

# Advanced LIGO Engineering Change Request (ECR)

**ECR Title:** ECR – Replace HSTS Lower Blade Stops    **DCC No:** E1201116-v2

**Date:** 22<sup>nd</sup> February 2013

**Requester:** Derek Bridges,    **Impacted Subsystem(s):** SUS  
Norna Robertson

**Description of Proposed Change(s):** The proposed change is to replace the current lower blade stops in the HSTS Upper Mass. Currently, for each Upper Mass, the stops are either 4X #4-40 X 0.5” long SSTL set screws, 4X Upper Mass Blade Lockdowns [D1200447] or 2X set screws and 2X Blade Lockdowns. The different configurations were due to the availability of the D1200447 parts. The optimum solution to the problem described in the next section is to replace these parts with 4X Rounded-End, Fully Threaded #4-40 X 0.375” long SSTL SHCS [D0900980]. For reasons of i) availability of these screws and ii) difficulty of access to already installed suspensions, two other solutions are also put forward. Until we have round-ended screws available, we will use (and leave in place) standard Fully Threaded #4-40 X 0.375” long SSTL SHCS for those suspensions being assembled or already assembled but not yet installed. For those suspensions already installed, where access is difficult, we will back off the screws currently in place and stake them with a small amount of EP30 epoxy, air cured.

**Reason for Change(s):** The reason for the proposed change is due to the fact that the current stops can and have moved from their set positions to interfere with the lower blade. This “winding down” of the stops can occur both before and after installation, outside and inside of the chamber. The rubbing of the stops on the lower blades negatively affects the performance of the suspension. The reason that the current stops can move is because they are not secured by a nut, due to a lack of access; 2 of the 4 stops cannot be adjusted after BOSEMs and flags are installed and the other 2 are very difficult to access. Replacing the current stops with a shorter rounded-end SHCS allows the SHCS to be tightened down with the screw head flat to the blade guard to secure the SHCS while providing a gap between the tip of the SHCS and the flattened blade. If a wire should break, the stop will catch the blade before it impacts the Upper Mass Blade Guard). The nominal gap is 1.6 mm for an ideal flat blades set at the correct d1 value. In practice given the shape of the blades under load, the use of different angled clamps and the tolerances, the gap may be up to a few mm.

A rounded-end SHCS is preferable to avoid scratching the nickel plating on the blade. However no scratching has been observed with standard ended screws, and contact between the screws and the blades will be a rare event.

**Estimated Cost:** 110X D0900980 rounded-end SHCS are needed for 23 HSTS (including spares). Assuming a unit cost of \$7 (based on previous quotes), the estimate cost is \$770.

**Schedule Impact Estimate:** For HSTS currently being assembled, the estimated schedule impact is 0-1 hour per suspension; this involves removing BOSEMs and flag holders, replacing the stop and reinstalling flag holders and BOSEMs. For HSTS in chamber, the estimated schedule impact is 2-3 hours per suspension; this involves locking the suspension, attaching optic protection, removing BOSEMs and flag holders, replacing the stop reinstalling flag holders and BOSEMs, removing optic protection and unlocking the suspension. In addition, the BOSEMs will then need to be realigned; the time required can vary greatly, depending on the position of the suspension in the chamber and the amount of realignment needed.

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## Nature of Change (check all that apply):

- Safety
- Correct Hardware
- Correct Documentation

- Improve Hardware
- Improve/clarify Documentation
- Change Interface
- Change Requirement

## Importance:

- Desirable for ease of use, maintenance, safety
- Desirable for improved performance, reliability
- Essential for performance, reliability
- Essential for function
- Essential for safety

## Urgency:

- no urgency
- desirable by date/event: \_\_\_\_\_
- Essential by date/event: \_\_\_\_\_
- Immediately (ASAP)

## Impacted Hardware (select all that apply):

- Repair/modify. List part & SNs: All HSTS, currently 17 total (D020700 SN 111, 114, 119-121, 123, 124, 501-508, 510, 512)
- Scrap & Replace. List part & SNs: \_\_\_\_\_

- Installed units? List IFO, part & SNs: L1-MC1 (HSTS SN 119), L1-MC2 (SN 121), L1-MC3 (SN 111), L1-PR2 (SN 114), H1-MC1 (SN 505), H1-MC2 (SN 503), H1-MC3 (SN 506), H1-PR2 (SN 501)

Of these installed units L1's MC1, MC2, PR2, PR3 will be staked with glue.

- Future units to be built

All HSTSs for LIGO-India, some of which are already assembled.

## Impacted Documentation (list all dwgs, design reports, test reports, specifications, etc.):

[D020534](#) (HSTS Upper Mass Assembly)

[E030518](#) (HSTS Assembly Procedure)

## Disposition (to be completed by Systems Engineering):

- TRB
- CCB
- Approved
- Additional information required. Define:

See DCC entry for electronic approval.

*[Requester re-submits with new information with the same DCC E-number for the ECR but the next version number.]*

## Concurrence by Project Management: (Acknowledged Electronically in DCC)

Project Systems Engineer: Dennis Coyne

Project Systems Scientist: Peter Fritschel