



LHAM2 & LHAM3

AUTHOR(S)	DATE	Document Change Notice, Release or Approval
Dennis Coyne, Eric James	27 Mar 2012	see LIGO DCC record Status

Instructions on the use of this document:

- 1) Use, and complete, this document on a cleanroom compatible computer while the work is proceeding. This procedure, and all of the applicable documents, must be available at all times during the procedure.
- 2) Use this procedure as a check list for preparation and during the installation; As each step is completed, enter the name of the person completing the work (or approving or checking the step), as well as the date and any comments or notes. In particular, note any discrepancies or deviations and augment with any missing definition. **ALL NOTES MUST BE RECORDED IN THE COMPLETED VERSION OF THIS DOCUMENT (NOT IN OTHER NOTEBOOKS OR FILES).** If the additional notes are too cumbersome to include within the body of this completed procedure, then electronically attach them to the completed procedure.
- 3) Once completed, file the document in the LIGO Document Control Center (DCC) as the next highest version of the procedure and add a note that this is a completed/finished procedure.
- 4) File any significant notes or data from the completed procedure in the electronic logbook (such as any deviations); as a minimum note in the electronic logbook that the installation was completed in accordance with this procedure (cite document number and revision).

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1 SCOPE

The scope of this procedure is installation of in-chamber components and assemblies in the LHAM2 and LHAM3 chambers (see Figure 1), which are defined in the following documents:

LHAM2:



ALIGO INSTALLATION PROCEDURE

LHAM2 & LHAM3

- LIGO-D0900365: [AdvLIGO Systems, HAM2-L1 Top Level Chamber Assembly](#)
- LIGO-E1100820: [HAM2-L Top Level Chamber Assembly BOM](#)
- LIGO-E1100742: [AdvLIGO Detailed Mass Properties-CG Report HAM Tables \(LLO\)](#)
- LIGO-D0900366: [AdvLIGO VE HAM2-L1 Vacuum Equipment Assembly](#)
- LIGO-D0900367: [AdvLIGO SEI HAM2-L1, XYZ Local CS for ISO Table](#)
- LIGO-D0900368: [AdvLIGO SUS HAM2-L1, XYZ Local CS for HLTS \(PR3\)](#)
- LIGO-D0900369: [AdvLIGO SUS HAM2-L1, XYZ Local CS for HSTS \(MC1,MC3,PRM\)](#)
- LIGO-D0900370: [AdvLIGO IO HAM2-L1, XYZ Local CS for SOS Assy \(SM1,SM2,PMMT1,PMMT2\)](#)
- LIGO-D1101537: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS \(SM1\) Sub-Assy](#)
- LIGO-D1101538: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS \(SM2\) Sub-Assy](#)
- LIGO-D1101539: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS \(PMMT1\) Sub-Assy](#)
- LIGO-D1101540: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS \(PMMT2\) Sub-Assy](#)
- LIGO-D0900371: [AdvLIGO IO HAM2-L1 XYZ Local CS for Faraday Isolator](#)
- LIGO-D0900420: [AdvLIGO IO HAM2-L1, XYZ Local CS for In Vacuum Periscope](#)
- LIGO-D1101406: [AdvLIGO SUS HAM2-L1, XYZ Local CS for Fixed Mount Optics](#)
- LIGO-D1000581: [CABLE HARNESS ROUTING CONFIGURATION - HAM2](#)
- LIGO-D1001625: [AdvLIGO HAM2-L1 ISI Table, Payload & Suspended Mass Assembly](#)
- LIGO-D1101407: [AdvLIGO IO HAM2-L1, XYZ Local CS for MC Refl Preiscope](#)
- LIGO-D1101408: [AdvLIGO, SUS HAM2-L1 Table, IO Straight Baffle Assembly](#)
- LIGO-D1101409: [AdvLIGO IO HAM2-L1, XYZ Local CS for Refl Beam Dump Assembly](#)
- LIGO-D1101410: [AdvLIGO IO HAM2-L1, XYZ Local CS for IO PSL PD Assembly](#)
- LIGO-D1101411: [AdvLIGO SEI HAM2-L1, XYZ Local for OptLev DLC Components](#)
- LIGO-D1101412: [AdvLIGO IO HAM2-L1 Table, IO EQ Stop Baffle Assembly](#)
- LIGO-D1101296: [ALIGO, AOS, HAM Chamber, Optical Table, Hole Tabulation](#)
- LIGO-D1002885: [Flange Layout - L1 Horizontal Access Module 2 \(HAM 2\)](#)
- LIGO-D1101233: [ALIGO IO L1 HAM2 INSTALLATION PLATE LAYOUT](#)
- LIGO-F1100030: [aLIGO Systems HAM2/3 Related Documents](#)
- LIGO-D1101775: [ALIGO, ELECTRICAL FEEDTHROUGH TYPES, TYPICAL SUBFLANGES, AND PORT CONFIGURATIONS](#)

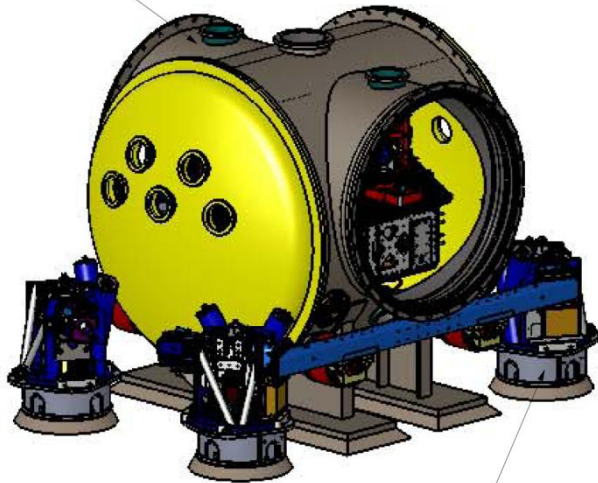
LHAM3:

- LIGO-D0900520: [AdvLIGO Systems, HAM3-L1 Top Level Chamber Assembly](#)
- LIGO-E1100818: [HAM3-L Top Level Chamber Assembly BOM](#)
- LIGO-E1100742: [AdvLIGO Detailed Mass Properties-CG Report HAM Tables \(LLO\)](#)
- LIGO-D0900521: [AdvLIGO VE HAM3-L1, Vacuum Equipment Assembly](#)
- LIGO-D0900523: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS \(PR2, MC2\)](#)
- LIGO-D0900522: [AdvLIGO SEI HAM3-L1, XYZ Local CS for ISO Table](#)
- LIGO-D0900524: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS \(PR2\) Sub-Assy](#)
- LIGO-D0900526: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS \(MC2\) Sub-Assy](#)
- LIGO-D1101393: [AdvLIGO SUS HAM3-L1, XYZ Local CS for MC2 and PR2 Scraper Baffles](#)
- LIGO-D1101118: [AdvLIGO HAM3-L1 ISI Table, Balance Masses Assembly](#)
- LIGO-D1002235: [AdvLIGO SEI HAM3-L1, XYZ Local CS for IO Optic Mount Components](#)
- LIGO-D1002234: [AdvLIGO SEI HAM3-L1, XYZ Local CS for ISC Components](#)
- LIGO-D1101463: [CABLE HARNESS ROUTING CONFIGURATION, HAM 3](#)
- LIGO-D1101394: [AdvLIGO SEI HAM3-L1, XYZ Local CS for OptLev DLC Components](#)
- LIGO-D1101296: [ALIGO, AOS, HAM Chamber, Optical Table, Hole Tabulation](#)
- LIGO-D1002886: [Flange Layout - L1 Horizontal Access Module 3 \(HAM 3\)](#)

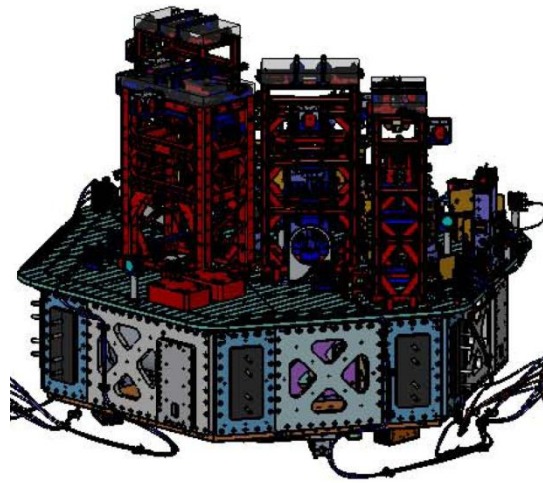
LHAM2 & LHAM3

- LIGO-D1101249: [ALIGO IO L1 HAM3 INSTALLATION PLATE LAYOUT](#)
- LIGO-F1100030: [aLIGO Systems HAM2/3 Related Documents](#)
- LIGO-D1101775: [ALIGO, ELECTRICAL FEEDTHROUGH TYPES, TYPICAL SUBFLANGES, AND PORT CONFIGURATIONS](#)
- LIGO-D1101296: [ALIGO, AOS, HAM Chamber, Optical Table, Hole Tabulation](#)

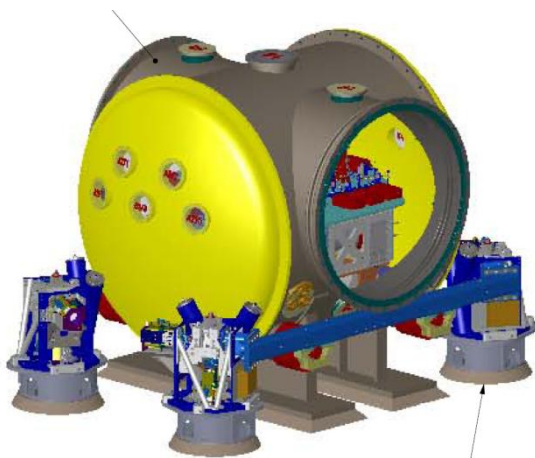
All of these documents are provided as “related document” links in the Document Control Center (DCC) entry for the top level chamber assembly drawings, [D0900365](#) and [D0900520](#).



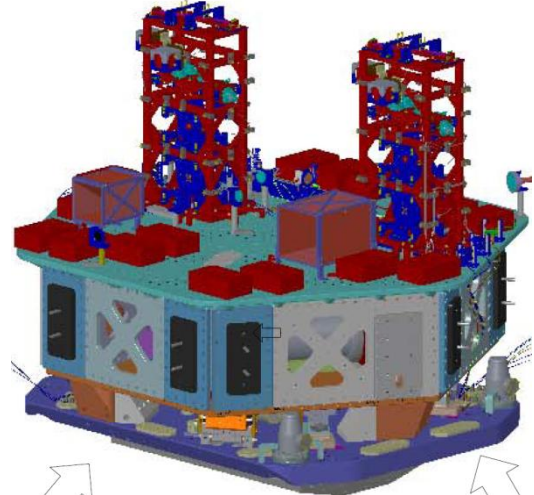
a) LHAM2 with vacuum equipment, HEPI



b) LHAM2 without vacuum equipment, HEPI, & ISI support frame



c) LHAM3 with vacuum equipment, HEPI



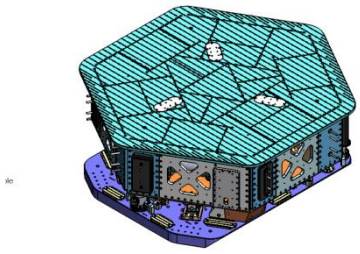
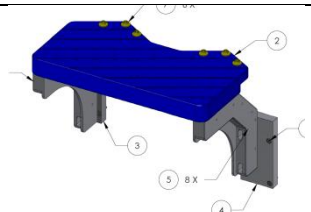
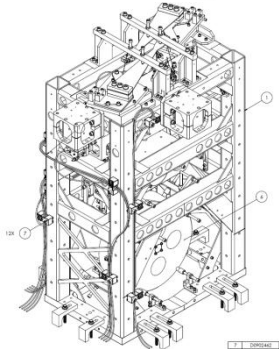
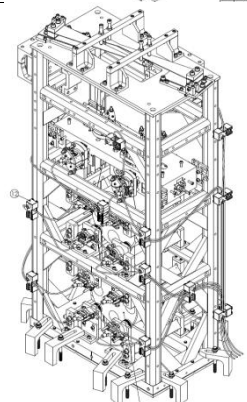
d) LHAM3 without vacuum equipment, HEPI, & ISI support frame

Figure 1 LHAM2 and LHAM3 Installation



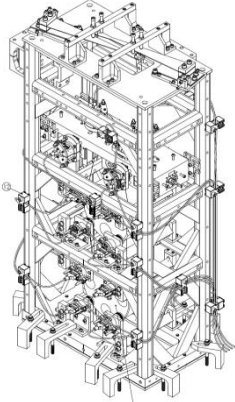
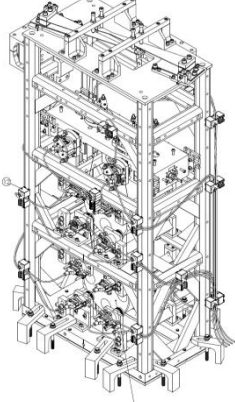
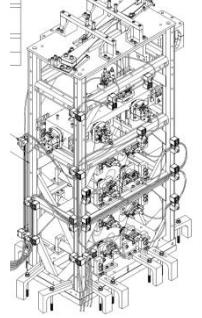
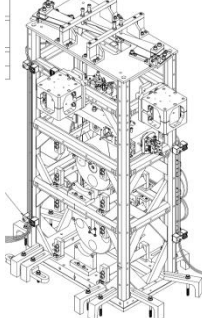
LHAM2 & LHAM3

This installation includes the following principal, sub-system major assemblies:

Subsys.	Assy Dwg	Sub-Assembly Name	Image
SEI	D0900124	LHAM2-ISI assembly <i>N.B.: LHAM2 and LHAM3 use the same ISI assembly</i>	
SEI	D1001472	LHAM2 Table Extension Assembly (LHAM2 only)	
SUS	D0900368	HLTS suspension assembly (PR3) (LHAM2 only) including: HLTS Assembly (D070447) Vibration Absorbers (D1002424) Optics Cap (D1101127)	
SUS	D0900413	LHAM2, HSTS suspension assembly (MC1) (LHAM2 only) including: HSTS Assembly (D020700) SUS Structure Spacer (D1100049) Vibration Absorbers (D1002424) Optics Cap (D1101143)	



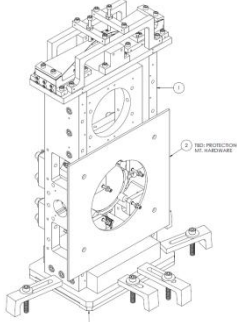
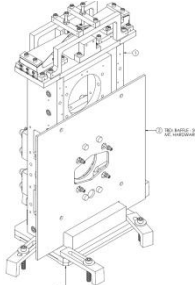
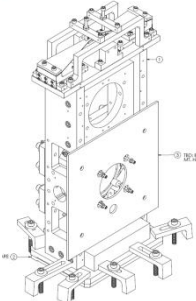
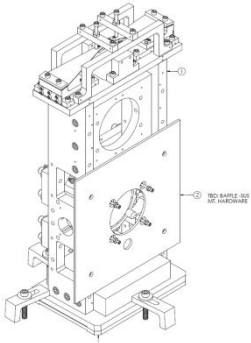
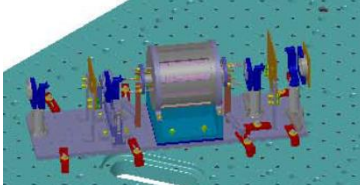
LHAM2 & LHAM3

Subsys.	Assy Dwg	Sub-Assembly Name	Image
SUS	D0900414	LHAM2, HSTS suspension assembly (MC3) (LAM2 only) including: HSTS Assembly (D020700) SUS Structure Spacer (D1100049) Vibration Absorbers (D1002424) Optics Cap (D1101143)	
SUS	D0900415	LHAM2, HSTS suspension assembly (PRM) (LHAM2 only) including: HSTS Assembly (D020700) SUS Structure Spacer (D1100049) Vibration Absorbers (D1002424) Optics Cap (D1101143)	
SUS	D0900526	LHAM3, HSTS suspension assembly (MC2) (LHAM3 only) including: HSTS Assembly (D020700) SUS Structure Spacer (D1100049) Vibration Absorbers (D1002424) Optics Cap (D1101143)	
SUS	D0900524	LHAM3, HSTS suspension assembly (PR2) (LHAM3 only) including: HSTS Assembly (D020700) SUS Structure Spacer (D1100049) Vibration Absorbers (D1002424) Optics Cap (D1101143)	



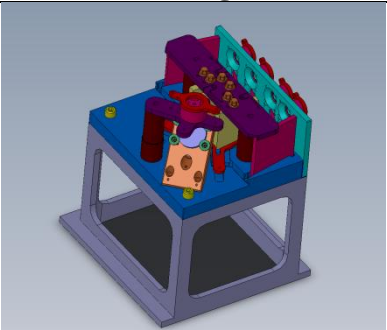
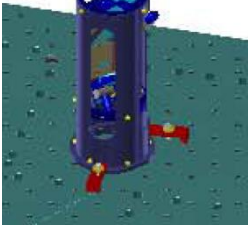
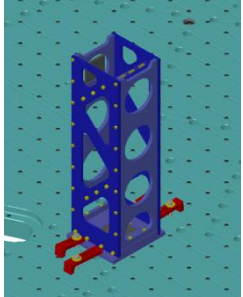
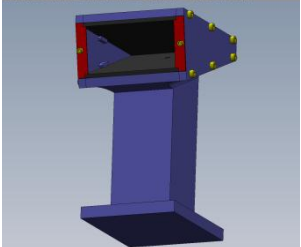
ALIGO INSTALLATION PROCEDURE

LHAM2 & LHAM3

Subsys.	Assy Dwg	Sub-Assembly Name	Image
IO	D1101537	LHAM2 AUX assembly (SM1) (LHAM2 only) including: Baffle Plate (D0902378) Riser Assembly (D1101523) HAM AUX assembly (D1000120)	
IO	D1101538	LHAM2 AUX assembly (SM2) (LHAM2 only) including: Baffle Plate (D1002745) Riser Assembly (D1101523) HAM AUX assembly (D1000120)	
IO	D1101539	LHAM2 AUX assembly (PMMT1) (LHAM2 only) including: Protection Baffle Plate (D0902380) Transmission Baffle Plate (D1003045) Riser Assembly (D1101523) HAM AUX assembly (D1000120)	
IO	D1101540	LHAM2 AUX assembly (PMMT2) (LHAM2 only) including: Baffle Plate (D0902382) Riser Assembly (D1101523) HAM AUX assembly (D1000120)	
IO	D1000332	L1 Faraday Isolator Assembly (LHAM2 only)	

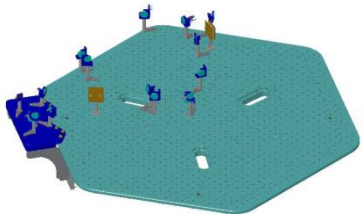
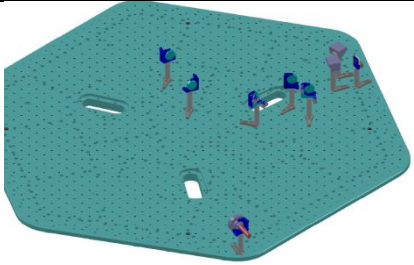
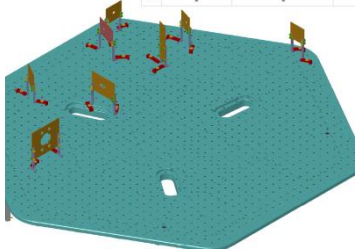
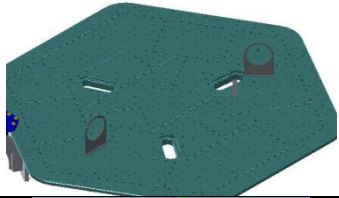
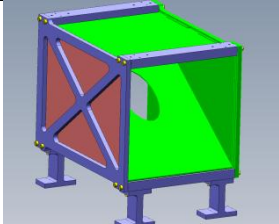


LHAM2 & LHAM3

Subsys.	Assy Dwg	Sub-Assembly Name	Image
IO	D1101059	IO ISS PD Assembly (LHAM 2 only)	
IO	D1002677	IO Reflecting Periscope Assembly (LHAM2 only) (2 required for LHAM2)	
IO	D1002350	IO In Vacuum Periscope Assembly (LHAM2 only)	
IO	D1002585	Refl Beam Dump Assembly (LHAM2 only)	



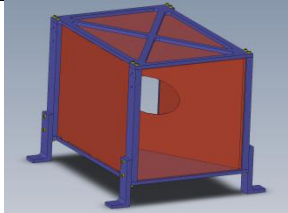
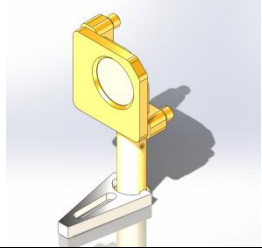
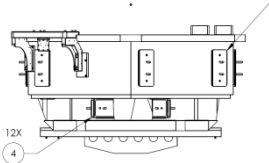
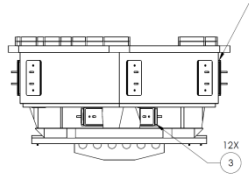
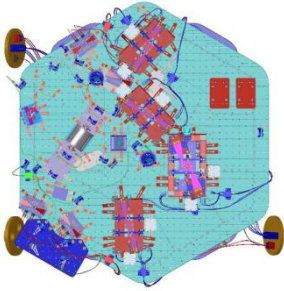
LHAM2 & LHAM3

Subsys.	Assy Dwg	Sub-Assembly Name	Image
IO	D1101406	LHAM2 Fixed Mount Optics Assembly (LHAM2 only) Includes the following 16 sub assemblies: <ol style="list-style-type: none">D1101466 Adaptive Optical Element Dummy HA12 Assy.D1102059 Adaptive Optical Element Dummy HA12 Assy.D1002075 Rigid Optic Mount RH Assy. (6 each)D1002085 Rigid Optic Mount LH Assy. (2 each)D1002085 Rigid Optic Mount LH Assy.D1002088 Actuated Rigid Optic Mount RH Assy.D1100789 (3.235) aLIGO In-Vac QPD Assy.	
IO	D1002235	Optic Mount Components (LHAM3 only) Includes the following 6 sub assemblies: <ol style="list-style-type: none">D1002085 Rigid Optic Mount LH Assy.D1002075 Rigid Optic Mount RH Assy. (2 each)D1002088 Actuated Optic Mount RH Assy. (2 each)D1100789 (3.235) aLIGO In-Vac QPD Assy.	
IO	D1101408	IO Straight Baffle Assembly (LHAM 2 only) includes the following eight sub assemblies: <ol style="list-style-type: none">D0902385 Straight HA1 Baffle AssyD0902389 Straight HA3 Baffle AssyD1003019 Straight P1 Baffle AssyD1101414 MC3 AR Baffle AssyD1101416 Straight HA13 Baffle AssyD1101417 Straight HA11 Baffle AssyD1101419 Straight HA9 Baffle AssyD1101422 PRM AR Baffle Assy	
IO	D11001412	IO EQ Stop Baffle Assembly (LHAM2 only) Includes three of the following sub assembly: D11001212 EQ Stop Baffle	
IO	D1000327	IO MC2 Scraper Baffle Assembly (LHAM3 only)	



ALIGO INSTALLATION PROCEDURE

LHAM2 & LHAM3

Subsys.	Assy Dwg	Sub-Assembly Name	Image
IO	D1000328	IO PR2 Scraper Baffle Assembly (LHAM3 only)	
AOS/ OptLev	D1101392	DLC Assembly	
SYS	D1001625	LHAM2 ISI Table Balance Masses	
SYS	D1101118	LHAM3 ISI Table Balance Masses	
SEI/SYS	D1101775 D1000581 D1101463	Electrical Feedthrough Types Cable Routing, HAM2 Cable Routing, HAM3	



ALIGO INSTALLATION PROCEDURE

LHAM2 & LHAM3

Subsys.	Assy Dwg	Sub-Assembly Name	Image
AOS/SLC	T1100292	Viewport Source List	

IFO	CHAMBER	VIEWPORT	FUNCTION	DESCRIPTION	VIEWPORT P/N	SOURCE
L1	HAM2	C1	VIDEO	FI/FR OUTPUT, SM1, SM2	5.4 DIA VP800/450009	CATALOG
L1	HAM2	D7	VIDEO	ZERO LENGTH REDUCER	12 in to 10 in zero length reducer	CUSTOM
L1	HAM2	D7	VIDEO	MC3	5.4 DIA VP800/450009	CATALOG
L1	HAM2	D8	DIAGNOSTIC	ZERO LENGTH REDUCER	12 in to 10 in zero length reducer	CUSTOM
L1	HAM2	D8	DIAGNOSTIC	COVER GLASS NON-WEDGED	6.0 in-AR1064/532_nonwedge	CUSTOM
L1	HAM2	D8	DIAGNOSTIC	REFL & PARKING DUMP BEAMS	6.0 in-AR1064/532_nonwedge	CUSTOM
L1	HAM2	VPA1F1	ILLUMINATION		5.4 DIA VP800/450009	ILIGO
L1	HAM2	VPA1F2	VIDEO	general view of HAM2	5.4 DIA VP800/450009	CATALOG
L1	HAM2	VPA1F3	VIDEO	MC1	5.4 DIA VP800/450009	CATALOG
L1	HAM2	VPA1F4	DIAGNOSTIC	COVER GLASS WEDGED	High Quality 6 in Wedged viewport optic	CUSTOM
L1	HAM2	VPA1F4	DIAGNOSTIC	MC-REFL	High Quality 6 in Wedged viewport optic	CUSTOM
L1	HAM2	VPA1F5	DIAGNOSTIC	SM1_TRANS	6.0 in-AR1064/532_nonwedge	CUSTOM
L1	HAM2	VPA2F1	VIDEO	FR input	5.4 DIA VP800/450009	CATALOG
L1	HAM2	VPA2F2	VIDEO	general view of HAM2	5.4 DIA VP800/450009	CATALOG
L1	HAM2	VPA2F3	DIAGNOSTIC	IO-TRANS-MONBEAM/PRC-MM-MONBEAM	6.0 in-AR1064/532_nonwedge	CUSTOM
L1	HAM2	VPA2F4	DIAGNOSTIC	IO-TRANS-MONBEAM/PRC-MM-MONBEAM	6.0 in-AR1064/532_nonwedge	CUSTOM
L1	HAM2	VPA2F5	VIDEO	PRM	5.4 DIA VP800/450009	CATALOG
L1	HAM3	VPA1F3	ILLUMINATION		5.4 DIA VP800/450009	ILIGO
L1	HAM3	VPA1F4	DIAGNOSTIC	MC2-TRANS	6.0 in-AR1064/532_nonwedge	CUSTOM
L1	HAM3	VPA1F5	VIDEO	MC2	5.4 DIA VP800/450009	CATALOG
L1	HAM3	VPA2F3	VIDEO	PR2	5.4 DIA VP800/450009	CATALOG

Rack and cable tray layout	D1003141	Not yet issued. In the interim refer to H1 layout in D1002704 .	
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2 Required Equipment List

Each of the procedures referenced within this overall procedure call out required equipment and parts/assemblies. Below is listed only those parts or assemblies not covered in the subsidiary procedures.

- LIGO-D1101674: [aLIGO, SUS, BSC/HAM INSTALLATION TOOLING](#)
 - for transporting HXTS and OMC structures (sheets 4, 5 & 6)
 - Genie lift adapter plate, D110515,

**LHAM2 & LHAM3**

- LIGO-D1101854: [aLIGO, HAM INSTALLATION ARM USAGE](#)
 - LIGO-D1001994: [aLIGO, HAM INSTALLATION ARM, ASSEMBLY, FLANGE MOUNT](#)
 - LIGO-D1002052: [aLIGO, ASSEMBLY, HAM ARM](#)
 - LIGO-D1001664: [HAM STRUCTURE LIFT ASSEMBLY, aLIGO, SUS](#)
 - LIGO-D1101674: [aLIGO, SUS, BSC/HAM INSTALLATION TOOLING](#)
 - see sheet 11 of D1101674
- LIGO-E1100831: [HAM Installation Arm User Guide](#)
- LIGO-D1001664: [HAM STRUCTURE LIFT ASSEMBLY, aLIGO, SUS](#)
 - HAM vertical lift, D1001667 (sheet 11)- 1 lift at each site (lifting arms, extenders being returned to CIT for rework). 1 spare at CIT

completed, approved or checked by:
date:

comments (optional):

3 ISI Installation for LHAM2 and LHAM3

3.1 Prepare the Chambers for ISI Installation

- The oxide layer removed from the interior of the HAM shells, and the HAM chambers certified as “clean”.
- Install the input septum plate ([C1001599](#)-v1, GNB dwg 114424-03S, Rev A) between LHAM1 and LHAM2
- Install HEPI per [E040011](#)
- Install the cable tray ([D1003141](#)) around the LHAM2 and LHAM3 chamber.
- Install HAM Chamber Cleanrooms around the LHAM2 and LHAM3 chambers and clean the chamber exterior and the region around the chambers.
- Vent the vertex vacuum volume and set the purge gas flowing per procedure [M1000360](#). Follow the Lockout-Tagout procedure [M990190](#)
- Install the dial indicators on the HAM support tube ends
- Remove the LHAM2 and LHAM3 Chamber Doors per procedure [M1000362](#)
- Install the electrical feed-throughs listed in [D1002885](#) into LHAM2 per procedure [M990173](#). Install the electrical feed-throughs listed in [D1002886](#) into LHAM3 per procedure [M990173](#).
Note: The electrical feed-throughs can be installed later in the sequence.

**LHAM2 & LHAM3**

- Install the field cabling from the electrical feed-throughs to the electronics racks, per **D#s?**
Note: The field cabling can be installed later, but must be done after the cable trays are in place, yet before the ISI is installed.
- Install the viewports listed in [T1100292](#) for LHAM2 and LHAM3, per procedures [E1100484](#) and [M990173](#)
Note: The viewports can be installed later in the sequence.
- Insure that the support tubes are level (to within 0.4 mrad) with a precision bubble level and HEPI static adjustment (per procedure [E040011](#))

completed, approved or checked by:
date:

Version numbers of all subsidiary documents followed:

comments (optional, e.g. deviations, exceptions, problems, "punch-list"):

3.2 Install the LHAM2 and LHAM3 ISI Assemblies

- Install the ISI assemblies into their vacuum chambers per [E080012](#).

completed, approved or checked by:
date:

comments (optional):

3.3 Perform final HAM-ISI testing/characterization prior to payload integration

- Perform the phase II testing associated with HAM-ISI installation prior to attaching payload to the optics table, per appropriate sections of [E1100994](#)

completed, approved or checked by:
date:

comments (optional):



LHAM2 & LHAM3

4 PAYLOAD INSTALLATION IN THE LHAM2 and LHAM3 CHAMBERS

The LHAM2 assembly is depicted in Figure 2. The major optics assemblies integrated into the LHAM2 assembly are the Power Recycling Mirror 3 (PR3) suspension assembly ([D0900368](#)), the Power Recycling Mirror (PRM) suspension assembly ([D0900415](#)), the Mode Cleaner 1 Mirror (MC1) suspension assembly ([D0900413](#)) and the Mode Cleaner Mirror 3 (MC3) suspension assembly ([D0900414](#)).

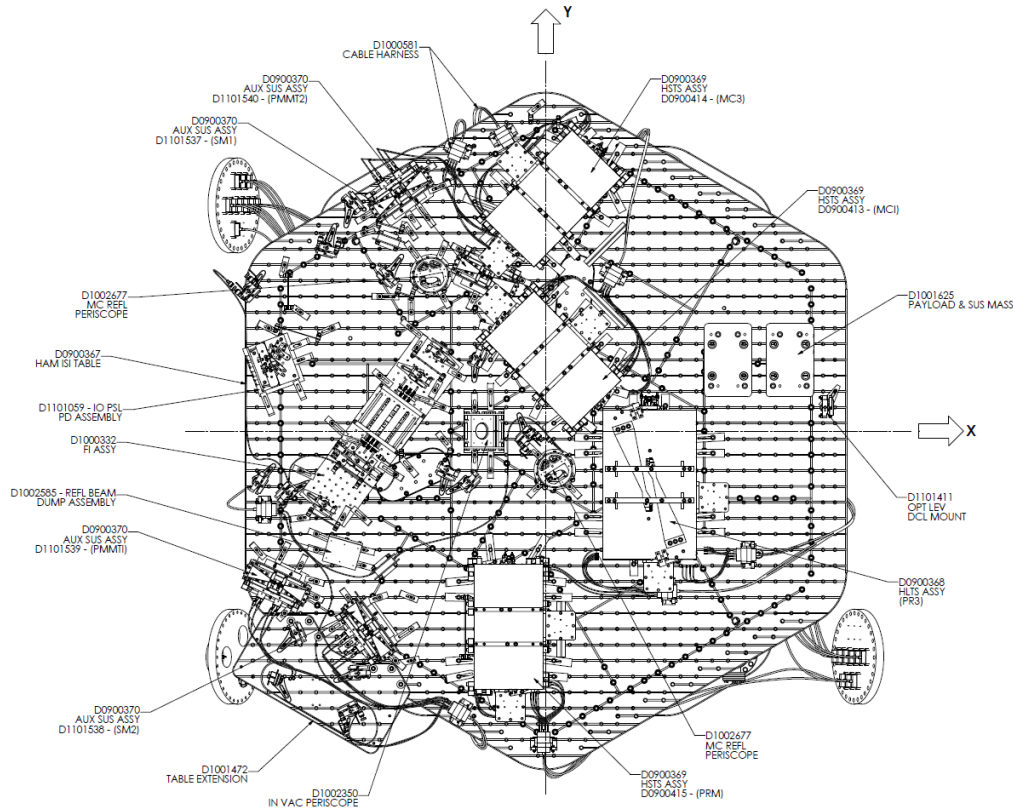


Figure 2: The LHAM2 ASSEMBLY ([D0900365](#))

The LHAM3 assembly is depicted in Figure 3. The major optics assemblies integrated into the LHAM3 assembly are the Power Recycling Mirror 2 (PR2) suspension assembly ([D0900526](#)), and the Mode Cleaner Mirror 2 (MC2) suspension assembly ([D0900524](#)).



LHAM2 & LHAM3

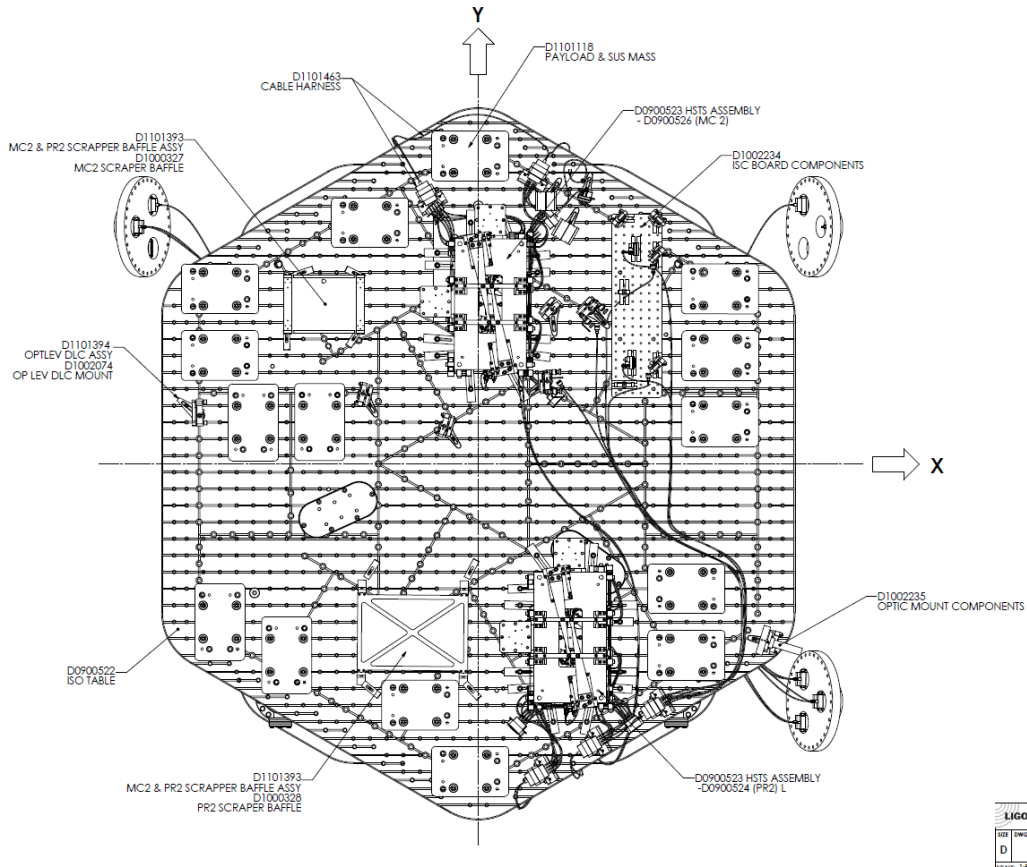


Figure 3 LHAM3 ISI Assembly ([D0900520](#))

4.1 Applicable Documents

Listed below are all of the applicable and referenced documents for this installation procedure. This list gives the latest revisions of the documents; within the installation steps, only the document number (and not the revision) is quoted.

Only documents actually required to perform the installation should be included in this list and not background or reference material. It is essential that all of the procedures and all of the drawings listed below are available with this procedure during the installation/integration work.

Document No.	Document Title
General Documents	
E0900047-v12	LIGO Contamination Control Plan
Install/Align Procedures	
T1000097	Input Optics Plan
E1100783	Initial Alignment Procedure: LHAM2 and LHAM3



LHAM2 & LHAM3

Test Procedures[E1100994](#) aLIGO HAM-ISI Testing Procedure, Phase II : Integration process**Safety****Drawings****LHAM2**LIGO-D0900365: [AdvLIGO Systems, HAM2-L1 Top Level Chamber Assembly](#)LIGO-D0900367: [AdvLIGO SEI HAM2-L1, XYZ Local CS for ISO Table](#)LIGO-D0900368: [AdvLIGO SUS HAM2-L1, XYZ Local CS for HLTS \(PR3\)](#)LIGO-D0900369: [AdvLIGO SUS HAM2-L1, XYZ Local CS for HSTS \(MC1,MC3,PRM\)](#)LIGO-D0900370: [AdvLIGO IO HAM2-L1, XYZ Local CS for SOS Assy \(SM1,SM2,PMMT1,PMMT2\)](#)LIGO-D1101537: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS \(SM1\) Sub-Assy](#)LIGO-D1101538: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS \(SM2\) Sub-Assy](#)LIGO-D1101539: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS \(PMMT1\) Sub-Assy](#)LIGO-D1101540: [AdvLIGO SUS HAM2-L1, XYZ Local CS for AUX SUS \(PMMT2\) Sub-Assy](#)LIGO-D0900371: [AdvLIGO IO HAM2-L1 XYZ Local CS for Faraday Isolator](#)LIGO-D0900420: [AdvLIGO IO HAM2-L1, XYZ Local CS for In Vacuum Periscope](#)LIGO-D1101406: [AdvLIGO SUS HAM2-L1, XYZ Local CS for Fixed Mount Optics](#)LIGO-D1000581: [CABLE HARNESS ROUTING CONFIGURATION - HAM2](#)LIGO-D1001625: [AdvLIGO HAM2-L1 ISI Table, Payload & Suspended Mass Assembly](#)LIGO-D1101408: [AdvLIGO, SUS HAM2-L1 Table, IO Straight Baffle Assembly](#)LIGO-D1101409: [AdvLIGO IO HAM2-L1, XYZ Local CS for Refl Beam Dump Assembly](#)LIGO-D1101410: [AdvLIGO IO HAM2-L1, XYZ Local CS for IO PSL PD Assembly](#)LIGO-D1101411: [AdvLIGO SEI HAM2-L1, XYZ Local for OptLev DLC Components](#)LIGO-D1101412: [AdvLIGO IO HAM2-L1 Table, IO EQ Stop Baffle Assembly](#)LIGO-D1101296: [ALIGO, AOS, HAM Chamber, Optical Table, Hole Tabulation](#)LIGO-D1002885: [Flange Layout - L1 Horizontal Access Module 2 \(HAM 2\)](#)LIGO-D1101233: [ALIGO IO L1 HAM2 INSTALLATION PLATE LAYOUT](#)**LHAM3**LIGO-D0900520: [AdvLIGO Systems, HAM3-L1 Top Level Chamber Assembly](#)LIGO-D0900523: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS \(PR2, MC2\)](#)LIGO-D0900522: [AdvLIGO SEI HAM3-L1, XYZ Local CS for ISO Table](#)LIGO-D0900524: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS \(PR2\) Sub-Assy](#)LIGO-D0900526: [AdvLIGO SUS HAM3-L1, XYZ Local CS for HSTS \(MC2\) Sub-Assy](#)LIGO-D1101393: [AdvLIGO SUS HAM3-L1, XYZ Local CS for MC2 and PR2 Scraper Baffles](#)LIGO-D1101118: [AdvLIGO HAM3-L1 ISI Table, Balance Masses Assembly](#)LIGO-D1002235: [AdvLIGO SEI HAM3-L1, XYZ Local CS for IO Optic Mount Components](#)LIGO-D1002234: [AdvLIGO SEI HAM3-L1, XYZ Local CS for ISC Components](#)LIGO-D1101463: [CABLE HARNESS ROUTING CONFIGURATION, HAM 3](#)LIGO-D1002886: [Flange Layout - L1 Horizontal Access Module 3 \(HAM 3\)](#)LIGO-D1101249: [ALIGO IO L1 HAM3 INSTALLATION PLATE LAYOUT](#)



LHAM2 & LHAM3

Common

LIGO-D1101775: [ALIGO, ELECTRICAL FEEDTHROUGH TYPES, TYPICAL SUBFLANGES, AND PORT CONFIGURATIONS](#)LIGO-F1100030: [aLIGO Systems HAM2/3 Related Documents](#)LIGO-G1000125: [Advanced LIGO BSC and HAM ISI Conventions](#)LIGO-D1101296: [ALIGO, AOS, HAM Chamber, Optical Table, Hole Tabulation](#)**4.2 Weigh the full suspension payloads**

- Weigh the full MC3 HSTS suspension, record below
- Weigh the full MC1 HSTS suspension, record below
- Weigh the full PR3 HLTS suspension, record below
- Weigh the full PRM HSTS suspension, record below
- Weigh the full MC2 HSTS suspension, record below
- Weigh the full PR2 HSTS suspension, record below
- Weigh the Faraday Isolator Assembly, record below
- Weigh the HAM Optics Table Extension Assembly, record below
- Systems to confirm, or revise, the mass balancing plan ([E1100742](#), “AdvLIGO Detailed Mass Properties-CG Report HAM Tables (LLO)”) and drawing of the balance mass locations:
[D1001625](#), AdvLIGO HAM2-L1 ISI Table, Payload & Suspended Mass Assembly
[D1101118](#), AdvLIGO HAM3-L1 ISI Table, Balance Masses Assembly

Payload	Mass (Kg)	Comments/caveats
MC3 HSTS Suspension		
MC1 HSTS Suspension		
PR3 HLTS Suspension		
PRM LSTS Suspension		
MC2 HSTS Suspension		
PR2 HSTS Suspension		
Faraday Isolator Assy		
HAM Table Extension Assy		

completed, approved or checked by:
date:

comments (optional):



LHAM2 & LHAM3

4.3 Install LHAM2 table extension assembly

- See [D1001472](#), aLIGO, Table Extension, HAM2

completed, approved or checked by:
date:

comments (optional):

4.4 Install the IO components, Optical Lever mirrors and balance mass

- The detailed steps for the installation of the most of the payload elements on the optics tables of LHAM2 and LHAM3 are defined in [T1000097](#), *Input Optics Installation Plan* This plan covers the IO components. Additional payload elements to be installed are listed below.
- N.B.: For the first instance of the addition of a major assembly to the optics table, the table will be re-balanced, floated and SEI will take transfer function measurements in order to help identify (at a later time after post-processing) any troublesome modes. These major assemblies are: HSTS, HLTS, Faraday Isolator, and IO periscopes. *Note that this is for the first installation instance on any optics table. For example if an HSTS (say MC2) is added to LHAM2 and SEI takes transfer function measurements, then no further transfer functions are required when other HSTS suspension are added to LHAM2 or LHAM3 optics tables.*
- As the HSTS and HLTS suspensions are installed, add the vibration absorbers per:
PRM: [D0900415](#)
PR2: [D0900524](#)
PR3: [D0900368](#)
MC1: [D0900413](#)
MC2: [D0900526](#)
MC3: [D0900414](#)
- For the optical lever mirror assemblies on each optics table, see:
[D1101411](#), AdvLIGO SEI HAM2-L1, XYZ Local for OptLev DLC Components
[D1101394](#), AdvLIGO SEI HAM3-L1, XYZ Local CS for OptLev DLC Components
- Install the balance masses in accordance with [D1001625](#): AdvLIGO HAM2-L1 ISI Table, Payload & Suspended Mass Assembly, and [D1101118](#): AdvLIGO HAM3-L1 ISI Table, Balance Masses Assembly.
- Rebalance the Table per ISI procedure **REF#?**

**LHAM2 & LHAM3**

completed, approved or checked by:
date:

comments (optional):

4.5 Align the Optics

- Align the optical elements on the cartridge in accordance with [E1100783](#): Initial Alignment Procedure - LHAM2 and LHAM3.

completed, approved or checked by:
date:

comments (optional):

4.6 Clean the Optics

- Inspect the optical surfaces. If cleaning is required, then complete the following steps:
- Lock down the HAM-ISI stages per [E1101037](#)
- Lock down ITMy per [T1100406](#)
- Lock down the FMy per [T1100489](#)
- Clean the optics if needed. First Contact™ cleaning (per procedure [E1000079](#)) is the preferred method.

completed, approved or checked by:
date:

Version numbers of all subsidiary documents followed:

comments (optional, e.g. deviations, problems):

5 Testing

Conduct final checkout and inspection per [T1000097](#).

completed, approved or checked by:
date:

Version numbers of all subsidiary documents followed:



LHAM2 & LHAM3

comments (optional, e.g. deviations, problems):