

The Cassegrain ADC for Keck I
Preliminary Design Review Process and Charter
September 15, 2003
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INTRODUCTION

The Technical Facilities group of the UCO/Lick Observatory located on the Santa Cruz campus of the University of California Santa Cruz (UCSC) is designing a Cassegrain Atmospheric Dispersion Corrector (ADC) for the Keck I telescope at the W.M. Keck Observatory (W.M.K.O.).

The Cassegrain ADC project is currently in the preliminary design phase and this document describes the Preliminary Design Review (PDR) process, the PDR success criteria and the charter for the PDR committee.

REVIEW PROCESS

Documentation

The primary documentation for the PDR will be a preliminary design report that consists of the sections identified in Appendix A of this document, "ADC Preliminary Design Report Outline".

Committee

The PDR committee will use the preliminary design report as the basis for its evaluation, which will take place in a one day meeting at UCO/Lick on October 16, 2003. The PDR committee will consist of 6 invited reviewers including 2 W.M. Keck Observatory staff members who will be personnel who are not directly involved in the CARA portion of the Cassegrain ADC project. The chair of the review committee will be one of the 4 external reviewers.

Objectives

The objective of preliminary design is to establish the feasibility and performance of the design proposed for the instrument. This design will be completed in the next phase of the project, detail design. The preliminary design work for the Cassegrain ADC includes a complete optical design that permits starting optical procurement and fabrication at the start of the detailed design phase. The preliminary design phase includes the development of a preliminary specification for the instrument, and the drafting of a preliminary interface control document (ICD) for the observatory interfaces required by the instrument.

The objective of the PDR is to evaluate the work done in the preliminary design phase, and to consider the preliminary specifications and their suitability to the scientific goals of the instrument and the requirements of the observatory. The PDR will also examine the schedule and budget proposed for completion of the instrument.

Review Process Guidelines

In order to make the review as effective as possible we have established four guidelines for the PDR process:

1. The charter for the preliminary design review committee has been drafted by CARA in collaboration with the Cassegrain ADC design team. This charter clearly states all of the questions that the design team is expected to address for the review.
2. The review will be made on the basis of a written report. This report should include all of the materials that the design team and CARA believe are appropriate to address the questions in the charter for the review committee. No additional materials should be presented at the review except for those needed to answer questions raised by the review committee prior to the review meeting.
3. The CARA project team and the Cassegrain ADC design team will meet for an internal review of the preliminary design report prior to its final release. The purpose of this review is to ensure that the CARA project team understands and supports the preliminary design described in the report.
4. The review agenda will include time for a brief presentation that summarizes the report, but it will be assumed that all of the attendees have reviewed the report in detail prior to the meeting.

COMMITTEE CHARTER

The review committee is asked to do the following:

1. Read the preliminary design report prior to the review meeting.
2. Submit questions to the Cassegrain ADC design team prior to the review meeting as required for clarification or to obtain further information.
3. Consider the answers to any questions asked in item 2.
4. Hold a one day committee meeting with the Cassegrain ADC design team to discuss the preliminary design report and the questions asked in the review charter.
5. Hold an “executive session” at the end of the review meeting and finalize the committee’s report and recommendations consistent with item 7.
6. Provide an oral summary of the review outcomes to the CARA instrument program manager, the Cassegrain ADC principal investigator and the Cassegrain ADC design team.

7. The chairperson of the review committee will lead the drafting of a written report. A preliminary or summary report will be issued within 7 days of the meeting and the final report will be issued within 21 days of the review meeting. This report will include the following:
 - a. A summary of the review meeting's discussions
 - b. Answers (and comments or recommendations) for these questions regarding technical and programmatic issues:
 - i. Does the preliminary design report provide an appropriate set of science requirements for the Cassegrain ADC in view of the capabilities of the LRIS instrument on the Keck I telescope and the science cases proposed to justify the implementation of the Cassegrain ADC?
 - ii. Does the projected performance of the Cassegrain ADC described in the preliminary design report and in the preliminary specifications meet the science requirements?
 - iii. Do the preliminary specifications for the Cassegrain ADC meet the observatory requirements?
 - iv. Is the optical design presented in the preliminary design report ready to be released for fabrication?
 - v. Does the proposed design present any features that raise concern for maintainability and reliability?
 - vi. What is the likelihood of success in performance, schedule and budget terms?
 - vii. Are there any other risks that should be considered in the continuation of the development plan?
8. The preliminary and final reports of the PDR committee will be delivered to the Observatory Director.

SUCCESS CRITERIA

Success for a preliminary design review means that the preliminary design and preliminary specifications presented in the report are accepted as meeting the science requirements and

observatory requirements for the instrument, and that the remaining work to complete the instrument can be accomplished in a timely manner consistent with the overall project budget.

Specific success criteria for the preliminary design review consist of the following:

- The established project scope reflects a reasonable balance of performance and cost
- The feasibility of the proposed design is substantially demonstrated by the work accomplished in the preliminary design phase
- The science requirements for the proposed design reflect the science case for the instrument and the anticipated scope of use for the instrument at the Keck Observatory
- The proposed design and preliminary specifications are clearly tied to specific elements of the science case and science requirements
- Flow down from the science case and science requirements to instrument features and functions is clearly established
- The preliminary specifications are complete and consistent with the science requirements
- The preliminary specifications are complete and consistent with the observatory requirements as established in the requirements document
- The suitability of the proposed implementation has been verified by potential users
- The cost to complete has been established consistent with the project budget
- Known performance, cost and schedule risks have been resolved
- The preliminary interface control document for the instrument clearly identifies all interface requirements that must be addressed in the detail design phase.

ISSUES RAISED IN THE DELTA CONCEPTUAL DESIGN REVIEW REPORT

The Delta Conceptual Design Review meeting was held on February 14, 2003. In the report on this review, released on February 26, 2003, the following issues were raised by the review committee:

1. Definition of the science requirements for the LRIS-ADC against which the Preliminary Design can be matched. This is an urgent matter since these requirements must form the basis for the Preliminary Design effort. Its definition should involve collaboration between the PI, the SSC and the WMKO.
2. A more in depth optical analysis of the combined performance of the LRIS/ADC combination especially where it relates to field curvature and de-focusing effects.
3. An optical analysis based on a finite element and thermal analysis of the large ADC optics. The committee expressed concerns about effects of sag and thermal non-uniformity on the performance of the ADC. In case these concerns are substantiated, the sub-aperture ADC version should be revisited.

Instrument Program Management

The Cassegrain ADC for Keck I

Preliminary Design Review Process and Charter

September 15, 2003

It is assumed that these issues are being considered and will be directly addressed in the preliminary design report.

APPENDIX A: ADC PRELIMINARY DESIGN REPORT OUTLINE

The ADC Preliminary Design Report outline, in draft form, is as follows:

1. Summary
2. Introduction
3. Specifications and Requirements
 - 3.1 Science Specifications and Requirements
 - 3.2 Preliminary Instrument Specifications
 - 3.3 Compliance Matrix for Requirements
4. Preliminary Design
 - 4.1 Optical Design
 - 4.1.1 Diameter of the prisms
 - 4.1.2 Resulting vignetting of both the science and TV guider fields
 - 4.1.3 Thickness of the prisms
 - 4.1.4 Prism angle
 - 4.1.5 Prism stroke
 - 4.1.6 Throughput
 - 4.1.7 Optical material specification
 - 4.1.8 Optical material homogeneity specification
 - 4.1.9 Dispersion Correction performance between zenith and 72 degrees zenith angle, with full correction to 60 degrees zenith angle
 - 4.1.10 Analysis of expected ghosting caused by ADC as designed
 - 4.1.11 Anti-reflection coating specifications
 - 4.1.12 Imaging performance with and without LRIS
 - 4.2 Mechanical Design
 - 4.2.1 Changes from the delta Conceptual Design Review
 - 4.2.2 Location, Weight, Mounting
 - 4.2.3 Prism Cell Design
 - 4.2.4 Structure
 - 4.2.5 Mechanisms
 - 4.2.6 Structural Analysis
 - 4.2.7 Thermal Analysis
 - 4.2.8 Mechanical Performance
 - 4.2.9 Encoder, fiducials and limit locations, mounting and logic
 - 4.2.10 Jack Stand Design
 - 4.2.11 Assembly and Part Drawings: PDF files of all drawings
 - 4.2.12 Cost and Schedule Estimates
 - 4.3 Electrical Design
 - 4.3.1 Control Computer

Instrument Program Management

The Cassegrain ADC for Keck I

Preliminary Design Review Process and Charter

September 15, 2003

4.3.2 Electronics Enclosure

4.3.3 Communications

4.3.4 AC Power

4.3.5 Stage Wiring

4.3.6 Cooling

4.3.7 Observatory E-Stop

4.3.8 Local Operation

4.3.9 Documentation

4.4 Software

4.5 Interface with K1 Telescope and CARA facilities

5. Project Schedule

6. Project Budget

7. Detail Design Phase Work Plan

8. Preliminary Design Report Revision History

9. References