Attachment Number 1 to the

Memorandum of Understanding (LIGO-M950025-0-M)

between

Australian Consortium for Interferometric Gravitational Astronomy (ACIGA)

and the

Laser Interferometer Gravitational Wave Observatory (LIGO) Project

June 1, 1995

This Attachment to the Memorandum of Understanding LIGO-L950025-0-M describes the activities of the Australian Consortium for Interferometric Gravitational Astronomy(ACIGA) at the Australian National University (ANU) in developing an interferometric motion sensor (compatible in form with the existing shadow sensors) for control of the LIGO test mass position. The period of performance for the activities in this Attachment is from June 1, 1995 to May 31, 1996. This period may be modified by agreement to a revision of this Attachment.

1. Goal - The aim of developing the interferometric motion sensor is to produce a motion sensor with a sensitivity of better than 10^{-12}m/Hz$^{1/2}$ for stabilizing a LIGO suspended test mass. The sensor will minimize physical disruption and will maximize the Q of the test mass because it will rely for information on a small mirrored surface of the test mass. The main deliverable from this task will be the design and production of a working prototype of a LIGO compatible motion sensor. The task is described in greater detail in the Technical Proposal and Statement of Work (LIGO-C95020079-I).

2. Management and Technical Representatives - The interferometric motion sensor task will be led by Mal Gray (under the supervision of David McClelland and Hans Bachor). They will meet weekly to assess the progress of work relative to the Schedule. Significant delays or alterations will be communicated to LIGO management through ACIGA/ANU. Comparisons with the Schedule will be included in all progress reports. Staff and facilities will be provided by the ANU Physics Department electronic and mechanical workshops. The Technical Representative from ANU/ACIGA for this Attachment is Mal Gray. The Technical Representative from LIGO is Seiji Kawamura.

3. Statement of Work and Deliverables - The initial tasks will be conducted at the ACIGA/ANU physics department facilities. The final compatibility tests will be performed at LIGO. The tasks to be carried out are the following:

    a. Build a rigid interferometric sensor system, design the relevant optic system and electronics, and perform tests for shot noise limited performance, frequency response(minimum

frequency limit at shot noise floor) and electronic noise cancellation/stabilisation

b. Develop the tracking mirror chassis, spring, actuator and driving electronics, and test the frequency response and tracking performance of the complete tracking mirror system
c. Assemble the total sensor and test the total noise floor of the tracking mirror interferometer in air on a rigid test platform, achieving a sensitivity of better than 10^{-12}m/Hz$^{1/2}$.
d. Vacuum test the total system at 10^{-6} torr using the existing ANU vacuum chamber and pumps, modifying the vacuum chamber as needed.
e. Build a simple two stage suspension system and test the dynamic performance of the interferometric motion sensor on a two mass, suspended system, in air.
f. Upon completion of these tasks the apparatus will be taken to LIGO where the final system performance and compatibility with LIGO will be tested.

4. Cost and Schedule Reporting - A technical progress report and a financial statement will be prepared quarterly, after the work starts. Each of the technical tasks listed in item 3, will be reported on. Any changes, anticipated changes and/or delays in the scheduled will be highlighted and the possible consequences discussed.

5. Cost - The cost of the project is estimated to be US$77,900. The LIGO Project will provide US$58,160 through a subcontract with ANU and ANU/ACIGA will contribute staff and other support estimated at US$19,740.

6. 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 750, Intangible Property.

Approved:

Barry C Barish

Barry Barish
LIGO Principal Investigator

6/12/95

Date

John Sandeman

John Sandeman
ACIGA Principal Investigator

6/19/95

Date