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**Arm Cavity Baffle  
Installation Procedure**

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## Scope

This document covers installation of the Arm Cavity Baffle onto an overhead mechanical interface for testing and onto the Stage 0 structure inside a BSC chamber. This procedure must be read before beginning the installation of an Arm Cavity Baffle.

Note that the installation of the Arm Cavity Baffle is one element of the Stray Light Control (SLC) subsystem. The installation plan for SLC components is covered in “SLC and Viewports Installation plan”, LIGO-[E1000099](#).

## 1 Installation Procedure

### 1.1 Installation Preparation

BSC flooring must be in place.

List of all Parts, Fixtures and Tools required:

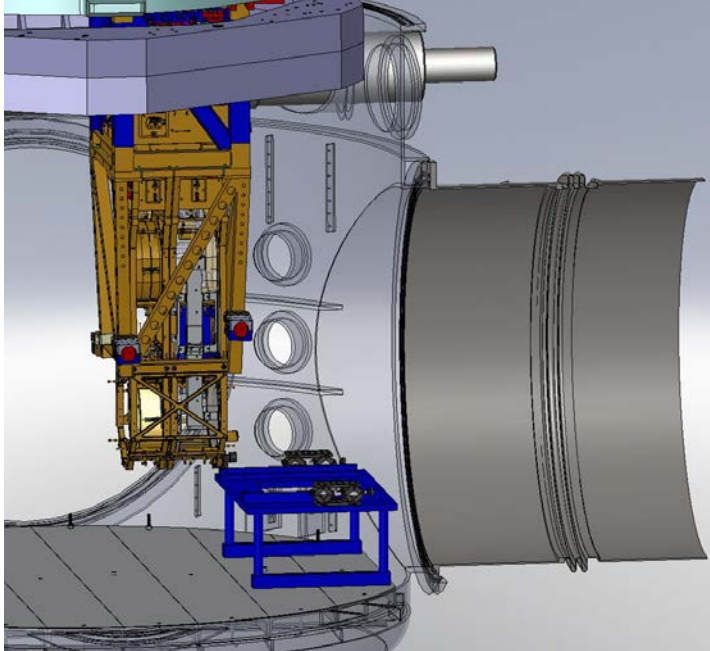
- a. Interface Fixture Pushers (2)
- b. Plumb Bob
- c. Counterweights
- d. Weights
- e. Safety Lanyards (2)
- f.

1.1.1 Transport required equipment into adjoining Spool (PRIOR to the Cartridge installation) and position in order of use. Item #1 is closest to the chamber opening:

1. Assembled Thor Table with Legs
2. Slider Rails (2)
3. Jacks (2)
4. Secondary Table
5. Suspension Assembly secured in Expandable Stand in collapsed configuration.
6. Sled Stand
7. Sled
8. Baffle Box Assembly

## 1.2 Installation Set-up

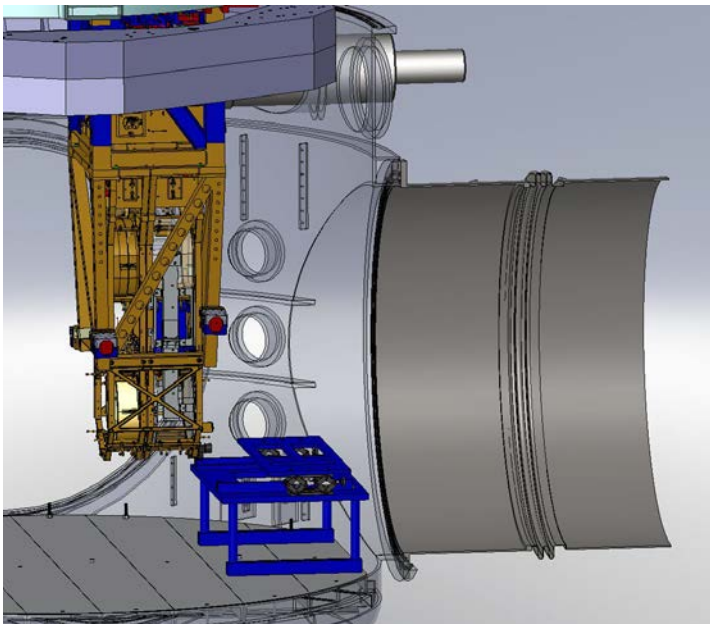
- 1.2.1 Install Suspension Lift Assembly (D1101953) into Chamber. Attach Plumb Bob to STAGE 0 at Baffle centerline to center Suspension Assy.



- 1.2.2 Remove the Plumb Bob and set aside.

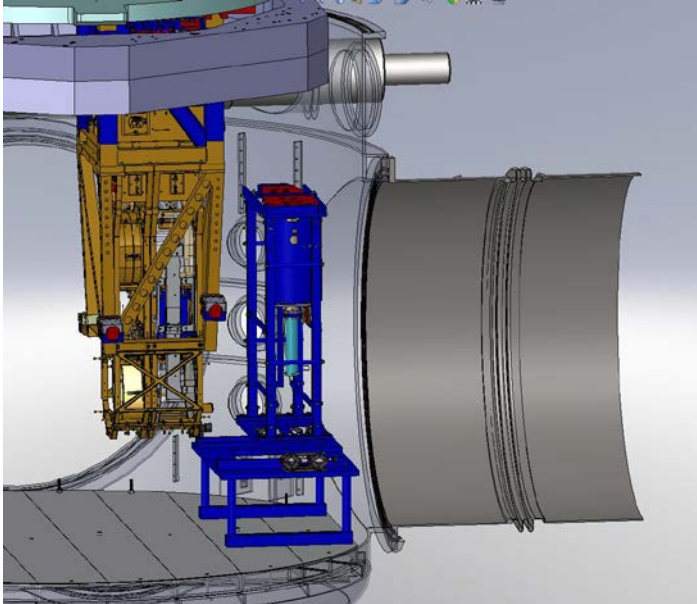
- 1.2.3 Verify Jacks are in completely collapsed state.

- 1.2.4 Install Table, Secondary, Suspension (D1101962), fastening with SHCS,  $\frac{1}{4}$ -20 x  $\frac{5}{8}$  Lg. (qty 12).



### 1.3 Suspension Assembly Installation

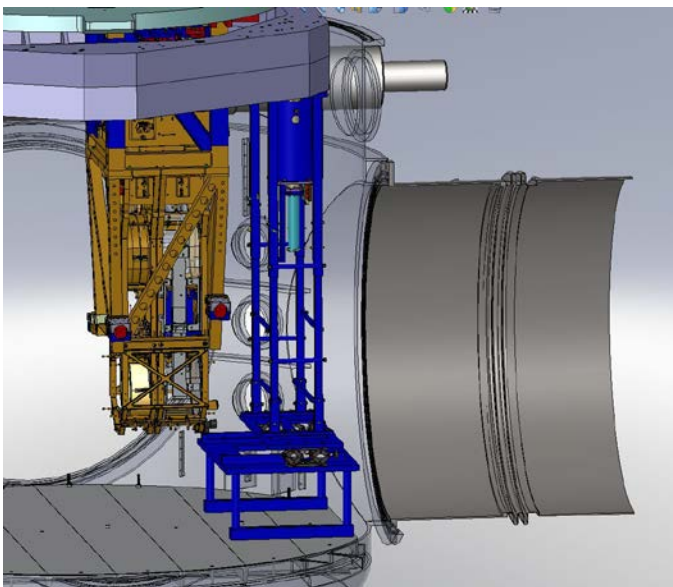
- 1.3.1 Bring in collapsed Installation Stand (D1101957) and carefully place on Table, Secondary, fasten with SHCS, 5/16-18 x 1.0Lg (qty 4).



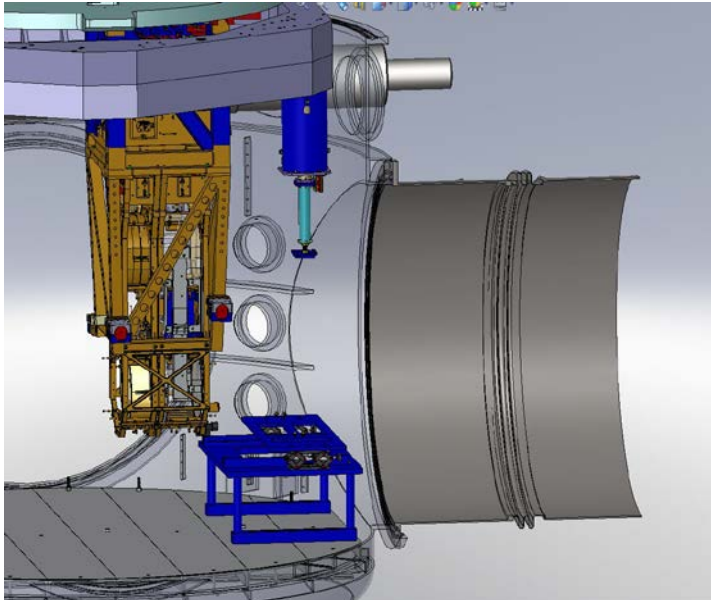
- 1.3.2 Attach Safety Lanyard from Stand to Chamber wall.

- 1.3.3 With Installation Stand secured, remove upper clamp on Stand.

- 1.3.4 Elongate the Suspension Assembly Stand to xx.xx feet and lock into position.



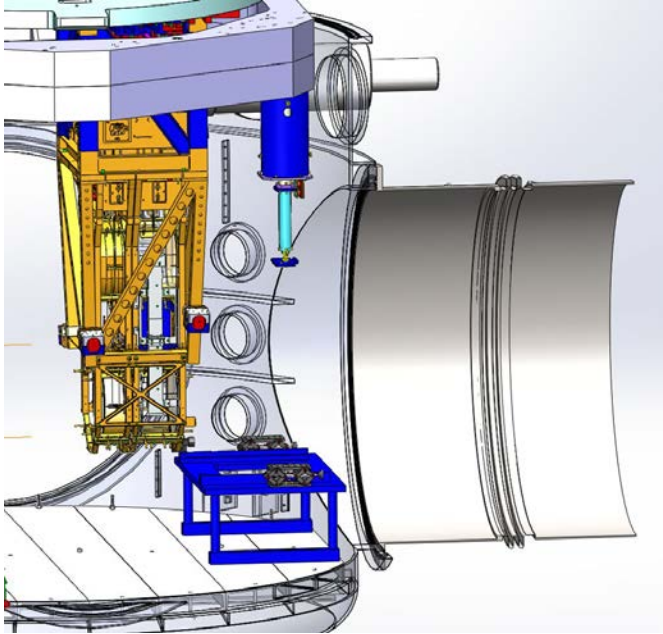
- 1.3.5 Slowly raise Jacks simultaneously until Interface Plate touches STAGE 0.
- 1.3.6 Align Stage Zero Guide Block (D1101595) and Stage Zero Dog Clamp (D1101613) to Stage Zero. Fasten using Hex Head 5/16-XX x X.0 Lg (qty 4)
- 1.3.7 Position Suspension Assembly into Alignment Clamp completely. Hand tighten.
- 1.3.8 Remove Safety Bar on Stand and set aside.
- 1.3.9 Slide D1101700 Interface Fixture Mover between Interface Plate and Spring Blade.
- 1.3.10 Install #5/16 bolts and washers, 4 places, to attach Interface Fixture Mover and Interface Plate to Stage 0. Hand tighten.
- 1.3.11 Lower the lifts enough to remove Stand. Return Stand to collapsed state, disconnect Safety lanyards and set aside.



- 1.3.12 Tighten all bolts.

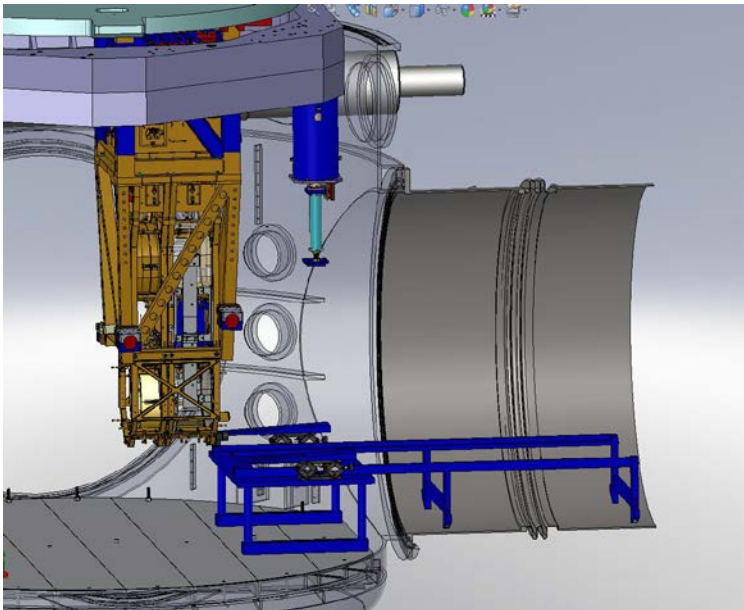
## 1.4 Baffle Box Assembly Installation

1.4.1 Remove Secondary Table and set aside. Keep hardware for next assembly.



1.4.2 Verify Jacks are in completely collapsed state.

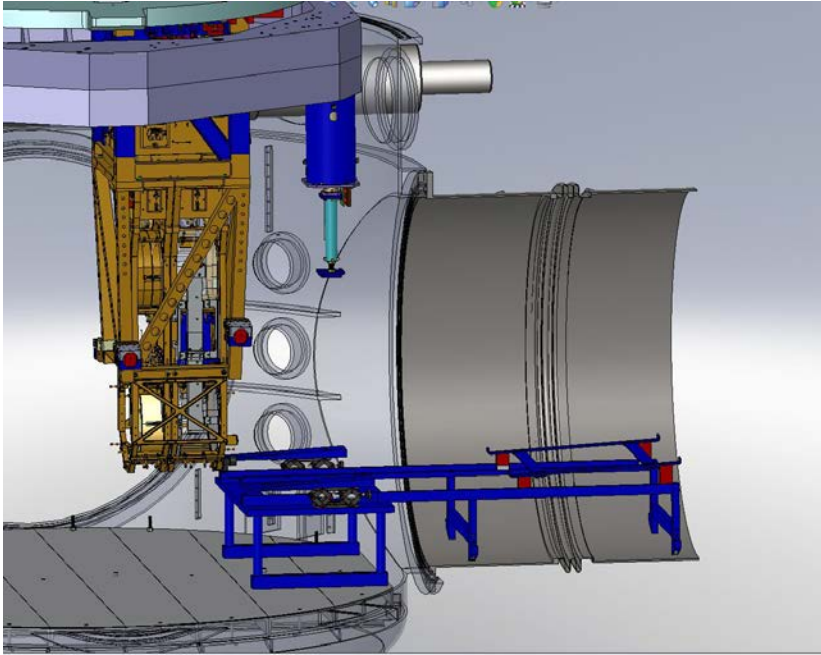
1.4.3 Attach Wedge Lifts (2) D1101952 with existing hardware.



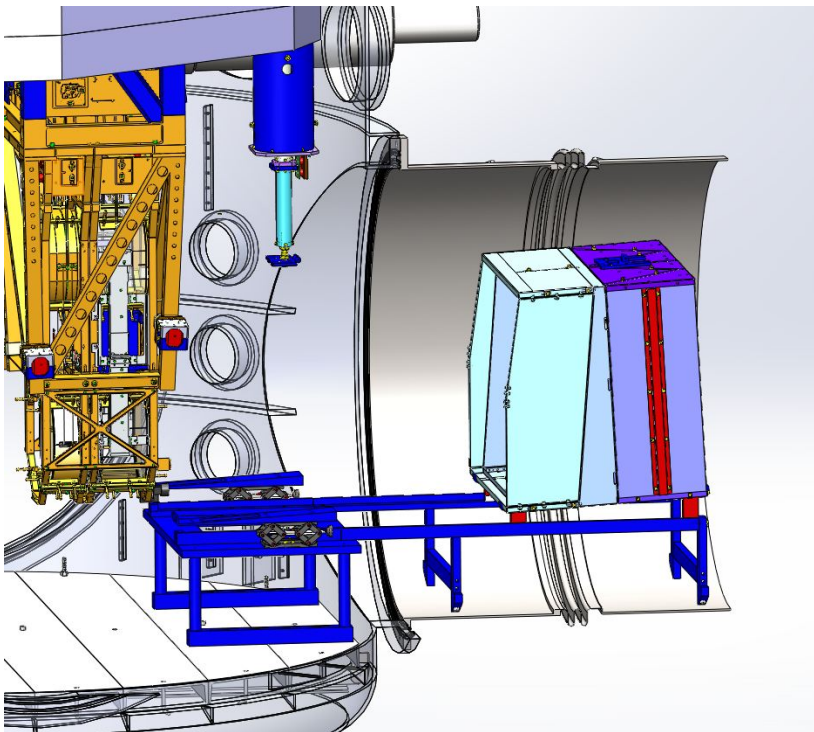


1.4.4 Attach Rail ACB Assembly (D1101724) using  $\frac{1}{4}$  dowel pins and  $\frac{1}{4}$ -20 x  $\frac{5}{8}$ " lg SCHS (qty 2 ea).

1.4.5 Place Slide, Baffle Carrier Assembly, (D1101958) a top Rail, ACB Assembly.

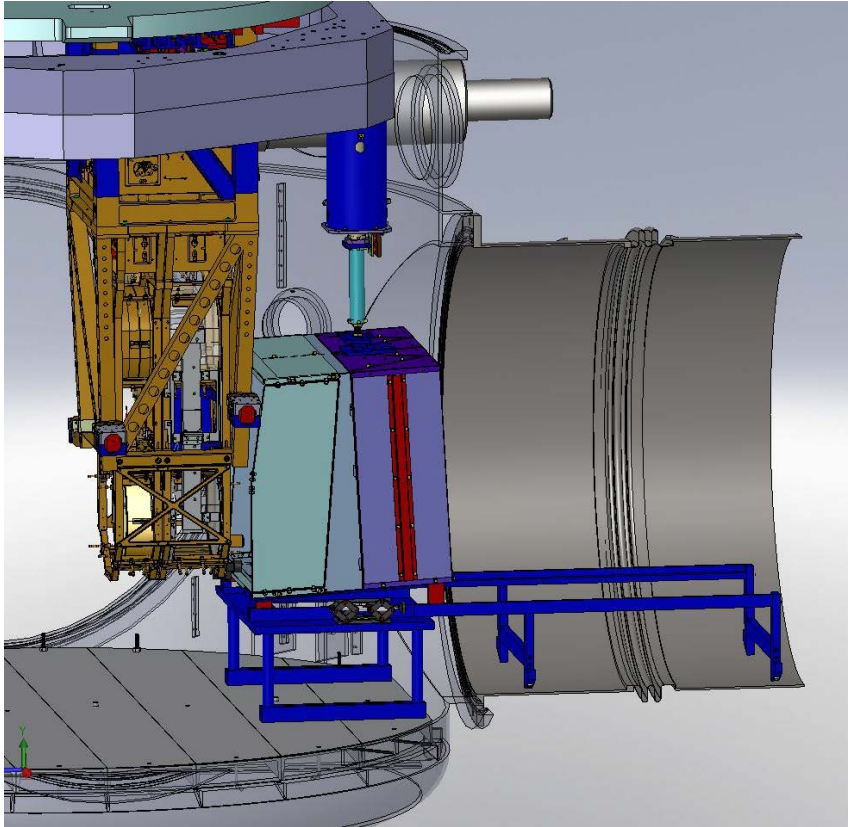


1.4.6 Carefully lift baffle and place (approximately on centered) onto Slide, Baffle which is on Rail, ACB.

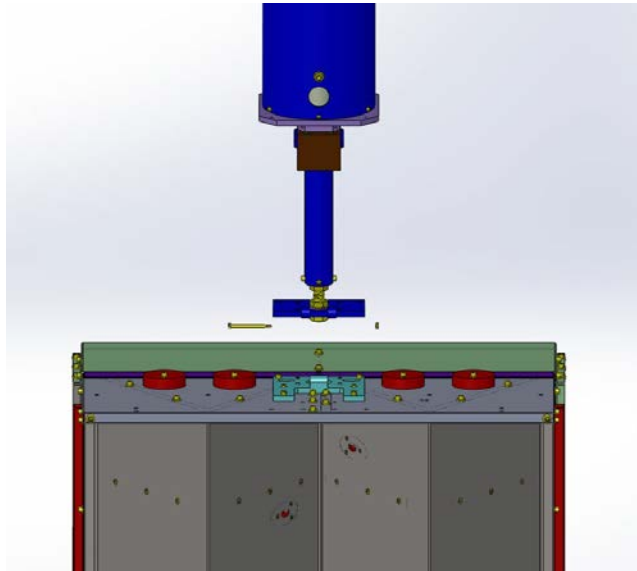




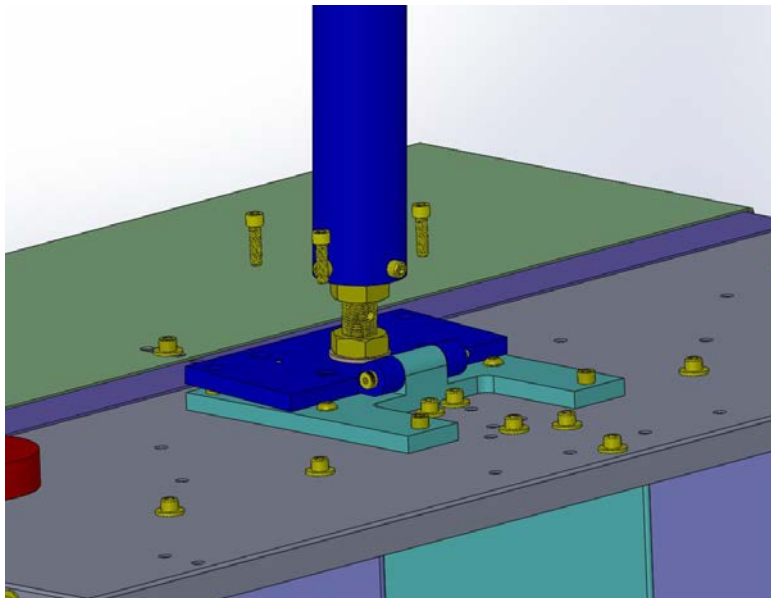
1.4.7 Slide Baffle toward Quad, stopping at the approximate location need to raise and attach hinge portions.



- 1.4.8 Fasten Safety Lanyards to Baffle from eyebolts to rails on Chamber wall, 4 places.
- 1.4.9 Raise Jacks to lift Baffle Box Assembly and align to top hinge plate at bottom of Suspension Assembly.
- 1.4.10 Attach Baffle Box Assembly to Suspension Assembly with shoulder screw, nut and washers, 1 place.



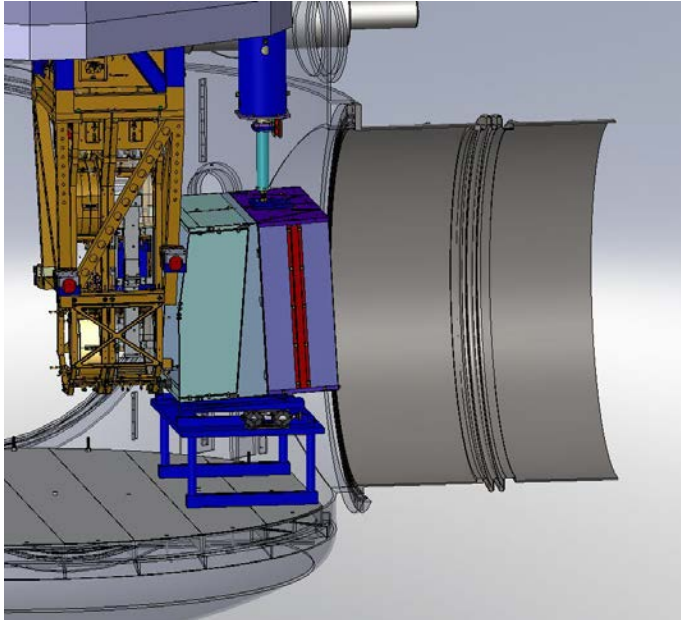
- 1.4.11 Install screws through Top Hinge Plate on Suspension Assembly to Bottom Hinge Plate on Baffle Box Assembly (4 4 ¼-20 x 1.0" lg SCHS and washers).



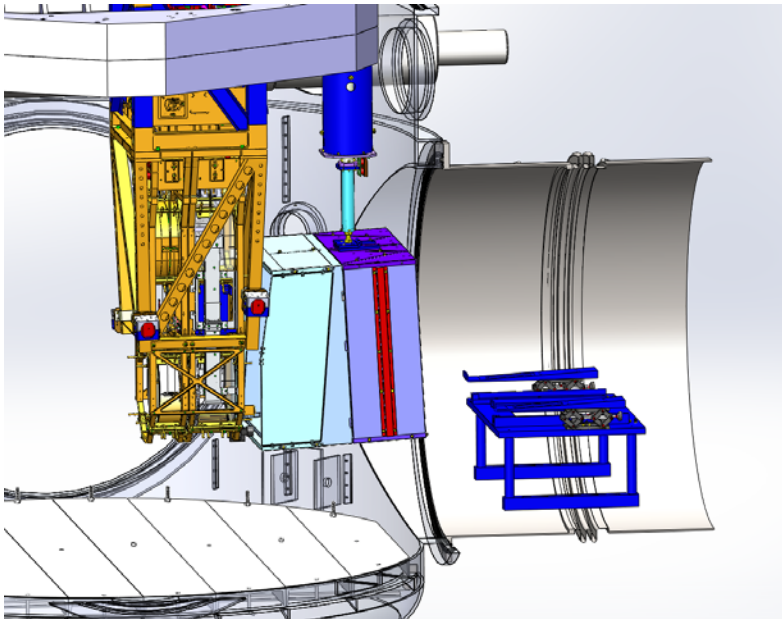
1.4.12 Slowly lower Jacks while removing Tongue Depressor from behind Spring Blade.

1.4.13 DO NOT REMOVE SAFETY LANYARD AT THIS TIME.

1.4.14 Lower Jack stand and Wedge Lift completely, and remove Rail, ACB Assembly.



1.4.15 Suspension lift Assembly can now be slid out and dis-assembled.



## **1.5 Additional Assembly**

Attach Counter Weight assembly parts.

## **1.6 Align Baffle Assembly**

Install the Interface Fixture Pushers, 2 places. Torque = ?

## **1.7 Route and secure cables along Stage 0**

## **1.8 Removal of Fixtures and Tooling**

## **1.9 Servicing - Baffle Swingback**

## 2 Other Installation Requirements

### 2.1 Installation inside Downs - Room 318

Verify there are 3 dog clamps loosely attached to ceiling plate. Make sure they are turned to not interfere with the placement of the Interface Plate.

Items needed for attachment to ceiling plate –

- screws, washers and spacers, 4 each

- 3 - 2' chains

- 6 carabiners

- 3 eyebolts with shoulders

- 4 people, minimum, required

- Genie

- Table with legs positioned at widths to fit Genie arms

- Clamping mechanism to secure table to Genie

Position Genie centered under installation location overhead. Lock wheels, make sure it is secure and cannot topple.

Place table onto Genie with 8 – 12” legs resting in arm slots. Secure table to Genie.

Attach one end of a chain, with carabiners on each end, to overhead eyebolts (3 places).

Verify there are 3 eyebolts (with shoulders) attached to the Suspension Assembly.

Two people carry the Suspension Assembly to tabletop secured to Genie. The weight of the assembly is now resting on the table. Personnel are to remain in place to hold Suspension Assembly upright and in place temporarily.

A third person is needed to attach the loose end of each chain to the eyebolts on Suspension Assembly. Assembly is now secure.

A fourth person slowly elevates Suspension Assembly by operating Genie to raise arms. The third person removes the slack from each chain sequentially as Suspension Assembly moves closer to ceiling plate by locking another link of the chain with the extra carabiner to the eyebolt, then remove other carabiner (3 places). Repeat this step until Suspension Assembly is within distance to attach Interface Plate to ceiling plate. **Note: Two people must remain beside the assembly during this process to supply support when needed to make sure the assembly remains upright.**

A third person is needed to attach the Interface Plate to the ceiling plate with screws, washers and spacers (1 to 4 places).

Position dog clamps with spacers and tighten (3 places).

Disengage chains and carabiners for testing. Set aside for later use.

Lift ACB box assembly (with Genie, ~100 lbs) and align to top hinge plate at bottom of ACB suspension assembly.

Attach ACB box assembly to ACB suspension assembly with shoulder screw, nut and washers (1 place).

Install screws from top hinge plate on ACB suspension assembly to bottom hinge plate on ACB box assembly (4 bolts and washers).

Lower Genie arms and remove from immediate area.

Remove tongue depressor from behind ACB spring blade.

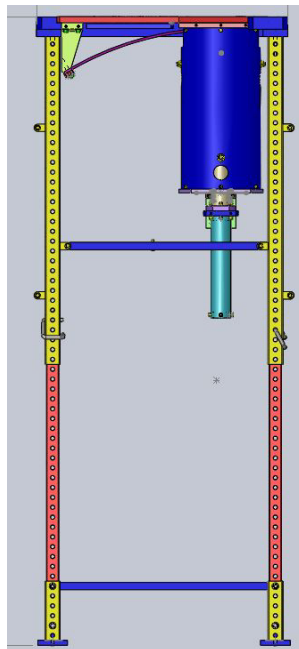


## 2.2 Installation inside Mezzanine Mockup Chamber



**Figure 1: Mezzanine Mock-Up Chamber**

### 2.2.1 Place Suspension Assembly into Suspension Assembly Stand.



**Figure 2: Suspension Assembly in Stand**

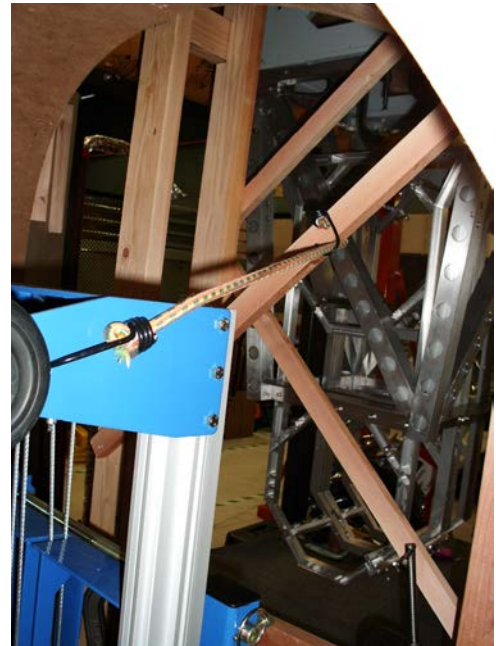
2.2.2 Position Vestil Utility Lift with arms extended below STAGE 0 attachment location.



2.2.3 Lift Stand with Suspension Assembly onto Vestil Utility Lift.



2.2.4 Secure Stand to Vestil Utility Lift.



2.2.5 Position Stand and Vestil Utility Lift so that the Interface Plate mounting holes align with mating STAGE 0 mounting locations.



2.2.6 Slowly raising Vestil Utility Lift, visually align and adjust the Interface Plate mounting holes with STAGE 0 mounting location.

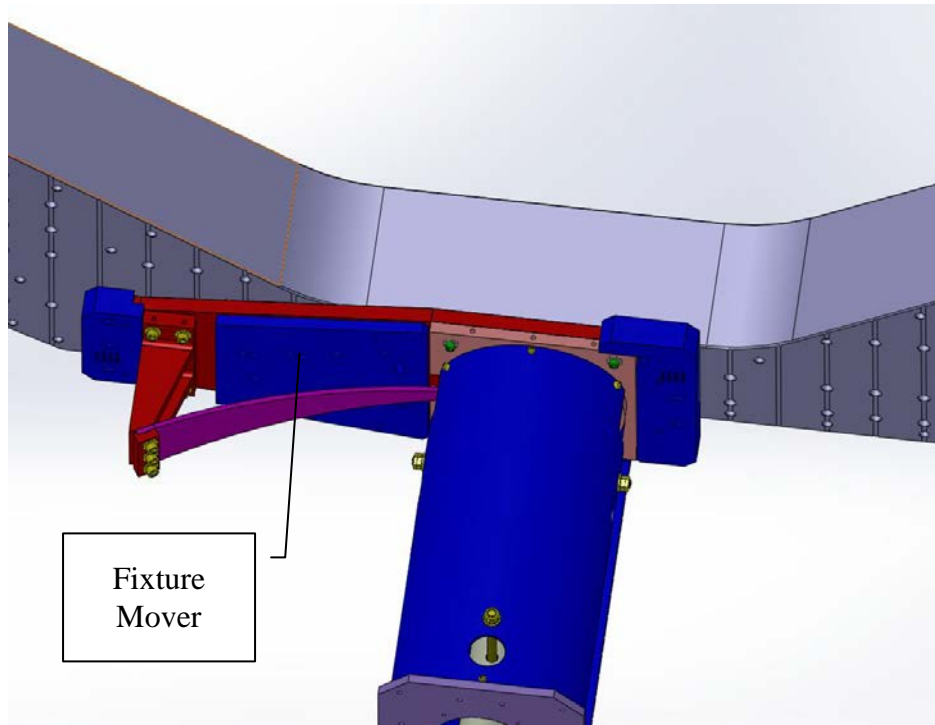


2.2.7 Raise the Vestil Utility Lift so that Interface Plate and STAGE 0 just touches.

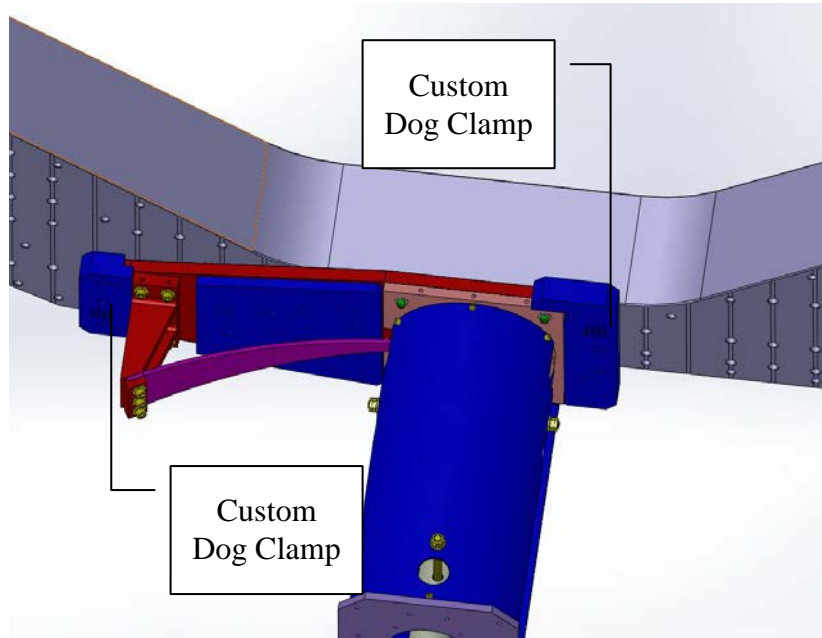


2.2.8 LOCK WHEELS ON LIFT.

2.2.9 Install #5/16 bolts, washers and nuts (4 places) to attach Interface Fixture Mover and Interface Plate to Stage 0. Tighten fasteners, 4 places.



- 2.2.10 Make sure arms are positioned over mock chamber floor. Cautiously lower Vestil Utility Lift with Stand.
- 2.2.11 Remove empty Stand from Vestil Utility Lift and remove from working area.
- 2.2.12 Install dedicated Dog Clamps over each end of the Interface Plate. Tighten fasteners, 2 places each.



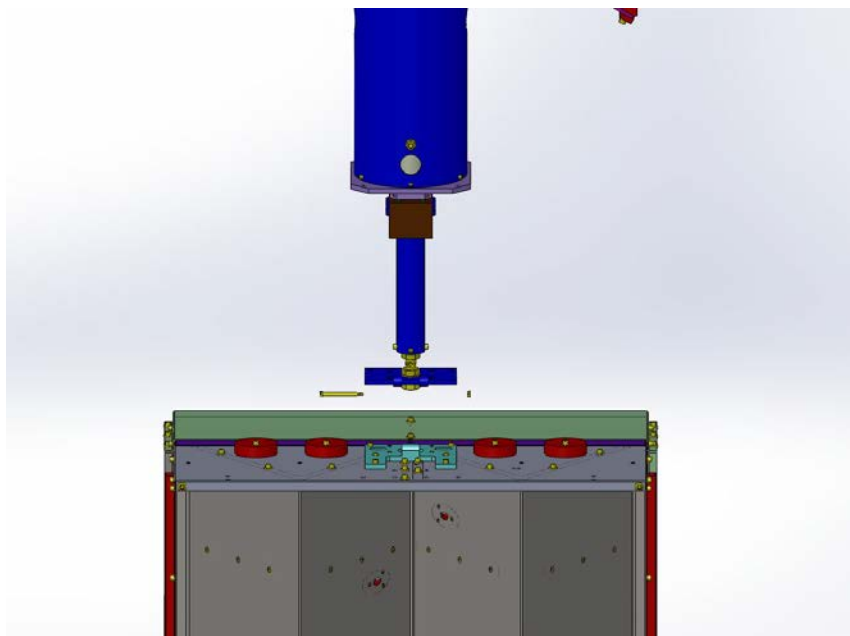
2.2.13 Position Vestil Utility Lift with arms extended below STAGE 0 attachment location.



2.2.14 Securely place Baffle Box Assembly onto Vestil Utility Lift arms.

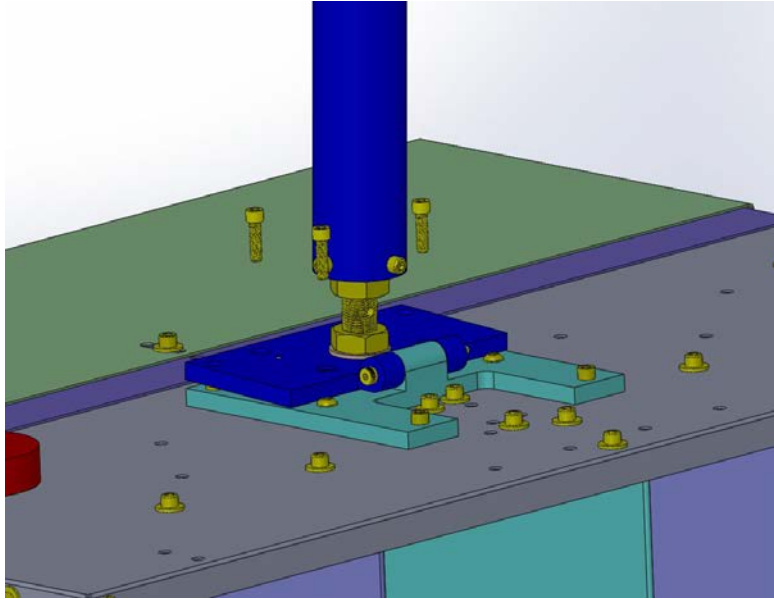
2.2.15 Slowly raising Vestil Utility Lift, visually align Bottom Hinge Plate to Top Hinge Plate at bottom of Suspension Assembly.

2.2.16 Attach Baffle Box Assembly to Suspension Assembly with shoulder screw, nut and washers, 1 place.



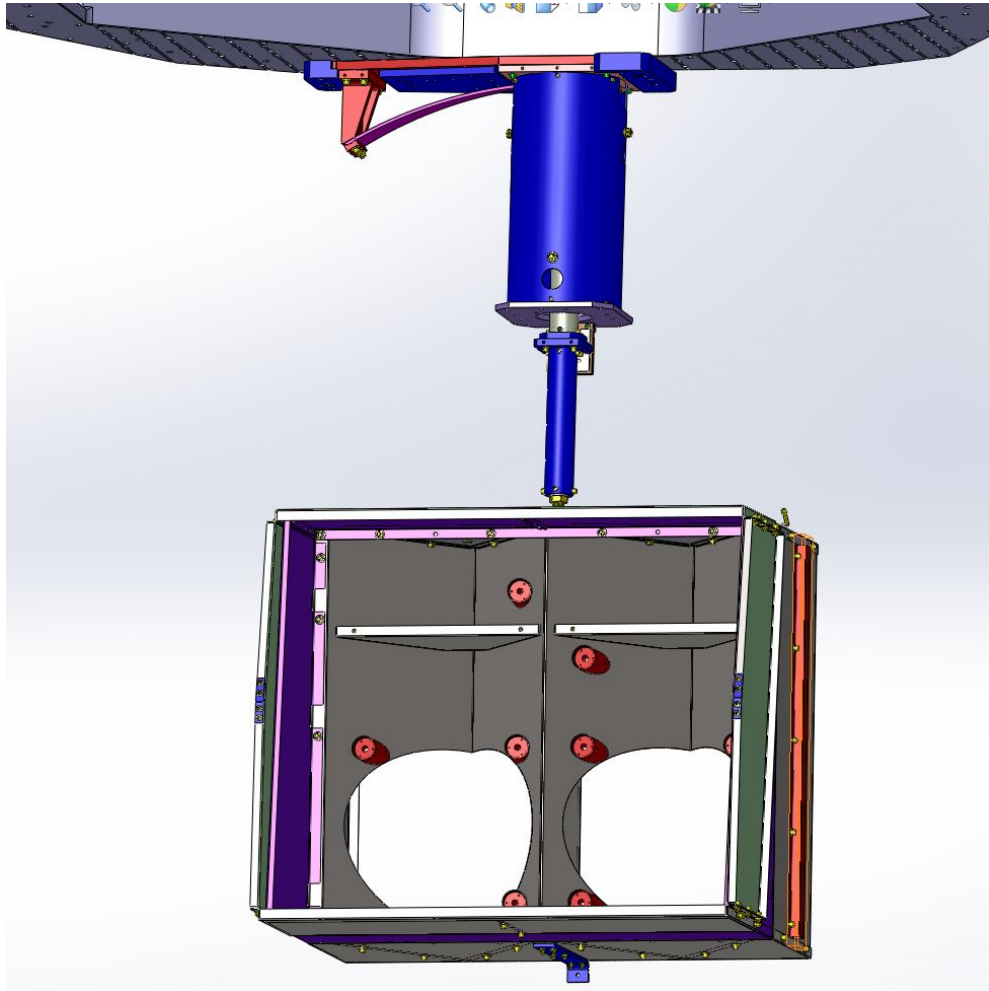


2.2.17 Install screws through Top Hinge Plate on Suspension Assembly to Bottom Hinge Plate on Baffle Box Assembly (4 bolts and washers).



2.2.18 Slowly lower Baffle Box weight onto suspension while removing Tongue Depressor from behind Spring Blade.

2.2.19 Lower Vestil Utility Lift arms and remove from immediate area.



2.2.20 Attach Counter Weight assembly parts.

## 2.3 Suspending by wire inside of Downs - Room 318 for vibration testing

Items needed for attachment to ceiling plate –

3 - 4' chains

9 carabiners

3 eyebolts

4 people, minimum, required

2 Wire Clamps

Wire

Attach one end of a chain, with carabiners on each end, to overhead eyebolts (3 places).

Attach Upper Wire Clamp to ceiling plate and attach wire. Position dangling wire out of working area.

Place wood blocks on floor and position under ceiling plate to support Baffle Box.

Place Baffle Box centered between blocks.

Verify there are 3 eyebolts attached to the Suspension Assembly.

Two people lift, rotate and carry the Suspension Assembly over Baffle Box with Top and Bottom Hinge Plates in close proximity. Seat large bolt at the end of the Suspension Assembly inside the hole in the center of the Bottom Hinge Plate. The weight of the assembly is now resting on the Baffle Box. Personnel are to remain in place to hold Suspension Assembly upright and in place temporarily.

Third person - attach the loose end of each chain to the eyebolts on Suspension Assembly. Assembly is now secure. **Note: Two people must remain beside the assembly during this process to supply support when needed to make sure the assembly remains upright until it is fully suspended.**

Third person – install shoulder bolt, washers and nut (1 place). **Note: Two people must remain beside the assembly during this process to supply support when needed to make sure the assembly remains upright until it is fully suspended.**

Third person - attach Top and Bottom Hinge (4 bolts). **Note: Two people must remain beside the assembly during this process to supply support when needed to make sure the assembly remains upright until it is fully suspended.**

Third person - attach Wire Clamp and wire to the Suspension Assembly at the CG. **Note: Two people must remain beside the assembly during this process to supply support when needed to make sure the assembly remains upright until it is fully suspended.**

Third person - attach additional parts to Baffle Box: Weights and Counterweight parts. **Note: Two people must remain beside the assembly during this process to supply support when needed to make sure the assembly remains upright until it is fully suspended.**

Disengage chains and carabiners for testing. Set aside for later use.

Slightly lift Baffle Box to remove support blocks underneath. Set aside for later use.

Lower Baffle Box weight onto suspension while third person removes tongue depressor from behind Spring Blade. Set aside for later use.

## 2.4 Disassembly of Suspended Baffle after testing

All people involved should wear safety shoes and eye protection.

Be sure that both earthquake stops are installed on suspension assembly. Install 2 transport brackets.

Attach the loose end of each (3) chain hanging from the ceiling plate to the eyebolts on Suspension Assembly. Assembly is now secure.

Place tongue depressor under Spring Blade.

Third person - place two adjustable supports beneath baffle box. Slowly raise the support so that it lifts the baffle box slightly (~1/4"). **Note: Two people must remain beside the assembly during this process to lift baffle box and to supply support when needed to make sure the assembly remains upright until it is fully suspended.**

Third person - remove adjustable counter weights from baffle box. **Note: Two people must remain beside the assembly during this process to supply support when needed to make sure the assembly remains upright until it is fully suspended.**

Third person - disconnect Top and Bottom Hinge (4 bolts). **Note: Two people must remain beside the assembly during this process to supply support when needed to make sure the assembly remains upright until it is fully suspended.**

Third person – disconnect shoulder bolt, washers and nut (1 place). **Three - five people must remain beside the assembly during this process to supply support when needed to make sure the assembly remains upright until it is fully suspended. One person to stabilize the baffle box. One person to support the suspension assembly. One person removes bolts. Two people maybe be needed to lower the supports beneath the baffle box.**

Two people lift box and move to a safe location, out of way of suspension removal.

Third person - disconnect Wire Block from top of suspension Interface Plate. **Note: Two people lift suspension assembly so enough slack is in the wire to remove the wire block. Face mask should be worn for the this procedure.**

Third person – remove ropes (if used) **Note: Two people must remain beside the assembly during this process to supply support when needed to make sure the assembly remains upright until it is fully suspended.**

Two people remove carabiners on Suspension Assembly. **Note: Two people must remain holding/lifting suspension assembly during this process to carry the full weight of the assembly as the support chains are disconnected.**

Two people lift and carry Suspension Assembly to destination, rotate and place.