

**TMT International Observatory LLC**

**Request for Proposal ("RFP")**

**For The**

**TMT VCAM Opto-Mechanical Final Design, Fabrication, Integration and Test**

**TMT Document No.: TMT.BUS.MGT.18.034.REL01**

**Date Issued: March 12, 2018**

**PROPOSALS DUE: May 8, 2018**

The information contained herein is provided to the recipient for the purpose of preparing a proposal to the TMT project. The institution or organization to which this RFP is addressed may utilize the information contained herein only for the above stated purpose and shall not disseminate it to anyone not involved in the preparation of its proposal.

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## 1.0 Description of Request for Proposal

### 1.1 Introduction

The TMT Project (the “Project”) is a collaboration of the California Institute of Technology, the University of California, the Association of Canadian Universities for Research in Astronomy, the National Astronomical Observatory of Japan, the Department of Science and Technology of India, and the National Astronomical Observatories of China with a mission to design, construct and operate a thirty meter optical/infrared telescope. The TMT International Observatory LLC (“TMT”) is part of the Project and is the legal entity that is issuing this RFP and any resultant contracts.

The first light TMT AO system (“NFIRAOS”) is a Laser Guide Star (“LGS”) Multi Conjugate AO (MCAO) System. It includes 6 (six) high-order LGS wavefront sensors cameras and one high-order Natural Guide Star (“NGS”) wavefront sensor camera for observations without lasers guide stars. The 6 (six) high-order LGS wavefront sensor cameras and the NGS wavefront sensor camera shall be referenced as the visible cameras (“VCAM”) system in this RFP.

Each VCAM is composed of a detector (“VCAM CCD”), the electronics (“VCAM EL”), the lenslet arrays (“VCAM LENSEA,” for the LGS WFS cameras only) and the opto-mechanical part of the camera itself (“VCAM OM”). The scope of this RFP is limited to the VCAM OM part.

Respondents shall submit a proposal including a firm fixed price and detailed schedule for TASK 1 of the statement of work and a not to exceed cost estimate and schedule for the option that encompasses TASK 2 and TASK 3 of the summarized statement of work below:

#### 1.1.1 TASK 1: VCAM Final Design

- a. Develop the final design of the VCAM OM in accordance with the requirements stated in this RFP;
- b. Work with the VCAM EL sub-contractor to complete the VCAM System design;
- c. Develop an option which TMT may exercise (either individually or collectively) to execute a firm fixed price contract for TASK 2 and TASK 3.

#### 1.1.2 TASK 2 (OPTION): VCAM Pre-Production Unit Fabrication and Test

- a. Fabricate and test a VCAM OM pre-production unit based on the TMT-approved design;
- b. Integrate, align, and test the VCAM pre-production unit with the VCAM EL sub-contractor using TMT VCAM supplied components.

#### 1.1.3 TASK 3 (OPTION): VCAM System Fabrication and Test

- a. Fabricate and test the VCAM OM components of the VCAM System based on the TMT-approved design;
- b. Integrate, align, and test the VCAM System in collaboration with the VCAM EL sub-contractor using the TMT VCAM supplied components.

### 1.2 VCAM OM RFP Background Information and Exhibits

The list of Exhibits for this RFP may be found in Section 7.0 of this RFP. Only Exhibits A through G shall be provided once a Respondent (1) notifies TMT in writing of their interest in participating in the RFP and (2) is confirmed by TMT to be a “qualified Respondent.”

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Within one week of the RFP publication, Respondents should submit a written request for the Background Information, sign the attached NDA (Exhibit L), and demonstrate qualification to receive the Background Information.

TMT will review Respondents' requests, and if approved, TMT will provide the Background Information using the Caltech Dropbox, which is a service for sharing large files. Qualified Respondents requesting the Background Information should receive an email message from the Caltech Dropbox that the Background Information is ready for transfer.

Respondents should propose any modifications to the Model Contract in the section designated for RFP deviations.

Exhibits A through G are referenced collectively as the "Background Information."

The Offer Submittal Form is attached to this RFP as Exhibit J.

A Presentation about the Work is attached to this RFP as Exhibit K.

### 1.3 Proposal Instructions

The Work described in the Statement of Work and the Deliverables being procured under this RFP are described in Section 6.0 of this RFP. Respondents are directed to use this RFP as their sole reference for understanding and addressing the requirements regarding the Statement of Work and Deliverables in the development of their proposal.

#### 1.3.1 Review of Background Information

Respondents shall review the Background Information for this RFP and review the statement of work for this RFP.

### 1.4 Proposal Terms

#### 1.4.1 Shipment and Delivery

Unless specified otherwise in writing, all deliverables shall be submitted electronically to TMT via electronic mail. All deliverables shall be submitted to [cboyer@tmt.org](mailto:cboyer@tmt.org), [lianqiw@tmt.org](mailto:lianqiw@tmt.org) and [pratheep@tmt.org](mailto:pratheep@tmt.org).

Respondent's proposal must include the cost of shipping all hardware deliverables in accordance with the requirements stated in Section 6.0 of the RFP. Proposed shipping methods and costs shall mitigate all reasonable risks that could damage the deliverable(s). For the purposes of this proposal, shipping terms shall be DDP to the NRC Herzberg (Victoria Canada) and TMT (Pasadena US).

#### 1.4.2 Contract Type for Proposed Work

- a. Respondents shall provide a firm fixed price proposal to perform the work described in Section 6.0 of the RFP under Article I.A (TASK 1).
  - i. The proposed firm fixed price shall be submitted to TMT by completing the cost matrix attached to this RFP as Exhibit A. Respondents are requested to submit firm fixed price information for all activities defined in the cost matrix.
  - ii. The proposal shall include a detailed, resource loaded schedule showing the project milestones and the different tasks to be performed for each

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activity. The amount of schedule “slack” in each task shall be indicated. The schedule shall be provided in MS Project format.

- iii. The proposal shall include a risk register for the VCAM OM. The risk register shall contain a comprehensive list of foreseeable technical, manufacturing and programmatic risks. For each risk, the list shall include a clear description, the consequences, the rating (probability, severity, and overall) and the proposed mitigation approach or resolution.
  - iv. The proposal shall provide the list and resume of key staff, including their role in the project, and a list of sub-contractors that will be involved in the VCAM OM project.
- b. Contractor shall prepare a cost-type proposal with a not to exceed ceiling price for the activities described in Articles I.B.2 (TASK 2) and I.B.3 (TASK 3) of the SOW.
- i. The ceiling price shall be the cost estimate that is generated by completing the cost matrix attached to this RFP as Exhibit A. Respondents are requested to submit the cost information for all activities defined in the cost matrix.
  - ii. Respondents shall also provide a schedule showing the project milestones and the different tasks that shall be performed for each of the project milestone. The schedule shall be provided in MS Project format.

#### 1.4.3 Validity Period

The proposal must be valid for sixty (60) days from the date of its receipt by TMT.

#### 1.4.4 Data Rights

TMT will own all rights to the work product developed or fabricated pursuant to the resultant contract awarded under this RFP and will have the right to use, reproduce and adapt it for any purpose.

#### 1.4.5 Proposal Schedule

The proposed schedule for TASK 1 described in the Section 6.0 of this RFP (Statement of Work) must be completed no later than nine (9) months from the Effective Date of the Contract.

The proposed schedule for TASK 2 and TASK 3 described in the Section 6.0 of this RFP (Statement of Work) must be completed no later than twenty-one (21) months from the start of TASK 2.

#### 1.4.6 Proposal Cost and Schedule Contingency

The proposal shall include any specific information on the proposal cost and schedule contingency.

While TMT prefers firm, fixed price proposals for the Work, Respondents are allowed to submit proposals that are priced on a cost-type basis. All cost-type proposals shall be inclusive of costs for the Work including, without limitation, all fees, taxes, shipping, and duties. In the event a cost-type proposal is submitted, TMT still requires that Respondent submit an accompanying firm, fixed-price for TMT’s comparison and review. Respondents

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that submit cost-type proposals should be prepared to discuss potential cost risks and mitigation approaches (if any).

#### 1.4.7 Format of Deliverables

For the purposes of this RFP, proposed deliverables shall be provided in MS Word (unless specified otherwise in the RFP).

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## 2.0 Instructions to the Respondent

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### 2.1 General Instructions

Read the information contained in this RFP, which includes the model contract (the "Model Contract"), and submit a complete response to all requirements, guidelines, specifications, and questions as directed.

The designated letters for the Exhibits in this RFP may be different than those in the awarded contract.

#### 2.1.1 Schedule of Events

|                                   |                |
|-----------------------------------|----------------|
| RFP Issued                        | March 12, 2018 |
| Respondent Qualification          | March 19, 2018 |
| Background Information Provided   | March 20, 2018 |
| Submission of RFP Questions       | March 27, 2018 |
| Proposal Submittal Date           | May 8, 2018    |
| Completion of TMT Proposal Review | June 15, 2018  |
| Estimated Contract Start Date     | July 1, 2018   |

#### 2.1.2 Offer Form

The proposal shall be submitted with the completed and signed Offer Submittal Form attached as Exhibit J to this RFP as the cover page. Additionally, the proposal shall follow the requirements described in Section 5.0.

#### 2.1.3 Proposal Submission Protocol

The required method of submission is in an electronic form. TMT will evaluate the proposal in its electronic form.

The font size of the proposal may not be less than 10 points.

Respondents must submit their proposals to Lianqi Wang ([lianqi@tmt.org](mailto:lianqi@tmt.org)), Corinne Boyer ([cboyer@tmt.org](mailto:cboyer@tmt.org)), Christina Wong ([cwong@tmt.org](mailto:cwong@tmt.org)) and Pratheep Eamranond ([pratheep@tmt.org](mailto:pratheep@tmt.org)) no later than the proposal submission date and time of May 8, 2018, 5:00PM Pacific Time ("Proposal Submittal Date and Time").

All questions, concerns, requests and correspondence regarding the RFP must be submitted by March 27, 2018 to ensure a response. RFP questions submitted after March 27, 2018 may not receive a response. RFP questions shall be directed (only) to [cboyer@tmt.org](mailto:cboyer@tmt.org), [cwong@tmt.org](mailto:cwong@tmt.org) and [pratheep@tmt.org](mailto:pratheep@tmt.org)

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### **3.0 Proposal Evaluation Process**

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#### **3.1 Proposal Evaluation Guidelines**

Proposals will be reviewed by a TMT Project Source Selection Board ("SSB") comprised of reviewers designated by TMT to determine the proposals that provide best value to TMT. The SSB will submit the result of their review to the Source Selection Official. The Source Selection Official will render the final determination of an award, if any, for this RFP.

Each proposal will be evaluated separately. The Source Selection Board's evaluation criteria are listed below in approximate order of importance with the most important criteria listed first:

- A. Proposed activities and deliverables
- B. Proposed cost and schedule to perform the Work
- C. Qualifications of personnel who will perform the Work
- D. Respondent experience
- E. RFP or contract deviations

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## **4.0 Contract Award Process**

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### **4.1 Contract Award Conditions**

Issuance of this RFP does not require TMT to award a contract. TMT reserves the right to reject any or all proposals, and to waive any technicalities, informalities, or irregularities in any proposal at its sole discretion. TMT reserves the right to request clarification or additional information at any time. TMT reserves the right to award multiple contracts, a single contract, or no contracts. In addition, TMT reserves the right to re-solicit proposals or to temporarily or permanently abandon the procurement. If TMT awards a contract, it will award the contract to the Respondent or Respondents whose proposal(s) is (are) the most advantageous to TMT as determined by TMT in the exercise of its sole discretion.

TMT also reserves the right to award a contract based (i) on proposals initially submitted, without discussion, clarification or modification, or (ii) on the basis of negotiation with none, any, or all of the respondents. Therefore, each respondent should make sure that its proposal is compliant with this RFP.

### **4.2 Qualified Respondent**

TMT will only establish contracts with a qualified Respondent. A qualified Respondent is defined as an organization or institution that demonstrates the financial ability, resources, skills, capability, willingness, and business integrity necessary to perform on the potential contract resulting from this RFP. TMT's determination of whether a proposal is from a qualified Respondent will be made at TMT's sole discretion.

For qualification, the Respondent shall submit a written statement (approximately 5 pages) to TMT that includes the following information: (1) Company Description, (2) Past projects and experiences that are relevant to this RFP, (3) a brief statement of why the Respondent wants to be selected for this effort, and three dates and times that the Respondent is available (during regular business hours between Mon. – Fri.) for a possible teleconference with TMT between March 12th through March 19th.

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## **5.0 Proposal Form**

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### **5.1 Proposal Form Guidelines**

The organization of the proposal shall be as follows:

#### **5.1.1 Offer Submittal Form**

The Offer Submittal Form, attached as Exhibit J to this RFP, shall be used as the cover page for the proposal.

#### **5.1.2 Table of Contents**

Respondents must provide a table of contents with page number references in their proposal. The table of contents should be in sufficient detail to facilitate easy reference to the sections of the proposal and all separate supplemental information.

#### **5.1.3 Introduction**

The Introduction shall include a description of the Respondent organization. The description should include, but is not limited to, stating how long Respondent has been in business, the principal areas of business activity, the number of employees, etc.

#### **5.1.4 Respondent's Experience**

This section should describe the experience and expertise that qualifies the Respondent to perform the work of this RFP for the VCAM OM Final Design and Fabrication, Integration and Test. Respondents should have experience in designing and manufacturing CCD Cameras for Shack Hartman WFS and if possible with refrigerant cooling.

#### **5.1.5 Proposed Activities and Deliverables**

This section should describe the activities Respondent proposes to accomplish in return for the proposed firm fixed price. This section should describe how the proposed activities address the work required in Section 6.0 of this RFP.

#### **5.1.6 Qualifications of Personnel**

List the actual, key personnel of Respondent and of any subcontractors who will be performing the work requested by the RFP. A curriculum vita ("CV") must be provided for the key personnel. Indicate the role of the actual and key personnel working on the proposed effort in an org chart form. Proposal must indicate the Project Manager for the proposed effort.

#### **5.1.7 Cost and Schedule**

Although TMT is not specifying a cost limit, the proposed cost and schedule for TASK 1 and for TASK 2 and TASK 3 are important criteria of the selection process. The overall schedule is defined in Section 6.0 of this RFP. As previously noted,

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Respondents must provide their proposed costs in the form of the completed VCAM Cost Matrix incorporated and attached to this RFP as Exhibit A.

#### 5.1.8 RFP Deviations

In this section, Respondents must list and describe all deviations from the RFP. TMT is not obligated to accept any deviation from the RFP. If possible, Respondents are asked to provide estimated costs for the RFP approach and the deviation for comparison. If the approach required in the RFP is not considered feasible, Respondents are requested to explain their conclusions.

## 6.0 Model Contract for VCAM Opto-Mechanical Final Design, Fabrication, Integration and Test

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This contract ("Contract") is made effective as of \_\_\_\_\_, 2018 ("Effective Date"), by and between the TMT International Observatory LLC, a limited liability company organized and existing under the laws of the State of Delaware ("TMT"), and \_\_\_\_\_, a corporation organized and existing under the laws of the State of \_\_\_\_\_ ("Contractor"). Each party to this Contract may be referred to individually as "Party" and collectively as the "Parties." The Parties agree as follows:

For the purposes of this Contract, the following acronyms and definitions shall be used:

### Acronyms

|                 |  |
|-----------------|--|
| <b>AO</b>       | Adaptive Optics                              |
| <b>ARC</b>      | Astronomical Research Cameras, Inc.          |
| <b>CAD</b>      | Computer Aid Design                          |
| <b>CCD</b>      | Charge-coupled Device                        |
| <b>DRD</b>      | Design Requirement Document                  |
| <b>EIDP</b>     | End Item Data Package                        |
| <b>FEA</b>      | Finite Element Analysis                      |
| <b>FDR</b>      | Final Design Review                          |
| <b>FMEA</b>     | Failure Modes and Effects analysis           |
| <b>ICD</b>      | Interface Control Document                   |
| <b>LGS</b>      | Laser Guide Star                             |
| <b>MIT/LL</b>   | MIT Lincoln Laboratory                       |
| <b>NFIRAOS</b>  | Narrow Field InfraRed Adaptive Optics System |
| <b>NGS</b>      | Natural Guide Star                           |
| <b>PPU</b>      | Pre-Production Unit                          |
| <b>PPUR</b>     | Pre-Production Unit Test Review              |
| <b>PRR</b>      | Pre-Production Readiness Review              |
| <b>PSR</b>      | Pre-Shipment Review                          |
| <b>RFP</b>      | Request For Proposal                         |
| <b>SOW</b>      | Statement of Work                            |
| <b>TEC</b>      | Thermoelectric Cooler                        |
| <b>TMT</b>      | TMT International Observatory LLC            |
| <b>VCAM</b>     | Visible Wavefront Sensor Camera              |
| <b>VCAM CCD</b> | VCAM CCD                                     |
| <b>VCAM EL</b>  | VCAM Electronics                             |

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|                    |                                     |
|--------------------|-------------------------------------|
| <b>VCAM LENSEA</b> | VCAM Lenslet Array                  |
| <b>VCAM OM</b>     | VCAM Opto-Mechanical                |
| <b>VCAM units</b>  | Both the LGS and NGS VCAM units     |
| <b>VCRM</b>        | Verification Cross Reference Matrix |
| <b>WFS</b>         | Wavefront Sensor                    |

### Definitions

- A. **NFIRAOS:** NFIRAOS is the TMT first light Laser Guide Star Multi-Conjugate Adaptive Optics System. In natural guide star mode, NFIRAOS utilizes one high-order visible natural guide star wavefront sensor, several infrared low-order natural guide star wavefront sensors, one deformable mirror and one tip/tilt stage to sense and compensate wavefront aberrations introduced by the atmospheric turbulence and the telescope itself. In laser guide star mode, NFIRAOS additionally utilizes six laser guide star high order WFSs and a second deformable mirror.
- B. **NFIRAOS VCAM System:** This is the NFIRAOS sub-system composed of the visible high order wavefront sensor cameras. There are two types of high order wavefront sensing cameras:
  - a. The LGS WFS camera version of VCAM provides wavefront sensing for the six LGS beacons generated by the TMT Laser Guide Star Facility. The LGS WFS version of VCAM uses a novel CCD, the CCID87 polar coordinate detector as the imager.
  - b. The NGS WFS camera version of VCAM provides wavefront sensing for the high order NGS when laser operations are not possible. The NGS WFS version of VCAM uses a 256 x 256 pixel conventional CCD (the CCID74) as the imager.
  - c. NFIRAOS VCAM consists of four major components:
    - i. The VCAM detector (VCAM CCD). This is the packaged CCID87 or CCID74 with integral thermoelectric cooler used to control the temperature of the CCD detector.
      1. **LGS WFS CCD:** The CCID87 polar coordinate detector is a high frame rate CCD imager designed to address the problem of adaptive optics laser guide star spot image elongation on extremely large telescopes. The polar coordinate detector is designed for use in a Shack Hartmann ("SH") wavefront sensor with square subapertures on a regular orthogonal grid. Each subaperture has an individual frame transfer imager that is optimally sized for the LGS image elongation as a function of distance from the laser projection point (aligned with the center of the telescope pupil); the polar coordinate detector requires 204,792 pixels, 25% of the pixels that are needed for 2,896 active subapertures with a conventional CCD. The center projection arrangement used for the LGS creates a rotationally symmetric layout. The design of the detector is based on 4 identical quadrants, each of which is simply a copy of the other, rotated by 90 degrees. The CCID87 has 128 video outputs and is packaged in a windowed hermetic

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package with a TEC. The CCID87 video outputs employ a very low noise readout amplifier using a planar P-JFET transistor as the first stage. The full-scale polar coordinate CCD (the CCID87) is being manufactured by MIT/LL.

2. **NGS WFS CCD:** The CCID74 is a conventional 256 x 256 pixel, split frame transfer CCD with 64 video outputs. These video outputs also employ the planar P-JFET output stage. The CCID74 is packaged in the same windowed hermetic package with a TEC as used for the CCID87. The CCID74 has been manufactured by MIT/LL.
- ii. The VCAM Electronics. This includes the CCD socket board, the readout electronics (which consists of a timing board, the clock board and 2 or 4 video boards), the flex cables, the power supply, the software and any dedicated tooling (if any) required for installing the VCAM EL.
  - iii. The VCAM Lenslet Array. The VCAM LENSEA includes the lenslet array for the LGS WFS camera version of the VCAM.
  - iv. The VCAM Opto-Mechanical part of the camera. The VCAM OM includes the main housing for the electronics, the housing for the front part consisting of the opto-mechanical assembly (required to hold the detector and the lenslet array in the case of the LGS WFS version of VCAM), the cold plate assembly, the detector and lenslet array opto-mechanical assembly, and the interface with NFIRAOS. The VCAM OM includes all the required fixtures necessary to align, test and handle the VCAM.
- d. Procurement of the NFIRAOS VCAM System:
- i. TMT has sub-contracted MIT/LL to manufacture the VCAM detectors. TMT will provide the VCAM detectors to the Contractor and the VCAM EL sub-contractor (ARC) for integration and testing of the VCAM System.
  - ii. TMT has sub-contracted Astronomical Research Cameras, Inc., in San Diego to design, manufacture and test the VCAM EL.
  - iii. TMT will procure the VCAM LENSEA and provide the VCAM LENSEA to the Contractor.
  - iv. TMT will provide a refrigerant chiller unit to the Contractor to perform the VCAM System tests.
  - v. The Contractor will work with the VCAM EL sub-contractor (ARC) to design, integrate and test the VCAM System.

#### Exhibit List

- A. **[Exhibit A]:** VCAM OM Cost Matrix
- B. **[Exhibit B]:** Subsystem Requirements Document for the NFIRAOS VISIBLE WAVEFRONT SENSOR CAMERA (VCAM)
- C. **[Exhibit C]:** Interface Control Document NARROW FIELD INFRARED ADAPTIVE OPTICS SYSTEM (NFIRAOS) to NFIRAOS VISIBLE CAMERA (VCAM)

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- D. **[Exhibit D]:** Interface Control Document NFIRAOS VCAM POLAR COORDINATE DETECTOR to NFIRAOS VISIBLE CAMERA (VCAM)
- E. **[Exhibit E]:** Mechanical ICD of the WFS Camera to LGS System
- F. **[Exhibit F]:** Mechanical ICD of the WFS Camera to NGS System
- G. **[Exhibit G]:** NFIRAOS VCAM Opto-Mechanical Preliminary Design Data Package

The following Exhibit H and Exhibit I are provided solely for reference purposes. Exhibit H and I are not incorporated into the Contract and are not binding on the Parties.

- H. **[Exhibit H]:** Contractor's VCAM OM Final Design Firm Fixed Price Proposal dated \_\_\_\_\_
- I. **[Exhibit I]** Contractor's VCAM OM Fabrication, Integration and Test Firm Fixed Price Proposal dated \_\_\_\_\_

#### **Article I. Statement of Work ("SOW")**

Contractor shall accomplish the following tasks:

##### **A. TASK 1: NFIRAOS VCAM System Final Design**

1. VCAM OM Final Design: Contractor shall develop the final design of the VCAM OM components. The final design of the VCAM OM components shall meet all the applicable design requirements and interface requirements specified in [Exhibit B] through [Exhibit F]. All quantitative VCAM OM component design and performance parameters shall be supported by documentation that describes how the quantitative values were determined, including a description of traceability to the VCAM OM component requirements. The final design of the VCAM OM components shall include, but is not limited to, the following tasks:
  - a. Review the final cooling system requirements given in [Exhibit C] and propose modifications to the VCAM OM component preliminary design given in [Exhibit G] that will meet those requirements.
  - b. Complete a revised thermal analysis over the expected range of operating conditions as described in [Exhibit B] (including stability of the optical alignment, stress, and strain) for all critical optical and mechanical components.
  - c. Further detail the VCAM OM alignment plan provided in [Exhibit G]. This includes a final error budget for LGS and NGS VCAM optical alignment. Design the VCAM OM alignment tools and fixtures required to implement this alignment plan.
  - d. Update the VCAM Finite Element Analysis model provided in [Exhibit G] to reflect the final VCAM OM component design. Use the FEA model to evaluate VCAM stability, vibration performance, and seismic event survival. Use these evaluations to confirm that the VCAM meets the requirements given in [Exhibit B] and [Exhibit C].
  - e. Update the VCAM OM CAD model provided in [Exhibit G] to reflect the final VCAM design.
  - f. Update the mass budget for VCAM to a final design level.

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- g. Develop the VCAM OM test plan and the verification matrix to a final design level.
- h. Prepare the VCAM OM component final design documentation.
- 2. VCAM System Safety, Reliability, Fabrication, Verification, and Quality: Contractor shall collaborate with the VCAM EL sub-contractor to prepare documentation as required by TMT for the final design of the VCAM System as follows:
  - a. Produce an updated hazard risk assessment for the VCAM System.
  - b. Produce an updated failure modes and effects analysis and a reliability prediction report for the VCAM System.
  - c. Produce an updated fabrication and integration plan including a plan for packaging and shipping the VCAM System to the NFIRAOS integration and test site. This shall include the design of any required customized shipping containers and protective packaging materials.
  - d. Produce a recommended spares list, a service and maintenance manual, and a maintenance plan for the VCAM System.
  - e. Produce an updated VCAM System design compliance matrix, updated design verification cross reference matrix (VCRM), and an updated verification plan describing all tests for the VCAM System (including verification of all interfaces).
  - f. Produce an updated quality assurance plan for the VCAM System.
- 3. Present the VCAM OM component final design work and VCAM System final design work at the VCAM Final Design Review.
- 4. VCAM OM Pre-Production and Production system binding fixed-price cost and schedule:
  - a. Contractor shall provide a valid, binding, firm fixed-price (U.S. dollars) offer to deliver to TMT the VCAM OM components of the VCAM pre-production unit of the VCAM system as described in Article I.B.2 (TASK 2) and the VCAM OM components of the Production units of the VCAM system as described in Article I.B.3 (TASK 3). The cost shall be broken down by tasks and per category as defined below:
    - I. Hours and cost of non-recurring engineering labor.
    - II. Hours and cost of manufacturing labor.
    - III. Hardware costs.
    - IV. Sub-contractor and supplier costs.
    - V. Other costs, such as taxes, travel, duties, materials, packaging, and shipping to the NFIRAOS Vendor Site. The "NFIRAOS Vendor Site" shall be designated by TMT by a date determined by the Parties. The NFIRAOS Vendor Site shall be located in Canada.
    - VI. Any contingencies included in the cost estimate.
  - b. Contractor shall provide a detailed, resource loaded schedule showing the project milestones and the different tasks to be performed for each activity to develop the VCAM OM components of the pre-production unit and

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production system as described in Article I.B.2 and Article I.B.3 of this Contract.

- c. Contractor shall provide an updated risk register for the fabrication, test, and shipping phase of the PPU and production units of the VCAM OM components. The risk register shall contain a comprehensive list of foreseeable technical, manufacturing and programmatic risks. For each risk, the list shall include a clear description, the consequences, the rating (probability, severity, and overall) and the proposed mitigation approach or resolution.

**B. TMT OPTION:**

1. The Parties agree that TMT shall have an option to exercise TASK 2 and TASK 3 (defined below) at TMT's sole discretion to be valid for at least three (3) months after the conclusion of TASK 1 (TMT's options for TASK 2 or TASK 3 are collectively referenced as the "TMT OPTION"). In the event that TMT exercises The TMT Option, the Contractor shall perform the following activities:
2. TASK 2: LGS VCAM Pre-Production Unit
  - a. Contractor shall prepare the assembly drawings, bills of material, and fabrication drawings for all mechanical components of the VCAM OM and prepare for the VCAM Production Readiness Review.
  - b. Contractor shall build and test a pre-production unit of the LGS VCAM OM components. Tests of the LGS VCAM OM PPU shall include, but are not be limited to, thermal, shock, and vibration tests. Tests of the LGS VCAM OM PPU shall be conducted using dummy heat sources (or dummy masses) for the VCAM detector and electronics.
  - c. Contractor shall integrate and align the LGS VCAM OM PPU with the LGS VCAM EL PPU, the VCAM LENSEA, and the TMT-provided CCID87 engineering grade detector.
    - i. For this task, Contractor shall collaborate with the VCAM EL sub-contractor to integrate the electronics and engineering grade detector. Contractor shall collaborate with the VCAM EL sub-contractor to perform initial operating verifications.
  - d. Contractor shall perform the VCAM OM component tests of the LGS VCAM PPU with the TMT-supplied refrigeration cooling system using the VCAM OM test plan and the verification matrix defined in Article I.A.1.g and prepare a verification test report for the LGS VCAM OM PPU.
  - e. Contractor shall deliver the assembled LGS VCAM PPU to the VCAM EL contractor to complete the LGS VCAM PPU system tests as defined in Article I.A.2.e.
  - f. Contractor shall present the results of the VCAM OM PPU Work at the VCAM PPU Test Review.
  - g. Contractor shall update the assembly drawings, bills of material, and fabrication drawings for all VCAM OM mechanical components as needed for production release.
  - h. Contractor shall update the LGS VCAM OM PPU and retest it as needed to obtain LGS VCAM production unit 1.

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### 3. TASK 3: VCAM System Production Manufacturing, Integration and Test

- a. At the successful completion of TASK 2, Contractor shall only commence with TASK 3 after the Contractor is authorized to do so in writing by TMT.
- b. Contractor shall manufacture and test the VCAM OM components for 5 additional LGS VCAM units, 1 NGS VCAM unit, 1 spare camera with two front parts (1 LGS front part and 1 NGS front part), and all required spares as identified in the vendor's proposal in Article I.A.2.d.
- c. Contractor shall integrate and align the VCAM OM components with the VCAM EL, the VCAM LENSEA, and the TMT-provided science grade detector (either the CCID87 or the CCI74 science grade detector).
  - i. For this task, Contractor shall collaborate with the VCAM EL sub-contractor (ARC) to integrate the electronics and science grade detectors. Contractor shall collaborate with the VCAM EL sub-contractor (ARC) to perform initial operating verifications.
- d. Contractor shall perform the VCAM OM component tests with the TMT-supplied refrigeration cooling system according to the VCAM OM component test plan and the verification matrix defined in Article I.A.1.g and prepare a verification test report for the VCAM OM units.
- e. Contractor shall deliver the assembled LGS and NGS VCAM units to the VCAM EL contractor to complete the VCAM unit system tests as defined in Article I.A.2.e.
- f. Contractor shall provide the shipping container(s) for the VCAM units.
- g. Contractor shall collaborate with the VCAM EL sub-contractor (ARC) to prepare the pre-ship review package and end item data package for the VCAM system and deliver it to TMT. Activities required to deliver the PSR package and EIDP include the following:
  - ii. VCAM system as-built documentation:
  - iii. As-built list for each VCAM OM unit that states the specific configuration of parts in each deliverable assembly including part and drawing revision numbers for all manufactured parts, and serial numbers within that assembly.
  - iv. Certificates of compliance for the VCAM OM units including certificate of compliance for all sub-contracted parts. Any applicable waivers for any manufactured item.
  - v. Traceability data for all supplied components including country of origin, the vendor, and the lot for the VCAM OM units.
  - vi. Proof of calibration and certification for all equipment being used for verification testing of the VCAM units.
  - vii. Process certification stating that all designated processes used in a delivered item were performed by individuals that are certified to have completed the necessary training, or to have the specific knowledge, skills, or abilities to satisfactorily accomplish the designated process.
  - viii. Completed verification test reports for the VCAM OM units.

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- h. When the pre-ship review is passed and the VCAM system is accepted by TMT, Contractor shall pack and ship the VCAM system to the NFIRAOS vendor site and pack and ship the spares and all other unused TMT provided components (such as detectors, lenslet arrays, and refrigeration system) back to TMT.

### C. Deliverables

*[Respondents shall provide a schedule for the submission of Deliverables. TMT anticipates that the final design will be completed in approximately nine (9) months and the work for the TMT OPTION shall be completed approximately thirty (30) months after the start of TASK 2.]* Whenever possible, all deliverables shall be submitted by Contractor to TMT electronically at [lianqw@tmt.org](mailto:lianqw@tmt.org), [cboyer@tmt.org](mailto:cboyer@tmt.org) and [pratheep@tmt.org](mailto:pratheep@tmt.org). Note that the format of the Deliverables shall be initially suggested by the Contractor but must be authorized by TMT. TMT shall not unreasonably withhold its authorization of a format suggested by Contractor. The purpose of the deliverables is to efficiently and economically convey the work done by the Contractor to TMT. Contractor shall provide the following deliverables:

1. Deliverables for the VCAM System Final Design Review: Contractor shall submit all final design documentation described in Article I.A to TMT. This includes:
  - a. The VCAM OM component final design documentation:
    - i. The VCAM OM component design description document
    - ii. Updated CAD and FEA models and updates for any other models or simulations developed as part of the VCAM OM component design and analysis work.
    - iii. Top level VCAM OM assembly drawings showing details and dimensions for all external interfaces.
  - b. The VCAM System final design documentation:
    - i. VCAM updated hazard risk assessment
    - ii. VCAM updated failure modes and effects analysis
    - iii. VCAM updated fabrication and integration plan
    - iv. VCAM maintenance plan including spare lists
    - v. VCAM updated verification cross reference matrix
    - vi. VCAM updated quality assurance plan
  - c. The VCAM OM Pre-Production and Production System binding firm fixed-price proposal including detailed cost and schedule.
2. Deliverables for the VCAM Production Readiness Review. Contractor shall submit all documentation described in Article 1.B.2.a to TMT. This includes but is not limited to:
  - a. VCAM OM component assembly drawings, bills of material, and fabrication drawings
3. Deliverables for the VCAM Pre-Production Unit Test Review. Contractor shall submit all documentation described in Articles 1.B.2.d, 1.B.2.e, and 1.B.2.f to TMT. This includes but is not limited to:
  - a. Verification test report for the LGS VCAM OM PPU
  - b. Verification test report for the LGS VCAM PPU

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4. Deliverables for the VCAM Pre-Shipment Review (PSR). Contractor shall submit the following deliverables to TMT described in Article 1.B.3.f. This includes but is not limited to:
  - a. VCAM system as-built documentation:
    - i. An updated VCAM OM component design description document.
    - ii. Complete assembly drawings for all VCAM OM component assemblies including details of external interfaces and dimensions.
    - iii. Updated bills of material, updated CAD model, and fabrication drawings for all mechanical components of VCAM OM.
    - iv. All models or simulations created for development and analysis of the VCAM OM component design.
    - v. Updated VCAM design compliance matrix and verification cross reference matrix (VCRM), updated verification plan describing all tests for the VCAM system including verification of all interfaces.
    - vi. Updated hazard risk assessment, safety warnings and constraints for the VCAM system.
    - vii. Updated FMEA and a reliability prediction report for the VCAM system.
    - viii. Updated spares list and service and maintenance manual including a maintenance plan for the VCAM system.
  - b. As-built list for each VCAM OM units
  - c. Certificates of compliance for the VCAM OM units
  - d. Certifications by suppliers/subcontractors
  - e. Traceability data
  - f. Proof of calibration
  - g. Process certification
  - h. Completed verification test reports
5. VCAM System and Spares: Following successful PSR,
  - a. The Contractor shall deliver to the NFIRAOS Vendor Site the six (6) LGS and one (1) NGS VCAM units in their shipping container.
  - b. The Contractor shall deliver to TMT the VCAM OM component spares, and all unused equipment, detectors, lenslet arrays that were provided by TMT. All spares and unused CFE shall be shipped in dedicated shipping boxes/containers.
6. Meetings and Reviews: Unless stated otherwise, the TMT participants for all meetings and reviews described below shall be determined by the TMT Technical manager and will consist of TMT project office staff. TMT participants may also include external experts designated by TMT. The attendance of external experts designated by TMT is contingent upon the authorization of the Contractor. Contractor's authorization of external experts shall not be unreasonably withheld.
  - a. Kickoff Meeting: The Contractor shall organize a teleconference meeting with TMT at a date to be determined by the Parties to review the statement of work, schedule, deliverables and technical work to be delivered by the Contractor.
  - b. Bi-Weekly Reporting: The Contractor shall have a teleconference with TMT every two weeks during the effective Term of the Contract to review Work progress against the Contractor's plan and any technical or programmatic issues that could impact the project, as well as the

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proposed corrective actions to resolve the issues. For the first bi-weekly meeting of each month, Contractor shall provide the percentage of completion for each Work activity. If the teleconference cannot be arranged, Contractor shall send in place an email report, which fulfills the biweekly reporting requirements.

c. VCAM System Final Design Review:

- i. After submission of all deliverables listed in Article I.C.1 for the VCAM system FDR, Contractor shall organize a face-to-face meeting, no less than two (2) weeks or more than four (4) weeks after submitting the required documentation for TMT's review and approval of the deliverables.
- ii. Following the VCAM system FDR, TMT shall prepare a written evaluation of the action items and the review report within two (2) weeks after the VCAM system FDR, indicating what modifications or additional information the Contractor shall provide, if any.
- iii. Contractor shall address the action items submitted by TMT within two (2) weeks of receiving TMT's written evaluation by submitting updated documentation for the VCAM system final design and/or proposing a plan for addressing these action items.
- iv. TMT and Contractor shall agree upon the final set of modifications and proposed plan for the VCAM system final design within one (1) week following the Contractor response under Article I.C.6.c.iii.

d. VCAM Pre-Production Readiness Review:

- i. After submission of all deliverables listed in Article I.C.2 for the VCAM OM components, Contractor shall organize a teleconference meeting, no less than (2) weeks or more than four (4) weeks after submitting the required documentation, for TMT's review and approval of the deliverables.
- ii. Following the VCAM PRR, TMT shall prepare a written evaluation of the action items and the review report within two (2) weeks of the VCAM PRR, indicating what modifications or additional information the Contractor shall provide, if any.
- iii. Contractor shall address the action items submitted by TMT within two (2) weeks of receiving TMT's written evaluation by submitting updated documentation for the VCAM OM component fabrication drawing review and/or proposing a plan for addressing these action items.
- iv. TMT and Contractor shall agree upon the final set of modifications and proposed plan within one (1) week following the Contractor response under Article I.C.6.d.iii.

e. VCAM PPU Test Review:

- i. After submission of all deliverables listed in Article I.C.3 for the VCAM PPU test review, Contractor shall organize a face-to-face meeting, no less than (2) weeks or more than four (4) weeks after submitting the required documentation, for TMT's review and approval of the deliverables.
- ii. Following the VCAM PPUR, TMT shall prepare a written evaluation of the action items and the review report within two (2) weeks of the VCAM PPUR, indicating what modifications or additional information the Contractor shall provide, if any.

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- iii. Contractor shall address the action items submitted by TMT within two (2) weeks of receiving TMT's written evaluation by submitting updated documentation for the VCAM PPU test review and proposing a plan to address any deficiencies in the LGS VCAM PPU.
  - iv. TMT and Contractor shall agree upon the final set of modifications and proposed plan within one (1) week following the Contractor response.
  - v. Following implementation of the plan to address any deficiencies in the pre-production unit, Contractor shall submit to TMT a revised set of verification test reports for approval by TMT.
- f. VCAM System Pre-Ship Review:
- i. After submission of all deliverables listed in Article I.C.4 for the VCAM system, Contractor shall organize a face-to-face meeting, no less than two (2) weeks or more than four (4) weeks after submitting the required documentation, for TMT's review and approval of the deliverables.
  - ii. Following the VCAM PSR, TMT shall prepare a written evaluation of the action items and the review report within two (2) weeks of the VCAM PSR, indicating what modifications or additional information are required.
  - iii. Contractor shall address these action items within two (2) weeks of receiving TMT's evaluation by submitting updated documentation for the VCAM system pre-ship review and proposing a plan to address any deficiencies in the as-built VCAM system.
  - iv. TMT and Contractor shall agree upon the proposed plan to address any deficiencies in the as-built VCAM system within one (1) week following the Contractor response.
  - v. Following implementation of the plan (defined in Article I.C.6.f.iv to address any deficiencies in the as-built VCAM system) and approval of the revised verification test reports by TMT, Contractor shall ship the VCAM system, spares, and other equipment as stated in Article I.C.5.

## **Article II. REPRESENTATIONS, WARRANTIES AND COVENANTS.**

A. During the term of this Contract, TMT will respond to Contractor's reasonable requests for data and other information to the extent that (1) such information is known by or readily available to TMT, and (2) it is legally permissible for TMT to provide such information to Contractor. In connection therewith, TMT will make its personnel available to confer with Contractor regarding the Work and any potential constraints.

B. Contractor is responsible for the direct management and supervision of its personnel. Contractor will inform all such personnel prior to the start of Work that there is no implied employment of Contractor personnel by TMT.

C. Contractor represents and warrants that the Deliverables will not infringe, misappropriate or otherwise violate any confidential or proprietary information, any trade secret or any intellectual property right belonging to any third party.

D. Contractor represents and warrants that it has not engaged in collusion with any other potential contractor to procure this Contract. Contractor further represents and warrants that no benefit of tangible value has been given, nor will be given to any of TMT's agents or employees as a result of being awarded this Contract.

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E. Contractor understands and agrees that this is a fixed price contract and that there shall be no allowances or reimbursement for any cost whatsoever except as otherwise explicitly provided in this Agreement. Contractor agrees that the Fixed Price includes, but is not limited to, all applicable taxes, fees, shipping costs, insurance and duties. Contractor agrees to fulfill its obligations under this Agreement, regardless of cost, for the sole and sufficient compensation stated in Article IV with no expectation of additional compensation. TMT will not be obligated to pay the Contractor any amount in excess of the Fixed Price specified in Article IV.

### Article III. TERM AND TERMINATION

A. Term. The term of this Contract begins as of \_\_\_\_\_, 2018 and shall end on \_\_\_\_\_. This Contract may be extended only by mutual written Contract of the Parties.

### Article IV. PRICE AND PAYMENT

A. Fixed Price. In consideration for the Work to be performed by the Contractor, TMT agrees to pay the Contractor the following fixed price of \$\_\_\_\_\_ U.S. Dollars (hereinafter referred to as the "Fixed Price" or "FP"). The Fixed Price includes interim amounts payable following TMT's acceptance of each Milestone Deliverable as set forth below:

1. [*Respondents shall propose a Milestone Payment Schedule that will provide for the Milestone Deliverables and the associated Milestone Payment.*]

B. Invoices. Following its delivery of each Milestone Deliverable to TMT, the Contractor shall submit an invoice corresponding to the Fixed Price designated for that deliverable to TMT. Each invoice shall be submitted cross-referencing the designated TMT purchase order number for this Contract. The TMT purchase order will be provided by TMT. The final invoice for this Contract shall be marked "FINAL." All invoices shall be submitted electronically to [invoices@tmt.org](mailto:invoices@tmt.org) or by mail to:

TMT International Observatory LLC  
100 West Walnut St.; Suite 300  
Pasadena, CA 91124  
Attention: Pratheep Eamranond

1. Contractor shall complete, execute and submit to TMT all required state forms to determine the applicability of California withholding tax. If Contractor is exempt from state withholding tax, Contractor will complete, execute and submit to TMT all required state forms certifying its tax exemption. Contractor must clearly indicate all work that is performed in California under this Contract as a separate line item on the invoice. With respect to transactions for which Contractor may be exempt from any tax or duty, Contractor will indicate its exemption claim within its invoice.

C. Payment. TMT's payments under this Contract will be made following TMT's review and approval of the invoice. Subject to the review and approval of the TMT Project Manager or the TMT Business Manager, the payment term on all invoices will be net (30) days from TMT's receipt and approval of the Contractor's invoice. TMT shall complete its review of the Contractor's invoice no later than ten (10) days from the receipt of the Contractor's invoice. TMT has the right to withhold any and all taxes and duties required by law or regulation. The Parties understand and agree that all terms and conditions

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regarding payment by TMT are contingent upon Contractor's full and timely compliance with all administrative and documentation requirements. Failure by Contractor to comply with all administrative and documentation requirements in a timely manner may result in a delay of payment. TMT is not liable for any delay of payment due to Contractor's non-compliance with this Article IV.C.

1. Payment shall be in U.S. Dollars. The remittance address, if payment is made by check, shall be:

[Supplier Address for A/R]

## **Article V. PROPRIETARY INFORMATION**

### **A. Proprietary Information Defined.**

1. "Proprietary Information" means confidential proprietary information (including business, financial or technical data, machine-readable or interpreted information, information contained in physical components, mask works or artworks in written or other permanent form) that is delivered to the recipient, bears the date of disclosure, and is visibly identified by clear and conspicuous markings as the disclosing Party's Proprietary Information. A non-written disclosure shall be considered Proprietary Information to the extent that such disclosure is orally identified as Proprietary Information at the time of disclosure and is confirmed in writing by the disclosing Party. Such written confirmation shall: (i) sufficiently describe the information disclosed in detail, its scope, and the date and manner of disclosure; (ii) identify disclosers and recipients; (iii) be supplied within 10 days after oral disclosure; and (iv) refer to this Article.
2. Contractor's Proprietary Information does not and shall not under any circumstances include: (a) any deliverables submitted by Contractor to TMT under this Contract unless otherwise agreed to in writing authorized by the Parties, (b) information in TMT specifications or in any future modifications thereto, including, but not limited to, modifications suggested by Contractor; or (c) any scientific data.

**B. Obligations of Receiving Party.** The receiving Party shall preserve the disclosing Party's Proprietary Information for three years from the date of disclosure and will maintain the confidentiality of the Proprietary Information with at least the same degree of care that it uses to protect its own confidential information, but no less than a reasonable degree of care under the circumstances. The receiving Party will not disclose any of the disclosing Party's Proprietary Information, except to its employees, project members or consultants who have a need to know and who agree to abide by nondisclosure terms at least as comprehensive as those set forth herein. The receiving Party will not disclose a disclosing Party's Proprietary Information to any third party without the disclosing Party's prior written authorization. Any copies that are made will be identified as belonging to the disclosing Party and marked "Proprietary" or with a similar legend. A receiving Party may not use Proprietary Information to reproduce, redesign, or reverse engineer any products or equipment of the disclosing Party.

**C. No Liability for Certain Disclosures.** The receiving Party will not be liable for the disclosure of any information, regardless of its designation as Proprietary Information, if it is (a) rightfully in the public domain other than by a breach of a duty to the disclosing Party; (b) rightfully received from a third party without any obligation of confidentiality; (c) rightfully known to the receiving Party without any limitation on use or disclosure prior to its receipt from the disclosing Party; (d) independently developed by the employees of the receiving

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Party; or (e) generally made available to third parties by the disclosing Party without restriction on disclosure.

D. Disclosures Required by Law. Should a receiving Party be faced with a legal obligation to disclose Proprietary Information received under this Contract, the receiving Party shall, as soon as possible, notify the disclosing Party, and upon request of the disclosing Party shall reasonably cooperate in contesting such disclosure. Except in association with a failure to discharge the responsibilities set forth in this paragraph, neither Party shall be liable for any disclosures made pursuant to federal or state law.

E. This Article V shall survive expiration or termination of this Contract.

## **Article VI. ADDITIONAL TERMS AND CONDITIONS**

A. Independent Contractor. Contractor is engaged as an independent contractor and not as an agent or employee of TMT. Contractor shall have no authority to bind or obligate TMT in any manner whatsoever. Contractor shall be solely liable and responsible for its employment practices and for paying its own employee salaries, benefits, taxes and withholdings.

B. Indemnity.

1. Contractor agrees to indemnify, defend and hold harmless TMT, its directors, officers, members, employees, agents, assigns and affiliates from any and all liabilities, claims, damages, losses, reasonable attorneys' fees, and other reasonable costs of defense (including costs incurred prior to commencement of a lawsuit) resulting from or attributed to (i) Contractor's breach of its representations, warranties or obligations set forth in this Contract; (ii) any assertion that any component of the Work infringes, misappropriates, or violates any patent right, copyright right, trade secret, or other proprietary right of any third party; or (iii) any negligent or unlawful act or omission of Contractor or any of its employees and/or agents in the performance of this Contract.

2. If TMT seeks indemnification pursuant to this Contract, TMT shall notify the Contractor in writing of any claim or the commencement of any action or proceeding that TMT believes is subject to indemnification (referred to as the "Claim"). TMT shall also forward all documents in its possession and communicate all information known by it to the Contractor to the extent such documents and information are relevant to the Claim.

3. The Contractor shall have the right, at its option and sole expense, to assume sole responsibility for defending or settling the Claim, and shall have the right to use legal counsel of its choice. If the Contractor exercises this option, (i) it shall notify TMT, (ii) TMT shall cooperate in the settlement or defense of the Claim, and (iii) the Contractor shall not be liable to TMT for any legal or other expenses subsequently incurred by TMT in connection with settling or defending the Claim. If the Contractor refuses to accept responsibility for defending or settling the Claim, TMT shall exercise reasonable efforts to defend or settle the Claim, and any recovery against TMT suffered by it in good faith under such circumstances shall be conclusive in TMT's favor against the Contractor.

4. This Article VI, Section B shall survive expiration or termination of this Contract.

C. Limitation of Liability. NEITHER PARTY SHALL BE LIABLE TO THE OTHER PARTY FOR ANY LOST PROFITS OR PUNITIVE, SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES ARISING OUT OF THIS CONTRACT, EVEN IF SUCH

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PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Notwithstanding anything to the contrary in this Contract, this paragraph shall not apply to damages arising out of or relating to the following: (i) damage claims payable to third parties, irrespective of the basis for such claims; and (ii) violations of law. This section shall survive expiration or termination of this Contract.

D. Insurance. At all times during the term of this Contract, the Contractor shall procure and maintain, at its own expense, the following insurance coverage: (A) workers' compensation at statutory limits, (B) employer's liability insurance with limits of at least \$1,000,000 per occurrence, and (C) comprehensive general liability (including bodily injury, property damage and contractual liability) insurance with limits of at least \$1,000,000 per occurrence. Contractor shall give TMT at least 30 days prior written notice of any cancellation of insurance coverage or any proposed reduction of insurance coverage below the limits set forth in this Section. Contractor shall provide TMT with a certificate of insurance for the required coverage promptly upon request.

E. Governing Law. This Contract shall be governed by and construed in all respects in accordance with the laws of the State of California without giving effect to its choice of law rules. This section shall survive expiration or termination of this Contract.

F. Export Regulations. Contractor shall comply with all export control laws and regulations in the performance of this Contract. The Contractor shall be responsible for (a) obtaining appropriate licenses or other approvals, if required, for exports of hardware, technical data, and software, or for the provision of technical assistance; and (b) all regulatory record-keeping requirements associated with the use of licenses and license exemptions/exceptions. This section shall survive expiration or termination of this Contract.

G. Dispute Resolution.

1. Pre-Arbitration Procedures. Except as provided below, in the event of any dispute or controversy arising out of or relating to this Contract, including its validity, enforceability, performance, or breach ("Dispute"), the Party alleging a Dispute will notify the other Party of the existence of the Dispute, and provide reasonable detail about the Dispute. Senior officials representing both Parties will meet and attempt to resolve the Dispute within 15 days of the notice.

2. Arbitration. In the event senior officials do not meet or are unable to resolve a Dispute within the above period, the Dispute shall be resolved exclusively by final binding arbitration in accordance with the then-current Commercial Arbitration Rules of the American Arbitration Association (AAA). The Parties shall endeavor to select a mutually acceptable arbitrator within fifteen (15) days of the Notice of a demand of arbitration ("Arbitration Notice"). In the event the Parties are unable to agree to such a selection, AAA procedures shall be used to select a single arbitrator. The costs for the arbitration and the fees of the arbitrator shall be shared equally by the Parties. All Parties agree that arbitration shall take place within the County of Los Angeles, California. The arbitrator shall not have the authority, power, or right to award punitive damages. The arbitrator shall have the power to issue mandatory orders and restraining orders in connection with the arbitration. The arbitrator shall endeavor to commence the arbitration within sixty (60) days of the Arbitration Notice. A written award shall be rendered by the arbitrator within thirty (30) days of the end of the arbitration hearing(s), and shall be final and binding on the Parties. Judgment may be entered thereon in any court having jurisdiction.

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3. Continued Performance Pending Dispute Resolution. Pending the resolution of the Dispute, the Parties shall, without delay, continue to perform their respective obligations under this Contract.

4. This Article VI, Section G shall survive expiration or termination of this Contract.

H. Notice. Written notices from one Party to the other shall be given by one of the following methods: (a) United States registered mail, return receipt requested, and said notice shall be deemed to have been given three (3) days after said notice is deposited into the United States mail; (b) personal delivery, and said notice shall be deemed given upon such delivery; or (c) recognized overnight courier service, (d) telefax; or (e) e-mail, and said notice shall be deemed given upon delivery by such service at the following addresses or at such other address of which either Party shall advise the other in writing:

To TMT: TMT International Observatory LLC  
100 Walnut Street  
Suite 300  
Pasadena, CA 91124  
ATTN: Pratheep Eamranond  
pratheep@tmt.org

To Contractor: [*Contractor Notice Information*]

This section shall survive expiration or termination of this Contract.

I. Force Majeure. Neither of the Parties shall be responsible for failure or delay of performance if caused by: an act of war, hostility, or sabotage; act of God; electrical, internet, or telecommunication outage that is not caused by the obligated Party; government restrictions (including the denial or cancellation of any export or other license); or other event outside the reasonable control of the obligated Party. The Parties will use reasonable efforts to mitigate the effect of a Force Majeure event. If such event continues for more than 30 days, either Party may cancel unperformed services upon written notice.

J. Entire Contract. This Contract constitutes the complete and exclusive statement of the Contract between the Parties and supersedes all prior representations, understandings, and communications, oral and written, between the Parties relating to the subject matter thereof.

K. Headings. The headings within this Contract are inserted for convenience of reference only and not to define, describe or limit the scope or the intent of this Contract or any term hereof.

L. Assignment. The Parties may not assign or delegate any of their rights or obligations under this Contract unless it is authorized through an advance, written amendment that is executed in accordance with Article VI.R of this Contract, and any attempt to do so shall be void.

M. TMT Property. FAR clause 52.245-1 (June 2007) is incorporated into this Contract in its entirety with the following exceptions:

1. "TMT" shall be substituted for all instances of "Government,"
2. "TMT contract manager" shall be substituted for all instances of "contracting officer" or "property administrator,"
3. "Customer Furnished Property" shall be substituted for instances of "Government Furnished Property,"

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4. Paragraph (h)(1) of FAR clause 52.245-1 is revised to read as follows:

- a. **Risk of Loss.** Contractor, upon the delivery to it or acquisition by it of any TMT property, assumes the risk of and shall be responsible for all loss thereof or damage thereto. When such property is no longer needed for the performance of this Contract, or at such other time as may be directed by TMT, Contractor shall return such property to TMT, as applicable, in as good a condition as when received, except for reasonable wear and tear, and except for such property as has been reasonably consumed in the performance of work hereunder.

N. **Waiver.** No failure of either Party to exercise any power given hereunder or to insist upon strict compliance with any obligations specified herein, and no custom or practice at variance with the terms hereof, shall constitute a waiver of any Party's right to demand strict compliance with the terms hereof.

O. **Severability.** If any term or provision of this Contract, or the application thereof to any person or circumstance, shall to any extent be found to be invalid, void, or unenforceable, the remaining provisions of this Contract and any application thereof shall, nevertheless, continue in full force and effect without being impaired or invalidated in any way.

P. **No Third-Party Beneficiary.** Nothing in this Contract, express or implied, is intended to confer on any person other than the Parties hereto and their respective successors and permitted assigns any rights, remedies, obligations or liabilities under or by reason of this Contract.

Q. **Data Rights.** Except as otherwise stated in this Contract and required by law, TMT will own all rights to the work product developed or fabricated pursuant to this Contract and will have the right to use, reproduce and adapt it for any purpose. If requested, Contractor will sign or assist in preparation of documents necessary to perfect title to the work product at TMT's expense. TMT's ownership and title to its information shall not be affected by the transfer of the information to the Contractor for purposes of carrying out the terms of this Contract. Ownership and right to use or modify the work product shall survive the term of this Contract.

R. **Changes to Contract.** This Contract may be modified, amended or waived only by a written instrument executed by both TMT and the Contractor. If the terms of this Contract are modified, amended or waived such that the change causes an increase or decrease in the cost of, or the time required for, the Work, the parties may agree to an equitable adjustment in the Fixed Price, the delivery schedule, or both. Contractor must assert its right to an adjustment under this clause within fifteen (15) days from the date it receives a written request for a change from TMT. Failure to agree to an adjustment shall be a dispute under the Dispute Resolution clause.

S. **Termination for Default.** TMT reserves the right to terminate all or any part of this Contract if Contractor breaches any provision of this Contract and fails to cure such breach within ten (10) days of receiving notice thereof from TMT. TMT may immediately terminate this Contract in the event of any of the following (a) insolvency of Contractor, (b) filing of a voluntary petition in bankruptcy by Contractor, (c) filing of any involuntary petition of bankruptcy against Contractor, (d) appointment of a receiver or trustee for Contractor, (e) or execution of an assignment for the benefit of creditors by Contractor, provided such petition, appointment, or assignment is not vacated or nullified within fifteen (15) days after such event. In the event of termination for default, TMT shall have no remaining liability to Contractor under this Contract other than to pay for any labor or materials accepted by

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TMT on or before the effective date of the default. TMT's rights under this paragraph are in addition to any other remedies available hereunder or by law.

T. Termination for Convenience. TMT reserves the right to terminate this Contract, or any part hereof, for its sole convenience. In the event TMT gives Contractor notice of such termination, Contractor shall immediately stop all Work hereunder and shall cause any and all of its suppliers and subcontractors to promptly cease work. Within sixty (60) days after the effective date of a termination for convenience, Contractor shall submit a detailed termination claim to TMT with sufficient supporting data to permit TMT's audit and such additional supporting information as TMT requests ("Termination Claim"). The Termination Claim must be certified by the Contractor to represent the sum of all claims under the terminated Contract. The Contractor must also certify on the Termination Claim that no additional claim for services, materials, rights or benefits under the terminated Contract will be brought by the Contractor. Subject to the terms of this Contract, Contractor shall be paid its reasonable out-of-pocket costs for terminating the Work as of the effective date of the termination. TMT's payment to Contractor shall be due within thirty (30) days after its receipt of the Termination Claim less any amount disputed in good faith by TMT. TMT, or its agents, shall have the right to audit and examine all books, records, facilities, work, material, inventories, and other items related to any termination claim of Contractor. Contractor shall not be entitled to reimbursement for any work performed or costs incurred which reasonably could have been avoided at the time of termination.

U. Effect of Termination. Upon termination of this Contract, the Parties shall have no further obligation to one another, except for those obligations that survive the termination of this Contract as expressly set forth herein.

V. Counterparts. This Contract, and any amendments hereto, may be executed in counterparts, each such counterpart to be considered an original and all of which shall be construed together as one and the same document.

W. Authorization. The undersigned individuals represent that they are fully authorized to execute this Contract on behalf of the named Parties.

IN WITNESS WHEREOF, intending to be bound, Contractor and TMT have caused this Contract to be signed by their duly authorized representatives.

**TMT International Observatory LLC**

**Contractor**

By \_\_\_\_\_

By \_\_\_\_\_

\_\_\_\_\_  
Name

\_\_\_\_\_  
Name

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

\_\_\_\_\_  
Date

\_\_\_\_\_  
Date

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# TMT International Observatory LLC

## 7.0 Exhibits

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### 7.1 Exhibits

All RFP Exhibits are provided on an "as is" basis. All of the Exhibits are subject to change without notice. TMT is not responsible for the content of these Exhibits or the results of using these Exhibits for any use other purpose than the review of the design and preparation of costs and schedules for this RFP.

List of Exhibits:

- A. **[Exhibit A]:** VCAM OM Cost Matrix
- B. **[Exhibit B]:** Subsystem Requirements Document for the NFIRAOS VISIBLE WAVEFRONT SENSOR CAMERA (VCAM)
- C. **[Exhibit C]:** Interface Control Document NARROW FIELD INFRARED ADAPTIVE OPTICS SYSTEM (NFIRAOS) to NFIRAOS VISIBLE CAMERA (VCAM)
- D. **[Exhibit D]:** Interface Control Document NFIRAOS VCAM POLAR COORDINATE DETECTOR to NFIRAOS VISIBLE CAMERA (VCAM)
- E. **[Exhibit E]:** Mechanical ICD of the WFS Camera to LGS System
- F. **[Exhibit F]:** Mechanical ICD of the WFS Camera to NGS System
- G. **[Exhibit G]:** NFIRAOS VCAM Opto-Mechanical Preliminary Design Data Package

The following Exhibit H through K are provided solely for reference purposes. Exhibit H, I and K are not incorporated into the Contract and are not binding on the Parties.

- H. **[Exhibit H]:** Contractor's VCAM OM Final Design Firm Fixed Price Proposal dated \_\_\_\_\_
- I. **[Exhibit I]** Contractor's VCAM OM Fabrication, Integration and Test Firm Fixed Price Proposal dated \_\_\_\_\_
- J. **[Exhibit J]:** Offer Submittal Form
- K. **[Exhibit K]:** RFP Presentation
- L. **[Exhibit L]:** Respondent's Non-Disclosure Agreement

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## EXHIBIT J - Offer Submittal Form

### Organization Information

Offeror Name:

U.S. EIN (If Applicable):

Address:

*Street Address*

*City*

*State*

*ZIP Code*

### Offeror Information

Full Name:

*Last*

*First*

*M.I.*

Title:

Address:

*Street Address*

*City*

*State*

*ZIP Code*

Tel: ( )

Fax: ( )

TOTAL ESTIMATED COST OF  
PROPOSAL

E-mail Address:

### Electronic Mailing Instructions

Please send to:

[pratheep@tmt.org](mailto:pratheep@tmt.org)

cboyer@tmt.org

cwong@tmt.org

TMT RFP No.: TMT.BUS.MGT.18.034.REL01

### Terms and Condition

The Offeror hereby accepts all the terms and condition set forth in the referenced RFP. The signature affixed below is made by an individual authorized to bind the Offeror.

Authorized Signature

Date Signed

Print Name

Title

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(Last Page of the RFP)

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