

**Attachment Number D 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 Advanced Detector Configurations Development Group (ADCDG). 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 Advanced Detector Configurations Development Group

(ADCDG).

4. Advanced Detector Configurations Development Group - The Advanced Detector Configurations Development Group (ADCDG) will be the scientific collaboration for defining and developing entirely new advanced interferometers. It is expected that this development group will pursue research in dual recycling, resonant sideband extraction, Sagnac interferometers, systems with non-transmitting optics and other advanced configurations. 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 ADCDG activities:

Universitat Hannover, Institut fur Atom und Molekulphysik: Max Planck Institute fur Quantenoptik, Garching, Glasgow University, Glasgow.

Faculty:	Danzmann (5%), Aufmuth (10%)
Equivalent Faculty:	Ruediger (10%), Schilling (20%), Winkler (10%)
Postdocs:	Strain (40%), Skeldon (20%)
Ph. D. Student:	Heinzel (80%)
Engineers:	Weidner (20%), Klein (20%), Emme (40%)

8. Investigations in Advanced Interferometer Configurations, relevant to Enhanced/Advanced LIGO Interferometers, for the period, February 15 1998 - August 15 1998.
 - a. System under development for GEO 600:
 1. The GEO 600 concept is a dual-recycled interferometer, using four-pass delay lines in its 600m arms;
 2. Signal recycling (power recycling is considered standard for all current detectors) is a unique feature of GEO 600, but one that could find future application in other detectors;
 3. Resonant Sideband Extraction, also being investigated, has many configurational similarities with signal recycling. It is being considered by several groups as a promising future configuration.

b. Planned research relevant to this Attachment:

Current and future activities at Garching (30m prototype), Glasgow (10m prototype), and Hannover (GEO site), will include:

1. Automated alignment of the optical components (30m), currently for 10 degrees of freedom;
2. A systematic lock acquiring procedure (30m), currently being brought to the required robustness;
3. Further quest for a fully dual recycled interferometer (30m), with the aim of demonstrating better noise behavior;
4. Simulation of optimized lock acquisition for dual recycling, both for the 30m prototype (already promising solutions) and for GEO 600;
5. Development of software for easier determination and design of transfer functions and for easier design of analog circuitry, including the simulation of noise and determination of stability.

c. Timescale

1. Some of the tasks described are essential for GEO 600, and they will be treated with highest priority.
2. Some other tasks will, however, not come to bear before the first detectors are in operation, and thus also the preparatory research will be done with lesser priority.

Approved:

Barry Barish
 Barry Barish
 LIGO Principal Investigator

March 12, 1998
 Date

Karsten Danzmann
 Karsten Danzmann
 GEO 600 Principal Investigator

17.3.98
 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