

## Weekly Report for Week Ending June 12, 2003

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*The LIGO Executive Committee Agenda for Monday June 16, 2003 will be:*

### STAFFING COMMITTEE MEETING

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#### *Special Announcements:*

***THE SUMMARY REPORT OF THE NSF REVIEW ON ADVANCED LIGO IS ENTERED BELOW. IT IS AN EXTREMELY SUCCESSFUL RESULT, RECOMMENDING THAT "THE PROCESS LEADING TO CONSTRUCTION SHOULD PROCEED". IT SAYS THAT OUR PLAN IS SOUND, NO MAJOR OBSTACLES HAVE BEEN IDENTIFIED AND MAKES IT CLEAR THAT ALL TECHNICAL COMMENTS MADE ARE CONSIDERED DETAILS. IT ARGUES FURTHER THAT MANY OF THE MAJOR RISK ITEMS WOULD LEAD ONLY TO MODEST COMPROMISE OF OUR SENSITIVITY GOALS. THIS IS A VERY THOROUGH AND INSIGHTFUL REPORT THAT SHOULD SERVE THE NSF WELL IN DECIDING HOW TO PROCEED.***

***THANKS TO ALL WHO BROUGHT US TO THIS SUCCESSFUL REVIEW THROUGH THE HARD WORK ON ADVANCED LIGO DEVELOPMENT AND THE HARD WORK ON INITIAL LIGO THAT THE PANEL CITED AS REASON TO HAVE CONFIDENCE IN US.***

***GHS***

#### ***SUMMARY REPORT TEXT:***

- Advanced LIGO will provide the capability to observe a variety of astrophysical phenomena including inspiral events, continuous-wave sources, bursts, and stochastic backgrounds. Achievement of the design strain sensitivity (more than a factor of ten beyond Initial LIGO) is feasible and detection of events is plausible. Detection of any source would be a dramatic direct confirmation of the existence of gravitational

waves and would have exciting and wide-ranging implications for gravitational physics, astrophysics, and our understanding of the universe.

- The committee agrees that the current state of the proposed project is at a sufficiently mature level that the process leading to construction should proceed. Although technical challenges remain, the plan for solving the technical problems appears sound and no major obstacles have been identified that would justify delaying the construction of Advanced LIGO.

In detail the committee has observed that:

- The procurement of optimal coatings for the advanced LIGO detector represents a significant technical risk, but the evaluation and down-selection processes for this item have been identified. Given the potential options available, the range of uncertainty encompasses variations of a factor of 20% in sensitivity to the detection of sources.
- Two options exist for the test mass substrate material for advanced LIGO: sapphire and fused silica. There are appropriate technical evaluation and selection processes in place. Only one vendor currently appears capable of supplying sapphire substrates and the required low absorption in large sapphire material is yet to be demonstrated. The range of uncertainty associated with the available options encompasses potential variations of a factor of 20% in sensitivity to detection of sources.
- The plan for procurement of the 180-Watt laser for Advanced LIGO is sound. A major challenge for the laser program is the demonstration of amplitude stability at the level of  $2 \times 10^{-9}$  Hz<sup>1/2</sup>. The potential risk is a factor of 20% in sensitivity for the detection of sources if design goals are not met.
- The optical components must be tested at the expected high-power operating levels associated with Advanced LIGO to insure that potential issues including charging, absorption in sapphire, mechanical losses in the coatings, and long-term degradation are addressed.
- The seismic isolation concept is based on substantial experience at JILA. The control of a two stage platform, with the required gain, in the 1-10 Hz band is a challenging task. Results of the simulation and first dynamical tests on the Stanford prototype (ETF) are encouraging. Further testing at the ETF will be valuable for the control strategy and to demonstrate the satisfaction of the requirements.
- We commend basing the suspension design on the mature and proven GEO600 design. The planned integration of a full scale prototype combining the suspension together with the active seismic isolator in the LASTI facility will be very valuable test. Damping of internal modes is required. Special attention is required to avoid introduction of sensor noise into the observation band. Full modeling of the seismic isolation and the suspension system is encouraged.
- We recommend that the Advanced LIGO team investigate the importance of the electrostatic charging of the mirrors soon. Charge buildup mitigation measures may influence the mirror design.

- End to end (e2e) modeling has been critical in predicting operating parameters of Initial LIGO. We encourage the adoption and expansion of the e2e-modeling to Advanced LIGO prior to the construction phase. Additional resources may have to be added.
- The committee commends the progress in creating the data analysis community within the LSC. We support the distributed computing model and their expanding use of the Grid. Their plan for Advanced LIGO computing is sound.
- The committee looked at the cost estimate for Advanced LIGO construction and in a few selected cases examined how the estimates were arrived at down to the most detailed WBS level. The committee concludes that the cost estimate is the result of a very thorough and well executed process and found no reason to question the reliability of the estimate. Given the good track record of their management team in the cost estimates and execution of the initial LIGO project, the committee concludes that the present management team has a high probability of completing Advanced LIGO with the cost estimate presented.
- Based on the quality of the cost estimate and the good contingency experience in the initial LIGO construction project, the committee concludes that there is a good chance that the level of 27 % contingency will be sufficient to complete the project. As protection, a list of possible scope reductions was identified, totaling somewhat over 10% of the total project cost. Some of the items on the list allow the scope to be recovered at a later date without severe schedule penalty, others are of a nature that the scope reduction can not be restored and thus lead to significant reductions in the eventual sensitivity of Advanced LIGO.
- The estimated operating budget for Advanced LIGO represents a substantial increase over the present level of operating and R&D support of Initial LIGO. The committee believes that given the added complexity of Advanced LIGO such an increased level is reasonable but should be revisited as the project matures.
- Given the good schedule performance of the initial LIGO project the committee has no reason to doubt the validity of the schedules presented for the completion of the Advanced LIGO project.
- The management plan for Advanced LIGO is based directly on the approach and tools that have already proved to be successful in managing initial LIGO essentially on time and budget. This approach could well serve as a model for other major scientific construction projects.
- The total funding plan relies on a number of different sources of support – new funds for construction, R&D funding from the current operations budget, installation and commissioning funds from the anticipated cooperative agreement for 2007-2011, individual grants to members of the LSC, and contributions from foreign partners. Close collaboration with the NSF will be required to ensure that both adequate coordination of funding sources and compliance with internal regulations at NSF are maintained.
- An installation plan has been developed which makes maximum use of existing manpower and minimizes the need for extra contract labor. It assumes roughly a six month stagger between the start of installation at each of the laboratory sites and extends for about two years

including the commissioning. To aid in the installation of the significantly more complex in-vacuum components, the LASTI facility at MIT will be used as an instructional test bed for training personnel for the installation. The committee endorses this plan.

- The LSC and LIGO observatories are to be commended for a sustained commitment and planning process to produce a coherent strategy for developing future education and outreach initiatives. The current NSF proposal for the observatories has been developed through an excellent planning process that builds community support. The timeline is reasonable and the new staff is adequate for the start-up period.
- Scaling up the assessment of educational needs from 2 to 30 - 40 institutions requires careful planning so that LSC members build local community support through personal contacts. The relationships among scientists, teachers and community members are key to the success of local programs. One possibility is to build an inventory of core program models for K-12 from which LSC member institutions can pick and choose to create their own focus. These programs should not replace participation in ongoing local programs that are outside the scope of the core programs.
- Depending on the number of LSC member institutions that offer education and outreach activities, and the design and scope of the core program, it may be necessary to hire additional outreach assistants to maintain an adequate support level that assures program quality and supports evaluation and reporting requirements in 2006. A realistic staff member/member institution ratio might be 1:12 – 15.

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### *Weekly Report Highlights*

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### **LSC Issues (Saulson)**

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no report

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### **LIGO I Construction/LIGO Laboratory Administration (Lindquist)**

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## Laboratory Administration (Lindquist)

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### LIGO Weekly Site Telecon (Lindquist)

There was no site teleconference held on Thursday, June 12, 2003 due to the NSF Review of the Advanced LIGO Proposal.

The list of current actions revised to reflect the status of open actions assigned through May 29, 2003 may be found at [ACTION LIST](#).

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### PROPERTY MANAGEMENT (Chargois)

**From: Ed Chargois <chargois\_e@ligo.caltech.edu>**

- Provided assistance to the Detector Group (H. Armandula) with packing and shipping of several Substrates (Optics) to Research Electro-Optics (D. Ness), Boulder CO. Account Number P204317.
  - Provided assistance to the Detector Group (H.Armandula) with packing and shipping of two (2) Substrates (Optics) to MIT (G. Harry). Account Number P204317.
  - Prepared a Purchase Requisition for two (2) Taylor-Dunn Electric Carts for LHO, Schedule Delivery date 3 July 03. Account Number LIGO.HAN 2.2.4 NSFLIGO.FY02OF.
  - Assisting Caltech Property Services with the Annual Campus Inventory..
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### DOCUMENT CONTROL CENTER (Turner, Mak)

**>From: Linda Turner - turner@ligo.caltech.edu>**

Web pages for the DCC give simple how-to's for document numbering, easy access to the latest on-line documents, and search capabilities for the DCC database. [Take a look](#). . .

### ACCOMPLISHMENTS

- Nothing significant to report.

- **Reminder to LIGO staff: Please make sure that as a minimum, each document submitted has a LIGO number, author's name, and date. It's surprising how many documents are missing one or more of these essential pieces of information!.**

> From: Cleveland Mak <mak\_c@ligo.caltech.edu>

#### ACTIVITY

- No report this week

Press here to access the [DOCUMENT CONTROL CENTER WEB PAGE](#).

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#### **COST SCHEDULE CONTROL SYSTEMS (Cunningham, Brambila, Kaufman, Salone)**

From: Esther Cunningham <esther@ligo.caltech.edu>

Press here for [ACCOUNTS PAYABLE HISTORY DATA](#) .

From: "Brambila, Ruth" <Ruth.Brambila@caltech.edu>

- Completed an internal modification to CSRS, change order #3 and an internal modification to Star Service, change order #14 to Crystal Systems, change order #10 to F Kaufman, change order #16 to Research Electro Optics, and change order #12 to Venturi Staffing.
- Working on an change order #5 and an internal modification to U.S. DOE, change order #3 to Lawrence Berkeley, Received 7 change orders for Triad which I am working on.
- Pcard administrators are now requiring invoices or priced packing slips for all pcard orders. I have gone back and obtained hard copies of receipts on April's pcard report and also May's pcard report. As a rule, I am now asking vendors to automatically fax invoices rather than obtaining the information over the phone. .

From: Gina Salone <gsalone@ligo.caltech.edu>

- No report this week.

**From: Florence Kaufman <[fkaufman@ligo.caltech.edu](mailto:fkaufman@ligo.caltech.edu)>**

- Prepared three Cost Transfers.
  - Provided information on Costs to Date by WBS Numbers for report on usage of Construction Contingency.
  - Updated Constructions reports.
  - Worked on Policy and Procedures Manual.
  - Responded to request from Project Accounting for required funding realignments in the Constructin Award.
  
  - Financial reports can be found at: <http://docuserv.ligo.caltech.edu/~fireport>
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## **SUBCONTRACTS MANAGEMENT (Petrac, Jasnow)**

**From: irena@ligo.caltech.edu (Irena Petrac)**

- AdLIGO Optics Coating RFP: The RFP package is out on the street. Proposals are due end of the month. Proposers Teleconference is planned.
- Crystal Systems Inc.: CO No. 14, for the purchase of additional HEM sapphire test flats, was released to Purchasing.
- Research Electro-Optics: CO No. 16, for coating of additional LIGO supplied test optics, was released to Purchasing.

**From: Ed Jasnow <[jasnow@ligo.caltech.edu](mailto:jasnow@ligo.caltech.edu)>**

### **CONSTRUCTION:**

- The modifications to the LHO Laboratory Building are nearing the final stage of completion.
- The LDAS area of the LLO Staging Building is having a new air conditioning system put in to accommodate the additional computers installed. The existing air conditioning system will be moved to the second floor hallway.
- Three bids have been received for furniture for the LLO auditorium lobby. Barry Barish will review the samples provided when he is there next week.

### **OPERATIONS:**

- A teleconference on the subject of the Maiden Wind Farms near LHO was held on June 12. Participating were representatives and attorneys from LIGO, the NSF, BGPL, and the University of Washington. The strategy for submitting a package to the Benton County Board of Adjustment was agreed upon, as well as the timing for submission of a letter from the NSF.
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## SUPPORT (Baldon, Lloyd, Tischler)

### >Irene Baldon

- No report this week (illness).

### >Dorothy Lloyd

- Processed the usual invoices for payment. Tracked and followed up on invoice problems. Reviewed and recorded payments processed by Esther the week of June 2.
- Processed the usual requisitions, change orders and payment requests.
- Continue to monitor contract and blanket order encumbrance and notify task managers when supplements are needed.
- Jim continues with data entry in the LIGO database and helping out in the DCC.

### >From: Ryan Tischler <rtischle@ligo.caltech.edu>

- NSF review of Advanced LIGO
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## Advanced LIGO (Frey)

### From: Thomas Frey <tfrey@ligo.caltech.edu>

Attended NSF review meetings on June 11th and 12th.

For list of documents that are being used to develop Adv. LIGO Cost and Schedule, see [http://www.ligo.caltech.edu/~tfrey/Cost\\_MTG\\_082002/](http://www.ligo.caltech.edu/~tfrey/Cost_MTG_082002/)

Advanced LIGO MRE Proposal (Highest Priority)

- Updated a PowerPoint slide for Gary by removing Advanced LIGO.

- Finished input of available cost data, WBS definitions, and Basis of Estimates.
- Prepared hard copies of Cost Book, Cost Book Summary, and WBS Dictionary.
  - Purchased tabloid and letter size notebooks and dividers.
  - Executed printing and reproduction with Kinko's. Acquired refunds for botched work and over charge.
  - Burned CDs with PDF of cost book notebooks for the NSF.
  - Started to prepare expense report for re-imburement.
- Prepared PDF copies of Cost Book, Cost Book Summary, and WBS Dictionary, and issued to DCC.
- The following is a summary of status by sub system:
  - COC - Still need completed WBS dictionary and BOE.
  - PSL - No action items pending.
  - AOS - Still need completed WBS dictionary and BOE.
  - IO - Still need completed WBS dictionary and BOE.
  - SUS - No action items pending.
    - Schedule revisions pending in accordance with Dennis' acceleration plan.
  - SEI - Completed WBS entries and BOE entries.
  - ISC - Completed WBS entries and BOE entries.
  - LDAS - No action required at this point in time.
  - INSTALL - Completed WBS entries and BOE entries.
  - DAQ - No action required at this point in time.
  - PM - No action required at this point in time.
  - FAC - No action required at this point in time.
  - SUP - No action required at this point in time.

Continue to update the LASTI Schedule and incorporate any changes.

- Continue input of changes and comments from Mike Zucker.

Cost Book Tool.

- ROSTER DATABASE:
  - BK is continuing work on action items.
  - Input of supervisor, dept., and specialty codes on hold until after review.
  - Adjusted authorship queries to use new data input by Irena.
  - Purchased software to Word DOC conversion to LaTeX format.
  - Re-iterated authorship list.
  - Prepared a FTE breakdown of the LSC by organization.

- COST BOOK DATABASE:
  - BK is continuing work on action items.

Development of the Advanced LIGO Project Controls Guidebook continues.

Project Web Site for posting schedule and progress related data continues to be updated with the latest and greatest.

- See <http://www.ligo.caltech.edu/~tfrey/index.html>

## Reports (Lindquist)

The Construction project quarterly report for the end of February was scheduled to be submitted at the end of March. Irena has been working on this, but has been distracted by a number of other priority issues: LSC, contract activities for seismic isolation, optics coatings, etc. We have discussed priorities, and the quarterly report is still slipping.

Things we are going to need to do in the near future include the work plan for FY 2004 Operations, the Final Report for the Construction Project.

## Change Control/Contingency (Lindquist)

The following change requests are pending or new. Dennis Coyne submitted CR-030013 for Atomic Clock Timing Systems. I will request that these change requests be placed on the agenda for the next meeting of the Executive Committee.

CR-030008	Furniture for the auditorium lobby, interaction area underneath the skylight atrium in the OSB, and on the second floor interaction area of the new laboratory/office building. (ON HOLD pending additional cost data.)	M. Coles	April 29, 2003
CR-030011	Seismic External Pre-Isolation at LIGO Livingston Observatory	D. Coyne	May 16, 2003
CR-030013	Atomic Clock Timing Systems	D. Coyne	June 9, 2003

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## Human Resources (Akutagawa)

**From: Cindy Akutagawa <cindy@ligo.caltech.edu>**

- Various personnel/payroll /HR related work.
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## Quality/Safety (Tyler)

**>From: Bill Tyler <tyler@ligo.caltech.edu>**

- No report this week.
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## LIGO Hanford Observatory (LHO) and Interferometer Operations (Raab)

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**Summary of Commissioning Activities at LIGO Hanford Observatory** (compiled by M. Landry)

**We have had another incident on the LHO 2k IFO in which a small optic wire has broken. Unfortunately, the wire supporting MMT1 was severed by the laser during positioning of the RM to land the beam on the new combined MMT2 baffle and beam dump. Currently a spare MMT1 optic is being prepped, plus additional baffles for installation in HAM7, likely mid or late next week. Modelling is underway to better understand stray beam paths; for the time being we've shuttered both the 2k and 4k lasers. Work that does not require the interferometers, such as PSL/PMC/RefCav tuning, and AS sensing chain measurements, is underway.**

A series of elogs relating to MMT1 can be found starting [here](#).

SURF students have arrived at the lab, including Katherine Pegors, Anah Mourant, Rachel Berkowitz, Jared Markowitz and Drew Barker.

4K IFO

After last week's vent, the 4k ITMX pointing was restored with a 0.55mrad rotation in yaw via the coarse actuation system (Guenther, Radkins, Sigg). Radkins notes that flaky behaviour and delays in coarse actuation startup were due to faulty cable connections at the CA computer. Initially, floating of the air bearings excited the optics, possibly due to underuse: the remainder of the yaw actuation was smooth. Read some CA entries [here](#).

The 4k MC and PRM had been relocked earlier in the week, but we have not been able to expose the arms to the cornerstation. It is likely that the vacuum will be at a sufficient level to do so next week.

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## **LIGO Livingston Observatory (LLO) and Interferometer Operations (Zucker)**

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no report

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## **Detector/Technical Support (Coyne)**

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see also the Revision Technical Review Board (RTRB) status [here](#)

## **Seismic Upgrade Project**

*see also the LASTI report*

Jonathan Kern

Ameritech, the manufacturer of HEPI bellows was given a small order for quantities manufactured of 300 series alloy as well as 17-7ph. Both

bellows types have now arrived and both look very nice. The 17-7 PH have a slight straw color due to the heat treating. We have prepared one of the 304 bellows for test. It is welded to a replica of the stainless flanges and spaced apart by spacers of the correct length. The bellows under test will be filled with water and placed in a sealed chamber with an acrylic lid. As the pressure is increased inside of the bellows, air pressure in the chamber will be monitored with a 0 to 20 inches of water gauge. This will detect any yielding that occurs on the bellows, regardless of it's location. Expect test results later this week.

RFQs were sent to numerous shops for the machining of actuator parts, assembly of the actuator, machining and assembly of the double-start springs and quantities of Parker servo valves. Replies were asked for by June 10. Not unexpectedly a few have missed the deadline and I'm prevailing on them to get me their quotes ASAP.

HEPI Pump Station

Ken Mailand

Continuing on the following HEPI tasks:

Myron will sent me the LASTI pump, filter, coupling and a sample of the working fluid

The replacement pump and motor and coupling sent to LASTI have been installed and are running well and quiet after 2 weeks.

I will forward the received items to the lab for examination.

I have received a quote on a contaminant characterization assessment for the LASTI pump station 3 micron filter.

I received a preliminary quote on time and delivery of the site installation stainless reservoir

I have contacted the manufacturer of the LASTI 'Aquamil' fluid and have been referred to their lab that will do an analysis of the fluid in use now.

I have contacted IMO pump and discussed the issues with pump noise, and described the type fluid we are using, and the operating conditions of the pump.

IMO has sent me a return authorization for the pump, they will set up the pump in the lab and run it, then take it apart to find what may be making the noise.

A request for quote on price and delivery of a 55 gal quantity of clear Chem-Sol has been made, as a possible alternate fluid.

The fluid biological growth test is showing nothing after 27 weeks.

## **CDS**

no CDS weekly meeting last week de to the NSF advanced LIGO review

(past CDS weekly meeting minutes can be found in the [commissioning archives](#))

## **CDS Software**

Rolf Bork reporting

Primary goals for this week are to get the ETM controls installed and running

the the 40m lab and, now that we have enough high speed (2Gbit/sec) network

interface boards, to remove the slower network completely from the 40m lab and

go with the single fast network.

The first objective is almost complete. The ETM control PC and ETMY VME systems are installed and running. There is about a day of testing remaining, primarily DAQ and GDS connections. The ETMX VME is a direct copy, so should come up quickly after ETMY testing.

The move to the single network is complete, but there was a snag. The Arbitrary Waveform Generator (AWG) software was written to run on the older MIPS processors, but the new network cards do not work on these CPU boards (don't even get power indications on the cards). So, we have had to port the AWG code to Pentium processors. While this seemed straight forward and compiled fine, it did not work properly. It looks like Alex got it running last night though, so we'll test it more thoroughly today.

Hongyu is working on a change request to dataviewer. This change is to provide "drag-and-drop" channel selections to simplify this procedure.

Alex and I will be at MIT next week. We'll be there to look at EPI and plan the controls and their integration with the LLO system. We also want to look at the AdvLigo suspension controls for eventual port to LIGO style controls.

## **CDS Hardware**

Rich Abbott reporting

Jay Heefner reporting

LOS Coil Whitening Board

- 15 boards are now in fabrication and test. They should be ready for shipment by 6/19.

EMI Retrofit

- Met with Knurr to discuss the test results and requirements for the VME crates and racks. It turns out that the Knurr factory in Europe has produced shielded VME crates and racks that have specs much closer to what we need.

- Worked on the equipment relocation proposal with Rus. A draft of the proposal has been sent to Dennis for review.

- Equipto has submitted a drawing for the feedthrough panel on the top of their rack. On first glance it appears to be too small (2.25"x17.25").

Sander Liu

Working on the L4C preamplifier design.

**PSL**

PeterKing

NPRO S/N #259, originally from the 10-W laser at LLO, was shipped to

LLO to replace the master oscillator. A return home, in some sense. Joe

Kovalik installed the NPRO and brought the laser approximately back to

where it was.

I made a few measurements on the 10-W laser power supply. The current

loads when the laser was on standby and lasing were noted. In a discussion with Shannon Gomes of Lightwave Electronics, I found out that the fuse holder in the 10-W laser power supply has a tendency to get extremely hot when the contacts oxidize or when any dust gets in. The power supply installed in LLO:1X3 has had the fuse holder changed to a different style.

## Errant Beam Blocks

Mike Smith

The 2K RM beam dump located on the MMT2 baffle was placed too low, beyond the range of the pitch OSEM. The beam dump will be relocated on the MMT1 baffle 50mm below the beam line; to hit the beam dump will require an upward pitch angle of the RM of 0.3 mrad. The 4K beam dump will also be relocated on the MMT1 baffle 50mm below the beam line, and will require an upward pitch angle of the RM of 0.5 mrad.

## Optical Contamination Cavities

Lee Cardenas, Liyuan Zhang

### OTF Lab. (W. Bridge)

#### Contamination Cavity # 1

we are continuing taking ring down and beat frequency every day for the test sample a **10mm Capacitance position sensor** (given By: Rich Abbott) which consist of a sma cable and a ceramic connector at the end. So far we can tell from the Beat frequency and ring down that this sample is clean. Basically there is no contamination. Please see Dr. Zhang graphs for absorption, ring down and thermal lensing.

### Absorption Test Measurement prototype in progress

Scatterometer system is in STANDBY for measurements.

We are taking more absorption measurements for the 6 inches in diameter by ~ 3 inches thick Sapphire mirror.

We are characterizing a new sapphire mirror given by Garilynn. This mirror has different diameter (5.90 inches) than the previous one and as right now I am making the new base holder for this mirror.

We will be measuring the scattering, transmission and more important its birefringence measurement.

### OTF Lab at Lauritsen ROOM 38

#### Cavity #3

This cavity has 70 ppm mirrors and hung with one end at 1.8 degree higher than the other end.

Cavity is locked and we have 147 mw of power with a 95% ! visibility. We are taking ring down and beat frequency every day.

Cavity #2 Test cavity STILL in STANDBY.

Optical train upgrading is in progress.

New cavity assembly still in progress.

Misc. tasks.. placing orders to modify the scatterometer system.

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## **40 Meter Interferometer (Weinstein)**

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- Koji Arai helped Mike Smith and Alexei Ourjountsev re-assemble and align the vacuum-prepped mode-matching telescope and Faraday isolator before he left, and is preparing a writeup of the procedure.
- Lisa G and SURF students Matt and Naman are going through daily lab checklists, using EPICS, dataviewer and the iLog.
- Osamu returned from Japan, where he helped Kentaro lock his 4-meter signal-recycled Michelson, detuned. They moved on to the signal-recycled Fabry-Perot Michelson, in broad-band RSE. After much tuning and aligning, they were successful in both configurations. He modeled the error signals and power outputs with Finesse, and saw good agreement with the experiment.
- Core digital suspension controllers (DSC), LSC, ASC, and other Electronics (B. Abbott, Heefner, Bork, Taylor):
  - From Rolf:
    - Primary goals for this week are to get the ETM controls installed and running the the 40m lab and, now that we have enough high speed (2Gbit/sec) network interface boards, to remove the slower network completely from the 40m lab and go with the single fast network.
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after ETMY testing.

- The move to the single network is complete, but there was a snag. The Arbitrary Waveform Generator (AWG) software was written to run on the older MIPS processors, but the new network cards do not work on these CPU boards (don't even get power indications on the cards). So, we have had to port the AWG code to Pentium processors. While this seemed straight forward and compiled fine, it did not work properly. It looks like Alex got it running last night though, so we'll test it more thoroughly today.

◦ From Jay:

- The databases, processors and VME modules for the ends are installed and operational. Medm screens need to be generated. Checkout of the racks will begin next week.

◦ From Jay:

- All rack drawings and wiring diagrams for the ASC and LSC are now complete.

- Cross connect fabrication will begin next week and should take about 2 weeks. Rack assembly will begin after the cross connects are complete.

- The schematics for the new QPD to ICS interface moduel are complete. Board layout will begin next week.

◦ Art and Bob have been completing the remaining cabling to/from the ETM racks; just a bit more to do. Dennis set up ethernet hubs at the ends.

◦ Dennis set up memory dipperswitches on 1X1 VME boards with Alexei.

◦ Lisa has got the video EPICS controls working, and succeeded in getting signals to the control room projector and monitor. So right now we can see ITMX, ITMY, MC13 & MC2. She's running cables from the PSL and IMCR & SPS beamline cameras to the switch, with help from Bob. She has added illuminator buttons to the video EPICS screen, and is refining the layout.

• Suspended mass mode cleaner (Ugolini, Miyakawa, Vass, Abbott):

◦ The DSC and MC electronics are down, while Rolf and Alex make big changes.

◦ Osamu is back, and preparing to optimize the gains, cross-over frequency, and other parameters, to minimize the frequency noise.

• Mode Cleaner WFS system (Ourjountsev, Abbott, Eichenfield):

◦ Due to the DSC and PSL activities, WFS commissioning has been less productive than last week.

◦ Alexei tuned the second WFS demod board

◦ Alexei measured DC gains on both WFS heads.

◦ As soon as the MC is back up, Alex will measure the RF gains and match the overall phases on the WFS. Then he'll move the PZT mirrors with dtt. Then he can finally start taking transfer functions and commission the servo loop.

◦ Matt is helping Alexei with the WFS work and is learning all about it, to continue that work when Alexei leaves.

◦ Matt is working through Eric Black's paper on PDH locking, w hich led him to working out the FP arm reflected beam properties when it is not in equilibrium with the cavity (found a good paper by Benno Wilke and Robert Byer)

• PSL and ISS (O. Miyakawa, B. Abbott, R. Abbott, F. Nocera, D. Ugolini, S. Vass, C. Mow-Lowry):

◦ Plan to re-layout the PSL sometime in the next two weeks.

• Optical sensing (Smith, Ourjountsev, Goggin, Miyakawa, Arai):

◦ OPTICS PARTS LIST, Orders pending: 1 q-switch E/O shutter from Fast Pulse.

◦ FARADAY ISOLATOR: Assembly is expected the week of 6/16.

- OPTICAL LEVER ASSY: Assembly on hold.
- IFO STEERING MIRRORS: Parts are cleaned and baked. Assembly is expected the week of 6/16.
- MODE MATCHING TELESCOPE: Telescope is aligned and is awaiting installation.
- SPS BREWSTER PRISM MIRROR: Parts are cleaned and baked. Assembly is expected the week of 6/16.
- Electro-optic shutters (Smith, Ourjountsev):
  - Alexei realigned the EOS after modifications on the PSL table. Transmission goes from 0.025% to 98%, half-wave voltage is 3.79V.
  - Alexei is commissioning the EPICS control of the EOS's. Bob did some of the cabling for it.
- Facilities and vacuum envelope (Ugolini, Vass, Jones):
  - Steve Regenerated cryo. Maglev is still noisy a bit.
  - Steve ordered quad splitters for video monitors.
  - Steve helped Koji with mode-matching telescope alignment.
  - Steve measured 670nm transmittance of 40m safety glasses.
- South Annex Bake Ovens (Taylor):
  - Bob is doing a bake job on some more of the LHO baffle parts for Ken Mailand, they are in the oven now.
  - Bob is doing the clean and bake of the Pico Motors used to drive the shutter flags.
  - Bob has received the spare MOS and SOS suspensions to be baked when he gets a chance.

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## Thermal Noise Interferometer (Libbrecht)

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no report

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## LASTI (Zucker)

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report in Advanced LIGO report

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## Data Analysis and Computing (Lazzarini)

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### Simulation and Modeling (Bhawal)

#### SimLIGO

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(Matt) This week I worked on turning out an update to SimLIGO. The new version includes a working Common Mode servo (using the standard control scheme rather than non-resonant sidebands), ASC control of all DOF, functional if not robust lock acquisition, and many automated measurement scripts.

The noise curves produced by SimLIGO continue to show an unidentified noise source between 30 and 300Hz that fills in the bottom of the spectrum. We suspect that this noise arises from some non-linear effect, but the details are not understood. If this is not an artifact of simulation it has potential to be a limiting noise source for LIGO, so finding its origin is of some importance. Interersted readers may refer to: [www.ligo.caltech.edu/~e2e/pdfs/SimLIGNoise030611.pdf](http://www.ligo.caltech.edu/~e2e/pdfs/SimLIGNoise030611.pdf) .

### WFS signals

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(Biplab) Calculated WFS signals for the as-built LIGO hot-state and near-hot states. Trying to understand trends for some differences.

### Code development and maintenance

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(Melody)

- Worked on figuring out why NaN's were being generated for the SimLIGO output file by the modeler compiled with no optimizations using gcc 3.2.2. The cause was an unitialized value in one of the modules.
- Finished comparing the results generated by Sun and Linux systems

using different compiler versions and optimization levels.

- Started looking into using a compiler to process the FUNC\_XXX modules.

(Hiro) Studied Matt's new optics model; Worked with Melody to understand the compiler dependence/CPU dependence.

Alfi

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(Bruce)

- Completed work on Copy/Paste problems with Macro and settings not being copied into the new nodes properly (PRs 394 and 413).
- Fixed problem with junction removal (PR 412).
- Implemented changes in Alfi which cleared up inconsistencies in where the E2E\_PATH was being found/generated (PR 395).
- Created a script for Unix for startup of Alfi via WebStart which will allow command line arguments to be used (PR 401).
- Created documentation on the Web for many of these new features as download/install instructions where needed (partial PR 376).

## LIGO Data Analysis System

### Software Systems (Blackburn)

A problem with the database tables at LHO was discovered while upgrading that site to the new release of LDAS. This required a full days effort by Mary and Igor to sort out and test. It eventually evolved to require a full back up and restore of the database tables there. The problem is thought to be related to the T3 crash that occurred during the S2 run at Hanford.

We have started testing the RDS frames in the archive on the LDAS-CIT system. This is being done by running a couple of the burst jobs on all the lock data sections. We are about half way through the Hanford RDS frames at this time.

So far we have discovered one bad RDS frame and one lock section (according to the DMT lock segments in the database) with missing frames. Once a complete list of suspicious RDS frames are generated Philip Charlton will look into the details to see if the lock segment info is incorrect and if the source frames for the RDS generation were erroneous before attempting to fill in any missing frames (currently thought to be order a couple for LHO). We will then repeat the procedure for LLO RDS frames.

Since the code freeze has been lifted, we have begun working on our targets for the next release of LDAS we plan the following optimistic goals:

- a) migration to GCC 3.3 and possibly GCC 3.3.x (we've already identified a necessary patch for GCC 3.3's string class!)
- b) migration to 64 bit compilations for Solaris (this will increase the amount of memory that can be used in the frameAPI to all that is in the server).
- c) migration to Redhat 9 (support for Redhat 7.x is being dropped by Redhat this year).
- d) migration to TCL/TK 8.4.x (this will fix several instabilities in TCL code).
- e) rewrite the metaDataAPI to be multi-threaded and push computationally demanding TCL procedures into C++.
- f) introduce C++ threaded functions in the diskCacheAPI to eliminate the blocking of jobs when the diskCacheAPI is learning about new frames in the system.
- g) migration to IBM's DB2 version 8.1 or above (Version 7.2 doesn't work under Redhat 9 and vesion 8.1 just barely is working and may require a new release from IBM to fix the issues DB2 is having with Redhat 9's new thread model).

We have improved the distribution of the wrapperAPI's master process onto the Beowulf cluster this week. We have started improvements on the framequery option to better handle datasets from multiple interferometers. The command

to get channel names has been extended to support other data structures in the frame spec besides FrADCs.

Several of us in the group have also been involved with the PAC and NSF reviews late last week and this week.

Hardware Systems (Wilson for Anderson, who is traveling)  
CIT

Al

Set up new nodes for the Dev system. Datacon and Beowulf machines are upgraded to RH9.0 Also setting up desk top machines for SURF students. The rack for the Cit system are in place and are ready for the computers. Also The A/C unit is installed and ready for final plumbing.

Dan

continued refreshing NDAS frames to 9940B (higher density) drives. Am continuing to try to get Sun to figure out why the first few tapes were written with small block sizes (16k). Subsequent tapes are being written with the correct block size (256k).

Got StorageTek to bring our 2 new 9940Bs online. Their power supplies still don't have the correct mounting hardware. But they are ready to go from our end.

(In Powell-Booth, with Stuart) Swapped in our new Jupiter FC switch to replace the beta edition we had been using. Installed 3510 disk arrays in rack.

LHO

Ben & Greg

Ben Johnson has been doing most of the LDAS system administration work at LHO the past week, while I have worked with my SURF student and

prepared for next week's PULG F2F meeting. However, Ben and I (mostly Ben) continue to work on the installations of the new LDAS beowulf cluster, new L700 tape library system, new switches, and the recabling of the LDAS room to work with the new switches. I have also continued to work with Igor Yakushin to exchange AS\_Q only S2 RDS frames between the sites.

LLO

Igor

Reinstalled DB2 at LHO to fix the corrupted database catalog. Copied LLO's AS\_Q only RDS to tape and sent to LHO. Copying LHO's AS\_Q only RDS to disk (for some reason it is very slow - 10 hours per tape). On Sunday I discovered water dripping from the ceiling in the LDAS room. AC repairman told that the problem was that PVC vent, that is supposed to be closed, was actually open and sucked an air which condensed inside the system. The problem was fixed. No damage to LDAS equipment. Writing scripts to automatically set up replication sources and subscriptions. Ordered a replacement for yet another failed T3 disk.

Data Analysis Activities (Lazzarini)

Mendell:

1) Started work with my Surf Student, Anah Mourant, on her project to estimate signal parameters from simulated continuous wave data.

2) Wrote a simple simulation of the stackslide search and prepared for the PULG F2F meeting next week. The work in focusing on very basic things at the moment: understanding the algorithm, its computational complexity, and associated statistics.

Charlton:

**FCT:**

The FCT group is working on a new paper describing the "generalised" FCT algorithm and comparing it with matched filtering methods.

I have been working on code to demonstrate the fraction of SNR recovered by the FCT algorithm as a function of chirp times ( $\tau_0$  and  $\tau_1$ ) of an inspiral signal using the LIGO I noise curve.

**Chirplets:**

I have been working on some prototype code in matlab to decompose a data set in a chirplet basis.

**Weinstein:**

- last week, I prepared & gave a talk on burst search to PAC14
- working on burst S1 paper editing
- trying to quantitatively compare our results with bar results.

**Reilly, K.:**

This week I finished up the cvs move and helped with getting people their GC accounts so they can access the stochastic disk space.

I am back to working on the re-design of the stochastic DSO. After working through some LDAS issues, the intermediate data products are now being generated here at Caltech. It will take several days to have these products in hand.

**Shawhan:**

I spent several days investigating a peculiar thing that I noticed about the Monte Carlo simulation which is used to measure the efficiency of the analysis pipeline for the S1 inspiral upper limit analysis: a significant number of very large simulated signals were not found by the search code. Some loss was expected due to the chi-squared cut we make in the analysis, but the observed loss was much higher than expected. After tracking this down with Duncan, Patrick and Jolien at UWM, it turns out that part of

the loss was due to a bug in the code which caused some of the planned simulated signals to be skipped; this will require re-running some of the Monte Carlo jobs. The rest of the effect is apparently a real effect in the chi-squared test which is mysterious but is not as serious a concern, since the analysis pipeline is identical for Monte Carlo and regular data.

#### General Computing (Wallace)

MIT:

(Keith)

- Continuing to investigate triplesync problems with brownbear tech support
- Investigating samba over SSH for windows PC's

Livingston:

(Shannon)

- Set up several workstations for our summer visitors.
- Attending a Usenix conference and tutorials.

Hanford:

(Christine)

- More SURF student account and computer set-up.
- Computer and account set-up and purchases for summer outreach teachers and new hires.
- Rack mount and initial configuration of the new Cisco router completed. Nothing is connected to it yet.
- Spoke with Jim Schroeder of ESnet to schedule connection of our new OC3 network. The plan is to connect the week of 6/21/03, actual day and time to be determined by 6/19/03. ESnet will accept their new OC12 connection on 6/16 and will do the change over on the evening of 6/19. LHO will have a short network outage on 6/19 when they do the change over.
- The PR for the GigE network equipment was sent to Dot last week, but

there have been some changes to the quote that need to be modified in the PR.

- Setting up a new laptop for Fred. Finished setting up a new laptop for the new optics lab.
- Lots of user support.

CIT:

(Mike)

-Worked on Barry Barish's laptop due to a wireless problem. I had to call this laptop in, after many hours of trouble shooting plus many hours of dealing with IBM tech support on the phone trying to order the part. IBM is sending me out a replacement part to correct this problem.

-Worked on finishing up loading a workstation for Enrico Campagna. This included loading multiple engineering software packages, plus General Computing software.

I also swapped out his old computer and slaved his old drive to the new computer to have this user back up and running, right away.

-Worked on loading two new computers with General Computing software and additional engineering software for Alan Weinstein. I also took these computers over to 40meter and set these workstations up.

-Fixed a problem with M91 our media server that was having a problem with backups. I ended up having to stop and restart services. Then I had to reboot several times after going through and cleaning up registry errors that were coming up at the startup after a reboot.

-Updated all NTSRV's with security/os updates.

-Started loading a computer that we inherited from LDAS. I will be loading this computer as my master image to load an additional seven computers to swap out some of our older computers that will be used for visitors/surf students.

-Performed a lot of onsite/phone user support this week, that included software, networking & printer issues.

-Helped Larry & Lisa set up the NSF conference.

(Lisa)

- Preparation and support for the NSF review.
- Added a new block of IP numbers to DHCP.
- Worked on solaris 9 jumpstart server.
- User support - mostly for the students.

(Veronica)

- LIGO website: installed PAC14 talks. Posted updates to various pages. Tracked a late Aspen talk and added to the conference website. Edited a high-res image per a request from MIT for a paper submission. Made a DVD copy for Kip Thorne. After some trial and error, we decided that an upgrade was needed for my CD/DVD authoring software. Installed the upgrade; picked up a copy of the package for Mike. Use the last CaJAGWR video as a tryout for video capturing and editing. Working on an inventory of 'non-static' directories on Windows servers for more selective backup, to save tape space. Provided user support.
- Advanced LIGO website: posted last-minute updates.
- LSC website: discussed with Peter Saulson changes/updates to be made to the website. Implementing them one by one.
- CaJAGWR website: taped the last seminar. Processing the video for web streaming. Provided user support. Making a backup CD of presentations located outside of ITS disk space.

(Larry)

- Spent time working on a number of procurements and related issues. Purchased a number of misc. items for different people. Spent a number of hours getting the warranty upgrade on Barry's laptop. This should help Mike with the problem he has had in getting IBM to repair a defective part in a unit we recently purchased.
- Assisting on the setup for the NSF review has take a great deal of our time the past few days. Many thanks to Lisa and Mike for putting in the extra effort and time to make sure things worked, not only with the computers but with the room setups, catering, audio visual work, moving furniture in and out from the different rooms and assisting the visitors with their needs.

- Setup a number of user accounts and reactivated a number of old accounts. Setup items for the SURF students. Working with Mike on getting computers setup for the visitors we will be having this summer.
  - Worked a number of issues concerning the server room.
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## **Advanced LIGO Development (Shoemaker)**

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# **Advanced LIGO and supporting R&D**

## **Seismic Isolation**

From: Larry Jones <ljones@ligo.caltech.edu>

Evaluation is nearly complete of the proposals submitted 29 May for Phase I of the AdLIGO SEI structure design & fab contracts.

## **Suspension**

From: JaneenRomie <romie\_j@ligo.caltech.edu>

Prepared for the NSF Review.  
Supported damping work on the MC triple.

From: ctorrie <ctorrie@ligo.caltech.edu>

### Mode Cleaner

The mode cleaner suspension has now been damped in all degrees of freedom and all modes damp down with a settling time of 10s or less. I have measured the range of mode frequencies and all seem to be within the expected band. I have measured about 50% of the modes and matched them successfully with the theory.

The suspension has also been adjusted to be at the correct height above the optical table within 0.5mm

### MATLAB modelling

Ken Strain, Mark Barton, Norna Robertson, Caroline and I met to discuss version control, updates to the MATLAB files used to design a suspension and layout of these files. Several new concepts will be adapted.

### Suspensions

Norna and I met to discuss the layout of the ETM. Several key aspects were discussed in detail with Ken Strain and others.

## **Pre-stabilized Laser**

From: Peter King <pking@ligo.caltech.edu>

I have been working with BennoWillke on the material for the NSF Review. In the process we came across a few items that need to be updated in the costing.

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## **Input Optics**

No report.

## **Core Optics**

No report.

## **Auxiliary Optics**

From: Michael Smith <[smith@ligo.caltech.edu](mailto:smith@ligo.caltech.edu)>

### PHOTON DRIVE R&D

A 0.5 W laser was received from MIT. Miscellaneous optical elements were ordered for the experimental apparatus.

### NSF PROPOSAL

Technical and Cost/schedule information for the AOS subsystem was prepared for the NSF Proposal review.

## **Interferometer Sensing and Controls**

No report

## **Data Acquisition, Diagnostics, Network & Supervisory Control**

No report

## **Other Laboratory R&D**

LASTI (Allen, Coyne, Mason, MacInnis,

Mittleman, Ottaway, Adhikari, Rollins, Shoemaker, Zucker)

PSL (Ottaway, Adhikari, Rollins, Zucker)

- Updated the PSL EPICS screens

- Re-aligned 1 reference cavity

MEPI (Myron, Ken, Rich, Dave, Bill)

We now have a reasonably good data on the sensor correction coefficient for all three directions. The best coefficient is within 15% +/- 10%, of the calculated value in each case. The next step is to investigate what is limiting the resolution in these measurements, we increased the loop gain past the point where we are gain limited. After that we will look into the possibility of filtering Streckhiesen ground signal to improve the sensor correction.

HEPI (Myron, Ken, Rich, Dave, Bill)  
Nothing new to report

EPI Installation (Ken Mason)

I received all quotes from potential suppliers for the machined and fabricated parts required to build 11 HEPI systems for LLO and the remaining HAMS at LASTI. Marie is putting all quotes in excel format for comparison.

ISC Optical Periscope (Ken Mason)

The newly designed optical periscope was presented to the commissioning group for comments. The design was very well received and several excellent suggestions are being added which will further increase its stiffness.

Thermal Compensation Advanced LIGO (Dave)

Spent time preparing for NSF Review.

Quadruple Pendulum Prototype (Rich, Andrew)

Andrew Thomas (a summer UROP) has started working on the quadruple pendulum prototype with the goal of testing global control schemes.

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For additional information about this report, contact [sanders@ligo.caltech.edu](mailto:sanders@ligo.caltech.edu)