

**Attachment Number C to the
Memorandum of Understanding (LIGO-M970077-00-M)
between the
German/British Collaboration for the Detection of Gravitational Waves
(GEO 600)
and the
Laser Interferometer Gravitational Wave Observatory (LIGO) Laboratory
February 15, 1998**

This Attachment to the Memorandum of Understanding LIGO-M970077-00-M covers the role of GEO 600 as a Charter Member of the LIGO Scientific Collaboration (LSC) and a member of the Lasers/Optics Development Group (LODG). The period of performance for the activities in this Attachment is from February 15, 1998 to August 15, 1998. This period may be modified by agreement to a revision of this Attachment.

1. LIGO Scientific Collaboration - The LIGO Scientific Collaboration will be organized as a separate organization from the LIGO Laboratory. It will include scientists from the LIGO Laboratory, and those from collaborating institutions, and will have 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 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 will commence on March 1, 1997 and will end following the first full meeting of the Collaboration at which the Collaboration Council will assume its role. We expect that this transition will occur within six months. Membership in the Collaboration during this charter period will be initiated by proposal to the LIGO Laboratory Directorate.

Following the charter period proposals will be evaluated through the Collaboration Council. With Collaboration approval, 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 German/British Collaboration for the Detection of Gravitational Waves (GEO 600) and the LIGO Laboratory concerning the activities noted below, under provision 7, of GEO 600 as a Collaborating Institution in the LIGO Scientific Collaboration (LSC) and in the Lasers/Optics Development Group (LODG).

4. Lasers/Optics Development Group - The Lasers/Optics Development Group (LODG) will be the scientific collaboration for defining and developing future high power lasers and required improvements in optics for use in advanced subsystems for the initial LIGO interferometers or in entirely new advanced interferometers. A specific Attachment will define the roles and responsibilities of groups in this development group. Members of this group will normally be authors on publications reporting the work of the group and will normally be eligible to participate in data runs and science beyond the LIGO I data run.
5. Report of Progress - GEO 600 will provide a summary report of progress, monthly, by e-mail to the Collaboration Council and to the LIGO Laboratory Director. GEO 600 will submit a complete report on its activities every six months, supply an updated List of Collaborators, and a plan of activities for the next six months. This report should be submitted one month before the updated attachment will take effect.
6. Term of Membership - Membership will be renewed every six months upon evidence of satisfactory performance of agreed upon duties.
7. During the period February 15, 1998 to August 15, 1998, the following GEO 600 personnel will participate in LODG activities:

Universitat Hannover, Institut fur Atom und Molekulphysik and Max Planck Institute fur Quantenoptik, Garching

Faculty:	Danzmann (5%), Aufmuth (10%)
Postdocs:	Willke (80%)
Grad. Students:	Brozek (100%), Quetschke (100%)
Engineers:	Weidner (20%), Haupt (20%)

8. Investigation of cross-coupling between laser stabilization control loops of a Nd:Yag laser-system, relevant to Enhanced and Advanced LIGO interferometer, February 15 1998 - August 15, 1998
 - a. System under development for GEO600:
 1. A 10 Watt injection locked Nd:Yag laser system with a control-system topology similar to the LIGO-prestabilized laser (PSL);
 2. Frequency control to a reference cavity as an inner loop including an acousto optic frequency shifter as an actuator for the outer frequency stabilization loop;
 3. Intensity stabilization loop with feedback to the injection-locked slave pump diode;
 4. Table top cavity with 8m round-trip length to simulate cross coupling introduced by a mode cleaner;
 5. An analyzer cavity to measure out of loop frequency noise and cross coupling transfer functions.

b. Planned research relevant to this Attachment:

1. We will build a pre-stabilized laser system with 10mHz /sqrt (Hz) frequency noise and a relative intensity noise of 10^{-8} / sqrt (Hz) @ 100 Hz followed by a cavity with long round trip length able to simulate a mode cleaner.
2. Fabrication of 'detectors' for out of loop noise analysis and to measure cross coupling transfer functions: a analyzer cavity, high power photodetectors, position sensitive detectors;
3. Simulation and testing of several control system topologies;
4. Continuing cross coupling measurements with LIGO PSL-group;
5. Evaluating of design choices between MOPA and injection locking.

Approved:

Barry Barish

Barry Barish
LIGO Principal Investigator

March 12, 1998

Date

Karsten Danzmann

Karsten Danzmann
GEO 600 Principal Investigator

12, 3, 98

Date

James Hough

James Hough
GEO 600 Principal Investigator

March 13, 1998

Date

Bernard Schutz

Bernard Schutz
GEO 600 Principal Investigator

13 March 1998

Date