

**STRATEGIC & SPECTRUM MISSIONS ADVANCED RESILIENT TRUSTED SYSTEMS
(S²MARTS)
REQUEST FOR SOLUTIONS (RFS)**

in support of the

Hardware-in-the-Loop (HWIL) Technology Advanced Testbed (TAT) Prototype
Project

Project No. 20-05

All prospective respondents must be members of the NSTXL consortium.

- 1. Project Title:** Hardware-in-the-Loop (HWIL) Technology Advancement Testbed (TAT)
- 2. Prototype Project Sponsor/Requiring Activity:** U.S. Army Space and Missile Defense Command (SMDC), Research & Advanced Concepts Division (SMDC-TCP-AR), Air & Missile Defense Directorate, Technical Center
- 3. Contracting Activity:** U.S. Navy, Naval Surface Warfare Center, Crane Division (NSWCC)
- 4. Project Background & Current Capability:** The Department of Defense utilizes various test & evaluation processes to support the development, demonstration and assessment of HWIL TAT systems (typically comprised of a family of subsystems and simulated environments). U.S. Army SMDC conceives and matures leap-ahead concepts and technologies to ensure military forces are combat-ready for future wars. To ensure Warfighter effectiveness, both offensive and defensive systems are tested and assessed in environments that replicate operational conditions.

By employing replicable and modular simulated environments, the goal of the HWIL TAT prototype project is to create a testbed that allows for the demonstration, test, and assessment of processes and methodologies to enhance and improve test & evaluation (T&E) capabilities in support of next generation weapon systems. Evaluating systems under test using a testbed-based methodology is not a new concept, however, its application in support of the emerging technology areas supported by this project have not yet been developed. Using this style of simulated testing can identify technology issues (or opportunities) early thus saving tremendous resources when compared to testing a system in an operational, “live”, setting.

Specific technology areas and/or domains impacted by this prototype project will include hypersonics, missile defense solutions, directed energy, and small satellites.

U.S. SMDC is seeking a HWIL TAT prototype that blends existing, modified, and new, physical and virtual models within a common prototype framework capable of supporting the test and assessment of emerging technological systems and capabilities.

5. Desired End-State Objective(s) & Success Criteria:

The Government requires an advanced testbed capable of replicating realistic operational environments that will demonstrate and assess the effect of the simulated environments on critical systems, subsystems, components, sensors, control surfaces, material properties, and critical components (such as Inertial Measurement Units (IMU)) and systems that will enable and advance the most sophisticated weapon systems in the world. The HWIL TAT prototype will also shape advanced directed energy (DE) solutions by hosting emerging DE critical components, which may include beam control, power management, thermal management, and models of laser and Electromagnetic Pulse (EMP) sources. The proposed architecture will encompass:

- A multi-purpose testbed that integrates, simulates, and replicates realistic environments and component/subsystem performance through high-fidelity physics-based models, hardware, and test fixtures, through the use of a standardized prototyping architecture and data flow.
- A dynamic system that can be adapted to address emerging military systems and capabilities, such as future offensive hypersonic and missile defense solutions.
- A design and configuration for both open-loop device characterization and closed-loop dynamic HWIL simulation in order to properly characterize subsystem performance in realistic environments.

The HWIL TAT effort will utilize agile sprint processes and be comprised of multiple, severable phases (executed at the discretion of the Government). The Government will reserve the right to continue pursuit of a solution based on the success of the predecessor phase. However, at the Government's discretion, the subsequent phase may begin prior to the full completion of the previous phase. If all phases are pursued, the length of the project may exceed 41 months. The desired phase durations listed below are for planning purposes and will be finalized based upon the accepted solution(s).

Phase 1

Description: The initial project phase, referred to as Phase 1, is focused on design and initial development the HWIL TAT architecture. Specifically, this includes initial design of the Family of Systems HWIL TAT Architecture and testing environment, to include the

aggregation of the SMDC related portfolio of weapon and sensor systems, subsystems, and components.

Desired Duration: Not to exceed 3 months

Critical Phase 1 Focus Areas & Deliverables:

- Complete initial design of a dynamic architecture developed to support HWIL TAT (Using a Modular Open Systems Approach), to include:
 - Interface standards for each family of prototypes for each phase
 - Database and storage requirements
 - Forecasted timeframes and any dependencies for each future phase
 - An Interface Control Description Document (ICD) for hardware and software interoperability
 - Test objectives, requirements, and assessment criteria to support the creation and maturation of future test models and simulations, both ground and air, to test, assess, and advance emerging military systems and capabilities.

Phase 2

Description: Phase 2 is focused on integrating any design iterations resulting from Phase 1 and completing the Family of Systems Architecture and testing environment, to include the aggregation of the SMDC related portfolio of weapon and sensor systems, subsystems, and components. This phase will also include the design/development of a system architecture and technology testing ecosystem. The technology ecosystem will inform the vision of where to invest HWIL TAT prototype project resources, how to allocate sprints (technological/mission priorities), and when to engage the Warfighter with potential innovations and solutions for each family component.

Desired Duration: Not to exceed 8 months

Critical Phase 2 Focus Areas & Deliverables:

- Completion of high-fidelity models that support TAT (e.g.);
 - Evaluation of material properties (stress, strain, and thermal)
 - Atmospheric models
 - Control and flight guidance at hypersonic speeds
 - Electromagnetic pulses
 - Beam Control (to include adaptive optics)
 - Radar and optics sensor models
 - Non-ballistic trajectory models
 - Lethality

Phase 3

Description: Phase 3 is focused on defining and executing a series of agile sprints of each component (with sprint progression based on the increasing complexity and detail of

components) to support the design and development of the HWIL TAT prototype system using the technology architecture and ecosystem.

Desired Duration: Not to exceed 9 months

Critical Phase 3 Focus Areas & Deliverables:

- Creation of simulated environments that enhance Warfighter lethality and training, to include:
 - Battle Management and Fire Control
 - Target engagement and missile defense
 - Intelligence, surveillance, target acquisition, and reconnaissance

Phase 4

Description: Phase 4 is focused on the design and development of HWIL TAT models -- based upon the technology architecture and ecosystem priorities -- to predict the behavior of systems, subsystems, and components when used in a simulation environment. Simulation environments will include real time and force-on-force (e.g. battle management and fire control) capabilities.

Desired Duration: Not to exceed 12 months

Critical Phase 4 Focus Areas & Deliverables:

- Creation of hardware prototype solutions that will emulate existing and emerging military systems, subsystems, and components, to include:
 - Inertial Measurement Units
 - Shaker Table (to emulate flight vibrations and maneuver)
 - Optics for infrared (visible and near infrared)
 - Missile bodies
 - Missile subsystems
 - Laser sources
 - Radar sources
 - Electromagnetic Pulse sources

Phase 5

Description: Phase 5 is focused on the initial demonstration of the HWIL models along with follow-on iterations to the architecture and ecosystem via agile sprint refreshes used to address the results from initial prototype evaluations and Warfighter feedback. This phase will also deliver a strategy for the infusion of emerging technologies and off boarding of legacy technologies throughout the life cycle. The selected performer will be responsible for providing the initial hardware, software, and facilities required to adequately develop, demonstrate, and assess the initial feasibility of the HWIL TAT prototype concept.

During Phase 5's agile development cycle, there may be a need to update and adapt the system, subsystem, and component technologies and capabilities based on updated

technology roadmaps, encountered dependencies and/roadblocks, and identified future agile sprints.

Desired Duration: Not to exceed 9 months

Critical Phase 5 Focus Areas & Deliverables:

- Development & execution of advanced test and assessment processes and methodologies that will:
 - Provide an assessment of modeling unknowns and uncertainties for future weapon systems, to include hypersonic systems, high energy lasers, missile defense, and small satellites.
 - Support hypersonic flight tests and ground tests, and use post-test assessments to update models/emulators with actual, proven data
 - Use the results and insights gained from performing the modeling and simulation actions to draft and/or mature requirements for future Warfighter solutions and doctrine

Upon successful completion of the HWIL TAT prototype project's Focus Areas, the performer will deliver the HWIL TAT prototype to the U.S. Army Space and Missile Defense Command located in Huntsville, AL. This delivery will include all components, systems, subsystems, and operations, maintenance, and training materials that comprise or support the HWIL TAT prototype. This may also include the initial sustainment of the HWIL TAT prototype during the transition of the HWIL TAT prototype from the contractor to the government.

6. Project Deliverables:

Deliverable 1: Monthly Status Report

Description: Report summarizing the project's process and events/actions completed during the previous month

Frequency: Monthly

Delivery Location: Electronic Submission

Deliverable 2: HWIL TAT Phase 1 Initial Architecture Design

Description: See Technology Objectives & Success Criteria

Frequency: 1/Once

Delivery Location: Electronic Submission

The following deliverables are outlined for planning/proposal purposes only. Details of each deliverable will be confirmed prior to executing the respective phases.

Deliverable 3: HWIL TAT Phase 2 Final Architecture Design & Testing Ecosystem

Description: See Technology Objectives & Success Criteria

Frequency: 1/Once

Delivery Method: Via Electronic Submission

Deliverable 4: HWIL TAT Phase 3 Agile Sprint Reports

Description: See Technology Objectives & Success Criteria

Frequency: Dependent on proposed approach & mission need

Delivery Method: Via Electronic Submission

Deliverable 5: HWIL TAT Phase 4 Predictive Simulation Models

Description: See Technology Objectives & Success Criteria

Frequency: Dependent on proposed approach & mission need

Delivery Method: To Be Determined

Deliverable 6: HWIL TAT Phase 5 Advanced Test & Assessment Processes

Description: See Technology Objectives & Success Criteria

Frequency: 1/Once

Delivery Method: Via Electronic Submission

Deliverable 7: HWIL TAT Prototype System

Description: See Technology Objectives & Success Criteria

Frequency: 1/Once

Delivery Method: Physical shipment to Huntsville, AL

7. Current Project Budget: \$ 45,000,000

This value represents what is currently available for the subject project for Phase 1-5 at the time of the RFS release. Based on the unknowns related to the potential solution(s), final allocation of the funding to the respective technical phases will be finalized once proposals are reviewed and selected. Respondents are encouraged to clearly explain how much of their solution can be developed for the advertised amount. Capabilities or project phases that will require additional funding beyond the project budget must be identified as such.

Allocation of the budget is anticipated as outlined below and is subject to change:

Phase 1: \$1,000,000

Phase 2: \$10,000,000

Phase 3: \$11,000,000

Phase 4: \$12,000,000

Phase 5: \$11,000,000

8. Security Classification, Respondent Restrictions, and other required compliances:

This RFS has been released under Distribution Statement A: *Approved for public release.*

This project encompasses the following restrictions:

- a. Security Classification: Up to SECRET; All contractors who support the HWIL TAT prototype project will be required to have cleared personnel and facilities at the SECRET level prior to Phase 3. Contractors will be required to submit a plan on how and when they will be capable of obtaining a Secret Clearance. If the contractor already has the appropriate clearance level, they should state it in their proposal. It is anticipated that all documentation produced under this effort will be marked as “Distribution Statement D - Distribution authorized to the Department of Defense and U.S. DoD contractors only (fill in reason) (date of determination). Other requests shall be referred to U.S. Army SMDC and NSWCC.
- b. ITAR Compliance is required at the time of submission.
- c. Respondents are limited to domestic companies based in the United States only; Subcontractors/teaming partners may not include foreign entities.
- d. Hazardous Material: None
- e. Additional Restrictions/Requirements:
 - The Government reserves the right to conduct advanced vetting of each respondent, via NSTXL, as it relates to critical aspects of supply chain management, Foreign Ownership Control or Influence (FOCI), and International Traffic in Arms Regulations (ITAR) compliance.
 - Public Law 90-629, “Arms Export Control Act,” dated 26 Dec 2013, as amended (22 U.S.C 2751 et. Seq.) requires that all unclassified technical data with military application may not be exported lawfully without an approval, authorization, or license under EO 12470 or the Arms Export Control Act, Continuation of Export Control Regulations, dated 30 Mar 1984, and that such data requires an approval, authorization, or license for export under EO 12470 or Arms Export Control Act. For purposes of making this determination, the Militarily Critical Technologies List (MCTL) shall be used as general guidance. All documents determined to contain export controlled technical data will be marked with the following notice: *“WARNING: - This document contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., App. 2401 et seq.) Violations of these export laws are subject to severe criminal penalties. Disseminate in accordance with*

provisions of DoD Directive 5230.25, “Withholding of Unclassified Technical Data from Public Disclosure, 6 Nov 1984 Incorporating Change 1, dated 18 Aug 1995.”

- Respondents must be compliant with DoDI 8582.01, “Security of Unclassified DoD Information on Non-DoD Information Systems” and DoDM 5200.01 Volume 4, “DoD Information Security Program: Controlled Unclassified Information”.
- Respondents must implement the security requirements in NIST SP 800-171, “Protecting Controlled Unclassified Information in Non-Federal Information Systems and Organizations”.

9. Level of Data Rights Requested by the Government:

Unlimited rights: The right to use, modify, reproduce, perform, display, release, or disclose technical data in whole or in part, in any manner, and for any purpose whatsoever, and to have or authorize others to do so.

Data Rights and Intellectual Property may be negotiated based on the offeror’s proposed solution.

10. RFS and Response Process:

This project will employ a two-phased evaluation approach for the award of HWIL TAT Prototype OTA. Phase 1 solicits an 8-page Capability Statement and a 5-page Rough Order of Magnitude (ROM) identifying the total price. Upon review of the Capability Statements, the Government will conduct a down selection and may elect to invite more than one respondent to Phase 2 evaluations, the virtual pitch/presentation. During Phase 2, respondents virtually pitch and further discuss their proposed their proposed HWIL TAT solution with the Government project leads.

Evaluation Round One – Technical Capability Statement

Technical Submission	Price Submission
Capability Statement (<8 pages)	Rough Order of Magnitude Only (<5 page)

a. The following is requested from all respondents:

The following formatting guidelines shall be followed by respondents:

- 10-point font (or larger) for all response narratives; smaller type may be used in figures and tables but must be clearly legible.
- Single-spaced, single-sided (8.5 by 11 inches).
- Margins on all sides (top, bottom, left, and right) should be at least 1 inch.

- Page limitations shall not be circumvented by including inserted text boxes/pop-ups or internet links to additional information. Such inclusions are not acceptable and will not be considered as part of the response
 - Files must be submitted in PDF and/or Microsoft Word formats only.
- b. Each submittal **must include** (i) a Cover Page, (ii) a Technical Response, and (iii) ROM pricing that each align to the instructions below:
- i. Cover Page: (Not included within page count) The cover page shall include the company's name, Commercial and Government Entity (CAGE) Code (if available), level of facility clearance (if available), address, primary point of contact, business size, and status of U.S. ownership.

Respondents shall also identify the applicable 10 U.S.C. § 2371b eligibility criteria related to the response (*please identify only one*):

- There is at least one nontraditional defense contractor (*defined below*) or nonprofit research institution participating to a significant extent in the project; **OR**
- All significant participants in the transaction other than the Federal Government are small businesses (including small businesses participating in a program described under section 9 of the Small Business Act (15 U.S.C. § 638)) or nontraditional defense contractors; **OR**
- At least one third of the total cost of the project is to be provided by sources other than the Federal Government.

Note: A *Nontraditional Defense Contractor* is defined as an entity that is not currently performing and has not performed, for at least the one-year period preceding the solicitation of sources by the Department of Defense (DOD) for the procurement of transaction, any contract or subcontract for the DOD that is subject to full coverage under the cost accounting standards prescribed pursuant to 41 U.S.Code § 1502 and the regulations implementing such section.

- ii. Technical Response (Description of Capability):

Responses should be constructed to align with the order of the instructions below (1 - 5).

1. Solution Narrative: Respondents shall concisely describe the approach used to design/deliver a unique prototype solution for the prototype technology objectives defined in RFS Section 5, Desired End-State Objective(s). While these focus areas are of significant importance, responses will be considered as a whole.

The Solution Narrative must also include a discussion on schedule and the timing of all deliverable(s) to include those outlined within RFS Section 6, Project Deliverables.

2. Explanation Supporting Eligibility for Award of a Prototype OTA:

Respondents shall provide rationale to support the specific condition that permits award of an OTA to the proposed prime contractor/performer. The onus of proof to support *nontraditional participation to a significant extent; small business or nontraditional defense contractor status; or any cost sharing arrangement* lies with the respondent and has a direct correlation to award eligibility.

3. Mandatory Compliance with Restrictions: Respondents must address the restrictions identified within RFS Section 8 (Security Classification, etc.), and confirm if each requirement/standard is currently, or will be met.

4. Summary of Subcontractor Participation (if applicable): Respondents must identify all subcontractors involved and their role within the performance of the proposed concept. The information must include the following:

- a. Subcontractor company name, Commercial and Government Entity (CAGE) Code (if available), level of facility clearance (if available), address, primary point of contact, business size, and status of U.S. ownership.
- b. If the subcontracted company's involvement is considered significant, rationale supporting the significance must be present within the narrative. The onus of proof to support participation to a significant extent or any cost sharing arrangement lies with the respondent and has a direct correlation to award eligibility.
- c. If applicable, Foreign Owned, Controlled, or Influenced (FOCI) Mitigation Documentation shall be provided for subcontractors and will not count towards the page count.

5. Data Rights Assertions and Level of Rights Proposed:

- a. The rights offered should be displayed in a manner that allows for ease of discussion in determining trade-offs and potential options for long-term sustainability of the deliverables of this effort.
- b. If rights are being asserted at a level less than the Government's desired level of allocation (see RFS Section 9, Level of Data Rights Requested by the Government), respondents must provide detail explaining the specific

rationale for the assertion. Please also review 9(b)(iii)(3) below for additional requirements related to data rights pricing.

- c. Any items previously developed with federal funding (and used for the proposed solution) should clearly identify all individual components funded by the Government and the recipient of the deliverables.
- d. If commercial software is proposed as part of the prototype solution, all applicable software licenses must be identified and included with the response. Note that any software license term or condition inconsistent with federal law will be negotiated out of the license.

iii. Price Response (Rough Order of Magnitude):

Respondents shall submit a Rough Order of Magnitude (ROM) price response and a notional schedule that aligns with Phases 1-5 listed in Section 5.

The ROM should include top level estimates for Phases 1-5 and identify any significant drivers for the phase pricing. Pricing for the phases will be finalized prior to the execution of each phase (if pursued).

If limited or restricted rights are being asserted within the response, a table that includes prices for both Government Purpose Rights and Unlimited Rights for any limited or restricted items must be included as an Attachment.

11. Evaluation Process and Methodology:

- a. Individual responses will be evaluated with consideration given to:
 - i. Demonstrated expertise and overall technical merit of the response;
 - ii. Feasibility of implementation; and
 - iii. Total project risk as it relates to the technical focus areas, price and schedule
- b. The Government will evaluate the degree to which the Capability Statement provides a thorough, flexible, and sound approach in response to the prototype technical objectives as stated in RFS Section 5, Desired End-State Objectives, as well as the potential to fulfill the objectives in this RFS. If invited to proceed to Phase 2 of the selection process, selected respondents will be provided additional process details and information.
- c. The Government will award this project, via S²MARTS (Agreement No. N00164-19-9-0001), to the respondent(s) whose solution is assessed to be the most advantageous to the Government, when price, schedule, technical risks, the level of data rights, and other factors are considered. The Government reserves the right to award to a respondent that does not meet all the requirements of the RFS.
- d. The proposed project ROM, schedule, and intellectual property/data rights assertions will be considered as aspects of the entire response when weighing risk and reward. The

assessment of risks is subjective and will consider all aspects of the proposed solution. Respondents are responsible for identifying risks within their submissions, as well as providing specific mitigating solutions.

- e. The Government reserves the right to reject a submission and deem it ineligible for consideration if the response is incomplete and/or does not clearly provide the requested information. Debriefings will not be provided.

12. Follow-On Activity:

- a. Upon successful completion of this prototype effort, the Government anticipates that a follow-on production effort may be awarded via either contract or transaction, without the use of competitive procedures if the participants in this transaction successfully complete the prototype project as competitively awarded from this document. The prototype effort will be considered successfully complete upon demonstration of the aforementioned technology objectives.
- b. Successful completion for a specific capability may occur prior to the conclusion of the project to allow the Government to transition that aspect of the prototype project into production while other aspects of the prototype project have yet to be completed.
- c. Requirements of other potential follow-on activities could involve, though not limited to, continued development and baseline management, fielding, sustainment, training, further scaling of the solution, integration of future capabilities, or integration of the solution with other capabilities.

13. RFS Attachments

- a. N/A

14. Important Dates

- a. Questions related to this RFS shall be submitted via email to **S2MARTS@nstxl.org** no later than Thursday, May 28, 2020 .
- b. Proposals submitted in response to this RFS are due no later than Thursday, June 18, 2020.
- c. To submit your proposal, visit the opportunities page at www.nstxl.org/opportunities, select the “Current” tab, locate the respective project, and select the “Submit Proposal” link. You must have an active account and be logged-in to submit your response.

- d. RFS Respondents must be active members of the consortium at the time of proposal submission.

15. Additional Project Information

- a. The Government intends to award one Other Transaction Agreement as a result of this RFS; however, more than one award may be made if determined to be in the Government's best interest. The Government also reserves the right to not select any of the solutions proposed.
- b. Acceptable responses not selected for the immediate award will be retained by NSTXL & the Government for possible future execution and funding. The non-selected proposals will be considered as viable alternatives for up to 36 months. If a proposal (that was not previously selected) is determined to be a suitable alternative, the company will be contacted to discuss any proposal updates and details of a subsequent project award.

Respondents whose proposals are not selected for the initial award shall not contact the Government or NSTXL to inquire about the status of any ongoing effort as it relates to the likelihood of their company being selected as a future alternative.

- c. The United States Navy, specifically Naval Surface Warfare Center, Crane Division, has release authority on any publications related to this prototype project.
- d. Unsuccessful respondents will be notified, however, debriefings for this project are not required nor planned at this time.
- e. If resource-sharing is proposed in accordance with 10 U.S. Code § 2371b(d)(1)(C), then the non-Federal amounts counted as provided, or to be provided, by parties other than the Federal Government may not include costs that were incurred before the date on which the OT agreement becomes effective. Costs offered as a resource-share that were incurred for a project after the beginning of negotiations, but prior to the date the OT agreement becomes effective, may be counted as non-Federal amounts if and to the extent that the Agreements Officer determines in writing that: (1) the party other than the Federal Government incurred the costs in anticipation of the OT agreement; and (2) it was appropriate for the entity to incur the costs before the OT agreement became effective in order to ensure the successful implementation of the OT agreement.
- f. Certain types of information submitted to the Department during the RFS and award process of an OT are exempt from disclosure requirements of 5 U.S.C. § 552 (the Freedom of Information Act or FOIA) for a period of five years from the date the Department receives the information. It is recommended that respondents mark business plans and technical information that are to be protected for five years from FOIA disclosure with a legend identifying the documents as being submitted on a business confidential basis.

- g. No classified data shall be submitted within the proposal. To the extent that the project involves DoD controlled unclassified information, respondents must comply with DoDI 8582.01 and DoDM 5200.01 Volume 4. Respondents must implement the security requirements in NIST SP 800-171 for safeguarding the unclassified internal information system; and must report any cyber incidents that affect the controlled unclassified information directly to DoD at <https://dibnet.dod.mil>.
- h. Export controls (if applicable): Research findings and technology developments arising from the resulting proposed solution may constitute a significant enhancement to the national defense and to the economic vitality of the United States. As such, in the conduct of all work related to this effort, the selected performer must comply strictly with the International Traffic in Arms Regulation (22 C.F.R. §§ 120-130), the National Industrial Security Program Operating Manual (DoD 5220.22-M) and the Department of Commerce Export Regulation (15 C.F.R. §§ 730-774).