

EXHIBIT I

**DELIVERABLE DOCUMENTATION
LIGO BEAM-TUBE MODULES**

- A. The deliverable documentation under this contract is summarized in the following Contract Data Requirements List (CDRL), which identifies the items to be delivered and when delivery is required, the quantity and type of each item, and frequency of issue. Documentation shall be delivered as early as available but no later than the date specified in the CDRL. The Data Requirement Description (DRD) forms referenced in the CDRL describe the specific requirements for the item(s) to be delivered.
- B. The Contractor shall display on the cover or title page of all deliverable non-design documentation (i.e., all documents except drawings, procedures and specifications) the following minimum information:
- Document Title
 - Contractor's Name
 - Contract Number
 - Document Number (Contractor assigned)
 - Approval Signatures — Contractor and Institute, where appropriate
 - Program Identification — LIGO
 - Date of Issue
 - CDRL Line Item Number
 - Revision or Change Identification
- C. The approval code on the CDRL is defined as follows:
- A = Submitted for Institute's approval
X = Institute approval not required

D. The following requirements apply to all data submitted for Institute's approval:

1. The Contractor shall submit the approval draft, with the Contractor-signed original cover or title page, on or before the date indicated.
2. If the draft is approved by the Institute, the Institute will transmit the signed cover or title page to the Contractor. The Contractor shall then prepare and deliver final copies as indicated in the CDRL.
3. If the submitted approval draft requires Contractor modifications before Institute approval will be granted, the following steps shall be taken:
 - a. The required modifications will be transmitted or discussed between the cognizant parties.
 - b. The Contractor shall submit an updated draft, containing the required modifications.
 - c. If the updated draft is approved by Institute, Institute will transmit the signed cover or title page to the Contractor. The Contractor shall then prepare and deliver final copies as indicated in the CDRL.

The requirements and approvals for data item revisions shall be the same as applied to the original data item submittal unless otherwise specified in the CDRL or DRD.

CONTRACT DATA REQUIREMENTS LIST

CDRL NO	DRD NO.	TITLE OR DESCRIPTION OF DATA	APPROVAL CODE	FREQUENCY OF ISSUE	DATE DUE TO USER	QUANTITY		REMARKS
						ORIG.	COPIES	
01	01	Project Control Plan	A	Once	1 month ARO ¹ *	1	3	¹ After receipt of order (ARO)
		Draft						
		Final						
		Revisions						
03	03	Draft	A	As required	15 working days ACC ³	1	3	² After receipt of comments to "Draft" (ARC)
		Final						
04	04	Draft	X	Once	15 working days ARC	1	3	³ After major contract change (ACC)
		Final						
05	05	Documentation Control Plan	A	Once	1 month ARO	1	1	
		Draft						
06	06	Final	X	Once	15 working days ARC	1	1	
07	07	Design Qualification Test Plan and Procedures	A	Once	10 working days prior to PDR ⁴	1	3	⁴ Preliminary Design Review (PDR)
		Draft						
08	08	Final	X	Once	10 working days prior to FDR ⁵	1	3	⁵ Final Design Review (FDR)
09	09	Detailed Design	A	Once	10 working days prior to FDR	1	3	
		Draft						
10	10	Final	X	Once	14 months ARO	1	3	

*See remarks column

CONTRACT DATA REQUIREMENTS LIST

CDRL NO	DRD NO.	TITLE OR DESCRIPTION OF DATA	APPROVAL CODE	FREQUENCY OF ISSUE	DATE DUE TO USER	QUANTITY		REMARKS
						ORIG.	COPIES	
11	05	Design Qualification Test Report	X	Once	10 working days prior to QTR ⁶	1	3	⁶ Qualification Test Review (QTR)
12	06	Project Review Data Package	X	Once for each Review	At the Review	1	3	
13	07	System Requirements Review Data Package	X	Once	3 working days prior to Review	1	3	
14	08	Preliminary Design Review Data Package	X	Once	10 working days prior to Review	1	3	
15	09	Final Design Review Data Package	X	Once	10 working days prior to Review	1	3	
16	10	Qualification Test Review Data Package	X	Once	10 working days prior to QTR	1	3	
*17	11	Screening and Acceptance Test Report	X	Once for each site	At the Completion Reviews	1	3	
*18	12	Completion Review Data Package	X	Once for each site	4 working days prior to Review	1	3	
19	13	Minutes	X	Once for each Review	1 week after Review	1	3	
20	14	Status Report	X	Monthly	15 calendar days APR ⁷	1	0	⁷ After Project Review (APR)
*21	15	On Site Daily Log	X	N/A	To be made available for review as required	N/A	N/A	

*Option only

~~Data Requirement Description (DRD)~~

Title: Project Control Plan, DRD No. 01

Purpose: To provide the basis for detailed scheduling, work progress reporting, and tracking of termination liability.

Preparation Instructions: Prepare a Project Control Plan identifying the planned implementation of the effort in Article I, Statement of Work. The Plan shall serve as a baseline document for project scheduling, for work progress monitoring and reporting and for tracking the termination liability. The Plan shall include:

- I. Work Breakdown Structure (WBS) reflecting the negotiated scope of work, at the work item level.
Work Breakdown Dictionary narratively defining the scope of each element in the WBS.
- II. A Summary Schedule containing schedules for implementation of all major WBS items, showing pertinent milestones.
- III. Configuration Management Plan.
- IV. Quality Assurance Plan.
- V. Summary labor-loading projections, by quarter.
- VI. Spending profile by quarter.
- VII. Procurement Plan.

Data Requirement Description (DRD)

Title: Documentation Control Plan, DRD No. 02

Purpose: To control release of Contractor documentation.

Preparation Instructions: The Documentation Control Plan shall include procedures to be followed in review, approval and release of the Contractor generated documentation and associated revisions. The Plan shall insure that no document requiring Institute's approval be released for further action prior to obtaining such approval. The Contractor's standard procedures, modified if necessary, will be acceptable if they meet these objectives.

Data Requirement Description (DRD)

Title: Design Qualification Test Plan and Procedures, DRD No. 03

Purpose: To qualify the design for LIGO beam tube modules.

Preparation Instructions: The Plan and Procedures for the Design Qualification Test shall control the implementation of the design qualification test, and shall demonstrate that the LIGO beam tube module design meets specifications. The Plan and Procedures shall include, but not be limited to, the following:

- I. Listing of items requiring verification testing and items verified by calculations; calculations in support of those.
- II. Procedures for fabrication, installation and testing of beam tube sections with measurement criteria to demonstrate that the leak rate and alignment requirements are met, and for measurement of outgassing rates.
- III. Demonstration of interfaces, clear aperture measurement, cleanliness, fitup and any other critical features of the LIGO beam tube module design.
- IV. Format for reporting the test results in the Design Qualification Test Report, DRD No. 05.

Data Requirement Description (DRD)

Title: Detailed Design, DRD No. 04

Purpose: To define and control the fabrication, installation and testing of LIGO beam tube modules.

Preparation Instructions: Prepare package of drawings, specifications, plans, procedures, etc., as described in the contract Article I (Statement of Work), paragraph A.1.

~~Data Requirement Description (DRD)~~

Title: Design Qualification Test Report, DRD No. 05

Purpose: To document the results of Design Qualification Test.

Preparation Instructions: Prepare a Test Report reporting and documenting the results of the Design Qualification Test in accordance with the approved format in DRD No. 03, Design Qualification Test Plan and Procedures.

~~Data Requirement Description (DRD)~~

Title: Project Review Data Package, DRD No. 06

Purpose: To assess project progress and status.

Preparation Instructions: The Data Packages to be provided in support of the project reviews shall contain all data and information on all topics to be discussed and presented at a review, and shall include, but not be limited to, the following:

- I. All current technical contract activities.
- II. Updated schedules including milestones and other events accomplished or missed, reasons for delay and corrective measures taken.
- III. Problem areas, including those concerns requiring action(s), decision(s) or assistance on the part of the Institute.
- IV. Action items closed during the review period, progress of open action items, and identification of new action items.
- V. Response to technical direction received.
- VI. Cost status showing expenditures and obligations made at the WBS report item level, including in-house costs, vendor costs, open commitments, actuals verses budget, percent complete at the WBS element level and calculated termination liability.

Data Requirement Description (DRD)

Title: System Requirements Review Data Package, DRD No. 07

Purpose: To demonstrate the Contractor's understanding of the contract objectives and to assess the adequacy of work implementation plans.

Preparation Instructions: The Data Package to be provided in support of the System Requirements Review shall contain all data and information on all topics to be discussed and presented at the Review and shall include, but not be limited to, the following:

- I. Summary of contract requirements.
- II. Summary of applicable LIGO system requirements to assure mutual understanding.
- III. Design issues including critical parameters and trade studies.
- IV. Listing of Contractor's concerns.

Data Requirement Description (DRD)

Title: Preliminary Design Review Data Package, DRD No. 08

~~Purpose: To present and substantiate preliminary design for LIGO beam tube modules.~~

Preparation Instructions: The Data Package to be provided in support of the Preliminary Design Review shall contain all data and information on all topics to be discussed and presented at the review and shall include, but not be limited to, the following:

- I. Sketches, layouts and drawings sufficient to describe the design concepts for the beam tube sections, expansion joints, pumping ports, baffles, beam tube supports, beam tube modules, plus any special fixtures, tooling, enclosures, covers, etc., required for fabrication, installation, and testing of the beam tube.
- II. Preliminary versions of all procedures for fabrication, installation, and testing of the beam tube components and modules, including, but not limited to, forming, welding, cleaning, screen testing, repairing, sealing, shipping, installing, fitting, aligning, welding, acceptance testing, and repairing in the field. Identify any special facilities, tooling, jigs, and fixtures required.
- III. Preliminary plan for the qualification test; identify all design features that can be demonstrated through analysis and those that must be verified by testing.
- IV. Analyses needed to verify that design for LIGO beam tube modules meets specifications.
- V. Preliminary plan for making alignment checks of the beam tube during operation, along with a procedure for correcting alignment.
- VI. Data and information to perform the Project Review, in accordance with DRD No. 06, Project Review Data Package (due at review).

Data Requirement Description (DRD)

Title: Final Design Review Data Package, DRD No. 09

Purpose: To present and substantiate final design for LIGO beam tube modules.

Preparation Instructions: The Data Package to be provided in support of the Final Design Review shall contain all data and information on all topics to be discussed and presented at the Review. The data package shall incorporate and/or address all Institute's comments provided pursuant to the Preliminary Design Review (PDR) and shall include, but not be limited to, the following:

- I. Master Data List accounting for all documentation generated and used by the Contractor, to design, develop, fabricate, test and manage the project. The list will include, but not be limited to, all documents, manuals, analyses, plans, reviews, reports and subcontractor/supplier-furnished data used and/or developed under the contract. The list will identify title, author and release date, for each data item.
- II. An assessment of Detailed Design of LIGO beam tube modules (DRD No. 04), measured against compliance with contract requirements.
- III. Final, detailed plan and procedures for the Qualification Test, as described in DRD No. 03, Design Qualification Test Plan and Procedures.
- IV. Updates of analyses verifying that design for LIGO beam tube modules meets specifications.
- V. Data and information to perform the Project Review, in accordance with DRD No. 06, Project Review Data Package (due at review).
- VI. Updated budgetary estimate for the Option effort. The estimate in the Contractor's proposal shall be used as the baseline for updating.

~~Data Requirement Description (DRD)~~

Title: Qualification Test Review Data Package, DRD No. 10

Purpose: To review the results of the Qualification Test, and their impact on the detailed design.

Preparation Instructions: The Data Package shall include, but not be limited to, the following:

- I. Qualification Test Report, as described in DRD No. 05, Design Qualification Test Report.
- II. A list of all proposed changes to the detailed design, generated as a result of the Qualification Test, with substantiation of need and effectiveness.
- III. Updated Program Control Plan, addressing the Option effort.
- IV. Updated budgetary estimate for the Option effort.

Data Requirement Description (DRD)

Title: Screening and Acceptance Test Report, DRD No. 11

Purpose: To document the results of Screening and Acceptance Tests.

Preparation Instructions: Prepare a Test Report documenting results of the Screening and Acceptance Tests.

~~Data Requirement Description (DRD)~~

Title: Completion Review Data Package, DRD No. 12

Purpose: To present all aspects of as built design and associated fabrication, installation and testing of LIGO beam tube modules, and to provide a permanent record of presented material and subsequent closeout of resultant action items.

Preparation Instructions: The Data Package to be provided in support of the Completion Review shall contain all data and information on all topics to be discussed and presented at the Review and shall include, but not be limited to, the following (for each beam tube module):

- I. Test report documenting the results of screening and acceptance tests, in accordance with DRD No. 11, Screening and Acceptance Test Report.
- II. Tube alignment verification.
- III. As-built drawings.
- IV. Status of clean up.
- V. Disposition of property procured under the contract or made available as Institute furnished property.
- VI. Remaining issues and open action items.

Data Requirement Description (DRD)

Title: Minutes, DRD No. 13

Purpose: To document proceedings of all formal Institute/Contractor LIGO project meetings.

Preparation Instructions: The Minutes shall document proceedings of all formal Institute/Contractor project meetings. The Minutes shall include:

- I. A summary of all business transactions between the Contractor and the Institute, including any alterations and/or clarifications to the Review Data Package generated during the Review.
- II. Contractor action items and planned completion dates.
- III. Institute action items and planned completion dates.

Data Requirement Description (DRD)

Title: Status Report, DRD No. 14

Purpose: To provide technical and schedule information relative to the contract work.

Preparation Instructions: The Status Report shall be provided on a monthly basis to report on the status of contract work. The Report shall be concise, no more than three (3) pages, indicating any new progress and concerns since the last Review.

Data Requirement Description (DRD)

Title: On Site Daily Log, DRD No. 15

Purpose: To track activity, and to record significant events and problems encountered.

Preparation Instructions: The On Site Daily Log is not a deliverable item, however, it should be made available to the Institute upon request. The Log shall be kept in accordance with established engineering/business practice and should as a minimum contain the following:

- I. Identification of Contractor and subcontractors teams at the site.
- II. Weather conditions, temperature, wind, rain, etc.
- III. Brief description of work performed, site activities.
- IV. Heavy equipment utilized.
- V. Any problems impacting work progress.
- VI. Foreseeable problems which may impact the progress of site activities.