



The Digital Manufacturing Institute

MxD

REQUEST FOR QUOTATION

5G System Configuration
Research for Industrial
Building Application

21-18-01

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I. RECORD OF CHANGE

Revision	Date	Sections	Description
1.0	15 September 2022	N/A	Original

II. TIMELINE

Deadline for submissions to be received	October 13, 2022
Follow up clarification meetings as needed	Throughout the submission phase
Feedback to participants	November 18, 2022

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.

MxD has invested over \$120 million in more than 85 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 is also the DoD's National Center for Cybersecurity in Manufacturing which focuses on three key areas. First, it uses its factory floor as a demonstration area for existing cybersecurity technology. Second, it works to develop new tools to address very specific pain points for manufacturers. And third, it is working with industry and government to figure out how to get these tools to small and medium-sized manufacturers. All MxD projects must take cybersecurity into consideration.

This RFQ is publicly available on the MxD website at <https://mxdusa.org/projects/>. This public posting represents the official notification of a request to submit the required documents. Amendments to an MxD RFQ may be used to extend due dates, clarify procedural requirements, or modify technical requirements. If an updated RFQ is issued, the previous RFQ will be rescinded. Those interested in responding to this RFQ should carefully monitor the MxD website after an original posting, up to the time of the quotation 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 respondents to monitor the MxD RFQ updates and ensure that their quotation meets the solicitation requirements.

The Respondent to an RFQ is the non-Federal organization that submits a quotation in response to the RFQ. The Respondent is considered the Prime contractor. Any other companies involved are considered Subcontractors typical of a Prime/Subcontractor relationship. All Subcontractors are subject to flow-down clauses in the Prime contract as required by all government stipulations.

Any questions regarding this solicitation must be provided to projects@mxdusa.org. The questions will be sent to the appropriate MxD point of contact, and answers will be published on the MxD website, if appropriate.



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TECHNICAL SUMMARY



IV. TECHNICAL SUMMARY

OVERVIEW AND BACKGROUND

This program seeks to establish a methodology to investigate the various types of 5G cellular architecture to determine the appropriate configuration for use in manufacturing facilities. Infrastructure will be chosen for a 5G system to optimize the adoption of Industrial Internet of Things (IIoT) devices within buildings for digital technology applications. Both technical and business dimensions will be considered. The chosen 5G system will then be installed within the MxD research facility to provide a test platform for the formulation of instructional guides and exercise of specific uses cases to demonstrate benefits and/or limitations of the use of digital technologies within an industrial facility setting.

Items such as wireless sensors, control systems, and related equipment will be tested within the facility over various conditions. Test results, lessons learned, and best practices will be made available within a report suitable for publication. The 5G system will also serve as an ongoing testbed for industry and DoD for additional use cases in the future.

PROBLEM STATEMENT

5G is often used in a singular context when talking about technology. However, 5G is made of several types of architectures and variables. These include variations in spectrum, hardware, software, and physical location of assets. When taken holistically, there are dozens of 5G configurations that provide both advantages and disadvantages depending on the use case.

These configurations then result in interdependencies between cost, complexity, availability, risk, and performance. Most literature and marketing materials are targeted at consumer use applications and are skewed toward service providers. One of the impediments to the adoption of 5G wireless technology in manufacturing is the confusion caused by this ambiguity.

MxD Project 21-18-01: 5G System Configuration Research for Industrial Building Application will focus on the research of 5G technology, both present and future. This project is one of several that comprise this 5G program.

OBJECTIVES

The primary goal of MxD Project 21-18-01 is to determine an optimal configuration of 5G, in a neutral and objective manner, for use in industrial buildings, specifically for IIoT and digital applications, and to make this information publicly available for broad industry use including DoD.

The objective of project 21-18-01 is to objectively determine and provide a report that details the best fit 5G system architecture and configuration for industrial settings.

REQUIREMENTS

Key Tasks:

- Research and map available 5G architecture and configurations given current specifications, equipment availability, spectrum availability, and legal requirements.
- Create a matrix of the costs, performance, and features of the available 5G architecture and configurations.
- Investigate and discuss the status of O-RAN specifications, advantages and disadvantages, and recommendations for industrial systems.



- List desired requirements of industrial building communications and connectivity, especially in a manufacturing setting, for small, medium, and large enterprises.
- Cross reference the configuration matrix with the desired requirements and offer recommendations of best fitting 5G architecture and configuration for industrial settings.
- Research available information on NextG, including 6G and 7G, and summarize future availability and impact on cost and performance of such technologies to manufacturers and facilities in an industrial setting.
- Detail cybersecurity design and implementation considerations in the report that affect 5G network communications for small, medium, and large enterprise manufacturing settings.

MxD will measure the performance of 21-18-01 as issuance of a detailed report, suitable for publication, which includes the analysis of the different dimensions of 5G configurations, performance parameters for industrial buildings, presenting benefits and risks of different architecture and configuration scenarios, and makes a recommendation of top scenarios for industrial building application. A presentation of the impacts of additional technologies such as O-RAN and Next G should also be included in the report.

Cybersecurity Considerations and Requirements:

TBD

A response to this RFQ must have a detailed, itemized breakdown of the minimum requirements outlined above and any additional inputs if they are relevant to supporting the objectives.

SCOPE OF WORK

Deliverable:

A report, suitable for publication, summarizing methodology, analysis, and recommendations for 5G architecture and configurations in industrial buildings, including present and future state of O-RAN and NextG. This report can be used as a guideline for facilities to begin their steps towards implementing 5G today, as well as detail considerations of the up-and-coming technologies of the future.

Period of Performance: 4 months

Estimated start date: January 2023

The proposal shall include a Gantt chart detailing tasks and milestones required to achieve the project outcome.

A line-item breakdown of costs must be included in the proposal. Costs should be reasonable relative to current market rates and must adhere to any federal government guidelines.



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PROGRAM OVERVIEW





V. PROGRAM REQUIREMENTS

PROGRAM MANAGEMENT

The selected Respondent will be awarded a contract as the Awardee. The Awardee is responsible for managing the project to ensure the team meets all the technical objectives and requirements as contracted based on the quotation. The Awardee will coordinate with the MxD point of contact (POC) for reporting purposes and for coordinating the integration at MxD. The MxD POC will monitor technical performance and project costs relative to the associated contract. The Awardee will submit the reports listed below in Table 1 to their MxD POC to fulfill their reporting requirements. These reports will be accessed by the MxD Senior Director PMO, MxD Director of Engineering, the MxD POC and other authorized staff members in the course of their official duties.

Program Deliverables: Table 1

Deliverable	Description	Due
Gantt Chart	Program schedule and milestones	Quotation Response
Program Review	Summary of progress towards of objectives and deliverables.	Weekly
Technical Documents and Test Reports	Per Technical Deliverables	Per Technical Deliverables
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.	Immediately on Occurrence
Government Required Documentation	Additional reporting based on government contractual requirements.	As Needed



PERIOD OF PERFORMANCE REQUIREMENTS

Estimated period of performance is 4 months from contract award. MxD is flexible on implementation time dependent on objectives quoted. However, there is no increase in funding beyond what was agreed to per contract.

TRAVEL, FACILITY ACCESS AND INSURANCE REQUIREMENTS

All travel requirements and associated costs needed for execution of the objectives and deliverables must be included in the quotation. There is no increase in funding should additional travel be required to fulfill the agreed upon requirements. Proposals must include an estimate for required travel known to be necessary to perform all work as defined above.

OWNERSHIP OF DELIVERABLES AND INTELLECTUAL PROPERTY

The contract will be a work for hire relationship. It is expected that the solution to meet the objectives will be a commercially available solution. Any existing, background intellectual property (IP) remains the property of the IP owner. Ownership and other rights in new IP produced as a result of the work performed under this contract will be determined at the time of contracting.

FUNDING REQUIREMENTS

MxD anticipates awarding a **fixed-price contract** resulting from this RFQ. MxD reserves the right to fund all, some, or none of the quotations received under issued RFQs. Final award amounts will be determined accordingly based on quotations received, subsequent evaluations, and final agreement between MxD and the Awardee.

Cost share is not required for this contract. However, cost share is encouraged to support the Institute's mission.

MxD recognizes the difficulty in completing a final, fixed-price quotation without additional information or site visits for certain projects. Therefore, **clearly document and explain all assumptions used to generate the quotation.**

If down selected, the Respondent will have the opportunity to gather additional details and revise the quotation. The Respondent must then submit substantiating documentation for costs (including any cost share). MxD will complete a comprehensive cost analysis (including cost reasonableness and cost realism) prior to contract award.

Neither MxD nor the U.S. Government has any responsibility for costs associated with development, submissions, or pre-award negotiations for this quotation and subsequent contract.

VI. ELIGIBILITY

MxD MEMBERSHIP

This RFQ is open to the public; any organizations regardless of membership status may submit a quotation in response to this RFQ. **Membership in MxD is not required to be awarded a contract as a result of this RFQ.**

If a Respondent or Awardee wishes to promote their affiliation with MxD as a result of this RFQ or subsequent award, MxD membership is required. This can include participation in workshops, social media promotion, and networking with other members. MxD membership does not grant



rights to publish association with the project. Publication of association with the project will be subject to terms to be determined at the time of contracting.

Any Respondents who are non-MxD members 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 RFQs in any capacity unless they address the following conditions:

- FFRDCs or Government entities may not exclusively respond to this RFQ.
- 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 RFQs as a respondent or subcontractor should notify MxD in advance of the RFQ submission. For RFQs utilizing federal funding, special agreements and considerations may need to be implemented to enable participation.

NOTIFICATION OF PARTICIPATION NON-U.S. CITIZENS

Award 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")).

It is a requirement that work related to the Award must be completed in the U.S. by people legally authorized to work in the U.S. All proposed participation by non-U.S. Citizens must be disclosed to MxD on Attachment 1 non-U.S. Citizens at least 60 days prior to proposed participation. Written approval of non-U.S. Citizens must be received by the Awardee from MxD prior to commencing work.

VII. QUOTATION EVALUATION

EVALUATION PROCESS

An MxD Evaluation Board (EB) will review and evaluate each submitted quotation 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 Senior Director of the PMO, Director of Engineering, MxD POC, 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 quotation. Selectability determination incorporates average EB judgement of objective compliance, budget availability, and overall perceived value. The EB will identify a list of quotations that are “selectable for negotiation” to the MxD POC. The Senior Director PMO and the Director of Engineering, with the consultation of MxD POC, will determine which subset of the proposed quotations 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 mission and strategic goals as well as external stakeholder requirements (when applicable).

EVALUATION CRITERIA

Each quotation is evaluated by a specific set of criteria. Below are the quotation evaluation criteria for this RFQ:

Quotation Evaluation Criteria
<p>Requirements Compliance</p> <ul style="list-style-type: none"> • <i>Quoted solution clearly addresses all mandatory objectives identified in RFQ</i> • <i>Clear identification of assumptions, risks, and mitigations</i> • <i>Complete and clear itemization of all requirements</i> • <i>Program management plan meets requirements in the RFQ</i>
<p>Respondent Qualifications</p> <ul style="list-style-type: none"> • <i>Respondent and any proposed subcontractors highly qualified to accomplish objectives with clear delineation of roles and responsibilities</i> • <i>Respondent and any subcontractors have unique capabilities that are directly associated with the target technology</i>
<p>Cost Factors</p> <ul style="list-style-type: none"> • <i>Quoted costs are reasonable and realistic for the proposed work effort</i> • <i>Quoted costs are competitive relative to other commercial offerings</i> • <i>Value is maximized through inclusion of optional cost share and objectives</i>

VIII. PROJECT AWARDS

CONTRACT

The award of this contract will be subject to the requirements of the Collaboration Agreement between National Center for Manufacturing Sciences and MxD. All contractual negotiations related to RFQs will be executed by MxD. Funds will be distributed to the Awardee selected through the evaluation/selection process utilizing a fixed price contract.



FINAL REVISIONS

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

SUBMISSION DETAILS

Each Respondent must submit their quotation no later than **5:00PM Central Time, October 13th, 2022**. All submissions must be made on the MxD website. The SUBMIT button can be found on the program page at <https://mxdusa.org/projects/>. By clicking the SUBMIT button, applicants will be directed to the official Submission Form.

IX. REFERENCES AND ACRONYMS

References: Table 2

Document Title	Document Number
US Code of Federal Regulation	N/A

Acronyms: Table 3

DoD	Department of Defense
EB	Evaluation Board
FAQ	Frequently Asked Question
FFRDC	Federally Funded Research and Development Center
IP	Intellectual Property
ITAR	International Traffic in Arms Regulations
PoC/POC	Point of Contact
PoP	Period of Performance
RFQ	Request for Quote



Attachment 1

Certification of Non-U.S. Citizens

___ There is NO participation by Non-U.S. Citizens proposed for this effort.

___ The following Non-U.S. Citizen is participating in this effort.

Non-U.S. Citizen Name, Contact Info	Country of Citizenship	Primary Employment Location	Employer	US Work Authorization (Visa, Green Card, Etc)	Justification*

*The Justification section should clearly outline the rationale behind the individual's request for participation, the type of data they will have access to, and other pertinent information regarding their skill set/expertise.