

**Attachment Number A to the
Memorandum of Understanding (LIGO-M020307-M)
between the
Hobart & William Smith Colleges LIGO Group (HWSLG)
and the
Laser Interferometer Gravitational Wave Observatory (LIGO) Laboratory
February 15, 2004**

This Attachment to the Memorandum of Understanding LIGO-M020307-00-M covers the role of the Hobart & William Smith Colleges LIGO Group (HWSLG) as a Member of the LIGO Scientific Collaboration (LSC), and a member of the LIGO I Development Group (LIDG). The period of performance for the activities in this Attachment is from February 15, 2004 to August 15, 2004. This period may be modified by agreement to a revision of this Attachment.

1. LIGO Scientific Collaboration - The LIGO Scientific Collaboration (Collaboration) is organized as a separate organization from the LIGO Laboratory. It includes scientists from the LIGO Laboratory, and those from collaborating institutions, and has its own leadership and governance. The Collaboration will ensure equal scientific opportunity for individual participants and institutions. It will organize the research, publications, and all other scientific activities. The Collaboration will report to the Laboratory Directorate for final approval of its research program, technical work, observational physics publications, and talks announcing new observations and physics results. This will be done through regular semi-annual reports to the Directorate and its PAC.
2. Charter Membership - An initial period for formation of the Charter group of institutions in the LIGO Scientific Collaboration commenced on March 1, 1997 and ended following the first full meeting of the Collaboration at which the Collaboration Council assumed its role.

Following the charter period, proposals will be evaluated and approved, as appropriate, through the Collaboration Council. An MOU with the LIGO Laboratory, including Attachments defining specific work, will be required for any participating institutions.

3. This document is an agreement between the Hobart & William Smith Colleges LIGO Group (HWSLG) and the LIGO Laboratory concerning the activities of HWSLG as a Collaborating Institution in the LIGO Scientific Collaboration (LSC) and in the LIGO I Development Group (LIDG), and as indicated in Items No. 8, No. 9 and No. 10.
4. LIGO I Development Group - The LIGO I Development Group is the scientific collaboration for implementing and exploiting the initial LIGO detector and physics through the initial science data run. Only groups who establish a specific Attachment approved by the LIGO Labo-

ratory, which defines a sufficient contribution and participation in LIGO I development, implementation or data analysis will be part of this initial LIGO data run and science. Participation in future data runs and science that follow LIGO I will be possible for other groups, with guidelines to be determined by the LIGO Scientific Collaboration. It is anticipated that LIGO I data will only be made available through formal collaboration within the LIGO I Development Group during the first two years following its collection.

The general guideline for institutional membership in the LIGO I Development Group is that the contribution per collaborator of any new group to the design, construction, and implementation of the initial LIGO detector and to the first data run be comparable to that of the LIGO Laboratory scientists.

5. Report of Progress - HWSLG will provide a status report on its activities in support of LIGO every six months. The report will consist of: a) a summary status on research by topic as indicated Item No. 10 including progress against the milestones if any, significant accomplishments such as new insights/discoveries or publications, issues of concern if any, and an indication of invested time, b) updated List of Collaborators, and c) a plan of activities for the succeeding six-monthly period. The report will be due one month before the close of the period of performance under the Attachment in question.
6. Term of Membership - The Membership will be renewed every six months upon evidence of satisfactory performance of agreed upon duties.

The coordinates of HWSLG members are included in the Attachment Z to the Memorandum of Understanding LIGO-M020307-00-M.

7. Intellectual Property Rights - The rights to intellectual property developed under this Attachment will be subject to the National Science Foundation Grant Policy as indicated in Section 730, Intellectual Property.
8. LAL Software Conventions - It is necessary that any delivered code conforms to the LAL style as laid out in the LAL specification T990030. This includes: 1) coding style, headers, etc.; 2) use of function calls, etc.; 3) organization of software in the directory structures indicated in the document; 4) inclusion of test codes and validation tests to enable users to verify successful installation of implementation; and 5) documentation and users manuals (html or pdf) to enable users to understand and adopt code.
9. LSC Service Functions - Participation in LIGO I brings with it responsibility for service functions to support the overall effort in achieving high detector sensitivity and high data quality. In particular, each LIGO I group is expected to assist in the staffing of scientific monitoring shifts during organized data runs. The staffing of these shifts is notable for both its importance and the travel burden it places on scientists. This burden makes an equitable shift allocation mechanism necessary.

A nominal guideline is that each LIGO I group should staff a fraction of the shifts comparable to its FTE fraction devoted to LIGO I activities. An eight-hour shift is assumed.

The current count of FTE in the Collaboration is 127 (not including GEO FTE). The Hobart & William Smith Colleges LIGO Group (HWSLG) has .5 FTE associated with LIGO I and is expected to staff .4 % of the scientific monitoring shifts during this MOU period.

Steven Penn will be responsible for interaction with the designated LSC Shift Organizer (currently Keith Riles of Michigan Univ.) with respect to the HWSLG's Service Function commitments.

Groups making extensive contributions to the LSC in other service efforts that involve a substantial travel burden may request a reduction in their nominal share of shift staffing. Those efforts can include:

- 1) Commissioning and instrument improvement
- 2) Participation in on-site detector characterization investigations
- 3) Development/operation of analysis software/hardware infrastructure and validation of analysis software that requires travel away from the home institution.

10. During the period February 15, 2004 to August 15, 2004, the agreed upon research plan and commitments for HWSLG will be as follows:

Detector Characterization

- a) Lead the Bilinear Investigation team in the Detector Characterization Working Group, which includes detecting and characterizing the primary sources of bilinear noise in the LIGO data stream with the goal of minimizing this noise source.
- b) Develop bicoherence data monitors for the Data Monitoring Tool (DMT) including a stand-alone, interactive bicoherence viewer (BicoViewer) and a background bicoherence monitor (BicoMon).
- c) Explore the use of bicoherence monitoring as a method for transient detection and possibly for gravity wave detection.

11. Educational Outreach

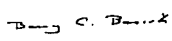
We have initiated a LIGO-related Research Program with Physics teacher Greg Baker at Geneva High School. The program is modeled after the successful program at Gladstone High School. The Geneva students will be involved in the Bilinear Noise Detector Characterization research.

Greg Baker will conduct bilinear noise research for five weeks this summer at LHO, and then initiate this research with his senior students in the fall.

12. During the period February 15, 2004 to August 15, 2004, the LIGO Laboratory will provide, as requested and necessary, LIGO data of relevance to the research topics in Item No. 10.

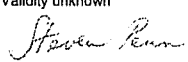

- 13. The research effort pursuant to this Attachment A will be coordinated by Steven Penn and Albert Lazzarini on behalf of HWSLG and the LIGO Laboratory, respectively.
- 14. Resource Sharing: The LIGO Laboratory will contribute resources including allocation of appropriate scientific and engineering personnel, research facilities and funding in support of the effort in Item No. 10, as indicated below.
 - a) Accommodations for HWSLG investigators while on LIGO research assignment at Caltech, and /or LIGO sites.

Approved:


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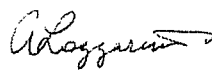
Barry Barish
LIGO Laboratory Director

Date

Validity unknown



Steven Penn
Principal Investigator, LIGO Group
Hobart & William Smith Colleges

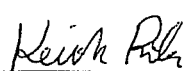
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Albert Lazzarini
LIGO Laboratory Data and
Computing Group Leader

22 June 2004

Date


Digitally signed by Keith Riles
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Keith Riles
LSC Shift Organizer

Date