NOTES FROM THE CDI CONCEPTUAL DESIGN
FOR SUSPENSION ALIGNMENT FIXTURE AND LIFT TABLE

DATE: 1/9/98
ATTENDING: Keith Swords, Alex Sokolskiy and Paul Hillsburg from CDI
Ken Mason, Mike Fine, Dennis Coyne (Aspen), Stan Whitcomb and Janeen Hazel
REPORTED BY: Janeen Hazel

This Conceptual design review covered CDI's design for the a**lignment fixture** and **lift table** for the Large Optic Suspensions (LOS). Keith wanted to review the lift table first. He had Fed Exed the drawings to Dennis in Aspen and to Janeen at Caltech.

Lift Table

Sheet 7: The table utilizes a vertically adjustable wedge with ball slide devices at 45 deg. Two blocks are pulled together with a 1/2-32 thread. A spring and double bearings are used to prevent backlash. Sheet 7 shows the three threaded holes for springs for preload. The other three threaded holes are for pitch adjustment of table's plate. Adjustment is performed with jack screw. There is a range of 4.5" to cover variations in height adapters. Clamps attach height adapter to lift table; they are not shown on the drawing.

Since there are no threaded holes in the temporary floor of the BSC and because the floor may have protruding hinges and screw heads, beams may be utilized to lift the table a bit above the surface of the temporary floor. A three point contact will be utilized for contact between the lift table and the floor. The table weighs about 50-60 lbs.

Stan felt that the lift table may not need to be screwed to the temporary floor or to the beams. We agreed that the weight of the assembly makes fastening it to the floor unnecessary. Dennis was concerned that the crank handles were too close to the floor. Alex said that there was about 1" clearance and that the usage of the handle doesn't require a lot of turning strength. Stan mentioned his concern about the ~1 foot distance between the wedge bearings and the large, tall weight above it. The alignment fixture weighs about 60lbs, the suspension and height adapter weigh about 170 lbs together. Alex felt assured, and others concurred, that this was not a problem.

Ken suggested CDI design in a safety feature that will act as a safety stop when the table is in the extended position. Keith agreed that Alex can design in a split sleeve to fit over the 1/2-32 screw when the table is in the uppermost position. (CDI Action Item 1)

Alex questioned the exact height of the height adapters. Dennis and Janeen will meet and report to CDI (Caltech Action Item 1) Currently, the range in heights of the height adapters is 2.5" to 5.906" (3.4") for a BSC arrangement and the range of the lift table is about 4.5".

The issue of dummy weights to simulate suspensions on the optical tables was discussed. The dummy weights will be needed to displace the table in the vicinity of the suspension installation. Dennis agreed that the tables need to be pre-loaded in the vicinity of the suspensions (Caltech Action Item 2). Ken suggested putting the dummy loads above the optical tables in the BSC. LIGO will check if the space between the optical table and the support plate is accessible for dummy loads.

We reviewed the installation process, making sure that the process and design allowed for the lift table to be removed after suspension installation. Dennis and I agreed that there appeared to be enough room. The lift table would need to be moved by two people. Keith remembers that OSHA recommends a one-man load of about 40-50 lbs. For the safety of the optic, two people should be involved in the installation.

Dennis, Ken and I gave a “thumbs up” and concurrence to the conceptual design and asked CDI to continue on to the detail design phase of the project.

Alignment Fixture

We first looked at the BSC type of installation shown on Sheet 3. It shows the riser block, which acts as a separator, when two LOSs are in one chamber. The riser employs the same design philosophy as the changes CDI requested for the Recycling Mirror (RM) height adapter. The riser block has brackets with holes like the RM height adapter. It attaches to the bottom of the LOS with bolts. Stan and Janeen strongly suggested removing the hex nuts mounted on the top of the LOS bottom plate. Installation of these hex nuts would mean a technician would have his/her hands very close to the suspended optic. Dennis recommended, and Keith agreed, on changing this concept to keep the conical pins but tapering the top of the conical pin to a .480 dia. pin that will fit in the .502 dia machined holes in the bottom plate. These pins will securely locate the suspension onto the riser plate. Also, clamps can be used on the short sides of the suspension to hold the riser to the suspension.

Sheet 3 includes the right view of the riser and the suspension. Ken questioned the tolerance stack up of conical pins at the left and right and suggested using a v-groove at one of these points. Keith agreed to changing this design, and the HAM alignment fixture attachment/interface, to include v-grooves to reduce the need for expensive tolerancing and machining (CDI Action Item 2)

Caltech must confer concerning the use of PAM screws in the suspension and how that affects the alignment fixture requirements. We will contact CDI early next week about this issue. (Caltech Action Item 3)

Sheet 1 shows the rotational movement mechanism for a HAM mounted suspension. Sheet 4 details the rotational movement mechanism with the anti-backlash design features. The course alignment will allow for 2 degrees of rotation for every 11 rotations of the screw. The fine alignment design allows for 3.4 arc seconds of angular adjustment for every revolution of the fine adjustment screw. The course adjustment screw is currently a 32 thread per inch and Ken suggested changing that to a 40 thread per inch for better course adjustment. We will cover this in a meeting internally and contact CDI with our conclusions (part of above Caltech Action Item 3)

Sheet 2 shows the X and Y adjustment mechanism for HAM and BSC mounted suspensions. The rails are stainless ball slides. CDI has contacted the vendor to determine if non-lubricated slides may be procured.

Dennis, Ken and I approved of CDI’s design approach and asked CDI to continue with the detailing of the design.