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Date:	1 October 2010
Refer to:	L1000357-v3
Subject:	Advanced LIGO Review Committee Report: Monolithic Stage of the Quad Suspension
To:	David Shoemaker, Carol Wilkinson
From:	Monolithic Stage of the Quad Suspension committee: Billingsley, Cook, DeSalvo, Evans, Meyer, Nolting, Shoemaker, Torrie, Worden
cc:	Bell, van Veggel, Strain, Robertson, Romie

Response to the review committee's report

The recommendation to proceed with realization of the design is accepted. The UK SUS folks are asked to provide a set of dates for when a progress update on the action items should be expected (may be phased for different actions).

David Shoemaker
Advanced LIGO Leader

Recommendation

We find the level of documentation and planning provided for review to be sufficient and we recommend approval of the final design for the monolithic stage of the Quad suspension. We commend our UK colleagues on their thoroughness and attention to detail.

Background

The committee to review the Monolithic suspension design met September 3, 2010 and heard a presentation¹ by Angus Bell on behalf of the Monolithic team at the University of Glasgow. The team supplied an extensive list of reference documentation in an easy to digest format². This is much appreciated. The committee has been asked to review the Final Design³ based on the following instructions.

¹ Monolithic Stage of Quadruple Suspension Final Design Review Presentation [LIGO-G1000785-v1](#)

² Design review documentation and drawing overview [LIGO-T1000521-v1](#)

³ Quadruple Suspension Monolithic Stage Final Design [LIGO-T1000337-v3](#)

Scope

While we do not have a formal charge, we find pertinent information regarding review committee responsibility for the final design review in: M050220-09

The documents under review are:

“Monolithic Stage of Quadruple Suspension Final Design Review Presentation” LIGO-G1000785-v1

“Quadruple Suspension Monolithic Stage Final Design” LIGO-T1000337-v3

Supporting documents (not specifically for review) include the documents listed in “Design review documentation and drawing overview” LIGO-T1000521-v1

Findings

- 1) The review committee finds the tooling and processes provide a reasonable balance between risk and resources. There are elements of the welding and bonding that require a trained and experienced operator; we recommend that the project provide for maintaining that experience base.

Actions

The following numeric references are to sections in the document T1000337-v3, Quadruple Suspension Monolithic Stage Final Design.

5.2. Requirements on interfaces between different suspension elements

- 1) Action: adopt 5 Hz as the per-interferometer spread requirement for violin modes; missing the requirement would trigger a discussion on acceptance (allowing a ‘soft’ edge to rejection if the numbers are close)
- 2) Action: Update documentation when the Vacseal replacement is finalized, cite in E1000277 and other appropriate locations and communicate when available.
- 3) Action: In the interest of risk reduction, SUS should consider the potential of actuation noise due to foreign material on magnets in parallel with the production of the current design; precautions like cleaning and inspection for crumbs between the magnet and holder are suggested.

5.3. Suspension Preparation.

- 4) Action: Include fumes from welding in the Hazard analysis and safety plan.
- 5) Action: Add timing and personnel requirements information to E1000007 or E1000006 as appropriate

5.4. Assembly

Fiber guard

- 6) Action: Reduce in weight by machining the main section down where thickness is not required.
- 7) Action: Consider slotting the removable cap is (vertically) to give extra range, provide weight to SYS.
- 8) Action: Add 2x tapped holes (heli-coils) in the fiber guard at the location 1" above the top of the sleeve.

5.5. Repair and Recovery Scenarios

- 9) Action: Provide a definition of the tooling and resources needed for the weld process. Provide document pointers to the committee when ready.
- 10) Action: Provide a checklist to record adherence to E1000366.
- 11) Action: Ensure that the test results for all fabrication and assembly processes are recorded in a standardized way, with pass/fail criteria bracketed, as per M1000211-v2. Provide document pointers to the committee when ready.

6. Future support

6.3. Technology transfer

- 12) Action: Provide an update to the list at LIGO-T1000337-v3 by October 31.