Statement of Work: Infrared Camera Sensor

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DKIST Instrument Development

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REVISION SUMMARY:

1. Date: Oct 6, 2020
   Revision: A
   Changes: Initial release
2. Date: Dec 9, 2020
   Revision: B
   Changes: Three phases, added test ROIC, added testing instructions

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1. SCOPE & OVERVIEW OF DELIVERABLES

1.1 SCOPE

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

1.2 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 Sensor ("Sensor") and all included components, as specified by **IRCAM.SEN.SPEC-004** ("Specification") and as required by this document.

Contractor shall be responsible for all aspects of the Work.

1.3 CONTRACTOR TASKS

Contractor shall perform the following tasks:

a. Schedule and hold a Kick-Off meeting with all Parties to the Contract not more than 30 (thirty) days after contract award.

b. Prepare and deliver progress reports of the Work at the conclusion of each Phase of Work as defined herein.

c. Prepare and deliver a Critical Design Review (CDR) of a sensor prototype to ensure that it meets the Specification by inspection and test.

d. Deliver one (1) test ROIC that meets interface and timing Specification.

e. Deliver two (2) shortwave and two (2) midwave production Sensors with associated test results for each sensor and certificate of compliance to the Specification.

f. Provide a Warranty period of two years after delivery of each sensor.

1.4 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.

Table 1. Phase Deliverables

Phase	Deliverable	Month	Milestone Payment
Phase 1: Planning and Development	Kick-off Meeting Project Plan Progress Report	1	20%
Phase 2: Critical Design	Critical Design Work Critical Design Documentation Critical Design Review Progress Report	10	30%
Phase 3: Production	Inspection and Acceptance Test Reports Progress Report Sensors Warranty	20	50%

2. PROJECT ORGANIZATION & CONTROL

2.1 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.

2.2 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.

2.3 PROGRESS REPORTS

Contractor shall submit a written progress report to AURA at the conclusion of each phase of Work. The report shall describe the technical, schedule, and financial progress of the Work during that phase. These reports shall include the following sections:

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

b. A technical narrative on each developmental area, including but not limited to: sensors, electronics, mechanical, firmware, software, assembly and sourcing, testing, production, documentation, and management.

c. A list of all outstanding action items involving Contractor and AURA.

d. Proposed changes in the Specification, Contract, Statement of Work or Deliverables.

e. 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.

2.4 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 either at Contractor's facility or via telephone/videoconferencing link with AURA personnel.

2.5 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.

2.6 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.

3. PHASE 1: PLANNING AND DEVELOPMENT

3.1 KICK-OFF MEETING

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

a. A presentation by Contractor of the designs proposed by Contractor in its bid proposal and as modified during contract negotiations;

b. A discussion of the project plan detailing the Work and all milestones; and

c. Initial discussions regarding the commencement of the Work.

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 sensors. 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 sensors 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.

3.2 KICK-OFF DOCUMENTATION

3.2.1 Project Plan

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

a. 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;

b. 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 above in section 2.4 of this SOW; and

c. 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.

3.2.2 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".

4. PHASE 2: CRITICAL DESIGN

4.1 GENERAL

Contractor shall perform the Critical Design Work, prepare the Critical Design Documentation for the sensors, 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.

4.2 CRITICAL DESIGN WORK

Contractor shall perform the Work required to reach the Critical Design level. Contractor shall perform the following Work to meet the Specification.

4.3 CRITICAL DESIGN DOCUMENTATION

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

a. An updated Project Plan, including a schedule for the remainder of the Work;

b. 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.

c. A Critical Design of the Sensor, including but not limited to:

   - A final mechanical design with 3D models and 2D drawings of the mechanical structure;
   - Final documentation of all mounting, optical, electrical, and thermal interfaces;
   - A final list of all materials, parts, and processes, including Commercial-Off-The-Shelf (COTS) parts;
   - A description of component manufacturability, including final plans for fabrication;
   - A summary of final design considerations that are to be implemented during the Production phase.

d. 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 sensor. The ATP shall assure through test, analysis, design, or inspection that each Specification requirement will been tested, analyzed, reviewed, or inspected as indicated and appropriate for that requirement.

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

4.4 CRITICAL DESIGN REVIEW

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

a. The CDR will be held online. AURA will host the online meeting room.

b. Contractor's staff to be present at all reviews shall include at least the Project Manager and lead engineers with additional staff as needed.

c. 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 to prior to the review meeting.

d. 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.

e. 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.

f. 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.

5. PHASE 3: PRODUCTION

5.1 GENERAL

Contractor shall perform the Production Work to produce, test, and deliver ROIC and sensors to AURA.

5.2 TEST ROIC

Before delivery of the sensors, Contractor shall deliver one (1) Test ROIC (Readout Integrated Circuit) to AURA. The Test ROIC shall be able to perform at warm temperatures, however it is not required to be photo-sensitive. The Test ROIC shall meet Specification for frame rate, modes of operation, timing, and interface.

5.3 SENSOR PRODUCTION

Contractor shall produce sensors based upon the Contract, Critical Design, and the Specification. Contractor may provide choices in sensor selection to AURA based upon production yields, characteristics, and test results.

5.4 SENSOR TESTING

All sensors shall be tested with the AURA-approved Acceptance Test Plan before delivery. Characteristics of each sensor shall be determined and documented, including, but not limited to, serial number, bad pixel and pixel cluster analysis, configuration, and results of the Acceptance Test Plan.

Contractor shall provide documentation of results and compliance/non-compliance of each Sensor with the Specification. Contractor shall provide additional analysis and potential mitigating actions for Sensors that fail any Specification requirement and/or Acceptance Test Plan step.

5.5 SENSOR DELIVERY

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

5.6 SENSOR WARRANTY

Contractor shall provide a warranty for each sensor for two years from date of delivery. The 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.