**Wide Field Infrared Camera Polarimetry (WIRC-POL) upgrade**

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**Statement of Work (SoW) for Chuck Henderson Support of Cryostat and Optics Systems Upgrades**

**May 1, 2016**

**Period of Performance: May 1, 2016 through April 30, 2017**

**I. Introduction**

This SOW specifies the tasks and associated level of effort included in Chuck Henderson’s (contractor) support of enhancements to the Wide Field Infrared Camera WIRC instrument for Caltech Optical Observatories (principal). Chuck was part of the original WIRC engineering and development team and is uniquely familiar with its design and construction. The purpose of the planned WIRC upgrades is to provide it with spectroscopic and polarimetric capabilities which will increase the value of its observations for studies of exoplanet and brown dwarf atmosphere dynamics.

**II. Summary of Required Upgrades**

The portion of the work required for the WIRC polarimetry upgrade covered in this plan includes design and implementation of modifications to the WIRC cryostat and optics systems to accommodate:

1. a combined quarter waveplate (QWP) and diffractive waveplate (DWP) optic that, positioned in the existing WIRC filter wheel, will provide low-resolution spectra, isolated according to polarization in the images of observed objects,
2. a focal plane mask to reduce the camera field of view, eliminating background in the regions of the image sensor used for observing spectra when used in tandem with the QWP/DWP optic.
3. a grism, also to be installed in the existing filter wheel (in a different position than the QWP/DWP optic) to provide spectra of objects within the camera FOV
4. a science grade Teledyne Hawaii-II (H2RG) Infrared Image sensor (to replace the H2 detector currently installed in WIRC) if such a detector meeting the project scientific and budgetary requirements becomes available.

**III. Statement of Work**

The following work plan includes a description of tasks and associated level of effort specified as total number of hours within the 12-month period of performance from May 1, 2016 through April 30, 2017. The tasks have been divided among an initial assessment phase (Phase A Tasks below), a second phase to implement WIRC opto-mechanical upgrades for polarimetry without implementing the H2RG detector (Phase B tasks below), and a third phase to be completed contingent on acquisition of a suitable H2RG detector (Phase C tasks below).

Phase A Tasks (to be completed between May 1, 2016 and June 17, 2016) :

1. Research of records of the original WIRC development effort leading to the recovery and archiving of existing drawings and documentation. This includes conversion of 2-d drawings to Solidworks 3D CAD models as necessary for designing the planned upgrades.

Level of effort: 61 hours

1. Conceptual design for filter wheel mechanisms, and detector mounting in preparation for preliminary design review.

Level of effort: 40 hours

1. Consultation and support of weekly progress meetings

Level of effort: 20 hours

Phase B Tasks (to be completed between July 11, 2016 and February 15, 2017):

1. Detailed design, fabrication oversight/coordination, installation and testing of modifications to the filter wheel drive system to provide improved positioning repeatability (to within .001 radian) of the QWP/DWP relative to the image sensor and mounting/registration for the additional optics.

Level of effort: 160 hours.

1. Build on existing design to implement focal plane mask insertion mechanism including fabrication oversight/coordination, installation and testing.

Level of effort: 100 hours.

1. Review of the WIRC instrument P200 interface and mounting procedure as a possible contributor to the failure of the earlier H2RG detector, including a report on the assessed role of the interface/mounting procedure in the failure and proposed changes to prevent future failures of a similar nature.

Level of effort: 40 hours

1. Support of project design reviews and weekly progress meetings.

Level of effort: 40 hours

Phase C Tasks (due to the contingency of this phase, start and end dates are to be determined, but should not extend beyond the April 30, 2017 period of performance end date without the agreement of both the contractor and principal):

1. Detailed design, fabrication oversight/coordination, installation and testing of a detector mounting system to accommodate a science grade H2RG detector, including any necessary modifications to the cryostat dewar and electrical feedthroughs.

Level of effort: 200 hours

1. Support of project design reviews and weekly progress meetings.

Level of effort: 40 hours

Any changes in the above Scope of Work or adjustments to the required levels of effort related to contingencies arising during the course of the project are to be agreed upon by both the contractor and the principal.