

**Attachment Number C to the
Memorandum of Understanding (LIGO-M970077-00-M)
between the
German/British Collaboration for the Detection of Gravitational Waves
(GEO600)
and the
Laser Interferometer Gravitational Wave Observatory (LIGO) Laboratory
February 15, 2004**

This Attachment to the Memorandum of Understanding LIGO-M970077-00-M covers the role of GEO600 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, 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 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 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 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 (GEO600) and the LIGO Laboratory concerning the activities of GEO600 as a Collaborating Institution in the LIGO Scientific Collaboration (LSC) and in the Lasers/Optics Development Group (LODG), and as indicated in Item No. 8.
4. Lasers/Optics Development Group - The Lasers/Optics Development Group (LODG) is 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 - GEO600 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. 8 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 GEO600 members are included in the Attachment Z to the Memorandum of Understanding LIGO-M970077-00-M.

7. During the period from February 15, 2004 to August 15, 2004, the following GEO600 personnel will participate in LODG activities:

University of Hannover, Institut für Atom und Molekülphysik and Max Planck Institute für Quantenoptik, Garching

Faculty:	Danzmann (10%), Willke (30%), Rowan (35%), Hough (20%)
Postdocs:	
Grad. Students:	Heurs (100%), Seyfert (100%),
Engineers:	Weidner (50%), zur Mühlen (50%)

8. The GEO600 group is taking the leading role in the Advanced LIGO (AdLIGO) pre-stabilized laser system (PSL) development. This includes overseeing the laser development at the Laser Zentrum Hannover (LZH) as well as the development of the power and frequency stabilization feed-back control loops. In addition the GEO600 group will continue the investigations of cross-coupling between the different stabilization loops of the GEO600 PSL and long-term test of this system at the GEO site.

During the period February 15, 2004 to August 15, 2004, the GEO600 group will work on the following tasks:

a) Work on the development of the AdLIGO laser system will continue at the LZH. During this MOU period the performance of a 200W laboratory prototype system will be tested. Injection locking studies as well as first stabilization experiments of this system are planned. Special attention will be paid to the free running noise of the system and the transfer function of available actuators for the power and frequency stabilization.

- b) One of the main challenges for the AdLIGO PSL will be the power stabilization. Experiments at the 10W level will continue to analyze and reduce the excess noise sources between in-loop and out-of-loop measurements.
 - c) We will work together with the AdLIGO systems group to prepare the Conceptual Design Requirements Document and the corresponding review.
 - d) Coordination of the Lasers Working Group of the LSC.
 - e) Studies of the mechanical dissipation of coatings (in collaboration with MIT, Hobart and William Smith Colleges, Caltech, Stanford and the coating vendors):
 - 1) containing doped or structurally modified Ta₂O₅
 - 2) using alternate high index materials.
9. During the period February 15, 2004 to **August 15, 2004**, the LIGO Laboratory will share, as requested and appropriate, LIGO data of relevance to the research topics in Item No. 8.
10. The research effort pursuant to this Attachment C will be coordinated by Benno Willke and David Shoemaker on behalf of GEO600 and the LIGO Laboratory, respectively.
11. Resource Sharing: The GEO600 and 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. 8, as indicated below.
- a) LIGO Laboratory will provide accommodations for GEO600 investigators while on LIGO research assignment at Caltech, and/or LIGO sites.
 - b) GEO600 will provide accommodations for LIGO investigators while on LIGO research assignment at GEO600 sites.

Approved:

Barry Barish
Barry Barish
LIGO Laboratory Director
19-Feb-04
Date

Karsten Danzmann
Karsten Danzmann
GEO600 Principal Investigator
27-3-04
Date

James Hough
James Hough
GEO600 Principal Investigator
16/03/04
Date

Bernard Schutz
Bernard Schutz
GEO600 Principal Investigator
15 March 04
Date