (i.e., manufacturing, assembly, etc.) from a design perspective.
- Determine an appropriate manufacturing use case based on data availability and suitability towards demonstrating improvements in defined KPI
- Determine which data are sensitive/contain IP and determine a strategy for securing this data including while the AI Design Advisor tool is consuming it
- Consider the long-term implications of the Tool's use of data and how to enable manufacturers to use/train/integrate their specific data into the tool's intelligence without compromising their IP or competitiveness
- Propose or evaluate standardized metadata to support AI development

2. **Development of Data Integration Framework:** Based on the results of the team's analysis of the data landscape, develop a data-integration framework that will allow for historical data ingestion by the AI tool(s) and provide feedback to the designer.

   It is expected that this framework will need to integrate with the organization's enterprise systems in order to provide a feedback loop to the human user (designer) as well as consumption of data produced elsewhere during the product life cycle.

   The requirements for this objective are as follows:

   - Framework should provide clear, lightweight interfaces between the designer's software tools or design output (CAD files, design software, PLM, etc) and the AI Advisor tool
   - Framework should provide integration with one or more enterprise systems (databases, MRP/MES, data lake, etc) to consume data where it is already stored and generated
   - Team should develop a System Architecture which clearly indicates component subsystems, communication, and interface requirements
   - Together, framework and AI Design Advisor tool will need to correlate in-process designs with past designs/data by identifying patterns or similarities that enable relevant and confident inferences to be made
   - Wherever possible and practical, the team should use standards-based data formats, file types, and communications protocols to ensure the broadest possible level of adoption and the highest potential for re-use and expansion.
   - While it will likely be impossible to provide a framework with developed integrations beyond those chosen for the specific project use-case, the framework itself should be flexible and provide a clear pathway to integrate with other software stacks (via API, etc.)
   - Framework should provide capability for real-time or near real time analytics
   - Framework should address relevant cybersecurity concerns
   - In previous efforts, MxD 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. The team is encouraged to make use of past work where possible.

- Ideally, this team can leverage the work done by the MxD 15-11-08 team "Model-Based Feature Information Framework." The MFIN project advanced model-based definition (MBD) by incorporating items such as manufacturing planning, logical and functional behavior, and performance requirements along with design attributes with significant enhancements in association at the feature level. This was accomplished through a complete digital thread using a neutral framework for semantic Product and Manufacturing Information (PMI) and MFIN links built upon and extending the Quality Information Framework (QIF) standard. Additional information can be found in the MxD Project Portal or by request.
- The team could also leverage the work done by the MxD 15-05-03 team "Lower Life-cycle Costs, Improve Design & Performance Robustness through the Digital Thread." This project developed and demonstrated a systems architecture that enables new technologies and models to be integrated within an original equipment manufacturer's (OEM's) product life-cycle feedback loop. It offers a generic, basic framework of a feedback network enabling information integration across the product life-cycle to enable the rapid use of actionable knowledge to improve and optimize design. The framework focused on translating compiled data from relevant sources into knowledge, which serves as a guideline for the engineering decision process. Additional information can be found in the MxD Project Portal or by request.

3. **Development of "AI Design Advisor" Tool:** Develop and iterate on algorithms, simulations, and tools to enable data-driven feedback from an organization's historical data to the design process.

   The project team is free to pursue a variety of artificial intelligence approaches such as digital twin, machine learning, or others in the development of this automated tool. Tool must be able to correlate past designs to in-process designs, make inferences based on data, and provide its output to the human user.

   The requirements for this objective are as follows:

   - AI Design Advisor tool should provide insight from past designs/components of design or automate portions of the design process based on past designs
   - Tool(s) should focus on aiding design engineers through the early concept design phase or modifying an existing design for a new purpose.
   - Using an agile methodology, integrate solutions, generate the machine learning algorithms, and develop software prototype.
   - While there is no requirement for a specific AI approach it is expected that the tool will at a minimum use historical data as part of its input rather than pure simulation.

- There is no specific required format for the tool itself, but some options include native CAD integration, a plugin/addon, a web-based tool, or an integrated component to an engineering change order (ECO) workflow
- Together, framework and AI Design Advisor tool will need to correlate in-process designs with past designs/data by identifying patterns or similarities that enable relevant and confident inferences to be made
- Define the type of feedback provided to the designer, including format (e.g. producibility score, probabilistic certificate of correctness, yield estimate, warning or alert, etc.)
- 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.
- Tool should provide its output in a manner timely enough to avoid interruptions in the designer's current work cycle

4. **Implementation in Design to Production Use Case:** Validate the tool(s) impact and usability by piloting the tool in a use case where impact to the relevant life cycle attributes can be ascertained.

   Wherever possible, this use case should conform with a realistic industry situation with broad applicability regardless of specific context. This objective will require validation not only of the tool's accuracy and impact but also the usability, workflow suitability, and user experience. Project teams should leave sufficient time in the project schedule for their chosen use case to be completed, as (for instance) design to manufacturing cycles can sometimes take weeks or months.

   The requirements for this objective are as follows:

   - Demonstrate the usage and effectiveness of the design advice tool through at least one iteration of the design to life cycle stage chosen. For instance, if the tool aims to improve manufacturing KPI's, then one design to manufacturing use case must be completed.
   - Clearly report the outcomes of the AI Design Advisor tool by demonstrating impact on relevant KPI's chosen as the target use case compared to a relevant baseline
   - Validate the usability of the tool from a human interface perspective, including obtaining feedback from the designers which utilized it
   - The project team is expected to provide their own specific use case, but the objectives of this project are aligned with the following more general use cases:
     - *As a manufacturing engineer, I want to combine data such as process parameters, quality inspection results, human intervention and more with model-based characteristics in order to give feedback for future design revisions.*
     - *As a manufacturing engineer, I want to share generated data across silos along a standards-based framework in order to create visibility and possibility for analysis that corresponds to the total product life cycle.*

- *As a design engineer, I want to obtain insights on performance and life cycle from past similar product designs in order to improve key metrics on scrap rate, assembly failure, or field degradation.*
- *As an engineering manager, I want to support less experienced designers in order to reduce preventable issues and socialize core competence across the organization.*

5. **Transition the Outcomes (Required):** Develop a transition strategy and refine the deliverables so that they can be distributed broadly to maximize their impact.

   While this project will likely only address a narrow use case to complete within time and budget, MxD's broader vision is that of a single system which could integrate data from all phases of the life cycle along a robust, flexible, and continuous digital thread. Competitive teams will clearly demonstrate how their chosen implementation would be extensible to other types of products, manufacturing processes, phases of the life cycle, data landscapes, or design tools. Beyond technical scalability, the team should also tailor their approach to provide ongoing support for tool development by commercialization, open-source code release, or other strategies.

   The requirements for this objective are as follows:

   - Wherever possible and practical, the team should use standards-based data formats, file types, and communications protocols to ensure the broadest possible level of adoption and the highest potential for re-use and expansion.
   - Special attention should be paid to the flexibility and ease of configuration of the data framework as every instance of a manufacturer has a unique data landscape
   - Clearly indicate what the lowest barrier next steps in development are to the tool (different types of products, more manufacturing processes considered, etc)
   - Clearly indicate what the higher barrier or future challenges in tool development are that are not on the near-term road map
   - The team must develop a strategy for distributing their outcomes to all members of the MxD membership base. Proposals should outline the team's high-level transition strategy and describe their unique qualifications that enable the team to execute this strategy.
   - Provide training materials on the benefits of the new software/tool(s) and how to utilize the new tool(s) developed.
   - Develop vendor-agnostic and part family/type-agnostic guidelines and lessons-learned content that will enable members of the broader MxD community to sharpen their own digital design strategies.
   - Clearly define MxD's role in the transition including for messaging, outreach, facilitating IP licensing, etc.
   - If the team is aware of existing follow-on funding opportunities, the team is encouraged to identify them as part of their transition plan including how MxD can facilitate ongoing development

RFP Scope of Work

The above objectives must be completed within the following project constraints:
Period of Performance: 12 months
Anticipated MxD Funding: $500,000
Minimum Cost Share Contribution: $500,000

During the period of performance, the team should perform initial market research to gain a deeper understanding of the needs of the industry to de-risk their approach, further refine the requirements for their deliverables and source any existing material that should be leveraged on the project.

The development process should employ agile methodology. Thus, the team should have active engagement from design and manufacturing partners throughout the period of performance to ensure the development is headed in a value-added direction. The team should avoid developing finished deliverables and then testing them via implementation. Instead, minimum viable products should be developed, validated, and then refined in the implementation phase.

Through this iterative development process, the team must develop (or apply an existing) data framework that is responsive to the manufacturer's specific data landscape. Attention should be paid to data access control and cybersecurity considerations. Once relevant data is available and prepared, team should begin development of software/algorithms to produce AI design advisor tool deliverable. Requirements should be documented and captured from pilot manufacturer team member, team should guide manufacturer towards requirements that meet their business objectives, the technology goals of the project, and long-term vision of single integrated digital thread feedback. MxD encourages the project team to use best available methodology and frequently update their approach and requirements during research and development. These learnings will inform case studies, user manuals, and transition plan.

During the period of performance, the team will produce deployable deliverables that will be shared with the MxD membership in accordance with the Membership Agreement. The recommended deliverables are listed below in Table 1, but **the team is encouraged to include additional deliverables or provide value-added changes to the recommended set of deliverables**. **As the team defines their deliverables, they should keep in mind that the outcomes should be above and beyond what any one organization can produce alone. They should fill a gap in industry and truly represent the mission of using federal funding to advance the state of US manufacturing.**

IMPORTANT: If changes are made to the deliverables, the team must provide the reasoning and detail any assumptions to provide context for the changes. Their proposed set of deliverables must align with MxD's focus on achieving deployable outcomes and enabling the transition of the research.

Table 1. Technical Deliverables

Deliverable	Description	Deliverable Due Date
System Architecture and Integration Framework	Documentation of the system architecture and integration framework including approach and diagrams	Month 3
Network Architecture	Documentation of the network architecture including approach, diagrams, and considerations for compliance and security	Month 4
AI Design Advisor Tool	All project-developed software including source code, executables, and APIs	Month 8
Test & Validation Report	Technical report on testing results for the digital technology developed and implemented	Month 9
Implementation at Design to Manufacturing Site	Implement the AI Design Advisor tool(s) at a design to manufacturing site (or separate design and manufacturing sites) to validate their effectiveness	Month 10
Detailed Case Study	A case study providing a detailed account of the implementation with a focus on best practices and lessons learned.	Month 11
Technical Demonstrations at MxD	Demonstration of technical research and development outcomes in MxD's factory or via remote presentation	Month 12
Developer Documentation	Includes software documentation, integration documentation, documentation for modifications to software, documentation of known bugs and issues	Month 12
User Manuals	Includes user manuals for operation; also includes installation and configuration instructions	Month 12

The team is expected to develop a transition plan, which is detailed in Table 2 in Section VI. MxD is focused on supporting the transition of project outcomes to its membership in the form of pilot integrations on their factory floors, follow-on research projects, open-source software release, or commercialized products available for use. Teams are expected to tailor their deliverables to their transition goals to provide outcomes that have continuing impact after the period of performance is complete. **Pilot deployments and actionable transition plans are a priority for MxD to help maximize the benefits of funded research to the membership and ultimately, help increase the competitiveness of the US manufacturing base through new technological advancements. Thus, it is important that proposals emphasize not just technical merit but transition and deployment.**

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PROGRAM OVERVIEW

V. PROGRAM REQUIREMENTS

COLLABORATION

Participation in this program requires collaboration with a team of organizations with diverse capabilities. Competitive teams should optimally include representation from the manufacturing base, academia, solution/service providers and standards bodies. While it is not necessary for a proposing team to include all such organizations in their direct performers, MxD believes that involvement of diverse stakeholders increases the strength and applicability of project outcomes while reducing unforeseen risk.

Each Proposal Team must include participation by an organization that performs product design to drive use case and operational requirements. This organization could be a design firm or a manufacturer which performs design work in-house. The design firm or manufacturer(s) are expected to define technical requirements, drive the business case for project outcomes and serve as a pilot manufacturer for test and validation of the solution. Specific team composition will depend on which portion(s) of the product life cycle the proposal addresses.

There is no requirement for a standards organization to be included on the Proposal Team but the Proposal Team is encouraged to collaborate with industrial standards bodies to better inform their draft standards and help popularize their work to increase the potential for endorsement in the future. This is especially true where neutral formats or standards-driven data objects are used or extended.

The Proposal Preparation Information section outlines the opportunities that MxD provides to facilitate proposal team development:

- Teaming List: MxD will collect contact information from parties interested in teaming during the first weeks of the proposal period and will then disseminate the compiled list of contacts to the responders via email.
- Pitch Session: MxD will host a Pitch Session to provide organizations and/or teams the opportunity to share a snapshot of their solution approach and allow them to identify synergies with other interested parties.
- Participation in the Teaming List and Pitch Session is optional and NOT required in order to submit a proposal.

PROGRAM MANAGEMENT

MxD will be responsible for managing the project to ensure the team meets all the technical objectives and requirements proposed within the project's period of performance and budget. The MxD Project Manager will coordinate with Principal Investigators (PIs) of the Proposal Team to manage the program following MxD's project processes. The Director of R&D Projects in coordination with the assigned MxD Project Manager, will monitor technical performance and project costs of the associated Enterprise Award Agreement (EAA), the agreement that governs a project awarded by MxD to the Proposal Team Lead. Proposal Teams will submit the reports listed below in Table 2 to their identified Project Manager to fulfill their reporting requirements. These reports will be internally accessed by the MxD Director of R&D Projects, the Government, the Project Manager and other authorized MxD staff members in the course of their official duties. Technology advancements will be summarized at least annually in order to support reporting to

the Executive Committee, Technical Advisory Committee, MxD Members, and the Government, when applicable.

Table 2. Program Deliverables

Deliverable	Description
Project Immersion Workshop	Face to face meeting with manufacturer(s) including stakeholders from key business units to review project transition plan and define pilot requirements.
Transition Plan	Written plan for successful transition of project outcomes after period of performance including technology integration, educational distribution, and potential commercialization.
Monthly Technical and Financial Reports	Monthly report from the Project Team Lead including the financial and technical status of the project
Member Technical Reviews	Presentation encompassing all technical advancements made prior to key milestone and presented to the MxD Project Manager, members of the Technical Advisory Committee, and other interested MxD members.
Presentations at MxD	Presentation and demonstration of developed technology presented in person at MxD
Annual Patent Reports	Report of inventions and subcontracts
Intellectual Property Reports	Participants must promptly notify the MxD Project Manager apprised of Project IP created, filing status, claims against the Project IP, and BIP licensed to other Members.
Safety Accident/Incident Report	Participants must report any major accident/incident (including fire) resulting in any one or more of the following situations: one or more fatalities or one or more disabling injuries; damage of Government property exceeding $10,000; impact to Project planning or production schedules or degradation of the safety of equipment under contract. Such report will also identify potential hazards requiring corrective action.
Draft Final Technical Report	Draft report must include a comprehensive, cumulative, and substantive summary of all technical advancements and significant accomplishments achieved during the project.
Final Technical Report	See above
Project Team Lead Release	Release by Project Team Lead confirming scope of work to be complete
Property Report	List of all MxD funded equipment and planned disposition
Final Patent Report	Report of inventions and subcontracts

Travel Requirements

Proposals should include funding for four (4) trips per year for two (2) people for each member of the Proposal Team. These trips will be used for face to face meetings and presenting to the MxD membership. These trips may be for travel to MxD or to another location at the request of MxD (e.g., a conference, workshop, showcase, etc.). For estimation purposes, use Chicago, IL as the destination. Proposals may include additional funding for travel to pilot site for implementation and testing with proper justification.

Period of Performance Requirements

Proposed projects should be no more than twelve months in duration. Please note that projects are initiated once an EAA is signed, therefore, the project duration must include the

subcontracting of all project participants between the Proposal Team Lead and each member of the Proposal Team.

Ownership of Deliverables and Intellectual Property

To accelerate digital adoption, cybersecurity, and workforce development across the U.S. manufacturing sector and to support the increased priority from our funding partners to transition project technology, MxD desires to own or co-own all the rights to intellectual property (IP) created during the project (Foreground IP or Project IP). It is the expectation that a member of the Proposal Team will co-own or will have a non-exclusive, non-transferable license to use the Foreground IP it creates. MxD will negotiate in good faith to achieve this result. MxD expects that the IP Management Plan (Attachment 1b) submitted with this proposal will reflect this position. MxD will have no rights to pre-existing intellectual property (Background IP) belonging to any member of the Proposal Team except as may be expressly agreed to in the Project documents. It is important to note that MxD will consider proposals that do not meet this request; proposals with IP Management Plans that reflect this will be favorably reviewed.

Funding Requirements

MxD anticipates awarding one project for no more than $500,000 of Federal Funding, not inclusive of required cost share, under the MxD-21-01 RFP. MxD reserves the right to fund all, some or none of the Technical Proposals received under issued RFPs. 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 the Proposal Team. For every dollar of Federal funding awarded, the Proposal Team must contribute at least a dollar of in-kind effort or cash. Thus, the Proposal Team in aggregate will need to provide at minimum 50% of the total project cost (inclusive of labor, equipment, materials, indirect, etc.) in cost share. This cost share can be in-kind or cash and can be distributed among the members of the Proposal Team however the team decides. Cost share must be accounted for and substantiated in the cost proposal, as described in the Cost Development Guide found in the Proposal Preparation Kit.

Neither MxD nor the U.S. Government has any responsibility for costs associated with Technical Proposal or Cost Proposal development, submissions, or pre-award negotiations.

If down selected, the Proposal Team must submit substantiating documentation for all Proposal Team Member costs (including cost share) and MxD will complete a comprehensive cost analysis (including cost reasonableness and cost realism) prior to award. In addition, the Government Agreements office may conduct a cost analysis of all submitted cost proposals to approve the project. Approval of the Cost Proposal and Technical Proposal by the Government Agreements office and the DoD Program Manager is required for all MxD projects.

NOTE: Project award timelines are subject to approval of the project plan by the government and the allotment of funds from the government.

VI. ELIGIBILITY

MxD Membership

This RFP is open to the public; any organizations regardless of membership status may submit a Technical Proposal and Cost Proposal in response to this RFP. However, the MxD Membership Agreement must be fully executed with every Proposal Team member prior to project award. Any non-MxD members of the Proposal Team are encouraged to review the Membership Agreement prior to submission and to direct questions to MxD's Director of Business Development, Tony Papke (tony.papke@mxdusa.org). For more information on how to become a MxD Member, please visit the MxD Membership page on our website.

Federally Funded Research and Development Centers (FFRDCs) and Government entities (Government/National laboratories, military educational institutions, etc.) are subject to applicable direct competition limitations and cannot propose to RFPs in any capacity unless they address the following conditions:

- FFRDCs or Government entities may not exclusively team on any specific proposal team.
- FFRDCs must clearly demonstrate that the proposed work is not otherwise available from the private sector and must also provide a letter on letterhead from their sponsoring organization citing the specific authority establishing their eligibility to compete with industry and propose to solicitations utilizing Government funding.
- Government entities must clearly demonstrate that the work is not otherwise available from the private sector and provide written documentation citing the specific statutory authority, as well as, where relevant, contractual authority, establishing their ability to propose to solicitations utilizing government funding.

Government agencies interested in participating in MxD RFPs as part of Proposal Team should notify MxD in advance of Proposal submission. For RFPs utilizing Federal funding, special agreements and considerations may need to be implemented to enable participation.

Notification of Participation by Foreign Firms & Non-U.S. Citizens

Membership in MxD shall be granted only to U.S. companies, firms, organizations, institutions, or other entities organized or existing under the laws of the United States, its territories, or possessions (as defined in Section 120.15 of International Traffic in Arms Regulations, 22 CFR § 120 et. seq. ("ITAR")).

Membership and project participation (or participation in projects without membership status) will be granted on a case-by-case basis at the sole discretion of the MxD Senior Leadership Team upon approval of the U.S. Government for any of the following:

- Any agency or instrumentality of a foreign government;
- Companies, firms, organizations, institutions, or other entities not organized or existing under the laws of the United States (as defined in Section 120.16 of the ITAR); and
- Non-U.S. Citizens.

In such event, all Members will be notified immediately of the foreign entity's role.

If a Member is a Corporation with subsidiaries or affiliates, its membership will include its wholly-owned and controlled and majority-owned and controlled U.S. subsidiaries and affiliates who qualify as a U.S. person under Section 120.15 of the ITAR.

It is a requirement that work related to the project must be completed in the U.S. by people legally authorized to work in the U.S. All proposed project participation by non-U.S. Citizens must be disclosed to MxD on Attachment 2c MxD Foreign Firms, Travel, & Non-U.S. Citizens at least 60 days prior to proposed participation. Written approval of foreign firms and/or non-U.S. Citizens must be received by the member of the Proposal Team from MxD prior to commencing work.

VII. TECHNICAL & COST PROPOSAL EVALUATION

EVALUATION PROCESS

An MxD Evaluation Board (EB) will review and evaluate each submitted Technical Proposal utilizing the evaluation criteria specified in the following section.

The EB may consist of recognized experts from industry and academia and key government stakeholder representatives (when appropriate). MxD representatives, such as the Director of R&D Projects, and respective Project Managers, may participate in and lead EB meetings. All members of the EB will need to meet strict standards of personal and organizational conflict of interest. The evaluators may be supported by subject matter experts to review and comment upon the proposed work.

Through its deliberations, the EB will determine “selectability” of each submission. Selectability determination incorporates average EB score, judgement of market impact, and budget availability. The EB will identify a list of all proposed Technical Proposals that are “selectable for negotiation” leading to a subagreement award, along with their associated evaluation scores, to the Project Manager. The Director of R&D Projects, with the consultation of other MxD representatives, will determine which subset of the proposed Technical Proposals deemed “selectable for negotiation” will be down selected for negotiations. This determination will take into account the EB’s recommendation, funding availability, alignment with MxD’s SIP as well as external stakeholder requirements (when applicable).

EVALUATION CRITERIA

MxD’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 how the solutions address business problems and technical requirements outlined in the RFP, any assumptions, and considerations for deployment of developed solution through a pilot.

Each proposal is evaluated by a specific set of criteria. Below are the Proposal Evaluation criteria for this RFP:

Proposal Evaluation Criteria	Order of Importance
Requirements Compliance • *Clearly articulates how the team will meet all the capabilities required by the RFP* • *Proposed solution clearly addresses problem statement and use cases identified in RFP* • *Clear identification of assumptions, risks, and mitigations; proposed deliverables align with requirements* • *Program management plan meets requirements in the RFP and is reasonable for the scope of work described in the technical proposal*	1
Methodology • *Clear and concise work effort scope targeted at problem statement* • *Proposed effort of direct relevance to RFP* • *Clear identification of barriers to implementation and explanation of how they will be overcome* • *Innovative methodology with high-potential for market impact* • *Significant and impactful use of external resources* • *Methodology demonstrates scientific and technical merit* • *SMART metrics and KPIs identified and described and demonstrate clear understanding of proposed work* • *Provides a maturity level assessment of both current and future state of technology with substantiation of assessed levels* • *Deliverables are fully described and identified*	2
Transition Plan • *Transition plan clearly articulates all project results and application into commercial and/or government products, systems and applications* • *Plan includes detailed descriptions of project results, risks/assumptions/mitigations, all required actions and timing, detailed funding and ROI strategy, key milestones, schedule and go/no-go decision points* • *Proposed team includes appropriate representation from supply chain, researchers and industrial partners* • *Transition tasks and partners identified and thoroughly defined, both to MxD members and the broader industry* • *Solution and strategy to rapidly enable the adoption of the new technologies across the US manufacturing base is presented* • *Clearly defined IP ownership and innovative licensing strategies designed for rapid adoption of the new technologies* • *Discussion of future transition and/or commercialization demonstrates a clear understanding of the industry and possible markets for the technology* • *Benefits of technology are clearly defined and substantiated.*	3

Team Qualifications • *Members of proposed team are highly qualified to accomplish project tasks with clear delineation of roles and responsibilities* • *Solid evidence of commitment by team members, such as letters of commitment from their companies* • *Team members have unique capabilities that are directly associated with the target technology* • *Team includes a broad mix of capabilities and experiences to ensure success along with the commitment of top-tier facilities to accomplish all project tasks.*	4
Cost Factors • *Proposed cost estimates are reasonable and realistic for the proposed work effort* • *The minimum cost share proscribed in the RFP has been met or exceeded* • *Cost share is clearly defined and directly applicable to the performance and success of the project* • *Cost share value is readily discernable* • *Cost share from partners is documented with letters of commitment.*	5

VIII. PROJECT AWARDS

CONTRACT

MxD projects will be funded under the MxD Technology Investment Agreement (TIA), Contract Number W15QKN-19-3-0003 between MxD and the Government. All contractual negotiations related to RFPs will be executed by MxD. Funds will be distributed to the Proposal Team Lead selected through the evaluation/selection process utilizing an Enterprise Award Agreement (EAA). EAAs are usually Cost Reimbursement/Cost Share agreements; Milestone Payment/Cost Share based EAAs will be considered upon request.

MxD has provided an EAA template within the PPK for Proposal Teams to **review** prior to proposal submission. **The EAA should not be submitted with the proposal.** After receiving a notification of down selection, MxD will request the down selected Proposal Team to officially begin contract review and negotiations. MxD would prefer to execute an EAA only with the Proposal Team Lead. Once the EAA is executed, the Proposal Team can begin working on the project. When applicable, it is the sole responsibility of the Proposal Team Lead to issue contracts with applicable flow down clauses outlined in the EAA to any subcontractors, consultants, and any suppliers.

FINAL TECHNICAL PROPOSAL & COST PROPOSAL REVISIONS

MxD reserves the right to negotiate the cost and scope of the proposed work with the Proposal Team that has been down selected prior to award. MxD will facilitate the creation of a Statement of Work with the Proposal Team including technical scope modifications and program management aspects. All members of the down selected Proposal Team who intend to pursue selection are required to participate in the proposal revision process prior to award. For example, MxD may request that the organizations revise the technical scope to better align to RFP requirements.

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PROPOSAL PREPARATION INFORMATION

IX. PROPOSAL PREPARATION INFORMATION

This Proposal Preparation Information section offers detailed instructions on how to respond to this RFP; the Proposal Preparation Kit (PPK) includes the required proposal templates and reference documents on how to complete the templates. Together, the Proposal Preparation Information and PPK are intended to provide the basic information necessary for assembling complete proposals.

NOTE: MxD recommends Proposal Teams review the Request for Proposal Technical Summary & Program Overview prior to the PPK.

X. TEAMING OPPORTUNITIES

TEAMING LIST

To facilitate proposal teaming, MxD will collect contact information from parties interested in teaming during the first week of the proposal period. MxD will then disseminate the compiled list of contacts to the responders via email. If you are interested in submitting your contact info to this distributed list, please email projects@mxdusa.org by 5:00PM Central Time, April 6, 2021 with the following information:

> ***"Subject: MxD-XX-XX RFP Teaming***
>
> *[Organization Name]*
>
> *[Name of Contact]*
>
> *[Email address of contact]*
>
> *[1 sentence description of expected contributions to Proposal]*
>
> *I agree to have the information herein disseminated to other organizations that have indicated interest in teaming for MxD's RFP 21-01."*

PITCH SESSION

Additionally, MxD will host a **Pitch Session** on Tuesday, April 20, 2021 to provide organizations and/or teams the opportunity to share a snapshot of their solution and receive preliminary feedback from the MxD community. It will also serve as an excellent teaming opportunity for individuals and groups to identify synergies between their pitches. Pitch Session registration information will be posted at www.mxdusa.org/projects. Participation in the Pitch Session is not required to submit a Technical Proposal and Cost Proposal.

XI. SUBMISSION INSTRUCTIONS

SUBMISSION DETAILS

Each Proposal Team must submit their Technical Proposal and Cost Proposal no later than 5:00PM Central Time, June 10, 2021. All submissions must be made electronically to projects@mxdusa.org. Please include the RFP designation (e.g., "MxD-<XX>-<XX> – <RFP Title> - <Proposal Team> - <Proposal Title>") in the subject line of the email.

REQUIRED PROPOSAL DOCUMENTATION

The following section provides guidance on the necessary documentation, templates and submission formats required to submit a Technical Proposal and Cost Proposal in response to this RFP. Below are the documents (organized by PPK folder) that must be completed and submitted by the due date:

Required Proposal Documentation			
Title	**Document**	**Template**	**Submission Format**
Technical Proposal ONE PER PROPOSAL TEAM	Technical Proposal	Attachment 1a MxD Technical Proposal Template.docx	PDF
	Resume(s) of the Principal Investigator and Key Technical Personnel	N/A	PDF
	Letter(s) of Commitment	N/A	PDF
	Intellectual Property Management Plan (IPMP)	Attachment 1b MxD IP Management Plan.xlsx	XLS
Cost Proposal and Participant Certification ONE PER PROPOSAL TEAM	Cost Proposal	Attachment 2a Project Cost Proposal Template.xlsm	XLS
	Cost Narrative	Attachment 2b Cost Narrative Template.docx	PDF
	Certification of Foreign Firms, Travel and Non-U.S. Citizens	Attachment 2c Foreign Firms, Travel, & Non-U.S. Citizens.docx	PDF

- Each Proposal Team must submit **one Technical Proposal** (Attachment 1a). The instructions for completing the Technical Proposal are in the Technical Proposal template provided in the PPK folder. All questions are required, and attachments should be included.
- Each Proposal Team must submit **one completed IP Management Plan** (Attachment 1b) for the entire team with the Proposal. Instructions for completing the IPMP are provided in the template. The IPMP must contain Background Intellectual Property (BIP), Project (Foreground) IP, and assertions of limited rights to the Government.
- Each Proposal Team must submit **one Cost Proposal** (Attachment 2a) **including the Cost Narrative** (Attachment 2b) that is a summary or "roll-up" of all Proposal costs including cost share. Please reference the MxD Cost Proposal Development Guide for instructions on how to develop the Cost Proposal. An example Cost Proposal Excel Sheet and Cost Narrative are provided for reference. **Proposal Teams should be prepared to**

provide substantiating documentation for all Proposal Team Member costs within two weeks of down selection if the proposal is down selected.

- Each Proposal Team must submit **one Certification of Foreign Firms, Travel and Non-U.S. Citizens** (Attachment 2c) with information from every Proposal Team member. If there is personally identifiable information, separate certifications may be submitted
- The EAA is provided for review prior to submission. **The EAA should <u>not</u> be submitted with the proposal.**

Proposals that do not include the minimum requirements identified in the RFP will be deemed non-responsive and will not be evaluated.