

Advanced LIGO UK  
Project management meeting number 49  
Telecon, Oct 17<sup>th</sup> 2008

Ken Strain, Justin Greenhalgh, Stuart Aston, Amanda Brumitt, Joe Odell, Ron Cutler,  
Deepali Lodhia, Nick Lockerbie

## 1 Participants

Justin Greenhalgh (chair)  
Stuart Aston (SMA)  
Mark Barton (MB)  
Ron Cutler (RMC)  
Russell Jones (RJ)  
Deepali Lodhia (DL)  
Norna Robertson (NAR)  
Ken Strain (KAS)  
Alistair Heptonstall (AH)

## 2 Comments on minutes from last meeting

There were no comments on the minutes from the previous meeting.

## 3 Actions from previous meeting

These are noted under item 13 below.

## 4 UK/US interactions

### 4.1 SUS and design meeting telecon issues

#### 4.1.1 Sus telecons:

In the bullets below, bold face indicates discussion during the PMC meeting.

- Much discussion of plating the blades. The current view is that the blades will be plated; we are getting a price to do it in the UK before deciding whether we do so or whether we deliver them unplated. The decision has been decoupled from the blade production.
- Very useful run-through of the “Keyence” system for measuring gaps between the masses.
- Several discussions of tooling requirements and usage procedures
- Ongoing report on progress of work towards monolithic stage. Centre of gravity has now shifted to LASTI.
- Discussion of who will wire up the ESD at LASTI. (Bob Taylor or someone he has briefed).
- Preparation for, and holding of, BS/FM Fabrication readiness review.
- Reports on progress on production in the UK (see below)

#### 4.1.2 Additional items from design telecons:

- These have been re-started as “technical meetings”. Currently being used for discussion on tooling and assembly procedures. MB had kindly agreed to chair them.

## 4.2 RODAs

For RODAs, see:

[http://www.ligo.caltech.edu/~coyne/AL/project\\_management/RODA/RODA\\_status.htm](http://www.ligo.caltech.edu/~coyne/AL/project_management/RODA/RODA_status.htm)

Summary of recent/current RODAs affecting UK work

May not be needed	Handedness of FM/ITM structure	No longer relevant.
None yet	SPI interface	Details still not clear, in discussion
M080134	D distances	Approved.
	Details of prism materials	A document was in draft by NAR and Calum Torrie. When complete, this will lead to a RODA.
Existing RODA may need updating	Wedge angles	Work has already been done on this; from which an updated RODA may result; see the document T080075-05, table 1. For those who know the LVC password, the document can be found at <a href="http://ilog.ligo-wa.caltech.edu:7285/advligo/OptomechanicalLayout">http://ilog.ligo-wa.caltech.edu:7285/advligo/OptomechanicalLayout</a>
None yet	VM dampers interaces	AV had agreed to push this forward
Drafted	Change from ribbons to dumbbell fibres	This decision had been well documented but no RODA had appeared.

## 4.3 Other news

An ACR (Advanced LIGO Change control request) has been raised within the US project noting that because of the agreement to change the training provision, driven by scheduling issues, some extra funds would need to be found for assembly in the US.

It had been agreed that AH would spend about one month at LASTI to help accelerate work there; Giles Hammond would travel to LASTI for a similar period, overlapping with AH.

## 4.4 Reviews

The BS/FM review had held two meeting in September, and the recommendations were being drafted. RJSG recorded his thank to the whole team (US and UK) for acting on the very restricted timescale. The review had not identified an major issues.

## 4.5 Visits and trips etc.

### 4.5.1 Past

NAR had visited Glasgow for the first three weeks in September with side trips to BHam and RAL on 8<sup>th</sup> and 9<sup>th</sup>.

RAJ, MVV, Liam Cunningham and AB had made visits to LASTI

Jay Heefner visited Birmingham 22-24 Sept.

The LVC meeting was held the week starting Sept 20<sup>th</sup>. NAR, Giles Hammond, SMA, DL and AV attended.

#### 4.5.2 Future

Members of the Glasgow team would be making trips to LASTI during the period up to and including the monolithic installation. Joe ODell was standing by to provide support including use of the triple hang tooling.

## 5 PAG/OsC issues

The next OsC was scheduled for October 29<sup>th</sup>. The report had been submitted on Oct 15<sup>th</sup>; RJSG thanked the UK team for their help in putting it together.

The PAG had been held on Oct 8<sup>th</sup>, preceded by a very useful informal discussion.

## 6 Finance

Finance reports up to Sep 2008 would be due at the next PMC meeting,

## 7 Changes

Extract from change report:

Date	Change	Impact on cost	Impact on time
Sept 08	Delay to weld tests at welding contractor. (They carried out the wrong tests due to a poor handover when a directory fell ill).	Some extra effort (few days) at RAL in managing the problem	May affect the delivery of weldments; contractor now promising end of March 09.

## 8 Web sites etc

[http://www.eng-external.rl.ac.uk/advligo/papers\\_public/ALUK\\_Homepage.htm](http://www.eng-external.rl.ac.uk/advligo/papers_public/ALUK_Homepage.htm).

Most recent updates:

- RAL May 2008
- ALUK Jun 2007.
- Glasgow: some extra photos added.
- The Birmingham Wiki is up and running, and is being updated consistently. The pages can be found at: <http://www.sr.bham.ac.uk/dokuwiki/doku.php?id=bal>

## 9 UK project plans

RJSG had used the most recent plans from SMA, MB, and JO to make up the combined schedule for the OsC.

## 10 Activity/plans and document summaries

### 10.1 Glasgow

#### 10.1.1 Activities in the previous month

- Glass masses: invoice received from Caltech, therefore processing payment, final price should be known within the month.
- Monolithic assembly: mock assembly succeeded, welding machine was able to make welds in all 8 locations in a lower-stage assembly. (Though for practice with the backup solution, two welds were actually finished with a flame.)
- Monolithic assembly: tooling – minor changes to the weld tooling were requested, the spare set of tooling was re-machined and retrofitted with alumina pushers to allow the fibre to be pushed into the weld zone during the first stage of tack-welding. The main set of tooling is in use at LASTI and these will be swapped after a test of the refined version at Glasgow.
- Monolithic assembly: strength – a realistic full strength test has not yet been completed. Testing of the new weld tooling involves production of a pair of fibres welded to 4 ears that can be tested as a set in the new breaking stress machine at Glasgow. This test should precede the final pseudo-monolithic assembly at LASTI (planned for the coming weeks).
- Ear redesign: a team has been formed at Glasgow to undertake the ear redesign. A brainstorming meeting came up with a few variants on a scaled-up “final GEO” ear (i.e. the design currently in GEO 600, adapted for higher load). We have great confidence in this design and the work has started with consideration of FE models to optimise the stress distribution and welding ergonomics.
- Sapphire prisms: break-off prisms for the penultimate masses, made from sapphire, following recommendations from LIGO, have been procured. They are due for delivery next month and then require final finishing involving laser-ablation of the wire grooves.

#### 10.1.2 Plans for the coming month

- A series of visits has been planned for Glasgow personnel to work at LASTI with LIGO personnel on the final steps of the monolithic assembly.
- Complete outline design of revised ears, including FE models.
- Initiate processing of sapphire prisms to incorporate grooves.
- Re-baseline costs to reflect actual cost of large glass and laser-ablation, leaving the only major uncommitted procurement as the ears.
- Transfer OSEM money to Birmingham.

#### 10.1.3 New and modified documents

Reports on activities at LASTI, including T080239-00-D *Report on visit to MIT (4th - 9th August 2008)*, and T080245-02-D *Report on bonding Viton stops, magnet holders and break-off prisms at LASTI*.

#### 10.1.4 Progress against schedule

The monolithic assembly is running slightly behind the revised schedule that was established in late Summer. Action has been taken to reduce fallow periods at LASTI by LIGO undertaking to provide nearly continuous staffing over the next couple of months.

## 10.2 RAL

### 10.2.1 Activities in the previous period

- Agreed a BS review date
- The Beamsplitter final design document has been finished ([T080218-00-K FDD](#))
- Other documents including a [drawing list](#), a [compliance matrix](#), a [parameters comparison](#) and [production plans](#) have been completed, in order to address all the point directed by Dennis in his [e-mail](#)
- PDFs were created of all the BS components
- Unfinished models have now been finished, with the exception of the stay final design, and the BS-Quad link bracket.
- I have added all the documentation for the review onto the BS review web page, so that it can be accessed by the States
- I have presented the BS design and documentation to the US BS review committee
- I have started to address the feedback from the review, and have created a [review response document](#)
- I have made all the necessary changes to models and drawings from review feedback received
  
- All the tender documents for the BS have been created.
  
- The BS has been sent out for Tender/Quote
- The tablecloth has been modelled with OSEMs and a model sent to TMH for FEA
- The link bracket between the Quad and BS structures has been modelled, and an assembly created ready for FEA by TMH
- All components that have changed significantly have been sent out to be re-made, ready for the training build in Dec.
- The BS LS tooling has been sent out for quote, to be ready for Dec BS training.
- The BS/FM has been modelled up in the tank, and talks are under way to discuss the position/optics layout. This is still in progress
- All ETM/ITM tenders now placed.
  - Machining contract is progressing nicely ahead of schedule.
  - Structures are behind schedule; latest problem is distortion in the structure during welding. This is greater than had been expected and falls outside the machining allowance.
  - Blade material contract completed and the start of the manufacture has begun with small problems.
  
- Visits to structures contractors to progress
- Inspection of the machined parts.
- Organised training session for BS at RAL
- Tooling at LASTI
- Changed masses to Caltech request

- Looked into packing case options for the shipment of mechanical part to the sites

#### 10.2.2 Actions carried:

- Finish BS model and drawing changes, including final design for stay
- Make necessary changes to models and drawings from review feedback received
- Create Tender documents for BS
- Send BS out for Tender/Quote
- Finish BS model and drawing changes, including final design for stay
- Await quotes for BS components, and send out for manufacture
- Check all drawings for dimensions, fits, and materials
- All docs to DCC post review
- Design bump stop mounting tool
- Order things outside OJEU
- Update web pages
- Finish off assembly procedures
- Buy an extra laser
- Organise training session for first article at Livingston
- First article assembly

### 10.3 Birmingham

#### 10.3.1 Activities over the previous month

##### Travel

- SMA, DL, AV attended the LVC meeting in Amsterdam 22-26th Sept 08
- NAR visited Birmingham 8th September 08
- RMC visited RAL (RJSG, NAR) 9th September 08
- Jay Heefner visited Bham on Sept 22-24<sup>th</sup>.

##### Mechanical

- Received complete shipment of MACOR parts
- Received part-shipment of BOSEM connectors
- Continue to receive full-production BOSEM metal parts from suppliers
- Ongoing inspection of all parts received
- Procurement of BOSEM shipping materials underway
- Automated shipping label production
- Duplicate (x4) BOSEM IRLED/PD screening stations (fixtures, tooling, test equipment)

##### Electronics

##### Production:

- We have converged on the number of production units needed.
- The need for additional staff has been accepted – members have been identified
- Discussions have taken place with the subcontractors on the best approach to production

##### Pre-production:

- The designs of all the Quad drivers have been finalised.
- A problem found on the first UIM driver board when operated at the extremes of the specification during testing has been resolved. The solution has been accepted and modifications are complete
- Full test documentation has been generated for the pre-production UIM
- Plans are underway to use new staff to test the remaining pre-production UIM boards
- PCB problems with the TOP board have been resolved – the populated boards are being delivered to us this week
- The delivery of the monitor boards is expected on 24/10/08
- The PUM driver design has been approved – awaiting quotes from the layout company
- Design of the satellite box PCB is progressing
- Orders have been placed for boxes for the UIM drivers from the USA
- The details of the box drillings for the UIM have been drawn up, and details of the board placements have been checked
- The UIM pre-production front and rear panels have been designed

### 10.3.2 Plans for the coming month

#### Mechanical

- Place orders for harness parts (connectors & braid)
- Fabricate shielded harnesses for Quad training at LLO
- Continue with BOSEM cleaning, bakeout and assembly
- Confirm repeatability of BOSEM automated testing
- Duplicate automatic test equipment (ATE)
- Debug and optimize ATE software & data storage options
- Continue investigation of optimal IRLED/PD screening process
- Continue to investigate BOSEM sensor noise @ 1Hz

#### Electronics

- Test all the UIM boards, TOP boards and Monitor boards
- Layout of PUM boards, procure components, and assemble. Test if possible.
- Continue progressing with the satellite boxes
- Complete procurement of cases and drill them to suit
- Manufacture front and rear panels
- Manufacture wiring looms
- Progress as far as possible with the final assembly, testing and delivery to the USA (by the end of November)

### 10.3.3 New Documents

- G080466-00-K, SMA, 21/09/2008, Production BOSEM Status & Interferometer Development at Birmingham

### 10.3.4 Website

<http://www.sr.bham.ac.uk/dokuwiki/doku.php?id=bal>

### 10.3.5 Progress against schedule

M060242-08-K, SMA, 12/09/2008, ALUK WP4 Updated Schedule.

## 10.4 Strathclyde

Since the last report we have been investigating the possibility of putting just the Violin-Mode photodetector into the vacuum space, rather than the photodetector plus (in the immediate vicinity) its amplifier. This is because (on the US side) there seem to be some concerns surrounding the lifetime-against-failure of the amplifier.

We have placed a 680 pF capacitor in parallel with our detector, and have reported already that no noise gain peaking was seen.

We are now able to report that with the 680 pF capacitor in parallel with our detector, and within the passband of the Violin-Mode amplifier (300 Hz--12 kHz), there has been no reduction of gain. Indeed, no deleterious fall-off in gain was observed up to 100 kHz.

We have embarked on investigating a physically very compact 2-lens optical arrangement that will enable us to step the position of the fibre's shadow incrementally across the detector (an arrangement rather like a Galilean telescope, reversed).

**ACTION 49.01** SMA agreed to check with Nick Lockerbie whether he was still planning to deliver the prototype parts at the end of November as had been agreed on the day of the PAG meeting.

## 11 Visits etc and absences planned for the coming months

	Oct	Nov	Dec	Jan
General				
KAS	Osc 29th			
RJSG	Osc 29th		2 weeks A/L over Christmas	
MB	~50% LASTI	~50% LASTI Vacation w/b 17th		
SMA				
RMC				
RAJ				
AB			BS/FM training at RAL 1 <sup>st</sup> week	
JO			BS/FM training at RAL 1 <sup>st</sup> week	
NAR				
Giles Hammond		Mostly at LASTI		

AB is at college on Mondays; JO on Fridays.

## 12 AOB

It was agreed to try holding these meetings at 2pm on a Wednesday, starting on Wednesday November 5<sup>th</sup>.

## 13 Summary of actions

### 13.1 Closed

**ACTION 48.01 MB** to send the latest monolithic assembly schedule to RJSJG + AB. Done.  
**ACTION 48.02 RJSJG** to invite NL to Glasgow on the morning of the PAG for a progress discussion. (done; 11 am) Done..

**ACTION 47.02 NAR** to verify with Dennis Coyne that the handedness of the FM/ITM layout is no longer an issue for us. Done (in July).

### 13.2 Outstanding

**ACTION 48.03 MB** to write a commentary on the conclusions from the tests that had been done at LASTI on hysteresis-induced noise. Onoing.

### 13.3 New

**ACTION 49.01 SMA** agreed to check with Nick Lockerbie whether he was still planning to deliver the prototype parts at the end of November as had been agreed on the day of the PAG meeting.

## 14 Next meetings

Next ALUK weekly Friday 31st Oct 2008 at 2pm, then switch to Wednesdays

Next PMC **Wednesday** Nov 19<sup>th</sup>.

OsC 29<sup>th</sup> October.

Justin Greenhalgh with reports from the other authors.  
 17 Oct 2008

## 15 Summary for LIGO newsletter

ALUK held its latest Project Management Committee on 17 October 2008 (See LIGO-M080365-00-K). A brief activity summary follows:

- **RAL:** BS/FM review has been held and conclusions are being written up. No major issues. Out to tender for manufacturing; target date to let contracts is end October. Quad OJEU process status as follows:
  - **Machined items.** Deliveries to RAL continue.
  - **Weldments.** A complete welded upper structure has been produced but there problems with distortion. Technical solutions being sought.
  - **Blade springs.** Material has arrived. Blade manufacture has started.
 Continuing input to work at LASTI, focussing on ensuring no parts have been lost and that tooling is ready for monolithic assembly. Amanda Brummitt visited LASTI for a week.
- **Glasgow:** Continuing to support monolithic stage at LASTI with visits by Russell Jones, Liam Cunningham and Marielle van Vegel. Working on a detailed list to ensure

no tooling is overlooked. The procurement of the optics, being conducted by the US, is shortly to move forward with a formal order from Glasgow.

- **Birmingham/Strathclyde:** OSEM manufacturing ongoing. Specs for all electronics now complete and manufacture of parts has started. Plans being laid for main production run to follow once the test stand has been delivered.
- **Overall:** continuing to push on all fronts, all three partners working at full capacity of the staff available. Steps are being taken in the US to accelerate progress at LASTI and we are doing all we can to support this. Plans are being made for the “endgame”.