

# LSC Six-Month Progress Report

**LIGO- M000298-00-M**

**Organization** Louisiana State University Experimental Relativity Group (ERG)

**Report Date** August 15, 2000

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W. Johnson, J. Giaime, 9/18/2000. Progress through August 2000.

The following points refer to the lettered items from section 9 of LIGO-M000106-00-M, "Attachment A."

- a) The transmission of LLO seismic isolation stack (in-vacuum) was measured in Sept 1999 and draft report submitted to the DCC, (T000101-00-0).
- b) A fft-based algorithm for Wiener filtration of line noise was tested on a toy data set, and performed well, meaning that the lines in the input spectra were replaced by dips, and chirp signals went through the filter with very little loss in signal energy. We have come to realize that the rationale for "line removal" is in conflict with the rationale of Wiener filtering. This conflict needs to be brought out into the open, and the advantages/disadvantages need to be clarified.

Ed Daw, formerly with the MIT LIGO group, has joined the LSU LIGO group to work full time at LLO, with his first priority to be software for the global diagnostic system. He has delivered the first set of C++ code modules for implementation of recursive and non-recursive filtering, for multiband rms monitoring of DAQ channels.

- c) No progress was made on the Supernova monitor. R. Svoboda stopped working on LIGO when he accepted a new commitment to major construction of a subsystem of the Kamland experiment (a follow on to SuperK in Japan). He will be working on this for at least 1.5 years.

An unpromised task was undertaken: much more longer and more extensive measurements of seismic noise than have ever been done at LLO. We have about 30 days total of raw data stored on tape. A fine grained frequency-time analysis was performed, using 12 octave bands, both rms and peak. This was reported on at the March LSC meeting, and that report and a complete set of analysis graphs are available at <http://sam.phys.lsu.edu/johnson/>

- d) J.Giaime worked as a part-time "installation director" until Spring 2000.

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The following points refer to the lettered items from section 8 of LIGO-M000107-00-M, "Attachment B."

- a) The "stiff" design team continued work toward a LIGO-II seismic isolation design. This led to a series of documents submitted to the LIGO-convened "Technical Advisory Group." These documents include: "A Prototype Test Program Plan" (LIGO-T000015-00), "Simulation Plan" (LIGO-T000016-01), and "Baseline LIGO-II Implementation Design Description" (LIGO-T000024-00-U).

During the summer, the stiff approach was chosen for continued development, and J. Giaime began as lead scientist for the Advanced LIGO SEI team.

- b) Three developments have radically altered the direction of research on cryogenic suspensions. The first is the Moscow group's calculation that thermoelastic losses are certain to be a serious problem for room temperature sapphire; cryogenic operation of the mirrors is one way to attack this problem. The second development is the announcement and initial results from the first large research effort on cryogenic interferometers; the Japanese LCGT group has convinced themselves that mirror contamination is not a serious problem, and that sapphire fibers are a good candidate for suspension of cold mirrors. The third is the realization that the higher conductivity of sapphire at cryogenic temperatures will ameliorate thermal lensing problems. As a result, our research program has abandoned its original centerpiece: combination of a room temperature mirror with a cold suspension. New experiments are in progress. Visits were made to the Japanese cryogenic experiments, and several papers were given at the Aspen conference.
- c) An active seismic isolated granite block that supports the transient noise measurement apparatus, and a data acquisition system for it has been installed at LLO.