

AEDC Facility Digital Twins and Predictive Analytics

1.0 Program Objectives

It is the intent of the Arnold Engineering Development Complex (AEDC) to modernize its facility documentation and digital asset management capabilities by creating a comprehensive suite of high-fidelity, as-built 3D models of critical test facility infrastructure. This suite of models will provide accurate as-built, up to date, models and drawings capturing the current configuration of these facilities. The primary goal is to yield significant value by providing accurate as-built models and drawings to support future projects by reducing project timelines, reducing costs, enhancing operational safety, and improving configuration management.

This is a multi-year, phased program. The initial phase, planned for execution in Fiscal Year 2027, comprises the comprehensive scanning and modeling of the Von Kármán Gas Dynamics Facility (VKF), which includes both the facility buildings and the associated yard area. Subsequent phases will address the remaining facilities over the next four years (out-years) identified in Section 5.0.

2.0 Contract Objectives

The offeror shall propose a comprehensive, innovative, and compliant solution to provide all personnel, equipment, materials, and services necessary to accomplish the program objectives. At a minimum, the offeror's proposed Statement of Work (SOW) must provide a detailed plan that meets or exceeds the objectives defined throughout this SOO.

3.0 Quality Control

The offeror shall propose a robust Quality Control Plan (QCP) that describes the processes, procedures, and internal controls to ensure all requirements and objectives specified in this SOO are met. The QCP must detail the offeror's methodology for the internal verification and validation of deliverable quality, from initial data acquisition through final model submission, ensuring compliance with the accuracy, LOD, and completeness requirements in Section 6.0.

4.0 Program Management

The objective is to allow the contractor maximum flexibility to innovatively manage the schedule, performance, and risks to satisfy the Government's performance requirements. The offeror shall propose a Program Management Plan (PMP) that details their approach to project oversight, formal communication, risk management, and schedule management. The PMP must include a proposed Integrated Master Schedule (IMS) and describe how the contractor will coordinate with all relevant Government stakeholders, including engineering, security, and facility management personnel, while maintaining clear Government visibility into project status throughout the contract period of performance.

5.0 Facility List

The offeror shall propose a solution to perform 3D scanning and modeling for the following list of AEDC facilities. The program will be executed in phases, with the initial phase focused on the Von Kármán Gas Dynamics Facility (VKF) Yard and Plant areas.

Facility Scanning and Modeling Program Overview:

Fiscal Year	Facility	Est. Area (sq ft)	Scan Levels*	Total Scan Area (sq. ft.)
FY27	VKF Yard and Plant	260,000	4	1,040,000
Out-Years	PWT (16S, 16T, 4T)	660,000	6	3,960,000
Out-Years	ETF	680,000	6	4,080,000
Out-Years	ASTF	620,000	9	5,580,000
Out-Years	J5, SL-2, SL-3	300,000	4	1,200,000
Out-Years	J6	230,000	7	1,610,000
Out-Years	Mark One & Space Test Cells	100,000	8	800,000
Out-Years	APTU	100,000	3	300,000
Out-Years	MIB Building	45,000	6	270,000
Out-Years	Decade Building	58,000	3	174,000
Out-Years	ETF Fuel Farm	40,000	2	80,000
Out-Years	Steam Plant	34,000	3	102,000
Total		2,527,000		18,516,000

**Scan Levels are derived from the average facility height divided by 12 feet. Note: The areas and scan levels provided are Government estimates for planning purposes only. Offerors are responsible for validating the scope required to meet the performance parameters defined in this SOO as part of their proposal development.*

6.0 Technical Performance Requirements**6.1 Facility Background**

Arnold Engineering Development Complex (AEDC) is the most advanced and largest complex of flight simulation test facilities in the world. The facilities in this program are unique national assets with highly complex, dense infrastructure. The objective of this program is to create a comprehensive, engineering-grade 3D model repository of this infrastructure to support future engineering, maintenance, and modernization efforts.

6.2 Technical Objectives

The offeror 's proposed solution shall provide a detailed methodology to meet or exceed the following technical objectives:

- **6.2.1 Model Accuracy:** The contractor's process must ensure a final model dimensional accuracy of at least +/- 1/4 inch, globally referenced to the established project survey control. This tolerance is the maximum acceptable deviation between a point on the model and the corresponding point on the registered point cloud. A solution that details a methodology to achieve a verifiable accuracy of +/- 1/8 inch will be viewed favorably.
- **6.2.2 Level of Detail (LOD):** The contractor shall deliver 3D models developed to a minimum of LOD 350. This means all modeled elements, including structural, mechanical, and major electrical systems, shall be graphically represented as specific assemblies with accurate quantity, size, shape, location, and orientation. The model must be suitable for detailed multi-disciplinary design coordination, clash detection, and future engineering layout work. A solution that includes a plan to achieve LOD 400 for primary structural and mechanical connection points (e.g., pipe flanges, equipment anchor plates, structural steel connections), making them suitable for pre-fabrication verification, will be viewed favorably.
- **6.2.3 VKF Facility Buildings Coverage:** The contractor shall propose a solution to model all interior elements unless explicitly excluded. The scope includes all structural components (slabs, columns, beams, bracing), all major test-related machinery and equipment, all pressure-retaining systems (piping, tubing, vessels, devices), and all associated supports, platforms, walkways, and mezzanines. Exclusions are to be limited to:
 1. General electrical branch conduits and wiring.
 2. HVAC branch ductwork.
 3. Physically inaccessible areas.
 4. The interior architectural finishes of office spaces (where only the primary structure is required).

All process piping, pressure-retaining systems/components/devices, and testing infrastructure within the buildings shall be modeled as part of the Intelligent Process Model (see Section 6.2.6).

- **6.2.4 VKF Yard Area Coverage:** The offeror shall propose a solution for the comprehensive scanning and modeling of all exterior infrastructure, equipment, and components that support VKF testing. The scope is total, with only explicitly identified abandoned-in-place systems being excluded. The proposed scope must include but is not limited to all structures and their foundations, all pressure-retaining systems and components (e.g., piping, tubing, vessels, devices, heat exchangers), major electrical equipment, and all associated support structures and ducting. All process piping, pressure-retaining systems/components/devices, and testing infrastructure within the yard areas shall be modeled as part of the Intelligent Process Model (see Section 6.2.6).
- **6.2.5 Exclusion Reporting:** The offeror shall propose a formal process for the creation and delivery of an Exclusion Justification Report. This report must detail every component or area that was not modeled, providing clear justification (e.g., physically inaccessible, SOW exclusion), photographic documentation, and a description of the model's boundary at that location.

- **6.2.6 Intelligent Process Model (Plant 3D):** In addition to the architectural/structural model, the contractor shall deliver a separate, intelligent process model created in Autodesk Plant 3D. This model shall contain all process piping, pressure-retaining systems/components/devices, and testing infrastructure. The model must be data-centric, with components linked to project-specific piping specifications and aligned with existing AEDC P&IDs. A solution that details a plan to embed key metadata (e.g., line number, material, pressure rating) directly into the model components will be viewed favorably.

7.0 System Attributes and Deliverables

7.1 Overview

This section defines the objectives for the usability, functionality, and long-term value of the deliverables. The offeror's proposal must detail their approach to meeting or exceeding these objectives, demonstrating an understanding that the final products must be accessible and integrated assets for AEDC personnel.

- **7.1.1 Data Deliverable Formats:** The offeror shall propose a deliverable package that provides data in both native authoring and open-standard formats. At a minimum, this must include:
 1. Architectural/Structural Model: Native Autodesk Revit (RVT) files for the models.
 2. Intelligent Process Model: Native Autodesk Plant 3D project files.
 3. 2D Drawing Files: A complete set of key plans, elevations, and sections exported from the models in Autodesk AutoCAD (DWG) format.
 4. Registered Point Cloud: A unified point cloud in Autodesk ReCap (RCP) format.

A solution that also provides an open-standard Industry Foundation Classes (IFC) model, a structured ASTM E57 point cloud, and a published Navisworks (NWD) review model will be viewed favorably.

- **7.1.2 Model Naming and Structure:** The offeror shall propose a methodology for logically structuring the 3D model. This plan must detail how all modeled elements in both the architectural/structural and intelligent process models will be named according to AEDC P&IDs, and how the model's breakdown structure will align with AEDC's asset hierarchy to allow for system-level filtering, isolation, and seamless integration with existing asset management databases.
- **7.1.3 Virtual Walkthrough Capability:** The contractor shall provide a solution that enables Government personnel to conduct immersive virtual walkthroughs. The solution must, at a minimum, support navigation and point-to-point measurement within the native Revit environment. The federated review model must incorporate both the architectural/structural model and the intelligent process model into a single, coordinated environment. A solution that includes and provides licenses for a dedicated design review platform (e.g., Autodesk Navisworks

Manage) for federated model review, object property interrogation, dynamic sectioning, and clash detection will be viewed favorably.

- **7.1.4 Quality Assurance and Control:** The offeror shall propose a quality control process that details the methodology for ensuring all technical requirements are met. The proposal must describe the process for creating a Model Quality Control Report that includes, at a minimum, documented dimensional spot checks. A solution that incorporates advanced techniques, such as formal deviation analysis reports (heat maps), and provides Government access to the validation software project files for independent verification, will be viewed favorably.
- **7.1.5 End-User Training:** The offeror shall propose a formal training program designed to ensure AEDC personnel can effectively utilize all deliverables. The curriculum must address all delivered software platforms, including specific modules for the architectural model (e.g., Revit), the intelligent process model (e.g., Plant 3D), and the design review platform (e.g., Navisworks). The proposal must describe the training materials and how it will result in attendees demonstrating proficiency in model navigation, measurement, and data management. A solution that includes a long-term technical support agreement with a guaranteed response time and a program of periodic follow-on training sessions will be viewed favorably.

8.0 Security, Safety, and Policy Requirements

8.1 Overview

This section details the mandatory security, safety, and operational policy requirements. These are non-negotiable conditions of performance. The offeror's proposal must explicitly affirm their understanding of and ability to comply with every requirement herein.

- **8.1.1 Data Security:** All project data, including raw scans, processed data, models, and reports, shall be handled as Controlled Unclassified Information (CUI). The contractor must demonstrate a mature cybersecurity posture and the ability to comply with NIST SP 800-171 for data handling, storage, and processing. The proposal must describe the offeror's secure data lifecycle management plan, from initial transfer to final project closeout and data sanitization.
- **8.1.2 Location of Performance:** All work, including all scanning, data processing, 3D modeling, and analysis, shall be performed within the continental United States (CONUS). No project data, in any form, shall be transmitted to, stored in, or accessed from an overseas location or by non-U.S. persons.
- **8.1.3 Personnel Security:** All contractor and subcontractor personnel performing any work on this project, whether on-site or off-site, must be U.S. Citizens. The contractor is responsible for managing the entire security process for their personnel. All personnel must be able to pass background checks sufficient to be granted access to CUI and, for on-site personnel, to obtain a Common Access Card (CAC) or other credential required for unescorted base access via DBIDS.
- **8.1.4 Operational Constraints:** The contractor's on-site activities must not interfere with the facility's operational testing schedule. The offeror must describe their methodology for

developing a flexible work plan that maximizes data acquisition during non-operational periods. This plan must include their capability and willingness to perform work on third shifts, weekends, and during scheduled facility outages.

- **8.1.5 Technology and Equipment Approval:** All data-gathering equipment (e.g., scanners, drones, data collectors) must be submitted on a detailed inventory list and receive formal written approval from AEDC authorities prior to being brought on base. The offeror must describe their process for managing this approval cycle to prevent schedule delays.
- **8.1.6 Photography and Imagery Approval:** Any use of photographic or video equipment requires separate, explicit approval from AEDC authorities. The offeror must describe their plan for acquiring necessary photographic documentation, detailing how they will either get their own equipment and personnel approved or how they will coordinate with designated AEDC photographers to meet deliverable requirements.

9.0 Government Furnished Information (GFI)

The Government will provide the contractor with timely access to the following information, as available, to support the execution of this contract:

- **9.1 Engineering Documents:** Existing Piping and Instrumentation Diagrams (P&IDs), Piping Material Specifications, Equipment and Instrument Datasheets, and existing facility drawings. The Government does not guarantee the accuracy of this information; it is provided as a reference to support the creation of the intelligent model.
- **9.2 Standards:** Access to the latest version of the AEDC Drafting Standards.
- **9.3 Site Access:** Access to facility sites and coordination for required TOS escorts for all approved on-site activities.