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Date:	25 June 2008	Refer to:	L080069-00
Subject:	Review committee report on the Input Optics Long-lead procurements Final Design Review		
To:	David Shoemaker, Carol Wilkinson		
cc:	Reitze, Tanner, Mueller		
From:	Review Committee: Billingsley, Coyne, Fritschel, Gustafson, Harry, Smith, Torrie, Tyler		

## Background

A long lead procurement Final Design Review for the Input optic subsystem has been concluded. The review committee and the design team met April 29<sup>th</sup> to discuss questions arising from the committee's review. The committee questions are documented in LIGO-L080038-01-D, the design team response to these questions is found in L080041-00-D. The committee also offered a detailed review of the specifications and drawings under review, these are found in T080146-00-D.

## Recommendation

The committee recommendation is to proceed with purchase of the mode cleaner, steering mirror and telescope optics through coating. We also recommend procurement of the blanks for the PRM/SRM 1 and 2. We expect IO to delay the crystal procurement to await absorption improvement and thus, a more mature and advantageous design.

## Scope

The documents reviewed are the following:

### IOO Documentation

- L080041-00-D, Response to review committee questions to IO regarding the Long-lead procurements Final Design
- T080075-00-D, Input Optics Procurement Readiness Document
- T080079-00-M, Response to the Advanced LIGO Input Optics Preliminary Design Review Report

### Supplementary Documentation

- E080130-00-D, Test Plan and Acceptance Criteria for the Advanced LIGO Faraday Isolator
- T080080-00-D, Test Procedures for the Electro-Optic Modulators
- E080131-00-D, Metrology Plan for Advanced LIGO IOO Suspended Mirrors

## Drawings and Specifications

- E080128-00-D, ALIGO RTP crystals for Phase Modulators
- E080125-00-D, AdvLIGO TGG crystals for Input Optics Faraday isolator
- D080153-00-D, ALIGO RTP crystal
- D080154-00-D, ALIGO TGG crystal
- Specifications and drawings for input mirror, mode cleaner and pre mode matching
  - Blanks
  - Substrates
  - Mirrors

There were no drawings of PRM, PR2, SRM, SR2 or transport containers available for review. In response to the review committee questions, many of the review documents have been updated.

## Findings

From the review committee charge: L080030-00

*The basic question for this Final Design review is if the committee has confidence that the following are ready for procurement.*

- *Suspended optics (blanks, polish, coat), and transport containers for them*
- *EOM crystals*
- *Faraday isolator components*

The review committee finds the design of the majority of suspended optics is mature and complete; these pieces are ready for procurement. In addition, we find the design of the recycling cavity mirrors PRM, PR2, SRM and SR2 to be sufficiently understood to purchase the blanks. The final finish of PRM, PR2, SRM and SR2 is to be specified by Core Optics and is not yet mature enough to proceed with procurement.

We have reviewed the EOM and Faraday isolator design and advise waiting for possible lower absorption in the RTP crystals and therefore a more desirable design.

The transport container approach is based on the holder used for the LASTI test mass. While this design seems to have worked well, it has not been reviewed under any subsystem.

*Please review the final design package, including:*

- *Detailed engineering drawings/specifications*
- *Detailed procurement specifications/contract documents*
- *Detailed inspection plans/procedures*

The committee reviewed the suspended optics drawings/specifications in detail and documented our recommendations in T080146-00

The committee reviewed the procurement plan in T080075-01 and found it to be appropriate.

*Evaluate the results of the Prototype Testing for their bearing on procurement readiness.*

There were no prototype testing results presented for suspended mirrors. It is unnecessary for the suspended mirror designs since there are no open questions.

*Ensure that all issues relevant to these items raised during the PDR have been resolved.*

There is concern that the absorption seen on initial LIGO mirrors is due to contamination in the vacuum system. IO has no direct control over this problem, but is aware of the implications and is taking reasonable steps to assure the lowest possible absorption. All other actions from the preliminary design review either are addressed to our satisfaction in T080079-01 or are not relevant to this review.

*Ensure that the anticipated cost and schedule for the subsystem is compatible with the Project baseline.*

Cost data were not presented in any of the review documents. The IO management is tracking cost and anticipates delivering these pieces as estimated. The dates shown in the procurement plan in T080075-01 are consistent with the LIGO schedule. The plan shows suspended optics to be complete in late 2009. The LIGO schedule shows the IFO1 optics being delivered to the site in November 2010.

### **Action Items**

We find the response to questions found in L080041-00 to be satisfactory. Some of the work is ongoing and does not effect the procurement of suspended optics. We urge the IO group to pursue the other open issues in preparation for the full system design review.