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# NOT SENSITIVE IRA-7005

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## STATEMENT OF WORK

### FOR DESIGN AND SUPPLY OF

### RANGES INFRARED CAMERA SYSTEM

ARNOLD ENGINEERING DEVELOPMENT COMPLEX

ARNOLD AIR FORCE BASE, TENNESSEE 37389-9998

NOT SENSITIVE – IRA-7005

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## 1. SCOPE

- 1.1 The Contractor shall provide (4) high-resolution infrared camera systems for the Ranges Test Facilities. The Contractor shall deliver infrared camera systems with all system hardware, software, training, maintenance materials, data and acceptance testing to Arnold AFB, TN in accordance with this SOW.
- 1.2 Background
- 1.2.1 The Ranges Infrared Camera System is a critical system for operations at the Ranges Test Facilities. The hardware for the existing infrared camera system is obsolete and lacks critical resolution requirements for test programs. Therefore, a replacement for the existing infrared camera system is required.
- 1.2.2 The external systems that interface to the Infrared Camera System are shown in Figure 1.1, and the interfaces are specified in the provided legend.
- 1.2.3 The Infrared Camera System provides temperature data of in-flight projectiles, communicates with the Ranges Test Control Sequencer for triggering functions, provides data to the control computer via a facility fiber-optic data network, and supplied 120VAC from facility receptacles.
- 1.2.4 The user interfaces for the Infrared Camera System includes a control computer in the control room. The control computer is connected to a facility fiber-optic data network to control the Infrared Camera System remotely.

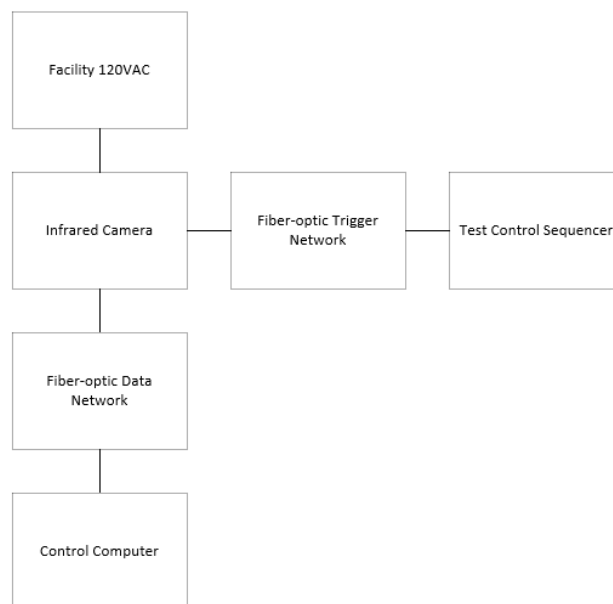


Figure 1.1 Infrared Camera System Scope Diagram

## **2. APPLICABLE DOCUMENTS**

2.1 Government Documents: None.

2.2 Non-Government Documents:

2.2.1 National Fire Protection Association:

A. NFPA 70-20                      National Electric Code (NEC).

## **3. REQUIREMENTS**

3.1 General:

3.1.1 The Contractor shall identify a hardware and software recommendations and provide an operational suitable system.

3.1.2 Based on Government acceptance of the design and implementation approach, the Contractor shall deliver the Infrared Camera System. All hardware/equipment, parts, and software and licenses shall be included with the Infrared Camera System. The Contractor shall develop simulations necessary to verify the capabilities and functions during the design and development phase.

3.1.3 The Contractor shall provide installation drawings and applicable instructions for the pre-installation cabling and the full installation.

3.1.4 The Contractor shall provide installation and acceptance testing and commissioning oversight. The Contractor shall also provide onsite training and training materials.

3.1.5 Operations and Maintenance:

A. O&M Life Cycle Cost Analysis. The Contractor shall deliver an Operations and Maintenance Life Cycle Cost analysis for the Infrared Camera System. Include expected life of major components, replacement expectations, and maintenance costs.

3.1.6 Reliability and Maintainability:

A. The Infrared Camera System shall be designed for use up to 30 minutes during test setup and during a test. Testing rate is approximately 50 tests per year.

B. Reliability is defined as the probability of the Infrared Camera System operating successfully for a ballistic range test operation. Preconditions are that the maintenance instructions and pre-

operations procedures prescribed by the contractor are followed. For this case the reliability shall not be less than 98.5% (3 temperature measurement failures in 200 test operations).

- C. Service manuals shall be provided for all delivered equipment.
- D. A list of spare components of COTS (commercial off the shelf) equipment shall be provided.

### 3.2 Interface Requirements:

- 3.2.1 All modules shall interface with existing range timing and event control equipment (see Figure 1.1). This includes TTL-level signals used for triggering.
- 3.2.2 The power source for the system shall be 120VAC 60 Hz.
- 3.2.3 Equipment wiring shall comply with the most recent NFPA 70 (National Electric Code).

### 3.3 Performance Requirements:

- 3.3.1 The system shall be capable of being operated remotely via a computer.

### 3.4 Environmental Conditions:

- 3.4.1 Operating temperature range shall be from -20°C to +50°C.
- 3.4.2 Storage temperature range shall be from -40°C to +70°C.
- 3.4.3 Humidity range shall be 0-50% non-condensing.

### 3.5 Physical and Spatial Requirements:

- 3.5.1 Weight of any single component shall not exceed 50 pounds.
- 3.5.2 Dimensions of the camera shall not exceed 13"x8"x7" without lens attached.

### 3.6 Technical Requirements:

#### 3.6.1 Camera

- A. The spectral range shall be 3 microns to 4.9 microns.
- B. The measurable temperature range shall be 0-3000°C.
- C. The detector type shall be cooled MCT.

- D. The spatial resolution shall be 640x512 pixels or more.
- E. The detector pitch shall be 16 micron or less.
- F. The camera shall have the ability to capture single full-frame images, if desired, in snap-shot mode.
- G. The exposure time shall be a minimum of 0.2 microseconds or less.
- H. The typical NETD (noise equivalent temperature difference) shall be 17 milli-Kelvin (though not greater than 1,000 milli-Kelvin) throughout measurable temperature range, while at the minimum exposure time, and while operating in snap-shot mode. Achieving NETD throughout the measurable temperature range may be achieved through use of up to three (3) selectable settings and filters.
- I. The dynamic range shall be 16-bit.
- J. The internal memory buffer shall be up to 32 gigabytes.
- K. The camera shall include enhanced high dynamic range imaging.
- L. The camera shall have the ability to accept warm/ND filters either by manual insertion into a static filter holder, or through a filter wheel (manual or remotely addressable)

### 3.6.2 Lens

- A. The lens mount shall be a bayonet interface to the camera.
- B. The focal length of the lens shall be 25mm.

### 3.6.3 Mount

- A. The camera shall be capable of receiving a 1/4-20 bolt on the bottom of the camera to interface with facility mounting hardware.

### 3.6.4 Control Computer

- A. The control computers shall operate on a 64-bit Windows 10 operating system or newer.
- B. The control computers shall have sufficient performance such that the software utilized to control the camera and receive/process collected data is uninhibited.
- C. The control computers shall be rack-mountable in a standard 19" rack.

- D. The control computers shall contain no wireless capability (e.g., Bluetooth, Wi-Fi, etc.).

#### 3.6.5 Calibration

- A. The system shall be delivered with a permanent calibration from 0°C to 2500°C.

### 3.7 Design and Administrative Requirements:

- 3.7.1 The Contractor shall produce and provide all drawings and user manuals required to fully operate and maintain the system.

### 3.8 Verification and Testing

#### 3.8.1 Site Acceptance Testing

- A. Commissioning Plan. The Contractor shall develop a Commissioning Plan to verify the hardware, software, basic function, and external systems communication. This plan shall verify the system is ready to execute checkout using the System Test Plan. The Commissioning Plan shall be executed by the Contractor at the Ranges Test Facility after the Infrared Camera System has been installed and all external system interface terminations have been made and checked. The plan shall also verify the system was not damaged during shipment to the Ranges Test Facility.
- B. System Test Plan. The Government will generate a System Test Plan (STP) to verify all functionality and operation of the Infrared Camera System and that all requirements have been met, which will include commanding the external systems, completing sequence run scenarios, and running full checkouts of one of the launchers with required systems and utilities. The STP will be executed by the Government with the Contractor present.
- C. System Acceptance. System Acceptance will be based on successful completion of Site Acceptance Testing, which includes execution of the Commissioning Plan and the System Test Plan.

- 3.8.2 Calibration: The Contractor shall provide the Infrared Camera System with permanent calibration included in the system.

### 3.9 Training

- 3.9.1 The Contractor shall provide on-site training during the system test/verification phase. The Contractor shall deliver training plans and manuals. The training shall instruct the Government and designated

AEDC engineers on how to operate, maintain, and modify the system, including the operator user interface, user programming interface, and hardwired operator interface panel. The training shall also include instructions on basic analysis.

3.10 Submittals – Provide the following in accordance with Appendix A, Submittal Procedure.

3.10.1 The following are types of submittals shall be included in design review submittals or as otherwise required:

- A. System Interface Diagrams. The Contractor shall deliver system interface diagrams including a hardware interface diagram. The hardware interface shall be in a block diagram format.
- B. Parts List and Spare Parts List. The Contractor shall deliver a list of all components, hardware, and software included in the system. Information shall include part name or number, description, dimensions (if applicable), quantity, manufacturer, vendor, price, and expected lead time from order. Identify recommended spare parts, including critical components for system operation.
- C. Installation Drawings and Instructions. The Contractor shall provide installation drawings and any applicable instructions for the pre-installation cabling and full installation by the Government personnel performing the work.
- D. System Manuals and Procedures. The Contractor shall deliver system procedures for any specific power up, power down, operation, and maintenance of the new Infrared Camera System, as well as user operating and maintenance manuals and datasheets for system hardware and software.
- E. Factory Acceptance Test Plan. The Contractor shall deliver a plan that defines the test objectives needed to verify all system requirements have been met. The plan shall include test cases that simulate Infrared Camera System operation and shall state how each requirement will be verified. A copy of the test plan documenting successful completion shall be supplied prior to shipment.
- F. Training Plans and Manuals. The Contractor shall deliver training plans, manuals, and any other documentation needed for the on-site training of Government personnel.
- G. O&M Life Cycle Cost Analysis. The Contractor shall deliver an Operations and Maintenance Life Cycle Cost analysis for the Infrared Camera System. Include expected life of major



components and replacement expectations, and maintenance costs.

3.10.2 Required submittal summary table:

Table 2 Submittal Summary

No.	Section Reference	Submittal Description
1	3.10.1.A	System Interface Diagrams
4	3.10.1.B	Parts List and Spare Parts List
5	3.10.1.C	Installation Drawings and Instructions
6	3.10.1.D	System Manuals and Procedures
7	3.10.1.E	Factory Acceptance Test Plan
9	3.10.1.F	Training Plan and Manuals
10	3.10.1.G	O&M Life Cycle Cost Analysis

APPENDIX A  
SECTION 01 33 00  
SUBMITTAL PROCEDURE

**PART 1 GENERAL**

- 1.1 DESCRIPTION OF REQUIREMENTS. This section specifies procedural requirements for non-administrative submittals, including but not limited to shop drawings, product data, manufacturer's certificate, design data, calculations, and verifications, manufacturer's instructions, manufacturer's field service reports, samples, operation and maintenance manuals, and other miscellaneous work-related submittals. These submittals are required to amplify, expand, and coordinate other information contained in the contract. This section describes the type and content of submittals that may be required for this work. The required submittals are included in the Statement of Work or Specification.

Non-work-related submittals are addressed elsewhere in the contract rather than in the specification and may include items such as: contract progress schedule, permits, payment applications, performance and payment bonds, insurance certificates, and progress reports.

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections of the Specification or Statement of Work.

1.2 SUBMITTAL PROCEDURE

- A. Definition: For the purposes of this section, the term "Contractor" denotes the prime Contractor.
- B. Listing: At the end of the Statement of Work is a summarized listing of item submittals requiring approval for the work. The listing is included for the convenience of users of the contract documents. The listing may not be all inclusive and additional item submittals may be required. Within 14 calendar days after receiving contract award, Contractor shall submit a copy of the summarized submittal listing with calendar dates assigned to each item submittal indicating when submittal will be received by the Government. If contract requires a pre-construction conference, Contractor may submit completed submittal listing at the conference.
- C. Risk: Do not proceed with the part of the work covered by an item submittal including purchasing, fabricating, and delivering until approval is received. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection. Any fabrication or other work performed in advance of the receipt of accepted

item submittals and approvals shall be entirely at the Contractor's risk and expense.

- D. Transmittal Timing: Coordinate the preparation and processing of item submittals with the performance of the work. Prepare and transmit each item submittal to the Contracting Officer sufficiently in advance of the performance of related work and other applicable activities. Transmit related item submittals for the same unit of work so that processing will not be delayed by the Government's need to review submittals concurrently for coordination. No delay damages or time extensions will be allowed for time lost in late submittals.
- E. Content: Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. All submittals which are generic and list more information than is specifically required shall be marked to identify required information. Complete a material approval submittal and attach as cover sheet for each submittal. Contractor may include multiple item numbers on a material approval submittal.
- F. Language: All item submittals shall be written in English, including documents, notes on drawings, sketches, and/or samples, calculations, manuals, and all other instances of written text and communication.
- G. Units: All item submittals shall be marked or show dimensions and values in the same units as specified in the contract documents.
- H. Review Time: Allow sufficient time so that contract performance will not be delayed as a result of the time required to properly process submittals, including time for re-submittals, if necessary. Allow 14 calendar days for initial Government processing of each submittal. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Government sufficiently in advance of the work.
- I. Contractor Certification: All submittals shall be carefully reviewed by an authorized representative of the Contractor prior to submission to the Government. Each submittal shall be dated, signed, and certified by the Contractor as being correct and in strict conformance with the contract documents. No consideration for review by the Government of any Contractor's submittal will be made for any items which have not been so certified by the Contractor. All noncertified submittals will be returned to the Contractor without action taken by the Government, and any delays caused thereby shall be the total responsibility of the Contractor.
- J. Deviations: Should any item submittals required by the contract documents show deviations from the contract requirement, the Contractor shall make specific mention of such deviations in the letter of transmittal, including

stating cost effects, and product and system limitations which may adversely affect the work, in order that if acceptable, suitable action may be taken for proper adjustment of the contract; otherwise the Contractor will not be relieved of the responsibility for executing the work in accordance with the contract documents and the approved submittals. Contractor shall clearly mark the proposed variation in all documentation and specifically point out deviations from contract requirements in transmittal letters. Failure to point out deviations may result in the Government requiring rejection and removal of such work at no additional cost to the Government. Deviations from contract requirements require Government approval and will only be considered when advantageous to the Government. When proposing deviations, deliver written request to the Contracting Officer, with documentation of the nature and features of the deviation and why the deviation is desirable and beneficial to the Government. If lower cost is a benefit, include an estimate of the cost savings. In addition to documentation required for deviation, include the submittal information required for the item. Allow an additional 14 calendar days beyond normal submittal review period for consideration by the Government of submittals with deviations.

- K. **Approved Submittals:** The part of the work covered by the approved item submittal may proceed provided it complies with the requirements of the contract documents. Final acceptance will depend upon that compliance. The term "Approved" shall only indicate that there is no exception taken to the submittal. Approval of the item submittal shall not be construed as a complete check, and indicates only that the general method or other information appears to meet the contract requirements. Approval does not relieve the Contractor of the responsibility for any error which may exist. After item submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment, or changes to any other information will be considered unless accompanied by an explanation of why a substitution or change is necessary.
- L. **Disapproved Submittals:** Contractor shall correct disapproved item submittals and resubmit for approval within timeframe noted. If no date is given, Contractor shall submit corrected submittal within 14 calendar days. If the Contractor considers any correction or notation on the returned submittal to constitute a change to the Contract Drawings, Specification or Statement of Work the Contractor shall notify the Contracting Officer.
- M. **Responsibility:** The Government's review of Contractor submittals shall not relieve the Contractor of the entire responsibility for the correctness of details and dimensions and conformance to the specifications. The Contractor shall assume all responsibility and risk for any mistakes and/or costs due to any errors in submittals.

- N. Inconsistencies: If a conflict or inconsistency arises between an approved item submittal and the contract documents, the contract documents shall govern.

1.3 SPECIFIC SUBMITTAL DESCRIPTIONS AND REQUIREMENTS: Submittal requirements for individual units of work are specified in the applicable specification section or Statement of Work (SOW). Except as otherwise indicated in the individual specification sections or SOW, comply with the following requirements for each type of submittal.

- A. Shop Drawings: These are technical drawings and data specially prepared for this contract including fabrication and installation drawings, setting and seaming diagrams, and coordination drawings (for use on-site). Shop drawings include drawings, diagrams and schedules specifically prepared to illustrate some portion of the work, diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project, or drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated. Information required on shop drawings includes dimensions, identification of specific products and materials which are included in the work, compliance with specified standards, and notations of coordination requirements with other work. Provide special notations of dimensions that have been established by field measurements. Highlight, encircle, or otherwise indicate deviations from the contract documents on the shop drawings. Furnish one hard copy and one electronic copy in AutoCAD version 2020 or earlier drawing file format (.dwg). The only permissible text font is ROMANS. Custom fonts and shapes are prohibited. The minimum allowable font size shall be 0.125-inch. The maximum allowable font size shall be 0.25-inch.
- B. Product Data: This data includes standard printed information on manufactured products that has not been specially prepared for this contract, including manufacturers' product specifications illustrating size, physical appearance and other characteristics of materials, installation instructions, standard color charts, catalog cuts, illustrations, schedules, standard wiring diagrams, standard product operating and maintenance manuals, and samples of warranty language when the contract requires extended product warranties. General information required specifically as product data includes manufacturers' standard printed recommendations for application and use, compliance with recognized standards of trade associations and testing agencies, the application of their labels and seals (if any), special notation of dimensions which have been verified by way of field measurement, and special coordination requirements for interfacing the material, product, or system with other work. Furnish three hard copies and one electronic copy.

- C. Samples: These are physical examples of work, including, swatches showing color, texture, and pattern, color-range sets, and units of work to be used for independent inspection and testing. Samples include fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged, color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project, and field samples and mock-ups constructed on the project site to establish standards by which the ensuring work can be judged. This includes assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work. Submit samples for the Contracting Officer's visual review of general kind, color, pattern, and texture for a final check of the coordination of these characteristics with other related elements of the work and for quality control comparison of these characteristics between the final sample submittal and the actual work as it is delivered and installed. Submit one each.
- D. Design Data: Design data includes design calculations, mix designs, analyses or other data pertaining to a part of work. Refer to individual sections of the Specification or Statement of Work for required quantities, formats, and signatures or certifications required. Furnish three hard copies and one electronic copy.
- E. Test Plans and Reports: Test plans shall include planned testing, including a description of the test, equipment and supplies needed, and step-by-step notation of test activities and tasks. Test reports include reports signed by an authorized official of a testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accordance with the specified requirements. Testing shall have been within three years of date of contract award for the project. Reports also include findings of tests required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to the job site, findings of tests made at the job site or on a sample taken from the job site, investigation reports, daily logs and checklists, and final acceptance test and operational test procedures. Furnish three hard copies and one electronic copy of each such report required.
- F. Certificates: These include statements printed on the manufacturer's letterhead and signed by the responsible officials of the manufacturer of a product, system or material attesting that the product, system or material meets specification requirements. Certificates include documentation required of the Contractor, or of a manufacturer, supplier, installer or subcontractor through the Contractor, to further demonstrate the quality of orderly progressions of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications. Examples include confined space entry permits, and text of posted operating instructions.

Certificates shall be dated after award of the project contract and clearly name the project. Furnish three hard copies and one electronic copy of each certificate required.

- G. Manufacturer's Instructions: Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data sheets concerning impedances, hazards and safety precautions. Furnish three hard copies and one electronic copy.
- H. Manufacturer's Field Reports: Documentation of the testing and verification actions taken by a manufacturer's representative at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation, to confirm compliance with the manufacturer's standards or instructions. The documentation shall be signed by an authorized official of a testing laboratory or agency and shall state the test results, and indicate whether the material, product, or system has passed or failed the test. Furnish three hard copies and one electronic copy.
- I. Operation and Maintenance Data: Data furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel, including manufacturer's help and product line documentation necessary to maintain and install the equipment, and needed by operating and maintenance personnel for the safe and efficient operation, maintenance, and repair of the item. The data is intended to be incorporated in an operations and maintenance manual or control system. Furnish two hard copies and one electronic copy.
- J. Final Design Drawings and Documentation: Final design documentation including drawings, specifications, estimates, and other required deliverables. Electronic documentation submitted shall include every associated component file of drawings and other documentation, including raster images, jpeg, tiff, Excel, and any related items required to view, modify, or manipulate the electronic files. Furnish a CD-ROM of all final design documentation, and drawings in AutoCAD 2020 version or earlier drawing file format (.dwg), to the Contracting Officer for approval prior to applying for final payment. The drawings shall be fully editable using AutoCAD software. In addition, drawings shall be delivered to clearly show the location and arrangement of all materials and equipment. The only permissible text font is ROMANS. Custom fonts and shape files are prohibited. The minimum allowable font size shall be 0.125-inch. The maximum allowable font size shall be 0.25-inch.
- K. Record (As-Built) Drawings: Record drawings showing final configuration of work accomplished. Show all changes, additions, and deviations from the original contract drawings and documentation. If no changes occur, furnish certification to that effect. Drawings shall be redlined electronic drawings,

unless waived by the Government, and shall accurately show as-built conditions during the progress of the job. Furnish drawings on a CD-ROM, in AutoCAD 2020 or earlier version, including every associated component file of the drawings, including raster images, jpeg, tiff, Excel, and any related items required to view, modify, or manipulate the electronic files. Submit to the Contracting Officer for approval prior to applying for final payment.

- L. Miscellaneous Submittals: These are work-related, non-administrative submittals that do not fit in the previous categories, including the following:
1. Maintenance agreements. Furnish one hard copy and one electronic copy.
  2. Survey data and reports. Furnish one hard copy and one electronic copy.
  3. Project photographs. Furnish both hard copies and digital files.
  4. Keys and other security protection devices.
  5. Maintenance tools, spare parts, and overrun or maintenance stock. Refer to individual sections of the specification for required quantities of spare parts, extra and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.
  6. Qualification certificates. Furnish one hard copy and one electronic copy.
  7. Employee training certificates and documentation showing successful completion of training.
  8. Documentation of percentage of recovered material content used during contract.
  9. Contractor safety and work plans and schedules.
  10. Warranties.

END OF APPENDIX