



ASSOCIATION OF UNIVERSITIES FOR RESEARCH IN  
ASTRONOMY, INC. (AURA)

Operating the National Solar Observatory (NSO)

## **INSTRUCTIONS TO OFFERORS**

FOR

**REQUEST FOR PROPOSAL  
RFP NO. N00038756C**

FOR

**IR CAMERA CONTROLLERS**

On behalf of

**THE DANIEL K. INOUE SOLAR TELESCOPE (DKIST)  
HALEAKALĀ OBSERVATORY, MAUI, HAWAII**

**PROPOSALS MUST BE RECEIVED BY:**

**10/30/2024 3:00PM MST (Tucson, U.S.)  
(CLOSING DATE)**

## Table of Contents

|  |    |
|--|----|
| SECTION 1. ANNOUNCEMENT OF OPPORTUNITY .....                 | 3  |
| SECTION 2. INSTRUCTIONS TO OFFERORS.....                     | 5  |
| SECTION 3. OFFEROR’S PROPOSAL FOR FIXED PRICE CONTRACT ..... | 11 |
| SECTION 4. REPRESENTATIONS AND CERTIFICATIONS .....          | 14 |
| SECTION 5. SAMPLE CONTRACT .....                             | 19 |
| SECTION 6. STATEMENT OF WORK (SOW).....                      | 25 |
| SECTION 7. SPECIFICATIONS .....                              | 1  |

## **REQUEST FOR PROPOSALS (RFP)**

**No. N00038756C**

### **SECTION 1. ANNOUNCEMENT OF OPPORTUNITY**

The Association of Universities for Research in Astronomy, Inc. (AURA)/Central Administrative Services (CAS) Contracts Office, is soliciting Request for Proposals (RFP) from qualified Contractors/Bidders to provide exhibit planning, design and installation supervision.

#### **PURPOSE**

The Association of Universities for Research in Astronomy, Inc. (AURA), on behalf of the National Solar Observatory, is soliciting this Request for Proposals (RFP) for the design and build of Infrared Sensor Controllers in support of the Daniel K. Inouye Solar Telescope (DKIST).

DKIST is the world's most advanced solar observatory, poised to answer fundamental questions about the basic processes which govern variations in solar activity. DKIST provides a revolutionary new window on the solar magnetic atmosphere and is the primary scientific tool for understanding the impacts of variations in the solar output on the Earth's climate. Solar astronomers use DKIST to understand what causes solar eruptions and to provide the knowledge necessary to develop space weather forecasting, necessary for protecting or mitigating the potentially devastating societal and economic impacts of solar flares and mass ejections on the nation's space assets, the power grid and communication systems.

AURA is soliciting proposals for three (3) infrared camera controllers and an option for three (3) additional controllers that meet the Specification (IRCAM.CTRL.SPEC-1) in support of the Daniel K. Inouye Solar Telescope (DKIST). See the set of documents released with this RFP for background information on this facility.

Funding for the operation of the DKIST is provided by the National Science Foundation (NSF).

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## **RFP SCHEDULE**

**RFP Posting:** 7/30/2024

**RFP Questions Close:** 10/25/2024 at 3:00 PM Arizona time

**RFP Close:** 10/30/2024 at 3:00 PM Arizona time

**Anticipated RFP Evaluations Complete:** 12/11/2024

**Anticipated Contract Award:** 2/25/2025

**RFP No. N00038756C**

**SECTION 2. INSTRUCTIONS TO OFFERORS**

**Article 1. Definitions**

1. All definitions set forth throughout as well as in any attachments and appendices are applicable to these Instructions to Offerors.
2. The "Request for Proposal Documents" (hereinafter "RFP Documents") consist of the following:
  - A. Instructions to Offerors;
  - B. Amendment to the Instructions issued prior to Closing Date (if any);
  - C. Statement of Work; and
  - D. Representations and Certifications.
3. "Amendment" means the written or graphic instruments issued prior to the Closing Date which modify or interpret the RFP Documents, including specifications, by additions, deletions, extensions, answers to questions posted on the RFP Webpage, clarifications or corrections.
4. "Contract Documents" may include any, or all, of the following:
  - A. Contract between AURA and the Contractor;
  - B. Representations and Certifications;
  - C. Terms and Conditions;
  - D. Statement of Work;
  - E. Construction Drawings;
  - F. Construction Specifications;
  - G. Photos of Area of Work; and/or
  - H. Amendments and all modifications incorporated in the documents before their execution.
5. "AURA" means the Association of Universities for Research in Astronomy, Inc., an Arizona non-profit corporation. The term "AURA" includes its authorized representatives. AURA operates the **Daniel K. Inouye Solar Telescope (DKIST)** and is engaged in managing, operating, and maintaining observatories and related activities for research in the field of astronomy.
6. "Foundation" means the National Science Foundation (NSF), an agency of the United States of America created under the National Science Foundation Act of 1950. The term "Foundation" includes its authorized representatives.

7. "Offeror" or "Bidder" means the person, authorized representative(s), or organization submitting a proposal, and if awarded, shall perform the Work described in the Contract as the "Contractor."
8. "Contractor" means the person, authorized representative(s) or organization responsible for the completion of the Work. If a proposal is submitted on behalf of multiple parties, the term "Contractor," shall apply to the party or parties responsible for completion of the Work.
9. "Work" means those tasks, requirements, and obligations described in the Statement of Work (SOW) as included in the Contract Documents.
10. "Subcontractor" means a person or organization, with a direct agreement with the Contractor to furnish labor, or labor and materials, in support of the SOW. The term also includes lower tier contractors of a Subcontractor, but it does not include suppliers who furnish materials not worked to a special design according to the drawings and specifications. Nothing contained in the Contract Documents shall be deemed or construed to create any contractual relation between AURA and any Subcontractor as defined above.
11. "Closing Date" means the specified date and time by when all proposal documents must be received by AURA.

## **Article 2. Proposal Procedures**

1. Proposals shall consist of the elements described in these RFP Instructions, including those described in Section II. **Section II, Offeror's Proposal Document, must be completed in its entirety and submitted to the email address indicated in Section 6 below.** The Offeror's price information shall be in accordance with the format indicated in Section II. The entirety of the proposal shall be in English. **Any proposal or part of a proposal not conforming to the specified formats shall be cause to reject the entire proposal**
2.
  - A. Due to AURA's tax-exempt status, prices quoted shall not include federal, state, or local sales or excise taxes. Offerors subject to a mandatory value-added tax (VAT) may include VAT in the comprehensive price quote.
  - B. Prices quoted in the proposal(s) shall include furnishing of all transportation, materials, equipment, tools, supplies, labor and services necessary or proper for performance and completion of the Work, except such as may be otherwise expressly provided for in the RFP documents.
  - C. Offeror shall conform its price in accordance with the payment and milestone schedule. Prices shall be in U.S. Dollars (\$USD).

3. In the event of discrepancy between the prices quoted in the RFP in words and those quoted in figures, the words shall control.
4. Proposals shall be in an electronic version using MS Office (2003 or later) or .pdf of the entire proposal, not later than the scheduled Closing Date.
5. A proposal may be deemed non-compliant if the entire submission package has not been received at the designated location by the Closing Date.
6. Proposals shall be delivered via electronic mail to:

**Brandon L. Morrison**  
Contracts Officer  
AURA

Email: [bmorrison@aura-astronomy.org](mailto:bmorrison@aura-astronomy.org)

7. Offeror may withdraw its proposal, either personally or by written request, at any time prior to the Closing Date. If a qualified Offeror determines that it will not submit a proposal, notice of such is requested by AURA.
8. Offeror's proposal shall be valid for one hundred twenty (120) days beginning with the Closing Date.

### **Article 3. Communication and Questions**

Any questions or requests for clarification of this proposal must be solely directed to the designated official in Article 2, Section 6.

Questions must be submitted by email and must be received at least five (5) business days before the Closing Date by 3:00 PM Arizona time. All questions and responses from any Offeror will be provided to all parties via the [AURA procurement website](#). Responses will be anonymous as to the questioner/Offeror. Any question not conforming to this format will be disregarded. Offerors shall disregard references to any other contract, such as that found on the AURA procurement website. AURA will endeavor to respond to questions within three (3) business days.

#### **Article 4. Review of Documents**

1. AURA reserves the right to make additions, deletions, or modifications to the RFP Documents in writing by amendment at any time prior to the Closing Date. If, in the opinion of AURA, any such change causes an increase in the time required for submission of proposals, AURA may, at its sole discretion, adjust the Closing Date in the form of an Amendment posted on the AURA website.
2. Offerors shall examine the RFP Documents carefully. Any request for interpretation or correction of any ambiguity, inconsistency, or error that Offeror discovers must be made as per Article 3, not later than the date indicated for RFP Questions Close.
3. All interpretations and corrections to the RFP or to the Contract Documents will be issued in the form of an Amendment posted on the AURA website. Offerors shall not rely on any interpretation or correction to the RFP or Contract Documents given by any other method.
4. Prior to receipt of proposals, addenda, if required, will be posted on the AURA website.
5. The failure of Offeror to receive or examine any form, instrument, amendment or other document, or failure to acquaint itself with existing conditions shall not relieve Offeror from obligations and responsibilities with respect to its proposal or to the Contract. The submission of a proposal will be taken as prima facie evidence of agreement with this section.

#### **Article 5. Representations**

1. Offeror, by submitting a proposal, represents that it is familiar with existing conditions under which the Work will be performed, including, but not limited to, environmental, cultural, and operational requirements.
2.
  - A. Offeror, by submitting its proposal, represents that it has read and understands all the RFP Documents and by submitting a proposal acknowledges acceptance of all of the Terms and Conditions of the RFP Documents as defined in Section 1.2 of these Instructions.
  - B. Any exceptions to the Contract Documents by Offeror shall be stated in writing on Offeror's letterhead and submitted with its proposal with clear and concise justification(s). Offeror shall provide alternative wording for consideration by AURA.**



- C. Offeror, by submitting a Proposal, certifies that the Contract Documents, including the Terms and Conditions and SOW, have been reviewed and accepted by the Contract Representative of the Offeror, or similar binding authority, or has noted such exception with its Proposal.
3. Offeror shall be prepared to submit a resolution giving evidence of its qualification of corporate signature authority, if requested.
4. Offeror shall complete, sign, and submit the Representations and Certifications of Section III with the Proposal.

#### **Article 6. Alternative Provisions**

1. Offeror represents that its Proposal is based upon the specifications, terms and conditions described in the RFP documents, unless alternative provisions are expressly permitted by an Amendment.
2. A proposal containing an alternate provision(s) shall be accompanied by full and complete justification and technical description of the alternate provisions(s) along with a detailed cost analysis of the differences between the alternate and original provisions. AURA reserves the right to request such other additional information as may be required for approval either before or after receipt of proposals.
3. Failure to provide justification or technical descriptions for approval purposes may be cause to reject the proposal.

#### **Article 7. Completion Time**

Offerors shall represent in the proposal that they can complete the Work within the timeline indicated by the SOW or propose an alternative completion date with justification. The time of performance shall be dated from receipt of a Contract, and all costs included in the proposal shall be for the Work to be completed within that period.

#### **Article 8. Evaluation of Proposal**

1. Proposals will be opened and evaluated privately by AURA after the Closing Date.

2. Proposals will be evaluated according to the following major factors, ranked or weighted in no particular order:
  - Technical criteria;
  - Price;
  - Schedule;
  - References; and
  - Relevant experience
3. All proposal documents received will be considered confidential and will not be released.
4. The award of the Contract(s), if any, made by AURA, will be made to the Offeror(s) that presents the best value. AURA reserves the right to determine, at its sole and exclusive discretion, which proposal, if any, properly meets the “best value” requirement and whether it is in the best interests of AURA to accept the proposal. Therefore, Offeror shall ensure that all requested information is included in its proposal.

### **Article 9. Costing**

While firm fixed price (FFP) is the typical pricing scheme for most acquisitions, AURA is open to different types of costing models, including firm fixed price, cost, cost plus, etc. Offeror should identify and propose what it thinks is the best, or most appropriate model, explain its choice, and why it is superior to firm fixed price. AURA reserves the option to request a proposal redrafted in an alternative costing model.

### **Article 10. Limitations of Liability**

Offeror’s proposal/contract should clearly describe its limitations of liability as well as that of its retained subcontractors, as applicable.

### **Article 11. [RESERVED]**

### **Article 12. Rejection of Proposals**

1. AURA reserves the right to accept or reject any or all proposals or any combination thereof, to withhold an award for any reason it may determine, or to waive any irregularities or informalities in the proposals or in the submission of proposals.
2. All submitted proposals shall become the sole and exclusive property of AURA.

**RFP No. N00038756C**

**SECTION 3. OFFEROR'S PROPOSAL  
FOR FIXED PRICE CONTRACT**

(This document **MUST** be completed and returned to AURA with Proposal)

DATE: \_\_\_\_\_

TO: AURA  
Attn: Brandon L. Morrison  
Contracts Officer

FROM: \_\_\_\_\_  
(Legal name of individual, firm or corporation bidding)

\_\_\_\_\_  
(Business address Line 1)

\_\_\_\_\_  
(Business address Line 2)

\_\_\_\_\_  
(Business address city, state and zip)

1. By submitting this Proposal, the Offeror accepts all of the terms and conditions of the RFP Documents as described in the Instructions to Offerors, or the Offeror has enclosed written exceptions to the terms of the Draft Contract. AURA will review the exceptions but is not obligated to accept (any or all of) them in a final contract, if awarded.
2. In compliance with AURA's Request for Proposal No. N00038756C, the Offeror hereby proposes to furnish all labor, materials, equipment and supplies to perform the Work for manufacturing and delivery of AURA's IR Camera Controllers in accordance with the Specifications, pertinent Contract Documents and Statement of Work.

3. Offeror's Proposal submittal shall include the following:
- A.** A Cover Sheet including: contracting General Information (RFP Number, if given; RFP title, name/address of the offering firm; technical and administrative points of contact; DUNS/UEI number, teamed organizations, if any; and any other pertinent information);
  - B.** An abstract summarizing the proposed effort, not to exceed 500 words;
  - C.** The Technical Proposal, which shall address:
    - 1) Relevant technical experience of Offerors;
    - 2) Relevant technical experience and role of any proposed subcontractors;
    - 3) Names, resumes, and role of key technical personnel;
    - 4) A minimum of 5 references on projects of a similar size, complexity and nature;
    - 5) Unique qualifications;
    - 6) Preliminary project plan, including project schedule and your proposed milestone or payment schedule;
    - 7) Documented Injury and Illness Prevention Plan
    - 8) Documented Hazardous Communication Program
    - 9) Documented Safety Program
    - 10) Proposed deviations from requirements with justifications and impact on price and schedule; and
  - D.** Any other relevant information.
4. The Offeror hereby specifies, in accordance with Article 7, Completion Time, of Instructions to Offerors that Work shall be completed within \_\_\_\_\_ calendar days after receipt of the Contract.
5. In accordance with the above completion schedule (Paragraph 4) and enclosed specifications, the Offeror hereby proposes to accomplish the work described above for the total of:

\_\_\_\_\_ Dollars (\$)  
 This amount includes all applicable Federal, state and city taxes

### MILESTONE PAYMENT SCHEDULE

As part of Proposal, Contractor shall provide a Milestone Payment Schedule based on key dates and milestones as described in Section 1.4 of the Statement of Work. Bidders may propose deviations with suitable justification. Bidder's Milestone Payments shall be based on verifiable deliverables identified in Bidder's preliminary Project Schedule. Sum of Bidder's Milestone Payments shall equal Bidder's full Contract Cost.

| Milestone | Month | Value (\$ or %) | Cumulative Value |
|-----------|-------|-----------------|------------------|
| 1-        |       |                 |                  |
| 2-        |       |                 |                  |
| 3-        |       |                 |                  |

This proposal is submitted by Offeror and endorsed by its authorizing official by the signature below:

By: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_  
(Printed/Typed Name)

Title: \_\_\_\_\_

**RFP No. N00038756C**

**SECTION 4. REPRESENTATIONS AND CERTIFICATIONS**

(This document **MUST** be completed and returned to AURA with Proposal)

Date: \_\_\_\_\_

To: Brandon L. Morrison  
AURA/CAS  
Contracts Officer  
950 N Cherry Ave  
Tucson AZ 85719

FROM: \_\_\_\_\_  
(Legal name of individual, firm or corporation bidding)

\_\_\_\_\_  
(Complete business address line 1)

\_\_\_\_\_  
(Complete business address line 2)

The Contractor, by checking the appropriate boxes, makes the following representations and certifications:

**A. REGULAR DEALER-MANUFACTURER**

The Offeror is (check all that apply):

- a regular Dealer/Distributor of the item(s) offered; and/or
- a regular Manufacturer of the item(s) offered.

**B. SMALL BUSINESS/SMALL DISADVANTAGED BUSINESS SUBCONTRACTING**

Pursuant to the terms of our Agreement with the Government and applicable Federal Procurement Regulations 1-1.701, AURA is required to maintain a Small Business and Small Disadvantaged Business Subcontracting Program. You are therefore requested to check the appropriate blocks below:

**Business Size (Check One)**

- Small A domestic concern that is independently owned and operated, is not dominant in the field of its operations, qualifies under the criteria covering annual receipts set forth in Section 3 of the Small Business Act and does not employ more than 500 employees.
  
- Large A domestic concern which, including domestic and foreign divisions and affiliates, normally employs 500 or more persons, is independently or publicly owned or controlled and operated, and which may be a division of another domestic or foreign concern.

**Business Classification (Check as many as are applicable)**

- Minority 51% of business or stock is owned by one or more socially and economically disadvantaged individuals and whose management and daily business operations are controlled by one more of such individuals.

Socially and economically disadvantaged individuals including Black Americans, Hispanic Americans, Native Americans, Asian-Pacific Americans, Asian-Indian Americans and other minorities, or any other individual found to be disadvantaged pursuant to Section 8(a) of the Small Business Act.

Native Americans include American Indians, Eskimos, Aleuts, and native Hawaiians. Asian-Pacific Americans includes U. S. citizens whose origins are Guam, the U. S. Trust Territories of the Pacific, Northern Marianas, Laos, Cambodia and Taiwan.

For assistance in determining your business size and socially and economically disadvantaged status, contact the nearest office of the Small Business Administration.

- Women-Owned A business that is at least 51% owned, controlled and operated by a woman or women.

**Note:** Controlled is defined as exercising the power to make policy decisions. Operated is defined as actively involved in the day-to-day management.

- Non-Profit A business or organization that has received non-profit status under IRS Regulation 501(c)(3).

- Public An agency of the Federal or State Government Sector or a municipality.

- Sheltered      A sheltered workshop or other equivalent business basically employing the handicapped.
- Handicapped      A business that is owned, controlled and operated by a handicapped person(s).
- Foreign      A concern which is not incorporated in the United States or an unincorporated concern having its principal place of business outside the United States.

**Business Status (Check One) - For IRS Reporting Requirements**

- Corporation      A business entity that is registered with a state in the United States as a corporation, including non-profit corporations but excluding professional corporations.
- Other      An individual, or other business entity that is not a registered corporation. This includes corporations, independent contractors, partnerships, and the like.

**Indicate Your:**

|                                    |  |
|------------------------------------|--|
| SAM Unique Entity Identifier (UEI) |  |
| Federal Employee ID                |  |
| SAM Registration (Check one)       | <input type="checkbox"/> Yes <input type="checkbox"/> No |

**WARNING:** Failure to provide this information may require that we withhold 20% of your payments and may result in fines imposed by the IRS.

**C. DEBARMENT/SUSPENSION STATUS**

Contractor certifies to the best of its knowledge and belief that it and its principals:

- a) are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from a covered transaction by any Federal department or agency;



- b) have not within a three year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state or local) transaction or contract under a public transaction; violation of Federal or state antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- c) are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (federal, State or local) with commission of any of the offenses enumerated in paragraph b of this certification; and
- d) have not within a three-year period preceding this proposal for bid had one or more public transactions (Federal, state or local) terminated for cause or default.

The Contractor agrees to provide immediate notice to the AURA Contracting Officer in the event of being suspended, debarred, or declared ineligible by any department or Federal Agency, or upon receipt of a notice of proposed debarment that is received after the submission of the bid or offer, but prior to the award of the purchase order or contract.

#### **D. MADE IN AMERICA/BUILD AMERICA, BUY AMERICA**

The undersigned certifies that it understands and shall comply with the “Build America, Buy America” (BABA) requirements per the federal law of the United States as it pertains to this Request for Proposals. Furthermore, the undersigned understands that the Build America, Buy America requirements apply to any and all portions of the project that are considered “infrastructure” (as defined), including subcontracted portions.

Information on BABA may be found at the [National Science Foundation’s BABA page](#) and [NSF’s Implementation Plan](#) and the [U.S. Office of Management and Budget](#).

Considering the above, Contractor represents that the Proposal (check all that apply):

- May involve developing “infrastructure” or developing a component to be incorporated into infrastructure in the United States.
- Does not involve “infrastructure” (for example, the work consists purely of services, such as consulting).
- The work is entirely outside the United States and no work product is destined to reside in the United States.

**CERTIFICATION**

The Contractor hereby certifies that it has read the above Debarment/Suspension Status requirements and that it understands and will comply with these requirements.

Please advise this facility as soon as possible when the status of your company changes from that indicated above.

By: \_\_\_\_\_  
(Signature)

Name: \_\_\_\_\_  
(Printed/Typed Name)

Title: \_\_\_\_\_

**RFP No. N00038756C**

**SECTION 5. SAMPLE CONTRACT**

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CONTRACT NO. N00038756C

Between

ASSOCIATION OF UNIVERSITIES FOR RESEARCH IN  
ASTRONOMY, INC. (AURA)

Operating the National Solar Observatory (NSO)

And

[TBD]

For

IR CAMERA CONTROLLERS

For

THE DANIEL K. INOUE SOLAR TELESCOPE (DKIST)  
HALEAKALĀ OBSERVATORY, MAUI, HAWAII



**CONTRACT No. N00038756C**

This contract (the "Contract") is entered into between the **Association of Universities for Research in Astronomy, Inc.**, an Arizona non-profit corporation (hereinafter "AURA") and **[TBD]**, having its principal place of business in **[Contractor address]** (hereinafter "Contractor"), and shall be effective as of the latest date affixed hereto.

**RECITALS**

**WHEREAS**, AURA performs scientific research and manages federally supported research facilities for certain federal agencies, including but, not limited to, the National Science Foundation ("NSF"), Department of Energy ("DOE"), and National Aeronautics and Space Administration ("NASA");

**WHEREAS**, in furtherance of AURA's work on behalf of one or more federal agencies, AURA requires certain supplies, services, or both, which are described in this Contract; and

**WHEREAS**, Contractor has the capability and desire to furnish such supplies and/or services to AURA in a manner consistent with the statement of work, applicable industry professional and/or technical standards, and all applicable laws.

**NOW, THEREFORE**, in consideration of the mutual promises contained herein and intending to be legally bound hereby, the Parties agree as follows:

**Article 1. Purpose**

The purpose of this Contract is for AURA to acquire from Contractor IR controllers IAW with this Contract, including any appendices or attachments.

## **Article 2. Contract Format**

### **1. Contract Terms and Structure**

This Contract is comprised of the terms and conditions set forth in the body of the Contract as supplemented by the Appendices attached hereto, all of which are incorporated herein by reference. **Attachments 1 and 2** sets forth the Statement of Work and Technical Specifications (hereinafter "SOW"), respectively. **Appendix 2** sets forth additional terms and conditions required by prime contracts between AURA and one or more federal agencies.

### **2. Most Restrictive Terms Govern**

To the extent that terms related to a particular subject matter are applied in a more restrictive manner in any particular section of this Contract, or by incorporation of Federal requirements by reference, the most restrictive terms shall apply. Any questions regarding any perceived conflict of terms shall be promptly brought to the attention of AURA's designated Contracts Officer.

### **3. Irreconcilable Conflict**

In the event of an irreconcilable conflict between the provisions of any of the documents that make up this contract, the terms of a document that appears higher on the numbered list immediately below shall control over the terms of a document that is lower on the list.

1. Main Documents (this document, including Terms and Conditions as applicable)
2. Statement of Work
3. All specifications

## **Article 3. Scope of Work**

### **1. Contractor's Obligation**

Contractor shall perform all work and furnish to AURA all deliverables set forth in the SOW. Contractor shall perform such work and prepare such deliverables in accordance with industry standards of skill, professionalism, diligence, and care. Contractor shall perform all such work in a manner consistent with all requirements of this Contract, including all federal requirements incorporated by reference herein.

### **2. Key Personnel**

Key personnel (if any) are listed in the SOW. Contractor shall not remove or replace key personnel without prior approval of AURA. Any proposed substitute key person shall have materially equivalent qualifications and skills to the person for whom substitution is requested. In the event Contractor is able to demonstrate that a proposed substitute meets such standards, AURA shall not unreasonably deny substitution.

### **3. Period of Performance**

The period of performance for this Contract shall be as follows:

| Phase of Work Item                | Delivery Date |
|-----------------------------------|---------------|
| Phase 1: Planning and Development | 1 Month       |
| Phase 2: Critical Design          | 5 Months      |
| Phase 3: Production               | 10 Months     |

#### 4. Milestone Payment Schedule

Contractor shall be paid in accordance with the Milestone Payment Schedule as set forth below. Each Milestone Payment shall be due and payable only to the extent it is supported by the completion of the corresponding individual Milestones. Each Milestone does not represent the cost of the Work included in such Milestone; accordingly, the Milestone Payments do not represent an actual measure of the progress of the Work. For the avoidance of doubt, any dates set forth in the table below for the achievement of a Milestone are indicative only and shall not affect Contractor's right to invoice or receive payment for a Milestone Payment for the achievement of the corresponding Milestone in any particular month.

| Phase of Work Item                | Deliverable  | Month(s) | Milestone Payment (%) |
|-----------------------------------|--|----------|-----------------------|
| Phase 1: Planning and Development | <ul style="list-style-type: none"> <li>• Project Plan</li> <li>• Progress Report</li> <li>• Kickoff Meeting</li> </ul>   | 1        | 10%                   |
| Phase 2: Critical Design          | <ul style="list-style-type: none"> <li>• Critical Design Documentation</li> <li>• Critical Design Review</li> <li>• Progress Report</li> </ul>                               | 5        | 20%                   |
| Phase 3: Production               | <ul style="list-style-type: none"> <li>• Inspection and Acceptance Test Reports</li> <li>• Progress Report</li> <li>• Delivery of Controllers</li> <li>• Warranty</li> </ul> | 10       | 70%                   |

### Article 4. Payment

#### 1. Invoices

Subrecipient shall submit invoices to AURA on the following basis: TBD. Invoices shall provide detail commensurate with the Budget and shall include any supporting documentation that is reasonably prescribed by AURA. The final invoice must be submitted no later than sixty (60) days after the end of the final period of performance. Invoices shall be submitted to:

Brandon L. Morrison  
Contracts Officer

Email: [bmorrison@aura-astronomy.org](mailto:bmorrison@aura-astronomy.org)

CC: Ramona Botkin  
Contracts Administrator

Email: [rbotkin@aura-astronomy.org](mailto:rbotkin@aura-astronomy.org)

An email copy of the invoice shall be sent to: [ContractsInvoice@aura-astronomy.org](mailto:ContractsInvoice@aura-astronomy.org)

## **2. OPTIONAL: Fixed Price Agreement (Supplies)**

This Contract is a firm-fixed-price supply contract. Payment shall be made in the amount of \$[Negotiated Contract Sum] upon Contractor's delivery of the supplies described in **Appendix 1**. AURA shall make final payment within thirty (30) days of delivery of supplies meeting the requirements of the SOW.

## **Article 5. Term**

### **1. Base Period**

This Contract shall commence on the effective date set forth above and shall continue through the end of the period of performance or final delivery date set forth in Article 3, Section 3 (Period of Performance), as applicable. AURA shall have the unilateral right (but not obligation) to extend the period of performance or final delivery date, prospectively or retroactively, as necessary to accommodate delays by Contractor.

### **2. Option Periods**

AURA shall have the unilateral right to extend the term of this Contract up to a total performance period of five (5) years. AURA may exercise its right to extend the Contract in multiple increments. Rates paid/applicable budgets during options periods shall be as agreed by the Parties and designated in **Appendix 1**. If no rate or budget has been negotiated for an option period, Contractor and AURA shall cooperate in good faith to set reasonable rates/budget commensurate with the rates/budget agreed for the base period, taking into account the nature of the work required during the option period.

## **Article 6. AURA Contracts Officer**

### **1. Contracts Officer Designation**

AURA's designated Contracts Officer(s) for this Contract is:

Brandon L. Morrison  
Contracts Officer

Email: [bmorrison@aura-astronomy.org](mailto:bmorrison@aura-astronomy.org)

### **2. Authority of Contracts Officer**

The Contracts Officer is AURA's primary representative for oversight and administration of this Contract. The Contracts Officer is the only person authorized to approve changes to this Contract.



### **3. Technical Representatives**

The Contracts Officer may designate, by written notification to Contractor, one or more Technical Representatives to provide technical direction to Contractor in the course of performing its obligations under this Contract. The Technical Representative has no authority to amend this Contract. Direction by the Technical Representative is only valid if it:

- i) is consistent with the SOW;
- ii) does not constitute a new assignment of work or material change to agreed performance obligations; *and*
- iii) does not create any additional cost of contract performance beyond that contemplated for the agreed SOW. In the event that Contractor believes that any direction provided by the Technical Representative may constitute additional work or a change to the agreed Contract terms, Contractor shall promptly notify the Contracts Officer.

### **Article 7. Contractor's Project Manager**

Contractor shall designate an individual to serve as Contractor's Project Manager. The Project Manager shall be responsive to communications from AURA's Contracts Officer. The Project Manager shall be sufficiently senior within Contractor's organization and knowledgeable about the type of work and/or deliverables covered by the SOW to facilitate efficient administrative coordination with AURA.

### **Article 8. Communications**

#### **1. Administrative Communications**

All communications concerning administration of this Agreement must be furnished solely to the AURA Contracts Officer at the address given in this Agreement. Communications of a technical nature only may be directed to the AURA Technical Representative designated by the AURA Contracts Officer.

## **2. Electronic and Written Communications**

- A. Documents relating to this Agreement may be effectively signed by either: (1) Electronically signing a PDF file using the Adobe Acrobat Digital Signature Tool; (2) Signing a hard copy and then either faxing it to the recipient or scanning it and emailing it to the recipient as a scanned document; or (3) Sending an original hard copy.
- B. When this Agreement requires that something be "in writing," an email communication is sufficient to meet this requirement.

## **3. Publicity**

Contractor shall not publicize or advertise in any manner anything relating to this Agreement without obtaining prior written approval from AURA for each publicity/advertising item. AURA may require acknowledgements of its sponsors as a condition of approval.

## **4. Publications**

- A. The Contractor is responsible for assuring that an acknowledgment of NSF support is made:
  - 1) In any publication (including World Wide Web pages) of any material based on or developed under this contract, in the following terms: "This material is based upon work supported by the National Science Foundation under Cooperative Agreement No. AST- 0946422."
  - 2) NSF support also must be verbally acknowledged during all news media interviews, including popular media such as radio, television, and newsmagazines.
- B. The Contractor is responsible for assuring that every publication of material (including World Wide Web pages) based on or developed under this award, except scientific articles or papers appearing in scientific, technical, or professional journals, contains the following disclaimer: "Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation."
- C. The Contractor is responsible for assuring that two copies of every publication of material based on or developed under this award, clearly labeled with the cooperative agreement number and other appropriate identifying information, are sent to the cognizant NSF Program Officer promptly after publication. The Program Officer's name and email address can be requested from the AURA Contract Officer.
- D. All reports and publications resulting from this Contract are encouraged to use the metric system of weights and measures.

## 5. Copyrightable Material

- A. The term "Subject Writing" refers to any copyrightable material which is produced by Contractor in the course of performing the Work under this Agreement or which otherwise arises out of the Work, and which is either delivered to AURA or is distributed to any persons other than Contractor's personnel and agents. Subject Writings include such items as reports, books, journal articles, software, databases, sound recordings, photographs, artwork, and videotapes.
- B. Contractor agrees to acquire, through written agreement or an employment relationship, the ability to comply with the requirements of the preceding paragraphs. The Contractor further agrees that any transfer of copyright or any other rights to a Subject Writing, by it or anyone whom it has allowed to own such rights, will be made subject to the requirements of this section.
- C. Any and all information furnished to Contractor by or on behalf of AURA shall remain the sole property of AURA and shall be used by Contractor only in connection with Contractor's performance of Work under this Agreement. Contractor shall not, without the prior express written consent of AURA, disclose or reveal such Information or any portion thereof to any person not employed by Contractor in performance under this Agreement (except designated authorized representatives of AURA) or utilize such Information for any purpose other than such performance; provided, however, that such restriction on disclosure shall not apply to Information which:
- 1) was or becomes part of the public domain otherwise than through any act or omission on the part of Contractor;
  - 2) was already in the possession of the Contractor at the time of its receipt of such Information without any restrictions on disclosure;
  - 3) was acquired by Contractor from a third party (other than from a representative of AURA) without any undertaking of confidentiality imposed on or by the disclosing party. Contractor shall take all precautions reasonably desirable and necessary to safeguard the Information and comply with the provisions of the preceding sentence. Upon the earlier of termination of this Agreement for any reason, or as requested by AURA at any time, Contractor shall promptly deliver all Information to AURA that has been provided to Contractor by or on behalf of AURA; or
  - 4) is required to be disclosed by law or court order.
- D. Contractor may retain the entire right, title, and interest of any and all Information first developed, acquired, or produced by Contractor related to the Work or this Agreement, including design documents developed as part of the project; provided, however, that with respect to any Information in which Contractor retains title:
- 1) AURA, or any organization that succeeds it as the Managing Organization, shall have a nonexclusive, non-transferable, irrevocable, paid-up license to use or have used on their behalf, for all purposes throughout the world; and
  - 2) each of the Parties shall have a non-exclusive, non-transferable, irrevocable, paid-up license to use or have used on their behalf such Information throughout

the world for research purposes. AURA, any organization that succeeds it as the Managing Organization, may translate, duplicate, reproduce, distribute, and disclose in any manner and for any purpose all such Information.

- E. Proprietary information acquired, developed, or produced by Contractor prior to the date of this Agreement that was not acquired, developed, or produced by Contractor for any purposes related to this project, shall not be deemed to be "Information" under this Agreement. To the extent that Contractor incorporates any Proprietary Information into the Work, Contractor hereby grants AURA a non-exclusive, non-transferable, irrevocable, paid-up license to use or have used on their behalf, to the extent necessary required to meet AURA's obligation to the Federal Government under AURA's Prime Award. Information shall only be considered "Proprietary Information" if it is clearly marked as such by Contractor. Should an organization succeed AURA as the Managing Organization, such organization shall have the same rights under this provision.

## **Article 9. Changes**

### **1. Change to SOW**

AURA shall have the unilateral right, through its Contracts Officer, to direct, in writing, changes to the SOW, **Appendix 1**. If such change will impact the cost of performance by Contractor, Contractor shall promptly so notify AURA, and the Parties shall cooperate in good faith to negotiate a reasonable increase in the contract price. Any such price adjustment shall be commensurate with the scope and complexity of additional work or modified work.

### **2. Contractor's Obligation to Proceed**

If the Parties cannot promptly agree on upon an appropriate price adjustment, AURA shall have the right to require Contractor to nonetheless proceed promptly with the work as modified, and Contractor shall be entitled to payment of an additional amount equal to its actual incremental increased cost of performance while the Parties continue to negotiate final payment amount. Alternatively, upon failure to promptly agree to a price adjustment, in its sole discretion, AURA shall have the right to (i) direct Contractor to proceed with the SOW as originally stated and (ii) identify an alternate means by which to accomplish the additional work (including engaging an alternate contractor for the additional work).

## **Article 10. Delays**

### **1. Delay**

Contractor shall promptly notify AURA of any expected delay in performance or delivery and shall cooperate in good faith with AURA to modify the performance or delivery schedule in such a manner as to minimize impact to AURA operations.

### **2. Remedies for Delay**

In the event of material impact to AURA operations, AURA shall have the right to reduce the contract price by an amount commensurate to the cost impact to AURA caused by the delay. Further, in the event that AURA cannot reasonably endure the delay in performance, AURA may terminate the Contract.

## **Article 11. AURA Facility Access and Use**

### **1. Contractor Access to Facilities**

Contractor shall be granted access to AURA facilities to the extent necessary to efficiently accomplish its obligations under this Contract. Matters of access shall be coordinated via AURA's Contracts Officer and Technical Representative(s). Access may be limited when necessary to ensure Contractor's work not interfere with other activities of AURA or its research partners. In the event that other AURA or research partner activities are an impediment to efficient performance of this Contract, AURA and Contractor shall cooperate in good faith to adjust the performance or delivery schedule accordingly.

### **2. Facility Rules**

Contractor and Contractor's personnel shall, at all times, obey all rules applicable to conduct within AURA facilities and shall comply with the reasonable direction of facility managers. In the event any such rules or direction becomes an impediment to efficient performance of this Contract, Contractor shall promptly bring the matter to the attention of AURA's Contracts Officer.

### **3. Bodily Injury and Property Damage**

If the SOW calls for performance of work on AURA premises, Contractor shall indemnify AURA for any (i) bodily injury to Contractor's personnel or third parties relating to Contractor's activities on AURA premises, and (ii) property damage arising out of Contractor's activities on AURA premises.

### **4. Damage to AURA Facilities or Equipment**

If the SOW calls for performance of work on AURA premises or work with AURA equipment, Contractor shall be responsible for all damage to facilities, equipment, or other property caused by Contractor or its personnel, subcontractors, or agents. Contractor shall promptly notify AURA's Contracts Officer of any such damage and shall reimburse AURA for the cost of repair.

## **5. Survival**

The rights and obligations of Sections 3 (Bodily Injury and Property Damage) and 4 (Damage to AURA Facilities or Equipment) in this Article 10 (AURA Facility Access and Use) shall survive the expiration or termination of this Contract.

## **Article 12. Insurance**

### **1. Insurance**

Contractor shall, during the term of this Contract, maintain in force the following insurance coverage with no less than the following minimum limits:

- A. Comprehensive General Liability with coverage at no less than \$1 million per claim and \$3 million annual aggregate.
- B. Workers' Compensation at statutory limits.

### **2. Contractual Liability Coverage**

If the SOW calls for performance of work on AURA premises, Contractor shall ensure that its Comprehensive General Liability insurance coverage includes coverage for "contractual liabilities."

### **3. Professional Liability Coverage**

If the work covered under this Contract entails activities for which professional liability coverage is customarily acquired (e.g., errors and omission or malpractice coverage), Contractor shall maintain such coverage at customary limits, but in no case less than \$1 million per claim and \$3 million annual aggregate.

### **4. Proof of Insurance and Tail Coverage**

Contractor shall promptly provide AURA with proof of insurance, naming AURA as additionally insured. Contractor shall ensure continuing coverage for liabilities that may be asserted in relation to activities under this Contract for a period of three (3) years from the end of the term of this Contract.

### **5. Self-Insurance Accepted**

Contractor may meet its obligations under this Article 11 (Insurance) by providing AURA with satisfactory proof of the pertinent coverages through a comprehensive program of self-insurance.

### **6. Survival**

The rights and obligations of this Article 11 (Insurance) shall survive the expiration or termination of this Contract.

## **Article 13. Termination**

### **1. Termination Without Cause**

AURA shall have the right to terminate performance under this Contract without cause upon thirty (30) days' written notice to Contractor.

### **2. Termination for Cause**

Upon material breach by Contractor, AURA shall have the right to terminate this Contract for cause in accordance with this section. In the event of material breach by Contractor, AURA shall notify Contractor in writing of the circumstances constituting the material breach. Contractor shall be afforded ten (10) calendar days after receipt of such notice to cure its breach. If Contractor fails to cure its breach within that time, AURA may proceed with termination of the Contract for cause by written notice, which may then be immediately effective. Material breach shall include, but not be limited to:

- A. Contractor's failure to meet required performance standards as described herein or in the SOW;
- B. Contractor's loss of any license necessary to perform the Contract;
- C. Contractor's failure to meet the insurance requirements of this Contract;
- D. Debarment, suspension, or exclusion of Contractor or its key personnel from participation in federal contracts or awards;
- E. A material change in Contractor's financial condition that reasonably indicates Contractor will be unable to perform its obligations under this Contract; or
- F. Contractor's failure to comply with federal standards or requirements incorporated into this contract by reference.

### **3. Contractor's Obligations Upon Termination**

Regardless of the reason for which this Contract is terminated, Contractor shall cease all work in progress and shall cancel, to the maximum extent possible without creating risk of loss of work already performed, all related obligations to third-parties. In ceasing work in progress, Contractor shall safeguard the work accomplished. If so directed by AURA, Contractor shall turn over all work in progress in a manner calculated to facilitate AURA's taking over of the work directly or through a replacement contractor.

### **4. Contractor's Right to Payment Upon Termination**

Upon termination without cause, AURA shall pay Contractor for work performed to the date of termination, plus reasonable termination costs such as subcontract winddown costs where subcontracts are not immediately cancellable. Upon termination for cause,

the Parties shall negotiate final payment as appropriate, taking into account the basis for termination and any liabilities of Contractor to AURA under the circumstances.

#### **5. Suspension or Termination of Contract for Loss of Federal Support**

Notwithstanding any other term of this Contract, AURA shall have the right to immediately suspend or terminate performance of this Contract in the event (i) federal funds available to fund the Contract are suspended or terminated or (ii) the project in furtherance of which the contracted work is needed is suspended or terminated. In such event, Contractor's right to payment shall be as set forth above for termination without cause.

#### **6. Survival**

The rights and obligations of this Article 12 (Termination) shall survive the expiration or termination of this Contract.

### **Article 14. Relationship of the Parties**

Contractor's relationship to AURA is that of an independent contractor. None of the provisions of this Contract are intended to create, nor shall be construed to create, any relationship between or among the Parties other than that of independent entities. Neither of the Parties shall be construed to be the agent, partner, co-venturer, employee nor representative of the other Party.

### **Article 15. Access to Records**

Contractor shall provide reasonable access to records related to performance of this Contract to AURA, the federal agency providing the funds for this Contract, NSF, and the federal General Accountability Office.

### **Article 16. Confidential Information**

If the work required under this Contract will require Contractor to have access to the proprietary or confidential information of AURA, Contractor shall execute a nondisclosure agreement ("NDA") in substantially the same form as that provided in **Appendix 2**.



## **Article 17. Warranty**

- A. Contractor warrants that the equipment and parts delivered to AURA hereunder meet and satisfies all of AURA's requirements set forth in the SOW (**Attachment 1**).
- B. Contractor warrants that the equipment delivered to AURA hereunder, including all hardware and software will, upon completion of the contract, be free from defects in material or workmanship for one year after delivery and installation. Further, Contractor warrants all labor related to the installation of the systems for a period of five years after installation. Products that are not manufactured by Contractor, but that are purchased by Contractor will be subject to the warranty provisions provided by the equipment manufacturer of such product(s), unless Contractor notifies AURA of any additional warranty provisions in writing. The obligation of Contractor under this warranty is the repair or replacement of any defective or malfunctioning parts with new or refurbished parts. If Contractor fails to replace or repair such parts, AURA's remedy shall be a refund of the price charged by the manufacturer of the part (whether that be Contractor or a third party) to its dealers for such parts as are proven to be defective. To obtain service under this warranty, AURA must bring the malfunction to the attention of Contractor or one of its authorized dealers during the one-year warranty period.
- C. Contractor warrants that its performance of the work, including the selection of the equipment to meet AURA's needs and the labor performed in the installation of said equipment, will be carried out with that standard of care, skill, and diligence normally provided by a professional organization in the performance of similar services. Contractor further warrants that the performance of subcontractors at any tier, or any other person assigned by it under this Agreement, shall be in accordance with sound practice and professional standards of its trade and the requirements of this Contract. If any portion of the services supplied fails to comply with this warranty, and Contractor is so notified in writing within one (1) calendar year after completion of this Agreement, Contractor will correctly perform such portion of the services at its own expense or, at AURA's option, will refund the amount of the compensation paid for such portion.

## **Article 18. Collaboration and Information Sharing in Performance**

To the extent that the work under this Contract impacts AURA's information technology or other technical systems, Contractor shall keep AURA's Technical Representative apprised of its activities through close coordination and regular updates. Such coordination shall be used to ensure Contractor is able to efficiently perform the work and to ensure that AURA is promptly apprised of any activities or events that may negatively impact AURA's systems or may interfere with other work of AURA.

## **Article 19. Information Security**

To the extent that the work under this Contract impacts AURA's information technology or other technical systems, Contractor shall keep AURA's Technical Representative apprised of its activities through close coordination and regular updates. AURA's Information Technology Network is to be used for AURA business purposes and to serve the interests of the corporation.

## **Article 20. Warranty of No Infringement**

Contractor represents and warrants that none of the services performed under this Contract, nor any supplies, equipment, instruments, or other deliverables provided under this Contract, will, in any way whatsoever, infringe, or constitute misappropriation of, any right of any third party, including, any copyrights, mask work rights, patent rights, trademark rights, trade secret rights or confidentiality rights.

## **Article 21. Patent and Copyright Indemnity**

Contractor shall indemnify AURA and the Government (and their officers, agents, and employees) against all liability, including costs, for infringement of any copyright or patent arising out of, or resulting from, the manufacture or delivery of supplies, the performance of services, or the construction, alteration, modification, or repair of real property, equipment, software, or instruments, under this Contract. AURA shall promptly notify Contractor if AURA becomes aware of any such claim or the potential for any such claim.

## **Article 22. Section 889 Compliance**

Contractor is prohibited, in performance of this Contract, from providing AURA any equipment, service or system that uses, as a substantial component, covered telecommunications equipment or services. "Covered telecommunications equipment" is defined at Section 889 of Public Law 115-232 (Aug. 13, 2018) and 2 C.F.R. § 200.216 to include the equipment and services of Huawei Technology Company and ZTE Corporation as well as that of certain other entities and affiliates. If Contractor determines, during the term of this Contract or during a period extending for one (1) year after the end of the term, that it failed to comply with this prohibition, it shall promptly notify AURA and replace the noncompliant equipment or service with compliant equipment or services at no additional cost to AURA. Contractor hereby acknowledges that it was placed on notice of this obligation in the course of the contract negotiation and award process.

### **Article 23. NSF Rights in Data Clause**

Notwithstanding any other term in this Contract to the contrary (if any), Contractor shall grant to NSF an irrevocable, worldwide, nonexclusive, royalty-free license to use, display, disclose, reproduce or modify (and to permit others to use, display, disclose, reproduce or modify), for any purpose whatsoever, the following items (which may constitute data or copyrightable works) to the extent delivered under this Contract:

- A. Preventative maintenance guides;
- B. Preventative maintenance histories;
- C. Operating manuals and similar plans;
- D. Facility and instrument drawings (including design, shop and as-built drawings), designs and specifications;
- E. Schematics;
- F. Warranty data;
- G. Schedules;
- H. Software and manuals developed under this Contract;
- I. Inventories;
- J. Document indices;
- K. Contracts and vendor agreements;
- L. Operations reports;
- M. Memoranda with third parties; and
- N. Safety manuals.

Contractor shall include a clause materially similar to this clause in all subcontracts under this Contract.

### **Article 24. [RESERVED]**

## **Article 25. Force Majeure**

Neither Contractor nor AURA shall be liable for failure to fulfill its obligations herein or for delays in performance or delivery, as applicable, due to causes beyond its reasonable control, including, but not limited to: acts of God, natural disasters, acts or omissions of other parties, acts or omissions of civil or military authority, Government shut downs (total or partial), the termination, lapse, or delay in government funding, changes in governmental priorities, changes in law, material shortages, fire, strikes, floods, epidemics, pandemics, quarantine restrictions, riots, war, or acts of terrorism (hereinafter collectively or singularly referred to as force majeure event). Where there is an event of force majeure, the party prevented from or delayed in performing its obligations under this contract must immediately notify the other party giving full particulars of the event of force majeure and the reasons for the event of force majeure preventing that party from or delaying that party in performing its obligations under this contract. That party must use its reasonable efforts to mitigate the effect of the event of force majeure upon its performance of the contract and to fulfill its obligations under the contract. Upon completion of the event of force majeure, the party affected must as soon as reasonably practicable recommence performance of its obligations under this contract. In the event of such delay, the date of performance or of delivery shall be extended for a period equal to the time lost by reason of said delay on written approval of AURA.

## **Article 26. Applicable Law**

### **1. Governing Law**

This Contract shall be governed under the law of the State of Arizona, without regard to its conflict of law provisions.

### **2. Construction in a Manner Consistent with Applicable Federal Laws**

Contractor's obligations under this Contract shall be interpreted and performed in a manner consistent with applicable federal laws, including, but not limited to, federal requirements incorporated by reference.

## **Article 27. Dispute Resolution**

### **1. Informal Dispute Resolution**

The Parties shall first attempt, in good faith, to promptly resolve disputes arising under this Contract informally by negotiation between AURA's Contracts Officer and Contractor's Project Manager. Upon identification of any matter of dispute, the aggrieved Party shall promptly notify the other Party of the matter and its position. Except that this clause shall not be construed as limiting AURA's suspension and termination rights under Article 12 (Termination) in any way whatsoever, the Parties agree that they shall not invoke more formal means of dispute resolution, including the filing of any lawsuit, for ten (10) calendar days following the commencement of informal negotiations, unless such

delay would materially prejudice the rights of the aggrieved party.

## **2. AURA Right to Invoke Mediation and Arbitration**

If a dispute, including any allegation of breach, is not resolved by informal means as described above, at AURA's sole discretion, AURA may invoke mediation or arbitration of the disputed matter. AURA's right to invoke mediation or arbitration shall apply to all disputes, including those first raised by AURA and those first raised by Contractor. If mediation or arbitration is invoked by AURA, the mediation or arbitration shall be conducted in accordance with the applicable Commercial Rules of the American Arbitration Association. There shall be a single presiding arbitrator or mediator, and the Parties shall mutually agree to such arbitrator or mediator within thirty (30) calendar days of AURA's invocation of mediation or arbitration. Unless otherwise agreed by AURA, the place of mediation or arbitration shall be Tuscon, Arizona. Mediation and arbitration under this section shall not be mutually exclusive; AURA may first invoke mediation and later invoke arbitration. In the case of arbitration, the award rendered by the arbitrator shall be final and binding on the Parties and may be entered and enforced in any court having jurisdiction. Each Party shall bear its own costs incurred in the course of mediation or arbitration and shall bear one half of the costs of the mediation or arbitration process.

## **3. No Other Limitations**

Except as otherwise expressly provided in this Contract, the Parties shall have and retain all rights to seek all lawful remedies for breach of this Contract.

# **Article 28. Assignment**

## **1. Assignment Required by Federal Agency**

When required by the federal agency providing the funds for this Contract, or when required by NSF in relation to management of an NSF Major Facility, Contractor agrees that AURA's rights and obligations under this Contract may be assigned to and/or assumed by the funding agency, NSF, or another entity designated by the funding agency or NSF to serve as the successor to AURA's interests under the Contract.

## **2. No Assignment by Contractor**

The rights, obligations and responsibilities established herein shall not be assigned, delegated, or transferred by Contractor without the express written consent of AURA.

## **Article 29. Miscellaneous**

### **1. No Waivers**

No assent or waiver, express or implied, of any breach of any one or more of the covenants, conditions or provisions hereof shall be deemed a waiver of any other covenant, condition or provision hereof, or a waiver of any subsequent breach of the same covenant, condition or provision.

### **2. Severability**

The provisions of this Contract are severable. If any clause, sentence, provision or other portion of this Contract is or becomes illegal, null, void, or unenforceable for any reason, or is held by any court of competent jurisdiction to be so, the remaining portions of this Contract shall continue to be valid and enforceable as to the Parties hereto, unless the Parties agree that such a clause, sentence, provision, or other portion of this Contract is of sufficient materiality to require amendment or termination of this Contract.

### **3. Intended Beneficiaries**

The only intended beneficiaries of this Contract are AURA and Contractor. Notwithstanding the forgoing, if the “standard patent rights clause” of 37 C.F.R. § 401.14 is incorporated into this Contract, the government shall be considered an intended beneficiary of this Contract to the extent, and only to the extent, set forth in such clause. Otherwise, there are no intended third-party beneficiaries of this Contract.

### **4. Survival**

All rights and obligations which, by their terms, are designated to survive expiration or termination of this Contract shall survive such expiration or termination and constitute continuing rights and obligations.

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**Article 29. Entire Agreement and Amendments**

This Contract represents the complete understanding of the Parties with regard to the subject matter. Any amendment to this Contract shall be in writing and signed by both Parties. This Contract supersedes any other agreements or understandings between the Parties, whether oral or written, relating to the subject matter of this Contract.

**IN WITNESS WHEREOF**, the Parties have caused this Contract to be executed by their duly authorized representatives, intending to be legally bound hereby.

**FOR THE ASSOCIATION OF UNIVERSITIES  
FOR RESEARCH IN ASTRONOMY (AURA)**

Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**FOR [TBD]**

Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

**APPENDIX 1.**  
**REQUIRED FEDERAL COMPLIANCE TERMS NATIONAL SCIENCE FOUNDATION**

**1. Funding Agency and Type**

This Contract is funded through a Cooperative Agreement with NSF Cooperative Agreement AST-0946422 and Cooperative Services Agreement (CSA) AST-1400450 through the NSF. As such, certain specific terms are required as set forth herein.

**2. Federal Requirements**

The performance of Contractor under this Contract is subject to the following federal requirements, which are incorporated by reference herein:

**A. 2 C.F.R. Part 200, as adopted by NSF at 2 C.F.R. Part 2500;**

**B. The NSF Cooperative Agreement Financial & Administrative Terms and Conditions (CA-FATC) (May 20, 2024) as supplemented and modified by the NSF Major Multi-User Research Facility Projects CA-FATC (May. 20, 2024), available at: [https://www.nsf.gov/awards/managing/co-op\\_conditions.jsp?org=NSF](https://www.nsf.gov/awards/managing/co-op_conditions.jsp?org=NSF); and**

**C. The NSF Performance & Award Policies & Procedures Guide (“PAPPG”), available at: [https://www.nsf.gov/pubs/policydocs/pappg20\\_1/index.jsp](https://www.nsf.gov/pubs/policydocs/pappg20_1/index.jsp), to the extent the requirements of the PAPPG are not inconsistent with the CA-FATC described immediately above.**

**3. Whistleblower Protection**

This Contract is subject to the whistleblower protection provisions of 41 U.S.C. § 4712.

**4. Fly America Act**

Any foreign travel funded under this Contract shall be carried out in a manner consistent with the restrictions of the Fly America Act, 40 U.S.C. § 40118. Contractor should contact AURA's Contracts Officer with any questions regarding compliance.

**5. Domestic Preference to the Extent Practicable**

To the greatest extent practicable for work under this Contract, Contractor shall use goods, manufactured products, or materials produced in the United States. For purposes of this clause, “manufactured products” means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum, plastics and polymer-based products, concrete, glass (including optical fiber), and lumber. For purposes of this clause, “produced in the United States” means, for iron and steel products, that all manufacturing processes, from the initial smelting stage through the application of coatings, occurred in the United States.

**6. Certification Regarding Lobbying (“Byrd Anti-Lobbying Amendment”)**

If this contract exceeds \$100,000, by signature on this Contract, Contractor's



representative certifies to the best of his or her knowledge and belief that:

- A.** No federal appropriated funds have been paid or will be paid, by or on behalf of Contractor, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal contract, the making of any federal grant, the making of any federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any federal contract, grant, loan, or cooperative agreement.
- B.** If any funds other than federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Contract or the NSF Cooperative Agreement funding this Contract, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- C.** Contractor shall require that the language of this certification be included all subcontracts and that all subcontractors shall certify and disclose accordingly.

The above certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. § 1352. Any person who fails to file the required certification may be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

## **7. Clean Air Act and Clean Water Act**

If this Contract is valued in excess of \$150,000, Contractor shall comply with all applicable standards, orders and regulations issued pursuant to the Clean Air Act (42 U.S.C. § 7401 *et seq.*) and Clean Water Act (33 U.S.C. § 1251 *et seq.*). Violations must be reported to AURA, NSF, and the local Regional Office of the Environmental Protection Agency.

## **8. Equal Employment Opportunity**

Contractor shall comply with Executive Order 11246, "Equal Employment Opportunity," as amended by E.O. 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and as supplemented by regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

## **9. Debarment**

No part of the work shall be subcontracted to parties listed on the General Services Administration's List of Parties Excluded from Federal Procurement or Non-Procurement

Programs in accordance with E.O.s 12549 and 12689, "Debarment and Suspension." By signing this contract or performing this purchase order contractor certifies that neither it nor any of its principal employees is on this debarred list. Contractor shall require a similar certification from all firms awarded subcontracts over \$25,000.

#### **10. Assignment/Subcontracting**

AURA may assign its rights under this agreement to either the National Science Foundation or to an organization succeeding it as the operator of NOIRLab. Contractor shall not assign or delegate its rights/responsibilities under this agreement without prior written permission from AURA, and any assignment without such permission shall be void. Any assignment with AURA's permission shall not relieve contractor of responsibility for successful performance of the work. Contractor may not subcontract any portion of the work, not including purchases of commercially available items, without prior written permission from AURA.

#### **11. Copeland Anti-Kickback Act**

Contractors and subcontractors on public building or public work financed in whole or in Part by Loans or Grants from the United States in excess of \$2,000.00 shall comply 18 USC 874. The Act provides that each contractor or sub-recipient shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he is otherwise entitled. AURA shall report all suspected or reported violations to the Federal awarding agency.

#### **12. Contract Work Hours and Safety Standards Act**

In performing the work contractor shall comply with Sections 102 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-333), as supplemented by Department of Labor regulations (29 CFR part 5). Under Section 102 of the Act, each contractor shall be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than 1½ times the basic rate of pay for all hours worked in excess of 40 hours-in the work week. Section 107 of the Act is applicable to construction work and provides that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous.

### **13. Nondiscrimination**

This agreement is subject to the provisions of Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d), the regulations issued pursuant thereto by NSF (45 CFR 611), and the Assurance of Compliance which the Contractor has filed with NSF. No person on the basis of race, color, national origin, or handicap shall be excluded from participation in, be denied benefits of, or otherwise be subjected to discrimination under this agreement. In addition, if the project involves an education activity or program, as defined by Title IX of the Education Amendments of 1972 (20 U.S.C. 1681-1686), no person on the basis of sex shall be excluded from participation in the project.

### **14. Davis-Bacon, as amended (40 U.S.C. 276a to a-7) (applicable to contracts for construction exceeding \$2,000.)**

All purchase orders for construction shall comply with the provision titled "Davis-Bacon Act (40 U.S.C. 276A to a-7) and as supplemented by the Department of Labor regulations (29 CFR part 5, "Labor Standards Provisions Applicable to Contracts Governing Federally Financed and Assisted Construction"). Under this Act, the contract shall be required to pay wages to labor and mechanics at a rate not less than the minimum wages specified in a wage determination made by the Secretary of Labor. In addition, Seller shall be required to pay wages not less than once a week. The Seller shall place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation and the award of a subcontract or purchase order shall be conditioned upon the acceptance of the wage determination. The Seller shall report all suspected or reported violations to AURA.

### **15. Domestic Preference to the Extent Practicable**

To the greatest extent practicable for work under this Contract, Contractor shall use goods, manufactured products, or materials produced in the United States. For purposes of this clause, "manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum, plastics and polymer-based products, concrete, glass (including optical fiber), and lumber. For purposes of this clause, "produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial smelting stage through the application of coatings, occurred in the United States.

### **16. Domestic Preferences for Procurements (CFR 200.322) "Build America, Buy America (BABA)"**

**A.** As appropriate and to the extent consistent with law, the non-Federal entity should, to the greatest extent practicable under a Federal award, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subawards including all contracts and purchase orders for work or products under this award.

**B.** For purposes of this section:

- 1) "Produced in the United States" means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.
- 2) "Manufactured products" means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber. Two General FATCs related to CFR 200.322 were added to the uniform guidance on October 4, 2021. These provisions are incorporated into this agreement in full text.

### **17. Domestic Preferences for Procurements**

The awardee is notified of the applicability of 2 CFR §200.322, entitled Domestic Preferences for Procurements.

### **18. Made in America**

In implementation of 2 CFR §200.322, Major Facility Construction Stage awards and Mid-Scale Research Infrastructure implementation awards greater than \$20 million must retain appropriate documentation to substantiate any circumstance where the awardee has deemed a U.S. preference not feasible in acquiring goods, products, or materials. The documentation must identify the basis for the determination and be based on:

- A.** Domestic non-availability – articles, materials, or supplies are not mined, produced, or manufactured in sufficient and reasonably available commercial quantities and of a satisfactory quality to meet technical or operational requirements;
- B.** Unreasonable cost – the price of the domestic end product (including transport to the construction site) is higher than the price of a foreign end product by 30 percent if offered by small business or 20 percent if offered by other than a small business;
- C.** The purchase is related to commercially-available information technology; and/or
- D.** The purchases are at or below the micro-purchase threshold (currently \$10,000 for most acquisitions), or related to procurements for use outside of the United States.

The requirements of this article must be included in all subawards, contracts and purchase orders for work or products under this award.

**RFP No. N00038756C**

**SECTION 6. STATEMENT OF WORK (SOW)**

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# **Statement of Work: Infrared Camera Controllers**

**Bret Goodrich**  
DKIST Instrument Development

Feb 17, 2024

## REVISION SUMMARY:

1. Date: Feb 8, 2024  
Revision: A  
Changes: Initial release
2. Date: Feb 17,2024  
Revision: B  
Changes: Corrections

## Scope & Overview of Deliverables

### Scope

This Statement of Work (SOW) defines the tasks, schedule, and deliverables required to complete the Work that shall be performed by the Contractor.

### Contractor Responsibilities

The Work is defined as: The development, design, analysis, procurement, fabrication, acceptance testing, packaging, transportation, delivery, and warranty of the DKIST Infrared Camera Controller (“Controller”) and all included components, as specified by **IRCAM.CTRL.SPEC-1** (“Specification”) and as required by this document.

Contractor shall be responsible for all aspects of the Work.

### Contractor Tasks

Contractor shall perform the following tasks, as defined in Sections 3 through 5:

1. Schedule and hold a Kick-Off meeting with all Parties to the Contract not more than 30 (thirty) days after contract award.
2. Prepare and deliver a Critical Design for a proposed controller to ensure that it meets the Specification by review and analysis.
3. Deliver three (3) controllers with an option of three (3) additional controllers, with associated test results for each controller and certificate of compliance to the Specification. The decision by AURA to execute the option will be at the completion of Phase 2: Critical Design.
4. Provide a Warranty period or service and support contract after delivery of the controllers.

### Project Phases of Work and Deliverables

The Work shall be divided into three (3) Phases as shown in Table 1. The Work and deliverables for each Phase are defined in Sections 3 through 5 of this SOW.

| Phase                                    | Deliverable  | Month | Milestone Payment |
|--|--|-------|-------------------|
| <b>Phase 1: Planning and Development</b> | Project Plan<br>Progress Report<br>Kickoff Meeting   | 1     | 10%               |
| <b>Phase 2: Critical Design</b>          | Critical Design Documentation<br>Critical Design Review<br>Progress Report                       | 5     | 20%               |
| <b>Phase 3: Production</b>               | Inspection and Acceptance Test Reports<br>Progress Report<br>Delivery of Controllers<br>Warranty | 10    | 70%               |

*Table 1. Phase Deliverables*



## Project Organization & Control

### Key Personnel

Contractor shall establish and maintain an effective project organization to accomplish the objectives of this Contract and to carry out the Work in an efficient manner. This project organization shall have effective control and support from appropriate senior company management.

Contractor's project management office shall coordinate and control all technical and commercial activities, project resources, and manage all disciplines required to successfully complete the Work. Contractor shall assign a Project Manager with authority over all personnel and resources of the project organization as well as those of other members of their industrial team. The Project Manager shall be assigned authority to negotiate and conclude with AURA for all issues related to the Contract to the extent consistent with the Contractor's organizational structure. The Project Manager shall be the single point of contact with AURA for all technical and contractual matters to the extent consistent with the Contractor's organizational structure.

AURA will appoint a Contract Officer (CO) to represent all contractual matters. AURA will appoint a Contract Officer's Technical Representative (COTR) to be the point of technical contact with Contractor via the Project Manager.

Change of duties and responsibilities or replacement for Key Personnel shall be communicated to all Parties of the Contract within 30 days of the change.

### Documentation of Changes and Communications

No aspect of the Work shall be modified by verbal or informal email communications. In order to be binding on the parties, a modification to the Work must be formally documented by the AURA Contracts Officer as provided in this Contract.

When Contractor requires technical information from AURA, the COTR will provide the information using a standard Technical Directive form and shall sign the form. All Technical Directives will be numbered in sequential order.

Staff from AURA and Contractor may informally communicate in order to explore issues and ideas related to the Work, provided, however, that:

- The Contractor Project Manager and the AURA COTR shall be copied on all substantive email communications between AURA and Contractor personnel and be provided with summaries of all meeting and discussions where they were not present.
- Once informal communications have converged on a solution to an issue the AURA COTR will either document the agreed solution using a Technical Directive (TD) or may ask the AURA Contract Officer to prepare a Contract Amendment to jointly modify the terms of the Contract.

### Progress Reports

Contractor shall submit a monthly written progress report to AURA. The report shall be delivered by the 15<sup>th</sup> calendar day of the subsequent month. The report shall describe the technical, schedule, and financial progress of the Work during that phase. These reports shall include the following sections:

1. A narrative on the progress made to date, with attention paid to the progress achieved during that phase;

2. A technical narrative on each developmental area, including but not limited to: controllers, electronics, mechanical, firmware, software, assembly and sourcing, testing, production, documentation, and management.
3. A list of all outstanding action items involving Contractor and AURA.
4. Proposed changes in the Specification, Contract, Statement of Work or Deliverables.
5. Updated milestone key dates, including:
  - Description of the key date;
  - Original scheduled date;
  - Modified scheduled date;
  - Schedule change in days from last phase's report; and
  - Percentage complete.

Progress reports shall be submitted in electronic format (MS Word or PDF) by email to the CO and COTR.

Contractor shall submit an updated version of the Project Plan as a part of the progress report. This updated Project Plan shall show both the original schedule, the percent complete of each task, and an updated schedule based on progress to date.

Independently, and in addition to the progress reports, Contractor shall immediately report any event, problem, or issue that has either positive or negative impact to the schedule, cost, or technical performance of the Work.

### **Meetings**

In addition to the Kick-Off Meeting and the Critical Design Review, Contractor shall meet regularly with AURA personnel upon request to update them on the status of the Work and discuss any matter related to the Work. All such meetings shall be held at Contractor's facility and/or via telephone/videoconferencing link with AURA personnel.

### **Access to Work and Information**

Contractor shall grant AURA personnel and representatives access during working hours to all places where contracted testing of the Work is being performed, including access to locations where Contractor's subcontractors are performing any part of the Work.

Upon request, Contractor shall allow AURA personnel to view, copy, and retain any design documentation, reports, or data produced under this Contract. AURA will make the request for the information not less than three (3) working days in advance of the desired time of receipt.

### **Delays**

If an event or events occur that may cause an impact to the schedule, Contractor shall evaluate all reasonable methods to avoid a schedule slip or a delay of achieving critical milestones. These methods may include utilization of additional Contractor manpower and facilities. AURA shall be notified within three (3) days of such events; notification shall include a description of schedule impact.

## Phase 1: Planning and Development

### Kick-Off Meeting

By the date provided in the Project Plan, Contractor shall meet with AURA for a Kick-Off Meeting. The Kick-Off Meeting shall include:

1. A presentation by Contractor of the designs proposed by Contractor in its bid proposal and as modified during contract negotiations;
2. A presentation and discussion of the project plan detailing the Work and all milestones; and
3. Initial discussions regarding the commencement of the Work and regular meeting between Contractor and AURA personnel.

Contractor's staff to be present at the Kick-Off Meeting shall include at least the Project Manager and lead engineers.

During the course of the Work, Contractor shall give AURA the opportunity to review the general concepts of the designs as early as possible. At the time of the Kick-Off Meeting, Contractor shall present a brief but informal report showing how the Contractor intends to apply best engineering practices during the design, fabrication, and test of the controllers. This report shall focus on all specific areas of the Work that Contractor believes represents potentially elevated risk to the project, including price, schedule, or future required changes to the controllers and the Specification.

Contractor shall provide Kick-Off documentation, the presentation, and any unresolved questions and issues prior to the Kick-Off meeting. This documentation shall be submitted to AURA five (5) calendar days in advance of the Kick-Off meeting. Contractor shall submit to AURA a summary of the Kick-Off meeting discussions and a list of action items within ten (10) calendar days after the Kick-Off meeting. Contractor shall include their responses to items raised by AURA staff in this summary. AURA will provide Contractor with a list of comments for response within five (5) calendar days after the Kick-Off meeting.

### Kick-off Documentation

#### Project Plan

Contractor shall submit a Project Plan to AURA. The Project Plan shall consist of:

1. A Work Breakdown Structure (WBS) of all of the tasks necessary to complete the Work, including but not limited to the development, design, analysis, procurement, fabrication, factory assembly, factory acceptance test, packaging, and delivery, including duration, cost, manpower, and resources required for each task;
2. A schedule based upon the task list which shows when each task will be started and completed. This schedule shall include the milestones and key dates specified herein; and
3. A list of the personnel resources, equipment, space, and other resources that will be used to complete the Work and are not otherwise noted in the WBS.

### Compliance Matrix

Contractor shall submit to the COTR a Compliance Matrix listing all of the Specifications. This Compliance Matrix shall not be construed as giving Contractor permission to deviate from the Specification; i.e., all Specification requirements are mandatory, and the Compliance Matrix only provides for an efficient means of disclosure of failures to meet the Specification. The Compliance

Matrix shall be accompanied by a report detailing any noncompliance noted, or any other technical or interface issues that will need to be resolved during the design effort and describing proposed methods of resolving these issues. The format of the Compliance Matrix shall be a six-column table as follows:

- Column #1: The source document and Specification requirement number.
- Column #2: Title or description of the Specification requirement number.
- Column #3: The verification method. Choices of verification method are: Design, Inspection, Analysis, and/or Test. Multiple verification methods may be used. The verification method for each Specification requirement is documented in the Specification.
- Column #4: Compliance. This cell is marked with the word “OK” if the Specification requirement is met by the Work and the word “Fails” if the Specification requirement is not met by the Work.
- Column #5: Test procedure number. The associated test procedure should describe the process of verifying the Specification requirement using one or more of the verification methods.
- Column #6: Notes on the compliance if other than “OK”.

## Phase 2: Critical Design

### General

Contractor shall perform the Critical Design Work, prepare the Critical Design Documentation for the controllers, and deliver the same to AURA by the dates provided in the Project Plan. A Critical Design Review of this documentation shall be held by the date provided in the Project Plan. Contractor shall perform the Work required to reach the Critical Design level. Contractor shall perform the following Work to meet the Specification.

### Critical Design Documentation

At a minimum, the Critical Design Documentation shall consist of the following:

1. An updated Project Plan, including a schedule for the remainder of the Work;
2. An updated Compliance Matrix, including all Specification requirements that have not being met;
  - For each non-compliant Specification requirement, Contractor shall provide a Request for Waiver (RFW) explaining the non-compliance, its effect on the requirement, and concessions offered for not meeting the requirement.
3. A Critical Design of the Controller, including but not limited to:
  - Completed documentation of all mounting, electrical and thermal interfaces,
  - Completed documentation of the Application Programming Interface (API).
4. An Acceptance Test Plan (ATP) describing each of the test procedures used for verifying Specification. The ATP shall be used during the Production phase for the acceptance and delivery of each controller. The ATP shall assure through test, analysis, design, or inspection that each Specification requirement will be tested, analyzed, reviewed, or inspected as indicated and appropriate for that requirement.

All Critical Design documentation shall be reviewed and approved by AURA.

### Critical Design Review

Contractor shall present the design and associated documentation at a Critical Design Review (CDR) per the following:

1. The CDR will be held online unless otherwise agreed by both parties. AURA will host the online meeting room.
2. Contractor's staff to be present at all reviews and shall include at least the Project Manager and lead engineers with additional staff, as needed.
3. Contractor shall notify AURA of the date it will be ready for the CDR at least two (2) weeks before such date. Contractor shall provide AURA with all Design Documentation at least two (2) weeks prior to the review meeting.
4. AURA will call and conduct the CDR on or near the date specified by Contractor. AURA will select the review committee members. The total number of review committee members will not exceed five (5). Contractor will not be responsible for any travel expenses of the review committee members.
5. Within two (2) weeks after the CDR, the COTR will send to Contractor a CDR Report based on the CDR committee recommendations, questions and comments. In this report, the COTR may direct Contractor, in writing, to make changes to the design documentation that are required in

order to make it consistent with the Specification and this SOW. Contractor shall promptly contact the AURA Contracts Officer if it feels that any requested changes are beyond the scope of the Specification and request a formal contract modification. Within two (2) weeks after receipt of the CDR Report, Contractor shall submit a Response to the CDR Report with point-by-point responses to each of the recommendations, questions and comments. Contractor shall promptly comply with all directions to make changes to the design documentation and submit the revised documents for approval. Once all requested changes have been implemented to AURA's satisfaction, the COTR will notify Contractor in writing that the Critical Design Documentation is approved.

6. The CDR is advisory and shall not relieve Contractor of any responsibility for the successful completion of the Work in conformity with the Specification. Similarly, comments or discussions during the design review shall not be construed as modifying or waiving any of the Specification requirements or relieving Contractor of any obligations under this Contract. As provided in the Contract or Sub-award, the Specification may only be modified by means of a written amendment or change order to the Contract.

## **Phase 3: Production**

### **General**

Contractor shall perform the Production Work to produce, test, and deliver controllers to AURA. Contractor shall produce controllers based upon the Contract, Critical Design, and the Specification.

### **Inspection and Acceptance Test Reports**

All controllers shall be tested with the AURA-approved Acceptance Test Plan before delivery. Contractor shall provide documentation of results and compliance/non-compliance of each Controller with the Specification. Contractor shall provide additional analysis and potential mitigating actions for Controllers that fail any Specification requirement and/or Acceptance Test Plan step.

### **Controller Delivery**

Contractor shall provide a schedule for controller deliveries to AURA at the National Solar Observatory (NSO) office in Boulder, Colorado, USA. Contractor shall ship and insure all controllers to this location as part of the Work.

### **Controller Warranty**

Contractor shall provide a Warranty or Service Agreement for each controller for ten years from date of delivery.

A Warranty shall include cost of any labor and materials required for replacement and/or repair of any defects found during this period. All parts, components, and accessories delivered by the Contractor, including firmware, software, mechanical, and electrical components shall be covered by the Warranty. New software or firmware updates developed by the Contractor shall be included during the Warranty period.

A Service Agreement shall include all replacement/repair requirements of a Warranty, except that Contractor shall provide at the Start of Contract a cost for each and/or all services provided for the duration of the agreement.

**RFP No. N00038756C**

**SECTION 7. SPECIFICATIONS**

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# **Infrared Camera Controller Specifications**

**Bret Goodrich, Erik Starman, Andre  
Fehlmann, Chris Berst**

**DKIST Instrument Development**

February 15, 2024

## **REVISION SUMMARY:**

1. Date: Jan 24, 2024  
Revision: A  
Changes: Initial release
2. Date: Feb 15, 2024  
Revision: B  
Changes: Section 4.4

# 1 INTRODUCTION

The Daniel K. Inouye Solar Telescope has purchased digital Focal Plane Modules from Raytheon Vision Systems (RVS). We are now looking for a camera controller to program and read out these infrared sensors. The information in this document is intentionally kept general to protect proprietary information. A successful bidder has to be able to enter a Non-Disclosure-Agreement with RVS to gain access to technical documentation.

These 4k x 4k sensors will be placed in custom cryostats at the telescope. Signals to and from the sensors have to travel through cables of at least 1000 mm in length and at least one hermetic bulkhead connector. Controller electronics may be located either in close proximity to the cryostats in the Coude Laboratory, or in the instrument racks located in a separate space at a distance of approximately 12 meters. Further details are provided in the Interfaces section.

The sensors provide a 14-bit digital data output stream on 8 parallel channels that need to be read out at high data rates to allow for 60 Hz full frame rates. A series of tunable analog bias voltages need to be supplied to the device to optimize performance. Sensor programming and initiation of a sensor exposure and readout is achieved by sending a digital Low Voltage Differential Signal (LVDS) bit stream called a Serial Data Word (SDW) to the sensor.

## 1.1 OVERVIEW OF REQUIRED CONTROLLER FEATURES

- Provide all bias voltages
- Support for specifying a stack of SDW's. The stack shall support either a single SDW or multiple SDW's.
- Support for reading and writing a full SDW.
- Support for reading and writing a partial SDW.
- Support via the API to control:
  - Exposure time
  - Camera mode
  - Gain mode
  - Shutter Mode
  - Region of Interests
  - Aggregation (binning)
- Support for receipt of an external TTL trigger input that initiates a sensor exposure and subsequent readout.
- Support for supplying a TTL "FIRE", or equivalent, output that can be used to determine when the sensor begins its exposure.
- A data interface that, at a minimum, must be capable of transferring 4Kx4K@60Hz frame data, including any additional metadata that may accompany each frame, from the controller to the DKIST Camera Systems Software (CSS).
- A 1GigE connection for command/control communications between the controller and CSS

## 1.2 VERIFICATION METHODS

Included in each major numbered specification listed in this document is a requirement verification method. These verification methods specify the minimum standards of verification required to ensure that the individual requirements and specifications are met.

Examples of verification methods include:

- Design Review. Verification by design review means that it is shown during an appropriate design review that the system meets specifications through its intrinsic design and configuration.
- Analysis. Verification by analysis demonstrates that the design meets the specification through the use of performance modeling metrics.
- Test. Verification by test and/or measurement means that it is demonstrated that the as-built system meets the specification through measurements of its operation performance. Testing is performed during acceptance testing and/or as part of a pre-ship readiness review.
- Inspection. Verification by inspection means that visual inspection verifies that the specification has been achieved on the as-built system during pre-assembly and/or during Site assembly.

## 1.3 DEFINITIONS

| Term            | Definition   |
|-----------------|--|
| Delivered frame | Frame sent by the controller to the CSS. Size depends on windowing and aggregation.  |
| Frame time      | The time from the start of an exposure to when the sensor is ready to be exposed again.  |
| Frame rate      | 1/Frame time.  |
| Exposure        | Integration of photo-electrons by camera pixels.   |
| Exposure time   | Time during which camera pixels integrate photo-electrons.   |
| Full frame      | All the imaging pixels in the sensor array.  |
| Non-Linearity   | The peak-to-peak deviation of camera digital output from its linear best fit least squares fit of digital output vs. exposure time divided by the maximum signal.            |
| Operability     | Pixels at a fixed location on the photosensitive area of the sensor whose quantum efficiency deviates from the median quantum efficiency of all pixels by less than +/- 20%. |
| Readout time    | Time required to read out a full frame or selected region of interest.   |
| Readout rate    | 1/Readout time.  |

## 1.4 GLOSSARY

The following table provides a brief description of some of the acronyms used in this document:

| <b>Acronym</b> | <b>Definition</b>  |
|----------------|--|
| <b>API</b>     | Application Programming Interface  |
| <b>CDS</b>     | Correlated Double Sampling is a method to measure electrical values such as voltages or currents that allows removing an undesired offset. It is often used when measuring sensor outputs. The output of the sensor is measured twice: once in a known condition and once in an unknown condition. The value measured from the known condition is then subtracted from the unknown condition to generate a value with a known relation to the physical quantity being measured.<br><a href="https://en.wikipedia.org/wiki/Correlated_double_sampling">https://en.wikipedia.org/wiki/Correlated_double_sampling</a> |
| <b>CML</b>     | Current Mode Logic   |
| <b>CSH</b>     | Camera Systems Hardware – All camera hardware including the physical detector, camera mount and motion stages, and all inter-connects to the CSS.  |
| <b>CSS</b>     | Camera Systems Software – The system consisting of the software, computer, frame grabber, and timing interface which is responsible for configuring and acquiring data from the CSH and then processing.   |
| <b>DIO</b>     | Digital Input/Output – Discrete Input/Output typically used for triggering.  |
| <b>LVDS</b>    | Low Voltage Differential Signaling   |
| <b>RICL</b>    | Reticle Image Composition Lithography  |
| <b>ROI</b>     | Region-of-Interest – A sub-region of pixels from a camera sensor.  |
| <b>ROIC</b>    | ReadOut Integrated Circuit - The electrical interface for the sensor.  |
| <b>SDW</b>     | Serial Data Word - The overarching control structure for the sensor as defined by Raytheon Vision Systems.   |

## **2 GENERAL CONTROLLER REQUIREMENTS**

### **2.1 SCOPE**

The controller shall include all hardware necessary to electrically and programmatically interface with a digital RVS sensor. The controller shall provide a digital interface for receiving commands and transmitting responses to/from its programmatic interface. The controller shall provide all readout electronics, clocking, signal conditioning, and a data interface between the controller hardware and the CSS and a control and status interface between the controller and the CSS. The controller shall provide facilities for receipt of an externally supplied TTL trigger input that initiates the actions necessary to result in a sensor exposure and readout. Any non-standard interface electronics required at the computer are also considered part of the “controller.”

*Verification: Design Review, Inspection.*

### **2.2 SOFTWARE INTERFACE**

The controller shall provide a Linux C/C++ Application Programmers’ Interface (API) to control all camera operational capabilities, to read data, and to read and set all camera parameters. No other interface shall be required for camera control.

*Verification by: Design Review*

### **2.3 FIELD UPGRADABLE**

The controller shall support field upgrades of any embedded firmware, software, and or FPGA programs.

*Verification by: Design Review*

### **2.4 CABLING**

If specialized cables are required to perform a field upgrade, then 2 sets of cables shall be provided with delivery of the controller.

*Verification by: Design Review, Test*

### **3 TIMING CONTROL REQUIREMENTS**

#### **3.1 EXPOSURE TRIGGERING**

The controller shall initiate an exposure, and subsequent readout, of the sensor by sending a full or an appropriate partial SDW.

*Verification: Design Review, Test*

#### **3.2 ACCEPTING EXTERNAL EXPOSURE TRIGGERING**

The controller shall be capable of initiating one or more exposures in response to an external trigger. On receipt of an external trigger, the controller shall iterate through the active SDW stack and sends the SDWs, in order, to the sensor to execute the exposure sequence. The exposures shall start deterministically according to the trigger-to-exposure latency requirement and the exposure start time stability requirement while meeting all other controller requirements.

*Verification: Design Review, Test*

#### **3.3 EXPOSURE RATE**

The controller shall be capable of accepting external triggers and triggering exposures that do not exceed the equivalent data rate of a full-frame (4k x 4k) exposure at a rate of 60 Hz. Consequently, windowed and aggregated frames could be triggered at a higher rate.

*Verification: Design Review, Test*

#### **3.4 TRIGGER TO EXPOSURE LATENCY**

The controller shall introduce latency between the receipt of a trigger and the start of the exposure integration of less than 10% of one frame time.

*Verification: Design Review, Test*

#### **3.5 EXPOSURE START TIME STABILITY**

The controller shall introduce a random variation in the delay between the arrival of the external trigger and the actual start time of the exposure of less than  $\pm 0.1$  ms RMS.

*Verification: Design Review, Test*

#### **3.6 EXPOSURE TIME**

The controller shall support adjustable exposure times inclusive of the full integration time range available by the RVS sensor.

*Verification: Design Review, Test*

### **3.7 EXPOSURE TIME FEEDBACK**

The controller shall provide a feedback mechanism, e.g. TTL “FIRE”, or equivalent, output, to notify the CSS when exposures will be taken.

*Verification: Design Review, Test*



## **4 SERIAL DATA WORD (SDW) CONTROL REQUIREMENTS**

### **4.1 SDW LVDS INTERFACE**

The SDW timing and data signals shall conform to the LVDS standard ANSI/TIA/EIA-644 unless specified differently in this requirement document.

*Verification: Design Review, Test*

### **4.2 SDW LVDS CLOCK**

The controller shall provide a 40 MHz LVDS clock signal that serves as the master clock for all sensor operations.

*Verification: Design Review, Test*

### **4.3 SDW LVDS CLOCK JITTER**

The LVDS clock signal jitter shall be less than 200 ps RMS.

*Verification: Design Review, Test*

### **4.4 SDW LVDS DATA**

The controller shall provide a 40 MHz LVDS data line that is used for the serial programming of the sensor.

*Verification: Design Review, Test*

### **4.5 PRE-PROGRAMMED SDW**

The controller shall support the selection and use of a factory default SDW.

*Verification: Design Review, Test*

### **4.6 POWER-ON DEFAULT SDW**

The controller shall support the selection of an SDW that will be used on power-up of the controller. The controller shall support the selection of either the factory default SDW or a user-specified SDW that is made available by the controller on power-up for immediate use with no interaction from the CSS.

*Verification: Design Review, Test*

## **4.7 FULL SDW READ/WRITE ACCESS**

The controller shall support programmatic reading of a full SDW from the controller by the CSS and for the CSS to write a full SDW to the controller. This shall include the capability of reading the factory default SDW.

*Verification: Design Review, Test*

## **4.8 SELECTED SDW FIELDS CONTROL**

The controller shall support simplified programmatic access to selected “fields” of a full SDW without the need for the CSS to supply a full SDW to the controller. This might require changing other fields automatically to accommodate the requested change. The fields shall include, but are not limited to:

1. Exposure Time
2. Shutter Mode (Integrate then Read vs Integrate while Read)
3. Camera Read Mode (CDS vs non-destructive up the ramp)
4. Gain Mode
5. Windowing
6. Aggregation (binning)

### **4.8.1 Exposure Time Control**

The controller shall support programmatic access to the integration time of the sensor. The integration time shall be adjustable to any value larger than 50 microseconds as allowed by the shutter and camera read mode.

*Verification: Design Review, Test*

### **4.8.2 Shutter Mode Control**

The controller shall support the selection of Integrate While Read (IWR) and Integrate Then Read (ITR) shutter modes.

*Verification: Design Review, Test*

### **4.8.3 Camera Read Mode Control**

The controller shall support the selection of on-chip CDS and non-destructive up-the-ramp readout modes.

*Verification: Design Review, Test*

### **4.8.4 Gain Mode Control**

The controller shall support the selection of high and low gain modes.

*Verification: Design Review, Test*

### **4.8.5 Windowing**

The controller shall support programmatic access to define between 1 and 16 row-based windows. Window height shall be adjustable in increments of 8 rows by providing a start row and stop row. The gain shall be selected for each window individually. The window readout timing shall be selected from 4 independently defined timing groups.

*Verification: Design Review, Test*

#### **4.8.6 Aggregation**

The controller shall support programmatic access to the aggregation capability of the sensor. The controller shall support the following aggregation modes:

1. No aggregation
2. 2 rows, 1 column (row aggregation)
3. 1 row, 2 columns (column aggregation)
4. 2 rows, 2 columns (row and column aggregation)

*Verification: Design Review, Test*

## **5 DATA READ REQUIREMENTS**

### **5.1 DATA STREAM SIGNAL**

The controller shall be capable of reading the CML data stream sent by the sensor. The CML differential voltage range is +/- 100 mV to +/- 600 mV. AC coupling capacitors are required at the CML receiver inputs.

*Verification: Design Review, Test*

### **5.2 NUMBER OF OUTPUT PORTS**

The controller shall be capable of reading 8 output ports from the sensor in parallel.

*Verification: Design Review, Test*

### **5.3 DATA RATE**

The controller shall be capable of reading the data stream from each output port at 2.56 Gbps (Giga bits per second).

*Verification: Design Review, Test*

### **5.4 DATA DECODING AND DESCRAMBLING**

The controller shall be capable of decoding the 8b/10b data stream from each output port and descramble all streams to a cohesive data header and a single 16 bits per pixel frame with 14 bits of significance per pixel.

*Verification: Design Review, Test*

### **5.5 DATA BUFFERING**

TBD

## 6 ELECTRICAL REQUIREMENTS

### 6.1 PHYSICAL INTERFACE

The interface to the sensor is a single 240 pin Airborn verSI connector (6 rows, 40 columns).

*Verification: Design Review, Test*

### 6.2 DISCRETE TTL TRIGGER INPUT

The controller shall support receipt of a 3.3 to 5v TTL trigger input that will be used by the controller to initiate a sensor exposure.

*Verification: Design Review, Test*

### 6.3 POWER SUPPLY REQUIREMENTS

The controller shall be capable of supplying and configuring six (6) bias supplies plus one (1) detector bias. A provided power on and off sequence has to be strictly followed.

#### 6.3.1 ROIC Bias Supplies

The controller shall be capable of supplying and configuring six (6) bias supplies. To protect the ROIC over voltage and current protection shall be used. Biases need to be energized and de-energized in the proper power-on and power-off sequence. The six (6) bias supplies are:

- 1.8V Analog Supply
- 1.8V Digital Supply
- 1.8V Analog PLL Supply
- 1.8V Analog IO Supply
- 3.3V Analog Supply
- 3.3V Digital Supply

The voltage tolerance as measured at the ROIC shall be +/- 50mV

The total integrated noise should be less than 25-50% of the noise floor at higher frequencies (> 10 kHz) and should be well below 1 mV close to DC (<10kHz).

The input ripple at the sensor shall be restricted to less than 0.5 mV.

Exact voltage, over-voltage, and over-current protection levels will be provided.

*Verification: Design Review, Test*

#### 6.3.2 Detector bias

The controller shall be capable of supplying and configuring one (1) detector bias:

1. 0V DETECTOR BIAS

*Verification: Design Review, Test*

## **7 TEMPERATURE MONITORING REQUIREMENTS**

### **7.1 CONTROLLER TEMPERATURE**

The controller shall be capable of monitoring its own temperature and supplying the temperature value through the programmatic interface to the CSS.

*Verification: Design Review, Test*

### **7.2 SENSOR TEMPERATURE**

The controller shall be capable of obtaining the sensor temperature from the digital data stream and supplying the temperature value through the programmatic interface to the CSS.

*Verification: Design Review, Test*

## 8 INTERFACES

### 8.1 ENVIRONMENT

Camera controller electronics may be located in the Coude Laboratory within 3 meters of the cryostats, or in the instrument racks at a distance of approximately 12 meters. Electronics and power supplies located in the Coude Laboratory shall not dissipate greater than 20 watts of unmitigated heat to the laboratory environment.

Camera controller electronics shall operate within specification at an altitude of 10,000 feet (3,050 meters).

Camera controller electronics shall operate within specification at an external temperature between 18°C and 22°C and an external humidity between 30% and 60%.

Camera controller electronics shall survive without damage at an external temperature between 0°C and 27°C and an external humidity between 5% and 95%.

*Verification: Analysis, Test*

### 8.2 SEISMIC

The camera controller electronics shall be able to survive a seismic event with horizontal acceleration of 1.8g and vertical acceleration of 0.8g.

*Verification: Analysis, Test*

## 9 NON-FUNCTIONAL REQUIREMENTS

### 9.1 MAINTAINABILITY

The camera controller hardware and associated programming must be maintainable through a warranty or service and support contract for a duration of 10 years minimum. Alternatively, this may be achieved by delivering the full hardware specifications, design files, programming source code, and programming tools.

*Verification by: Design Review*