Keck Adaptive Optics Note #306

KPAO Progress Report for October 2004-January 2005

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Introduction

In the fall of 2003 the Keck adaptive optics working group (AOWG) recommended a general purpose high Strehl AO system as Keck observatories highest priority future AO instrument. The new AO instrument is named The Keck Precision Adaptive Optics system (KPAO). In 2004 the AOWG reaffirmed that KPAO is the highest priority future AO project. A system design study for KPAO was initiated in fall 2004. Funding for the KPAO design study is in the observatory budget for FY05 and FY06. The goal of the KPAO study is determination of a feasible design that achieves the KPAO scientific goals. This phase of the work will culminate in a proposal to an outside agency for funds for the construction of KPAO.

This report focuses on the project activities during the period October 2004 up to an including January 2005.

I. Narrative

The project accomplishments and challenges over the past 4 months are presented in the following sections.

A. Summary

Management efforts were initially focused on securing a subcontract with the TMT that would provide funding to supplement the CfAO award for a postdoc. Following this the direction of activity was interviewing and hiring of the postdoc. In the technical area the focus has been to build up a simulation infrastructure that can support KPAO architecture decision in the early phase of the design and also be useful for more detailed trade studies in the final phases of the design.

B. Technical Status

1. Overall Assessment of Scientific and Technical Status

The technical work to date has been focused on determining the overall KPAO architecture, such as the number of LGS, the number of deformable mirrors etc.

2. Accomplishments of the Past Months

In October 2004 Christopher Neyman started full time as the lead engineer for the KPAO project. CARA also committed an additional 0.5 FTE in FY 05 spread across the engineering staff at the observatory. In addition to the CARA AO team, a high level of AO expertise already exists in the CARA community at JPL, the University of California and Caltech. The KPAO team is leveraging this experience base thru active collaboration with individuals at these institutions. This collaboration was further strengthened by a grant from the Center for Adaptive Optics (CfAO) that will fund a postdoctoral student to work on AO design issues that are of interested to KPAO and the Thirty Meter Telescope (TMT). The TMT is also committing funds to this effort. The postdoc will spend approximately 60% of his time in Hawaii and 40% at the TMT project office.

To ensure that KPAO is not only a technical success but is also scientifically useful, it is expected that the CARA astronomical community will participate in the determination of overall KPAO requirements. The KPAO project scientist Mike Brown with help from the AOWG is leading this effort. Mike Brown accepted the project scientist position in December of 2004.

Project efforts during the months of October and November concentrated on securing funding for postdoc position and hiring the postdoc. A proposal was submitted to the CfAO with Neyman as the PI and Co-PIs Wizinowich, Dekany (CIT), Troy (JPL), Lloyd-Hart (University of Arizona) and Ellerbroek (NOAO, now TMT). This proposal was funded for 60% of the amount originally requested. Fortunately this shortfall was made up by the TMT project in exchange for the postdoc spending approximately 40% of his time in Pasadena. A subcontract between CARA and the TMT project office was negotiated so that the TMT can help fund the postdoc. The subcontract in finalized and funding is now in place.

Several candidates for the postdoctoral position were interviewed. Ralf Flicker was hired in December 2004. He is currently at Leiden observatory and will start at Keck when his visa is finalized. Dr. Flicker has several years of AO modeling experience at the Gemini observatory working with Francois Rigaut and Brent Ellerbroek on various aspects of the Gemini MCAO system. We feel that Dr. Flicker will be a valuable addition to the KPAO team.

A first step in determining the KPAO system performance is development and verification of simulation codes for adaptive optics systems. Time has also been spent on determining the atmospheric and other Keck specific environmental parameters that are needed as input to the KPAO design process.

Neyman has successfully installed and tested the ARCADIA linear model that was originally developed by Brent Ellerbroek. This model is unique in that it models the AO system as a system of linear equations and is not a Monte Carlo simulation. As such it is useful for setting system parameters without the longer simulation runs typical of a Monte Carlo calculation. Neyman is presently working on extending the code to handle the larger number of actuators and wavefront sensor subapertures needed for KPAO.

Neyman has also attempted to install the YAO simulation package developed by Francois Rigaut (Gemini). Problems with this installation are detailed in problems section below.

Neyman conducted an extensive literature search for atmospheric data from Mauna Kea. Mark Chun provided SCIDAR data from a two week run in fall 2002. Neyman collected all these results in KAON 303.

The CARA AO team also submitted a proposal to the Adaptive Optics Development Project (AODP). This proposal was focused on improved tip tilt and low order wavefront correction for the current LGS system and for future AO projects like KPAO. As of February 2005 we have not heard from NOAO on the status of this award.

In January Olivier Lai and Sam Kim from the Canada France Hawaii Telescope have joined the KPAO collaboration. They will be involved in simulation of adaptive optics systems and will assist the project scientist and AOWG in development of the KPAO science case. Olivier Lai will support KPAO at the 20% level and Sam Kim will support KPAO at approximately the 60% level through May 2005 when his appointment at CFHT ends.

The TMT/KPAO collaboration has held monthly meeting to discuss the specific area for the CfAO/TMT funded postdoc to work in and other technical issues that are common to both projects.

Wizinowich and Neyman briefed the Keck SSC on January 26, 2005. The presentation is available as KAON 305.

3. Problems

Much time was lost attempting to install the YAO program because of features that are only support in the Gnu C language complier (gcc) version 3.3 and later. The Keck software group doesn't support this complier. Neyman was able to successful install the software on Linux PC and is continuing to evaluate this software package on this platform. In the future, March 2005, the retired K1 AO server workstation will be made available to the KPAO project and at this time the 3.X gcc complier and other tools will be installed as needed to support the KPAO design effort. Failure to decommission the current K1 AO server in a timely manner will delay the KPAO design efforts substantially.

C. Schedule and Budget Status

1. Overall Assessment of Progress and Expenditures

The KPAO project is being planned to CARA standards for new instruments. This will insure that the project is planned correctly from the start, stays on schedule and that technical goals are met in timely and cost effective manner.

2. Problems

In order to secure external funding in the shortest time possible the overall KPAO project plan leading up to the proposal is aggressive and is not without risks.

No one that is dedicated to the project is familiar with planning practices at Keck observatory. This has lead to slow development of the detailed plan and schedule. Getting support in learning scheduling tools such as Microsoft project has also been a problem.

D. Proposed Actions Regarding Problem Areas

1. Scientific or Technical

Check on the status of K1 AO server upgrade. Make revised plan if it is delayed.

2. Schedule

Continue planning efforts with Sean Adkins and Peter Wizinowich

3. Budget

Continue planning efforts with Sean Adkins and Peter Wizinowich.

E. Anticipated Accomplishments in the Next Two Months

The anticipated work in the next two months includes:

- Continue work on development of the KPAO science case**.**
- The design team will continue to develop the KPAO system architecture leading to a "strawman" design.
- The completion of the KPAO planning effort at the same level as other new instrument planning at CARA. This will include a detailed work break down structure, and a project schedule that can be tracked for earned value.

F. Other Issues and Information Deemed Essential to Include

II. Schedule

A. Current Schedule

1. Schedule for the next phase of the project

Currently the schedule is as under development. Neyman has completed a draft work breakdown structure and a project schedule. These are under review by CARA personnel and outsider collaborators.

2. Overall Project Schedule

B. Graph of Earned Value

Earned value analysis will be undertaken when the planning process is complete

C. Analysis and Discussion of Project Performance

III. Confirmation or Amendment of Project Schedule and Milestones

Currently the schedule is as under development.

IV. Confirmation or Amendment of Project Budget

No amendments to the budget have been made in the last 4 months.

V. Project Financial Summary

Project expenditures are under budget at this time