



LIGO LABORATORY
California Institute of Technology
1200 E. California Blvd.
Pasadena, CA 91125

Statement of Work

LIGO-C1401266-v2

1.0 Scope

LIGO Livingston Observatory requires four light maintenance workers to assist with cleaning of the Beam Tube. The Beam Tube is a stainless steel vacuum vessel of approximately 8km (5 miles) in length and 48inch in diameter. The Beam Tube is operating in the ultrahigh vacuum regime and caution must be taken to protect against corrosion and mechanical abrasion. Vacuum pressures in the tube will be monitored continuously while cleaning takes place in the event a leak is created or opened up. It is critical that the work location is known at all times. The Beam Tube was insulated in 1998 with fiberglass material, which had become contaminated with rodent nests and droppings. The insulation was removed several years ago but some staining and deposits were left behind. Due to concerns of corrosion LIGO plans to wash the entire tube with hot (100F) de-ionized water using powered vacuum washers (upholstery cleaners) and hand tools.

The work will take place inside 2km long concrete enclosures with no environmental controls except for passive and forced ventilation (if needed).

Approximately 300 meters of tube have been washed during prototyping work at the Hanford facility. LIGO expects the work to take place starting in January of 2015 with duration of approximately 30 workweeks.

The site Livingston layout is shown here:

https://dcc.ligo.org/DocDB/0018/D961257/000/D961257-00_large.pdf Note: that on this construction drawing from 1996 the arms is labeled Arm 1 and Arm 2.

The concrete enclosure and beam tube is shown here:

https://dcc.ligo.org/DocDB/0018/D960815/000/D960815-A_small.pdf

This drawing has a cross section of the enclosure showing a worker next to the beam tube

2.0 Document Access

Supplemental documents and specifications are incorporated into and made a part this Statement of Work. Click on the document links to access these documents from the LIGO Document Control Center (DCC) or go on line to the LIGO Public DCC at <https://dcc.ligo.org/> to access the DCC#.

3.0 Requirements:

In order to perform the precision cleaning, all tools will be provided by LIGO.

Under the supervision of LIGO employees and working with LIGO employees, workers will perform the following tasks;

- Operate the LIGO truck and trailer to transport equipment and supplies to the work location.
- Mount portable lighting along the ceiling of the concrete enclosure at the work location. Relocate this lighting as work progresses. Special cam-lock hangers are supplied and inserted into the enclosure gaps to support the lighting.
- Utilize the LIGO 200 gallon water tank to transport de-ionized water to the work location. Fill the water tank as needed by operating the de-ionized water supply (located at the corner building). Preheat water to 100F as needed using the exterior heaters and fill the wash machines.
- Operate the washing machines to clean between stiffening rings, and to clean the weld gap under the stiffening rings. One worker will work from the backside of the tube while another will work from the door side. Hand tools may be used to remove stubborn materials. Hand tools are used to clean the bellows sections. Non-skid step stools are provided to gain better access to the top of the tube.
- The Beam Tube supports consist of 4-inch square tube and are located every 20 meters. These tubes will be vacuumed and sealed.
- Place traffic cones at the work location to notify others on the road.
- Notify LIGO personnel of any unusual evidence or equipment found on or near the tube. Note the location. This will allow us to locate problems should we see a pressure event in the beam tube.
- Walk the length of the work section in order to remove spider webs.

4.0 Safety and access to the enclosure:

All contractors will go through a site safety orientation with the site Observatory SSO or designee. The beam tube enclosure is designated to be a non-permit confined space, is not air-conditioned and during the work the temperature will follow outside temperatures. The enclosure is not a habitation area. Exit doors are placed approximately every 400 feet. LIGO will provide Tyvek® suits, N95 face masks, gloves, eye protection and other PPE required during the work activities described above.