LIGO-C950032-00-P

THE RALPH M. PARSONS COMPANY

100 West Walnut Street • Pasadena, California 91124 • (818) 440-2000 • Fax: (818) 440-2630

Contract PP150969
Control No. 950213-0

received
FEB 13 1995

February 13, 1995

Mr. Fred Asiri
Technical Representative
Caltech -- LIGO Project
East Bridge Lab
Mail Stop 102-33
Pasadena, CA 91125

Subject: Transmittal of Draft Design Configuration Control Document

Dear Fred,

We are transmitting the following items to you:

Item	Copies	Dated	Description
1	3	2/13/95	Draft Design Configuration Control Document

These items are transmitted as checked below:

- [ ] For approval
- [ ] For your use
- [ ] As requested
- [x] For review and comment
- [ ] For bid due _______, 1995
- [ ] ______
- [ ] For your signature
- [ ] Make changes noted
- [ ] Revise and resubmit
- [ ]
- [ ] Resubmit ___ copies for review
- [ ] Submit ___ copies for distribution
- [ ] Return ___ corrected prints
- [ ]
- [ ] Returned after loan to us

Transmitted with this letter is the Subject document. As you fully understand, this is a growing document and will be updated and resubmitted as required. The next submittal will be 15 days after receipt of LIGO's review comments.

We are also transmitting a diskette containing a MS Word file that contains a suggested format for inputting and returning your review comments. This approach has been used successfully with other Clients for similar projects where reviewers are geographically scattered. This approach will assist with many problems in a typical review process. Jeff Hermann will provide additional clarification of this method when we next meet. Also attached to this transmittal is a hard copy of the review comments form, and an example page from a previous project.

Jeff Hermann will contact you to discuss possible time, place, and format of a presentation on the DCCD. We anticipate receipt of your comments by March 6, 1995 and will schedule a meeting to discuss disposition of these comments.

Sincerely,

Tyler M. Jackson, PE
Project Manager

TJ/JH/jh

Enclosure: Draft DCCD (1 Original, 3 Copies)
Diskette Containing MS Word Comments File

cc: Administration Files
Jeff Hermann
Tim Melott

File: 5.2.1

Draft DCCD Review Comments

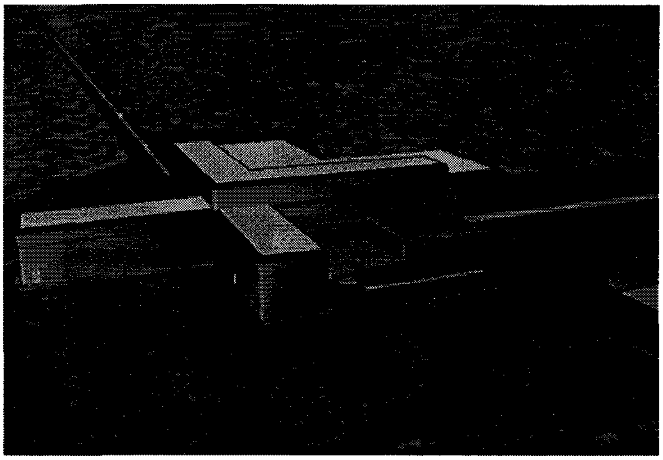
LIGO Facility

Item	Document	Reviewer	Comment	Code	Discipline -- Response

Codes: A--Accept; AI-Action Item; D--Duplicate; R--Reject; C--Clarification Needed; W--Withdraw; AWC--Accepted with Comment; Info--Information Provided;
AR--Architect; CE--Civil; CR--Crane; EE--Electrical; MA--Material Applications; MS--Mechanical Specialties; MU--HVAC; PL--Plumbing; ST--Structural; PM--Project Manager

Item	Document	Reviewer	Comment	Code	Discipline -- Response
1	ST-025	D.A.Zanese	Drawing shows a "DS-18 Platform Framing Plan", but does not say where frame is located. Provide reference back to mechanical drawing where duct and support.	A	ST -- We will comply.
2	ST-025	S.Staub D.A.Zanese	"DS-18 Platform Framing Plan" of this drawing calls for expansion anchors. Per specification 13080, Section 3.6, no expansion anchors are to be used to resist seismic or vibratory loads (unless test data are provided to verify the adequacy of the specific anchor and application) . Therefore , remove expansion anchors in Section B and Details 4 . Support must be designed using an importance factor of 1.5 in accordance with FDC paragraph 3.5.1.4.d and UBC section 2336.	AWC	ST --Typically this is best handled by requesting the ICBO approvals be submitted. Call-out for expansion anchors will be removed. Will use drilled holes and non-shrink grout for anchorage.
3	ST-027	D.A.Zanese	Detail 1 presents enlarging of footing at 12 and D.1, but it only presents specific rebar details of footing enlarging in north/south direction. It does not even say "typical" to apply rebar details -- adding of dowels, etc -- to the east/west footing enlarging. Detail 1 and Section A need to be revised to provide specific rebar details of footing enlarging in both north/south and east/west direction.	A	ST -- We will add "all around" note to Section A.
4	ST-027	D.A.Zanese	To be consistent with drawing ST-003, Section A should call out "3/4 inch joint filler" between two footings.	A	ST -- We will call out filler.
5	ST-027	D.A.Zanese	Section B presently refers to "Centerline of Crane". It should instead say "Centerline of Sliding Door".	A	ST -- We will correct.
6	ST-027	D.A.Zanese	Section B is taken in EIR and is cross section of grade beam added for door rail. My information is that access trench shown in this section is filled in, yet section shows open trench. Revise section to show filled in trench with slab across top (for reference, AR-002 also indicates trench is covered over, as it depicts "existing slab over trench").	A	ST -- We will show existing slab over trench.
7	ST-102	D.A.Zanese	Frame elevation at Column Line D.1 should show door frame between column lines 9 and 10 is removed.	A	ST -- We will add door.
8	Volume 1 Calculations (Structural)	D.A.Zanese	Page 31 uses factor of 10 percent in addressing impact load consistent with AISC. However, per AFM 88-3, Chapter 1, a factor of 25 percent should be used for impact. Revise calc (and design if necessary) to reflect impact value of 25%.	A	ST --

Codes: A--Accept; AI-Action Item; D--Duplicate; R--Reject; C--Clarification Needed; W--Withdraw; AWC--Accepted with Comment; Info--Information Provided;
AR--Architect; CE--Civil; CR--Crane; EE--Electrical; MA--Material Applications; MS--Mechanical Specialties; MU--HVAC; PL--Plumbing; ST--Structural; PM--Project Manager



Design Configuration Control Document

Draft

February 13, 1995

LIGO
Laser Interferometer Gravity Wave Observatory
California Institute of Technology
The Ralph M. Parsons Company
Contract Number: PP150969

LIGO Document	____
CDRL Number	06
DRD Number	03

APPROVAL STATUS

YES NO NOT REQUIRED

Project Manager, Parsons

Technical Representative, Caltech

Parsons–LIGO
Laser Interferometer Gravity Wave Observatory

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Table of Contents

1. Scope

The purpose of this document is to establish baseline design criteria for the Laser Interferometer Gravitational-Wave Observatory (LIGO) Facility Design. The baseline design criteria is developed from the LIGO Facility Request for Proposal No. YM 193, the LIGO Vacuum Equipment Request for Proposal No. MH 178, our understanding of LIGO Project needs, and industry standard design and construction practices that will meet or exceed these needs.

This document serves as a facility design criteria from which the configuration of the facility will evolve. As it evolves, this document will be updated. This document will continue to be the source for configuration control information for the direction of the design process. It is also the baseline for the design effort.

By reference, criteria provided in the LIGO Facility Request for Proposal Number YM 193, and the LIGO Vacuum Equipment Request for Proposal Number MH 178 constitue an element of this document and are therfore considered an element of the Facility's controlled design configuration. Concept strawman design appoaches presented in these RFPs are not an element of the controlled design configuration; however, the layouts of the Vacuum Equipement in the LVEAs are considered a controlled design configuration.

2. Facility Overview

The LIGO project is a pioneering effort to design and construct a novel scientific facility -- a gravitational-wave observatory -- that will open a new observational window on the universe.

LIGO will consist of two observatory facilities located at Hanford, Washington, and Livingston, Louisiana. These facilities will incorporate L-shaped vacuum systems with arms of 4 km length. The vacuum systems (by others) will house laser interferometer detectors sensitive to gravitational waves from astrophysical sources. Initial detector sensitivity will detect strains as small as 10^{-22}; the existing 1/100 scale prototype has measured strains to 10^{-17}. Correlation of data from interferometers at the two sites will allow identification of gravitational waves, their sources and origin in space. LIGO will become the first part of a planned worldwide network of gravitational-wave detectors coordinated to operate as a single observatory complex. Current plans are to begin observatory operations by the year 2000.

Constructed facilities at each site include the main corner station, with the large laser and vacuum equipment area, end and corner buildings on each beam tube leg, and a central plant. Building work includes power distribution, lighting, security systems, fire protection, communications, control system, access platforms, clean rooms, cranes, heating ventilating and air conditioning, and cable raceways. Each site will have two beam tube enclosure structures, each 4 km long. Sitework for the virgin sites includes site grading, drainage, roads, parking, landscaping, water supply developed from wells, sanitary facilities, waste water treatment and disposal and power distribution from area utilities.

Facility design will address special building requirements for the laser and vacuum equipment areas located at the corner, mid and end stations. Vibration isolation and reduction is required in order that transmitted vibration energy is no more than a factor of two above natural ambient levels. Both sites were selected based on their low ambient background noise and vibration levels. This requires seismic mass type foundations for critical scientific equipment and separate foundations and remote locations for vibration producing equipment and occupancy. Laser and vacuum equipment will be located in large open space of high volume (3.5 million cubic feet) designed as a clean room to Class 50,000. Smaller support areas for scientific equipment will require clean room conditions to Class 1000 or better. The laser interferometer detector is sensitive to EMI effects and will require special design for power, lighting, and control circuits to minimize disturbances. The laser interferometer detector is also sensitive to local gravity field gradients which requires special provisions for people and equipment movements.

3. Functional Description

3.1 Laser and Vacuum Equipment Area (LVEA)

This area is designed to house the high precision, sensitive interferometer components. The interferometers require a clean controlled environment with a minimum of disturbance from acoustic noise, ground vibrations, electromagnetic interference and other localized disturbances. Each interferometer uses one or more high power lasers which will be located within this area. Power and cooling must be provided for these lasers. The electro-optic interferometer components are contained within a high vacuum envelope generally referred to as the "vacuum equipment".

The vacuum equipment comprises a network of chambers, which house the sensitive interferometer components, and interconnecting beam-tubes which transmit laser beams between the chambers. High vacuum gate valves are provided between segments of the interconnecting tubing to isolate different portions of the vacuum system for diagnostics, maintenance, or upgrades while other portions remain operable.

Re-locatable vacuum pumps are deployed where needed by overhead crane and coupled locally to valved pumpout ports for initial pumpdown. Electrical power, compressed air, monitor/control system, and pump exhaust lines are provided near the pumpout ports. Stationary high-vacuum ion pumps attached to the individual chambers contend with normal outgassing, porosity and leakage. Liquid nitrogen (LN_2) pumps at the ends of the adjacent beam-tube modules provide additional capacity for removing condensable gases.

The vent/purge subsystem generates and distributes filtered, dry air for backfilling chambers when they are to be opened and provides internal filtered air showers to maintain cleanliness while working inside the chambers. A bakeout subsystem, comprising of relocatable heaters, insulation and power connections, allows optional vacuum baking of individual valved-off sections of the vacuum equipment. This permits removal of contaminants and reduction of outgassing when required.

In addition to lasers and vacuum equipment, this area contains the electronics racks and cabling for the interferometers. The racks house the servo loop electronics, control and monitoring electronics, and computer networking electronics. Cable raceways will each serve each chamber, pump or valve location.

3.2 Operation Support Building (OSB)

3.2.1 Staff Offices, Lobby, and Visitor Accommodations

This area includes offices and common areas such as rest rooms, break room, conference room, suitable for a permanent staff of 21 employees. This staff will consist of 8 professionals and 13 technicians/operators. Approximately 15 visiting scientists and interns are anticipated during the year, each with a stay of one week to six months. Other visitors will include tour groups of students, educators, scientists, and dignitaries. The facility entrance for employees, users, and visitors is through a lobby and controlled by a receptionist/secretary area. The conference room and all offices have provisions for computer networking.

3.2.2 Control Room

The control room is the operational center of the facility. It will provide an office quality environment for the operations crew. Physical plant control and monitoring is executed from this room. The control room equipment consists mainly of desktop computing workstations and rack mounted electronics. This room also provides space for the central monitoring panels of facility services such as fire protection, personnel access control, and building surveillance via a low-light level closed circuit television system.

3.2.3 Computer and Data Archives Room

This room houses rack-mounted computing equipment and peripherals (disk and tape drives, etc.) as well as storage cabinets for magnetic tapes. Portions of this area will have a access flooring to allow for easy cabling. The room will be provided with fire suppression equipment.