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Subject: Large Facilities Projects Monthly Report (End of January 2008)

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Subject: **LIGO End of January 2008 Highlights**

Reference: **LIGO-M080020-00-P**

General

LIGO is reviewing a draft report from the NSF team that performed a Business Systems review (BSR) in August. The report is generally favorable.

LIGO Scientific Collaboration (LSC)

A document outlining plans for the upcoming Astrowatch program using the Hanford two-kilometer interferometer has been circulated to the Gravitational Wave International Committee (GWIC). The document is intended to inform the global terrestrial gravitational-wave community about Astrowatch and describes the plans for running the LIGO, Virgo, and GEO detectors in 2008. The document can be found at <http://www.ligo.caltech.edu/docs/M/M080011-00.pdf>

Graham Woan has been elected to serve a two-year term as the Continuous Wave (CW) data analysis group co-chair, replacing Maria Alessandra Papa.

In early January a special gravitational-wave astronomy session at the American Astronomical Society meeting was held in Austin, Texas, and it was very well received. About 100 people attended, most coming from the astronomy community, and five talks were presented: Stefan Ballmer - "Building an International Gravitational Wave Network"; Giovanni Losurdo - "The Next Generation of Ground-based Gravitational Wave Detectors"; Szabi Marka - "Astrophysically Triggered Searches for Gravitational Waves"; Matt Pitkin - "Results from searches for a continuous gravitational wave signal from the Crab pulsar"; and John Whelan - "Searches for a Stochastic Background of Gravitational Waves."

A committee of LSC members has been formed to find improvements in the way LSC and Virgo members participate remotely in collaboration meetings. The immediate goal is to assess remote meeting packages developed for large collaborations (such as EVO, Polycom PVX, WebEx, Adobe Breeze) that will allow remote participants to have better "connectedness" (sound quality, perhaps video). We expect to implement a trial solution for the March LIGO-Virgo meeting.

A working group of LSC members has been established to develop education and public outreach (EPO) coordination among the various LSC institutions and explore ways to expand the LSC EPO footprint. The first face-to-face meeting will take place at the March LIGO-Virgo meeting.

Approximately 20 abstracts from the LSC were submitted to the April APS meeting.

Publications**Accepted or Provisionally Accepted:**

- The Inspiral/Burst group paper "Implications for the Origin of GRB 070201 from LIGO Observations" was accepted for publication in the *Astrophysical Journal*. In addition, the LSC put out a press release on the GRB 070201 event, which can be read at http://mr.caltech.edu/media/Press_Releases/PR13084.html.
- The revised CBC group paper "Search for gravitational waves from binary inspirals in S3 and S4 LIGO data" was accepted for publication in *Phys. Rev. D*.
- The revised Burst group paper "Search for gravitational waves associated with 39 gamma-ray bursts using data from the second, third, and fourth LIGO runs" was accepted for publication in *Phys. Rev. D*.
- The revised Burst group paper "A joint search for gravitational wave bursts with AURIGA and LIGO" was accepted in *Classical and Quantum Gravity*.

Published:

- The pulsar group all sky S4 analysis "All-sky search for periodic gravitational waves in LIGO S4 data" was published online at <http://link.aps.org/abstract/PRD/v77/e022001> and will appear in the 15 January 2008 issue of *Physical Review D*.

Education and Outreach**Livingston Observatory Outreach****Student Learning**

The LIGO Science Education Center (SEC) hosted 12 school visits this month with a total student attendance of 667. School visitor breakdown was:

129 High School students
 290 Middle School students
 248 Elementary students

In addition, one off-site visit was made to a local school's Young Astronaut Club. Fifty students attended.

Teacher Programs

- We conducted one off-site teacher Professional Development (PD) program. This was a trial run in St. Tammany Parish Program with six ninth-grade physical science teachers. Central office curriculum and instruction staff were interested in how the teachers responded to the training. Based on the response, this school system is making plans to request a formal partnership with LIGO SEC for further teacher PD.
- We conducted one on-site teacher PD program for a Math Science Partnership (MSP) project based in Livingston Parish. Twenty-seven teachers and administrators attended.
- We are now using Docents during our school visits. We would like to expand the use of docents and are working with our Southern University partner to increase individual Docent participation.

Training

- One SEC staff member participated in a one-day workshop in New Orleans. This workshop was supported by Chevron and the training targeted Middle School teachers. This opportunity permitted us to establish working contact with Chevron as well as science teachers in New Orleans. Chevron representatives are planning to visit the LIGO SEC in February.

Education Research

- Tulane University's research in student interactions during exhibit play continued this month at SEC with video data collection events at almost all school visits.

Hanford Observatory Outreach

In January, for the second consecutive year, Hanford hosted the TechREACH kickoff event. TechREACH, a program of the Puget Sound Center for Teaching, Learning and Technology, matches middle school students with professional science and engineering mentors in a mentoring relationship that occurs via email. The TechREACH program has expanded into the Tri-Cities region with the help of NSF support. The event provided students and mentors a chance to meet face-to-face. One hundred students, parents and mentors attended the morning session for boys. Seventy-five attended the afternoon session for girls. Several Hanford staff members participate in TechREACH as mentors.

Enhanced LIGO

Enhanced LIGO hardware installation continues on the four-kilometer interferometers at Hanford and Livingston.

At Livingston, the input optics team completed installation of the high-power Faraday isolator and other new input optics, and the vertex volume was pumped down. A gratifying "peek" down the beam tubes indicated that beam alignment was restored by dead reckoning to within a few arcseconds of perfect.

The Seismic Isolation team has completed assembly of the internal seismic isolator (ISI) and installed all magnetic actuators and sensors. The installation lift track passed its load test at the vendor's facility. The output horizontal access module (HAM6), now an isolated independent vacuum volume, was outfitted with seismic supports and sealing bellows. It has passed leak tests in preparation for ISI installation.

The Livingston four-kilometer interferometer Output Mode Cleaner (OMC) and its suspension arrived from vacuum prep at Caltech and are now being assembled on the experiment floor just outside HAM6. Advanced LIGO versions of electronics and software to operate the seismic, suspension, and OMC systems were also installed and tested at Livingston.

At Hanford we are completing the installation of the Faraday isolator and making final alignment adjustments before closing the vacuum. We have begun assembly of the Hanford four-kilometer internal seismic isolation system with installation of external supports and the staging and prep of components and hardware. Contractors have finished building a dedicated support facility to house the Advanced LIGO laser pump diodes and drive electronics. Meanwhile the two-kilometer interferometer has been restored to operation and is being commissioned to optimize range and duty factor for AstroWatch.

Advanced LIGO

Much of the work on Enhanced LIGO is directly relevant for Advanced LIGO: the assembly of the isolator for the multipurpose vacuum chambers (HAM), the completion and delivery of the output mode cleaner suspension to the observatory, the preparation of the facilities for the installation of the sources lasers, and the installation of the input optics components.

Additionally, strides were made in other efforts. We placed a contract for polishing the core optics with a new vendor engaged for a high-precision technique. We made a direct measurement of the thermal noise in a coating with optimized layer thickness, showing a lower thermal noise than in a similar coating without optimization, giving a proof in principle that the technique is applicable to Advanced LIGO. Work continued on the quadruple stage test mass suspension system, investigating the resonant structure as mounted on its seismic isolation system. A combination of technical difficulties in the seismic isolation system, and a complicated resonant structure, is extending this work, but we still have significant margin in the development schedule. We made progress assembling information for some of the early project-phase procurements and activities, such as facilities modifications, and fabrication of the seismic isolation pre-isolator for Hanford.

The updated proposal for Advanced LIGO was submitted to the NSF through the MIT and Caltech administrations in anticipation of an imminent project start.

