



The Digital Manufacturing Institute

MxD

REQUEST FOR QUOTATION

5G Private System Implementation

21-36-05

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I. RECORD OF CHANGE

Revision	Date	Sections	Description
1.0	May 3 rd , 2022	N/A	Original

II. TIMELINE

Deadline for submissions to be received	May 26 th , 2022
Follow up clarification meetings as needed	Throughout the submission phase
Feedback to participants	By June 15, 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 If an updated RFQ is issued, the previous RFQ will be rescinded.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.

TECHNICAL SUMMARY



IV. TECHNICAL SUMMARY

OVERVIEW AND BACKGROUND

The overall objective of The Rock Island Arsenal Modernization Program is to assess, develop, pilot, and implement a common set of processes and tools to modernize legacy manufacturing and maintenance facilities using the Joint Manufacturing and Technology Center (JMTC) at Rock Island Arsenal (RIA) as a surrogate. This initiative will help improve U.S. manufacturing and maintenance organizations and the JMTC's ability to manufacture, maintain, repair, and overhaul various ground systems and their associated components in a more efficient, effective, and affordable way.

These projects are considered pilots with the potential for subsequent work expected not only at Rock Island Arsenal but also other Department of Defense (DoD) facilities.

5G Private System Implementation (21-36-05) is one of several projects that comprise this RIA-JMTC modernization program.

PROBLEM STATEMENT

As part of the Army's Organic Industrial Base (OIB), the Rock Island Arsenal (RIA) Joint Manufacturing and Technology Center (JMTC) exists to maintain unit readiness across the force and give the Army the ability to surge in support of contingencies. To support the facility's ability to provide flexible and responsive warfighter readiness solutions MxD is implementing a mid-band, standalone, 5G private system.

Digital manufacturing involves many benefits that result from the use of data. This includes connecting factory floor sensors and other data sources to data centers or similar gathering points. This is done to collect, aggregate, and make data useful for identifying trends and opportunities to improve the operation. These connections can also be used to control the operation that the data is sourced from.

Traditionally, these data streams or points of data have been sent securely and with high integrity via hardwire in the factory environment. As the digital transformation advances, the use of sensors and other sources of data will be relied upon at an increasing rate. The cost and physical space to connect this equipment cannot be economically and efficiently done with hardwire. A wireless solution that allows flexibility, mobility and lower installation complexity and associated cost is a required substitute.

The Rock Island Arsenal (RIA) – Joint Manufacturing and Technology Center (JMTC) is looking to adopt emerging wireless technologies into their facility to benefit from communication protocols such as 5G cellular.

There are many different possible configurations of 5G systems. These included low-, mid-, and high-band spectrum, standalone verse non-standalone architecture, private verse public, etc. Each of these configurations have interdependencies which make them unique in terms of performance, cost, complexity, capability, and control. The last one being the biggest priority for the RIA.

OBJECTIVES

MxD is implementing a mid-band, standalone, 5G private system. Mid-band offers the flexibility of unlicensed spectrum and is readily available in standalone configurations. Standalone architecture enables additional options such as virtual networks.

The following sections highlight the minimum requirements proposed by MxD to meet the objectives of the project. However, MxD is open to receiving an expanded proposal with additional inputs if they are relevant to supporting the objectives while meeting budget and time constraints.

To support the key objectives of this project the proposal should try to prioritize the use of Commercial Off the Shelf (COTS) where possible.

TECHNICAL REQUIREMENTS

1. Requirements

- Installation of a turnkey 5G NR standalone system
- System architecture will be based on Option 2 as defined in 3GPP TS 23.501 [16]
- The goal is to be O-RAN (7.2x) compliant. Architecture can be changed to O-RAN if equipment is available during the project timeline.
- The System will be private and completely on the RIA-JMTC premises, without mandatory need for cloud access. However, nothing in the system design or components should inhibit cloud-based functionality in the future.
- The System will connect to the RIA-JMTC intranet, known as the Industrial Control Network (ICN)
- The System will operate in Citizens Broadband Radio Service (CBRS) unlicensed spectrum
- The System will utilize spectrum access service (SAS). The SAS will have the capability to access the internet via a different, segmented network at RIA-JMTC.
- The System will be capable of virtual network / network slicing for different use case optimization
- System design, including Remote Radio Head (RRH) quantity and placement, will be such that coverage will include all the areas of the RIA-JMTC facility with a signal strength of no less than -70 dBm. For quoting purposes, an estimate of 15 RRUs is to be used.
- The System's core components must not inhibit future upgrades to 6 GHz unlicensed bands. It is understood that new/additional RRHs and/or software may be required.

The System shall not use any integrated circuits, software, or other critical infrastructure sourced from restricted countries or suppliers as specified by the US government at the time of release of this RFQ.

- Location tracking capability is desired
- Applications which enable or enhance digital manufacturing capabilities, such as data aggregation or analytics, are desired
- Core software and/or applications, beyond what is typically deployed in 5G systems, is desired to further enhance cybersecurity
- Educational material to teach RIA-JMTC workers about topics such as component types, architecture, installation, maintenance, and security of 5G are required.

Material can include instructional books, lessons learned, software, video, and augmented reality tools as teaching aids.

- There are future considerations for a hybrid 5G system with a telco-based, high-band, 5G system to coexist with this private mid-band system. While not a requirement for this project, this consideration should be incorporated during system design
- Five system compatible gateways which will allow RIA to connect wired, portable equipment to the network using the 5G air interface shall be included.

2. Cybersecurity Considerations and Requirements

- Contractor must abide by security requirements outlined in NIST 800 SP-53 and NIST 800 SP-82 R2
- Only preapproved hardware and software components are permitted.
- There are Security Technical Implementation Guides (STIGs) for the implementation/configuration of preapproved hardware and software components. The STIGs and approved components can be found here: [STIGs Document Library – DoD Cyber Exchange](#)
- There is currently no STIG for 5G components. The 5G components will need to be approved by RIA.
- The allowed networking protocols, ports, etc. for both enterprise and Industrial networks can be found here: [Enterprise Connections PPSM – DoD Cyber Exchange](#)
- If no STIG exists for a particular component, please consult: [STIGs Frequently Asked Questions – DoD Cyber Exchange](#)

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

Period of Performance: 7 months

Estimated start date: 07/01/2022

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. Costs that will continue after the end of the PoP, such as software as a service costs, must be noted in the proposal.

All hardware and software installed during the scope of this project are to be tested and demonstrated to MxD and RIA personnel during commissioning.

1. Facility Upgrades

RIA-JMTC will undergo a series of facility upgrades as evaluated during site MxD visits. Assumptions for these upgrades shall be included in the quotation. Upgrades might include but are not limited to:

- Electrical power service including conduit and outlets and/or direct hookup to the System including RRHs per local code requirements.
- Ethernet hookup to the System including RRHs. This can be wire or fiber.
- Network hookup to the RIA-JMTC ICN. Hardware, such as server racks or mounting brackets, are to be included.
- Heating, ventilation, and air conditioning (HVAC) service extension to the system rack.

2. Project Responsibilities

The contractor is responsible for all aspects of system design, procurement, installation, configuration, and testing. This includes subcontract management with additional companies if required. Responsibilities, governed by Requirements above, include but are not limited to:

- System architecture and design including high-level design (HLD) and low-level design (LLD)
- Facility analysis including RF planning to determine RRH quantity and placement
- All System hardware for a turn-key system including RRHs and servers.
- All supporting hardware such as server rack and RRH mounting brackets
- All software for 5G core, virtualized radio access network (vRAN) central unit (CU) and distribution unit (DU), and network management
- All software required for remote maintenance service
- All software required for virtualization and network slicing capability
- Onsite installation of the system at RIA-JMTC
- Pre-staged and/or onsite configuration
- Initial SAS setup and provisioning
- Initial tuning and testing of the system
- RF performance testing and facility coverage map generation
- Initial set of SIM cards and SIM provisioning in the unified data repository (UDR)
- Training of RIA-JMTC personnel regarding system operation, configuration, and SIM provisioning
- Full system documentation including architecture schematics and bill of material/software
- Implementation of an ongoing maintenance contract

Table 1: Technical Deliverables

Deliverable	Description	Due
Facility RF Study	Facility RF simulation, RRH placement plan, System rack placement plan, and forecasted RF performance for agreed areas at RIA-JMTC. Use an estimated 15 RRUs for quotation purposes.	Month 1
HLD and LLD Documentation	Documented system architecture, including hardware and software. Bill of material/software including vendor names and locations.	Month 2
System Installation and Configuration	Onsite installation of all hardware at RIA-JMTC. Configuration of all software. Connection of RRHs and network. SAS configured and operational.	Month 4

System Test and Tune	SIMs configured. System RF performance and bandwidth performance tested. Facility RF coverage map completed.	Month 6
System Commissioning	Successful demonstration of System to RIA-JMTC management. Documentation of System performance including bandwidth and RF coverage. Presentation of report of HLD/LLD design objectives verse measured performance.	Month 7
Training	Training of RIA-JMTC personnel to operate and maintain the system. Training of how to manage SIM card activation.	Month 7
Maintenance Contract	Execute a professional services contract with RIA-JMTC for ongoing System maintenance or refer RIA-JMTC to a qualified company. Due to lack of internet access, this must be an onsite service	Month 5

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 RIA-JMTC. 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 2 to their MxD POC to fulfill their reporting requirements. These reports will be accessed by the MxD Director of R&D Projects, MxD Director of Engineering, RIA-JMTC, the MxD POC and other authorized staff members in the course of their official duties.

PROJECT REQUIREMENTS

All proposals must include a requirements verification cross reference matrix (VCRM). VCRM will include how the technical requirements will be verified (Analysis, Inspection, Demonstration, or Test) and when the requirements will be verified.

REPORTING

The contractor is required to submit a weekly project status report which includes progress towards deliverables, including schedule and budget updates.

The contractor is required to submit a test results report for any performance tests listed above at the completion of testing.

The contractor is required to submit a final project report which summarizes the scope of the project, accomplishments, challenges, and lessons learned. The final report shall also incorporate any/all test reports and a time-based summary of expenditures and milestones completion.

Table 2: Program Deliverables

Deliverable	Description	Due
Program Review	Summary of progress towards of objectives and deliverables.	Weekly
VCRM	Summary of how all requirements will be verified, when, and by who	30 days after contract award
Technical Documents and Test Reports	Per Technical Deliverables	Per Technical Deliverables
Final Report	Summary of the project to include accomplishments, challenges, and lessons learned	End of PoP
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 **7 months** from contract award. MxD and RIA-JMTC are 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

The RIA-JMTC is located in Rock Island, IL. 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 to RIA to perform all work as defined above.

Awardee and / or its authorized subcontractor(s) will need to access the RIA-JMTC facility to perform the necessary onsite installation work as outlined in this RFQ. Awardee and / or its authorized subcontractor(s) must meet any terms and conditions for access as set forth by RIA-JMTC.

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 will award a contract type resulting from this RFQ that is most appropriate to the specific procurement and selected Awardee. 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 BY 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 Director of R&D Projects, 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 Director of R&D Projects 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
Requirements Compliance <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>
Respondent Qualifications <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>
Cost Factors <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 contract appropriate to the procurement.

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 (including Attachment 1) no later than 5:00PM Central Time, **May 26th**, 2022. All submissions must be made electronically to projects@mxdusa.org. Please include the RFQ designation: "21-36-05 5G Private System Implementation Quotation <Respondent / Company>" for the file name and in the subject line of the email.

IX. REFERENCES AND ACRONYMS

Table 3: References

Document Title	Document Number
US Code of Federal Regulation	N/A
3GPP TS 23.501 [16]	

Table 4: Acronyms

CBRS	Citizens Broadband Radio Service
COTS	Commercial Off the Shelf
CU	Central Unit
DoD	Department of Defense
DU	Distribution Unit
EB	Evaluation Board
FFRDC	Federally Funded Research and Development Center
ICN	Industrial Control Network
IP	Intellectual Property
ITAR	International Traffic in Arms Regulations
OIB	Organic Industrial Base
PoC	Point of Contact
PoP	Period of Performance
RFQ	Request for Quote
JMTC	Joint Manufacturing and Technology Center
RIA	Rock Island Arsenal
RRH	Remote Radio Head
SAS	Spectrum Access Service
VCRM	Verification Cross Reference Matrix
vRAN	Virtualized Radio Access Network

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(s) are 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.