Gemini Instrument Feasibility Studies
RFP No. 0506720 Fixed-Price Contract:
Exhibit A: Statement of Work (Document GIFS-03.2)

Association of Universities for Research in Astronomy, Inc. (AURA)
Operating the
Gemini Observatory
Hilo, Hawaii and Cerro Pachón, Chile



0. Definitions. The following defined terms are used in this document:

Change Control. Change control refers to the formal process used to ensure that changes to a design element, document, or component are introduced in a controlled and coordinated manner.

Completion Date. This term refers to the date by which the study should be completed and Gemini accepts all project deliverables. The Completion Date is: 12 September 2015.

GIFS. The Gemini Instrument Feasibility Study contract.

Instrument. This term refers to the GIFS instrument design.

Instrument Budget. This term refers to the approximate budget for the instrument the feasibility study is based on. (conceptual design to commissioning), which is USD 8,000,000 to USD 12,000,000.

Instrument Schedule: This term refers to the approximate schedule duration for the instrument the feasibility study is based on. The desired time to take the instrument from the beginning of the conceptual design stage to commissioning is ≤ 6 years.

Requirements. Requirements include, but are not limited to, science, technical, operational, environmental and interface requirements either created by the contractor or derived from Gemini provided Interface Control Documents.

1. STAC Principles. (a) The STAC identified the following principles for feasibility design study in their 2012B report: (see http://www.gemini.edu/science/public/STAC/stac2012b_report.pdf)

- *The instrument should be a workhorse instrument, meaning that it has broad scientific appeal and enables a wide range of science cases.*
- *The proposals should be science driven and include science cases. Science cases that provide synergies with new capabilities coming online (e.g. LSST, JWST, ALMA, etc) are highly desirable, especially including capabilities needed to follow up survey discoveries.*
- *The instrument should fit within the technical constraints of the Gemini telescopes as they now exist.*
- *The expected cost of the instrument shall be capped at a cost that is to be determined as part of the process of defining the RfP.*
- *The technical risk of the instrument should be modest, i.e. the success of the instrument should not depend upon some not-yet-proven technology.*
- *The instrument should be highly efficient, maintaining the 8-m aperture advantage.*
- *Although proposals for all instruments fitting these criteria will be fully considered, it is the majority opinion of the STAC that a wide-bandwidth moderate-resolution spectrograph is likely to prove most compelling.*

In addition, the instrument design should be feasible with respect to the interfaces contained within Gemini's instrumentation Interface Control Documents (ICDs).

2. Scope of Work.

(a) Contractor shall perform all tasks necessary to successfully develop a feasible instrument design for a Gemini instrument following the principles set out by the STAC and as set forth in more detail in this Statement of Work (the "Work"). Contractor shall complete all Work by the Completion Date. (see section 0, Definitions)

(b) Gemini's nominal budget for this instrument is the Instrument Budget amount (see section 0, Definitions). Gemini's goal for completing the instrument (through completion of the Commissioning Stage) is the Instrument Schedule (See section 0, Definitions). Contractor shall prepare the feasibility study so that the studied instrument abides with the STAC Principles and can realistically be completed within the required timescale and budget.

(c) Contractor shall document their full science objectives, science case and science requirements.

(d) Contractor shall fully explain the relevance and value of the science to the Gemini Community.

(e) Contractor shall provide a Concept of Operations to demonstrate how operating at the observatory given typical operation/support resources would be feasible:

- Contractor should provide specific examples of science observations created from the science cases.
- Contractor should describe each of the instrument's operating modes and key operating scenarios.
- The operating scenarios should be described in sufficient detail for a technically and scientifically skilled, but non-expert, audience to understand.

(f) Contractors shall include technical requirements and requirement traceability:

- Each technical requirement must identify the source(s) used to derive it.
- Provide a brief description of how the requirement was derived from its source and explicitly state any assumptions made.
- Each requirement should be quantified such that it would be objectively verifiable at some stage in the testing or commissioning of the instrument.
- Demonstrate requirements compliance by providing:
    - A summary of the flowdown of the science cases cross-referenced to the instrument requirements.
    - Compliance summary matrix comparing the requirements and the studied design.

(g) Contractor shall document the rationale behind key design choices and any design flexibilities or design trades:

- Provide a description of priorities involved in any needed science, performance, or management trades.
- Discuss the results and analyses of any performed trades.
- Discuss the basis and results of any simulations used in the study.

(h) Contractor shall develop and document the optical, mechanical, electronic, and software designs of the instrument, including the detector and controller:

- Provide a description of the instrument's subassemblies.
- Demonstrate the instrument concept is feasible given Gemini's interfaces (see Interface Control Documents) and operating environment, including flexure, vibration, windshake, temperature, humidity, dust, etc.
- Provide a summary of the technical high risk items included in a risk register table.

(i) Contractors should make sure the optical design covers the following:

- A depiction of the general layout of the optical components.
- Analysis including spot diagrams, flexure analysis, tolerance, etc., as needed, to demonstrate feasibility.
- A description of optical mounting schemes, including the approach used to mount and align all optical components, demonstrating feasibility.
- A description of key risks associated with the optical design, e.g. long-term stability of optical alignment, manufacturability, coating reliability, expected lifetimes, etc.
- A description of any throughput budgets or required optical tolerances.

(j) Contractors should make sure the mechanical design covers the following:

- A schematic overview of all subassemblies in the mechanical layout.
- Designs, (3D models / drawings), for all subassemblies.
- A description of the design elements that is common to multiple assemblies.
- Outline of instrument integration procedure to verify feasibility.
- Analysis showing that there is no significant instrument handling or space envelope issues with the design as conceived.

(k) Contractors should make sure the electronic design covers the following:

- An overview of the electronic systems needed to operate the instrument to verify feasibility.
- Estimate of the number of separate control systems the electronics design must support.
- A summary of the use of commercial versus custom boards.
- A description of the detector and controller including a recommendation of what currently available detectors could be used in the instrument to satisfy as many of the requirements as possible.

(l) Contractors should make sure the instrument's software design covers the following:

- The identification of any instrument control software technical risks associated with feasibility.
- A description of the software functional requirements.

- A description of the hardware platform(s) envisioned along with the software architecture and physical layout of major instrument software components to demonstrate feasibility.
- A description of the overall software design including information on existing software that may form the basis of the instrument software.
- A top-level description of any internal interfaces to third party products, with a focus on types of communication between software components and protocols.
- A top-level description of required development platforms and tools, with specific identification of which items will need to be acquired.
- A summary of the algorithms and tools required for developing the software to demonstrate feasibility.

(m) Contractors should make sure the data reduction needs of the instrument are stated and are demonstrated to be feasible.

(n) Contractor shall consider the work required to design, fabricate, assemble, test and the deliver the instrument to demonstrate that the instrument could be completed within the Instrument Budget and Instrument Schedule. To demonstrate feasibility your study should include:

- The estimated cost of delivering the instrument the design was based on (including tolerances and assumptions).
- The estimated schedule of delivering the instrument the design was based on (including tolerances and assumptions).
- A draft Work Breakdown Structure.
- Potential management risks.
- Required facilities to execute the project.
- Any special skillsets/knowledge sets to execute project.
- Major and long lead procured items.

(o) Contractor shall track progress of the contract and provide a report that compares the completed work, schedule, and expenditures at the end of the contract to the original planned work, schedule, and expenditures given in the proposal. This report includes any realized deviations from the original plan in terms of planned goals, cost, duration, and risk reduction and describes expenditures in detail. This report will be included as a section in the Feasibility Study Report (see Section 6.1) and conclude with a discussion of any lessons learned.

3. Kickoff Meeting. Within two weeks of this Contract being fully signed, Contractor shall host a kickoff meeting. The Technical Representative and other Gemini personnel shall attend (either in person or via videocon) for Gemini, and at least all key members of Contractor's team shall attend. The Contractor shall present a summary of the content of their proposal, and how they plan to manage the feasibility study work. Gemini will provide clarification of the project and its requirements, as needed.

4. Monthly Progress Reports. By the fifteenth day of each month, Contractor shall submit a brief written progress report to the Technical Representative describing the technical, schedule, and financial

progress of the Work as of the end of the previous month. Within one week after a progress report is submitted, Contractor shall hold a telecon with the Technical Representative to go over the report and answer questions. These reports will include:

- Information regarding the technical status of the Work;
- An updated schedule to consist of the most current project plan to completion and a comparison of the current plan to the original baseline plan. This plan will be maintained in Microsoft Project, or equivalent;
- Problem areas related to the Work, including potential for delays and risk mitigation plans;
- Action items for Gemini and Contractor (both open and closed), and associated status; and
- Proposed changes in key personnel.

5. Midpoint Site Visit. By the date given in the Schedule, Contractor shall host a one-day meeting. The Technical Representative and other Gemini personnel shall attend for Gemini (either in person or via videocon), and key members of Contractor's team shall attend. The Contractor shall present a brief and formal summary of its progress to date and discuss the remaining major issues that need to be resolved.

6. Feasibility Study Deliverables. Contractor shall prepare three deliverables:

- Feasibility Study 2015 Gemini Meeting Progress Presentation
- Feasibility Study Report
- Feasibility Study Review Presentation

Each deliverable shall be delivered to Gemini at the date given in the Schedule.

6.1 Feasibility Study 2015 Gemini Meeting Progress Presentation.

(a) The Contractor shall create a progress presentation to deliver to attendees of the 2015 Gemini Meeting. Contractor shall provide Gemini a .ppt or .pdf or the presentation material prior to the presentation.

(b) Gemini shall be responsible for all travel expenses of the main presenter. Additional team members may attend at Contractor's expense.

(c) The presentation should be described in sufficient detail for a technically and scientifically skilled, but non-expert, audience to understand.

6.2 Feasibility Study Report.

(a) The comprehensive feasibility study report will be broadly similar in format to the proposal, but developed in much more detail and with much more supporting documentation. Contractor shall deliver a feasibility study report containing the following sections, as described in more detail in the scope of work:

Feasibility Study Report Format

- Gemini requests that the proposal does not exceed 200 pages in length.
- The entire report must be paginated. Margins, in all directions, must be at least an inch. Proposers are strongly encouraged to use only a standard, single-column format for the text.
- Use one of the following typefaces identified below:
    - Arial 11, Courier New, or Palatino Linotype at a font size of 10 points or larger;
    - Times New Roman at a font size of 11 points or larger; or
    - Computer Modern family of fonts at a font size of 11 points or larger.
- A font size of less than 10 points may be used for mathematical formulas or equations, figures, table or diagram captions and when using a Symbol font to insert Greek letters or special characters. However, the text must be readable without the use of a magnifying device (eye glasses excepted).
- No more than six lines of text within a vertical space of one inch.
- The report must be submitted in PDF format.

Feasibility Study Report Content

- Executive Summary
- Science object, science case and science requirements
    - Science case
    - Science objectives
    - Science requirements
    - Concept of Operations
- Feasible Technical Requirements and Instrument Design
    - Top-level requirements and flow down
    - Instrument design
        - Design summary
        - Performance trades
        - Systems engineering considerations (including Interface Requirements)
        - Optical design
        - Mechanical design
        - Electrical design
        - Instrument Software design
        - Data Reduction software considerations
        - Design options / variations
        - Technical risks
- Project Management Aspects
    - Estimate and justify the estimated cost of the instrument
    - Estimate the justify the estimated schedule of the instrument
    - Present a draft Work Breakdown Structure
    - Describe key potential management risks
    - Describe any unique facilities required to execute the project.

    - Describe any special skillsets/knowledge sets required to execute the project.
    - List the major long lead procured items.
- Project review report comparing the planned work, schedule and expenditures to the actual work, schedule and expenditures

(b) An Initial Feasibility Study Report will be made available for download by Contractor four weeks before the Gemini Instrument Feasibility Study Review Presentation. The Initial Feasibility Study Report should be a complete report, hence all planned study work completed by the time of submission.

(c) The Final Feasibility Study Report will include reasonable changes requested by Gemini as a result of the Review Presentation and shall be submitted by the date contained in the Schedule.

(d) Contractor will deliver one hard copy of the Final Feasibility Study to the Technical Representative.

6.3 Gemini Instrument Feasibility Study Review Presentation.

(a) Contractor shall present the results of the feasibility design study to Gemini in Hilo at the date contained within the schedule.

(b) The content of the presentation should reflect the material in the study report (see 6.1). It is expected that the review will last 0.5 days. Contractor shall provide Gemini a .ppt or .pdf or the presentation material prior to the presentation.

(c) Gemini shall be responsible for all travel expenses of the main presenter and another member of Contractor's team travelling to the meeting. Additional team members may attend at Contractor's expense.

(d) Within ten working days of the review, Gemini will produce a written report (Review Actions) containing a list of proposed actions based on the study report and presentation for the team to address.

(e) Within ten working days of receipt of the Review Actions, Contractor will produce a response to this report (the Review Response), which includes what actions Contractor intends to take for each issue raised in the Review Actions, when the actions will be completed.

(f) Within five days of receipt of Contractor's Review Response, Gemini may direct that changes be made to the Feasibility Study Report to make it consistent. Contractor will promptly comply with all such direction, and will complete the changes within a reasonable period of time.

7. **General Rights and Responsibilities.**

(a) Gemini may freely use delivered intellectual property. As described in the COPYRIGHTABLE MATERIAL provision of the Terms and Conditions, Gemini and the parties to the Gemini Agreement have the right to freely use any drawings or documentation delivered to Gemini under this Contract.

Gemini intends to use the documentation delivered to it under this contract for whatever purpose(s) best serve the interests of the Gemini Observatory, and this may include using elements of Contractor's design.

(b) Communications between design team and Gemini. All communications that might be construed as direction or permission to modify any aspect of the GIFS requirements or design, including interfaces, must be made by means of written communications between the Technical Representative and the Study Manager. Both parties will explain this requirement to all staff involved in this work, and will ensure that all design/requirement modifications go through the primary contacts. Contractor recognizes that the Technical Representative is the only person with authority to provide technical direction with regard to the study, and that no other person, committee or board has any authority to direct or influence any aspect of the Work on behalf of Gemini. In the event that Contractor receives direction or a suggestion from any other source that it feels has merit, it will communicate the same to the Technical Representative with its recommendations, and the Technical Representative will make a decision in consultation with the Study Manager.

(c) Access by Gemini. Contractor will grant Gemini personnel access at reasonable times to all places where the Work is being performed, including access to locations where Contractor’s subcontractors are performing any part of the Work.

(d) Delay. Contractor will promptly notify Gemini in writing of any event that may result in a delay in performance or completion of the Work. Contractor will not be liable for delays in performance or completion of the Work that are a direct result of causes beyond its reasonable control, and not otherwise due to its willful misconduct or negligence. Contractor will, however, resume performing the Work in a manner to expedite the original schedule for completion of the Work to the extent reasonably possible promptly upon termination of the cause of such delay.

(e) Information Transfer. Gemini and Contractor shall respond to requests for information related to this Work Scope in a timely fashion. All such requests for information will specify a date by which said information is required. Each party will use its best efforts to provide the requested information by the date requested.

(f) Key personnel. Gemini has selected Contractor for this work in part because of the experience and qualifications of the Contractor personnel named in Contractor's proposal submitted in response to RFP No. 0506720. For this reason, Contractor may not significantly reduce the effort of any of such personnel in performing this work without advance written permission from the Technical Representative. Contractor shall not need permission from the Technical Representative for changes in level of effort that are outside of its reasonable control, such as personnel leaving Contractor's employment or being absent from work because of illness or disability.