

Memorandum of Understanding
between the
Advanced LIGO United Kingdom (ALUK) Group
and the
Laser Interferometer Gravitational Wave Observatory (LIGO)

The purpose of this Memorandum of Understanding is to define the roles, responsibilities and rights of the Advanced LIGO United Kingdom (ALUK) Group (constituted by members of the German-British GEO consortium) to participate as an International Partner with the Laser Interferometer Gravitational Wave Observatory (LIGO) in Advanced LIGO development, installation and integration. Both parties share the goals of developing and upgrading the existing LIGO observatories, using them to observe gravitational radiation, and subsequently using gravitational radiation as an astrophysical probe. This memorandum outlines the ALUK Group's proposed contribution to the Advanced LIGO Project in exchange for access to data from the LIGO Observatories and participation in Advanced LIGO Project management.

1. The Laser Interferometer Gravitational-wave Observatory (LIGO)

The Laser Interferometer Gravitational-wave Observatory (LIGO) comprises two related organizations, the LIGO Laboratory and the LIGO Scientific Collaboration.

The LIGO Laboratory is a United States national facility for gravitational wave research, providing opportunities for the broader scientific community to participate in detector development, observations, and data analysis. The LIGO Lab comprises designated groups of scientists, engineers, and staff at the California Institute of Technology (Caltech), the Massachusetts Institute of Technology (MIT), and the two LIGO Observatories. Caltech and MIT share prime responsibility for the operation of the LIGO Laboratory and for the design and construction of upgrades, under the terms of a Cooperative Agreement between Caltech and the United States National Science Foundation (NSF).

The LIGO Scientific Collaboration (LSC) is an international consortium of academic and research organizations that contribute to data analysis, the scientific operation of the LIGO observatories, and research and development in support of upgrades to the LIGO observatories. It includes scientists from the LIGO Laboratory and collaborating institutions and has its own internal leadership and governance. The Collaboration ensures equal scientific opportunity for individual participants and institutions. It organizes the research, publications, and other scientific activities. The organization of the LSC and its governance are defined in its Charter.

These two entities report to the LIGO Directorate, consisting of the LIGO Executive Director, the LIGO Scientific Collaboration Spokesperson, and the LIGO Laboratory Deputy Director. The LIGO Oversight Committee provides active oversight of the LIGO Laboratory to assure that the Laboratory acts in the best interests of Caltech, and of MIT and of LIGO's other major stakeholder institutions.

2. Advanced LIGO United Kingdom (ALUK) Group

The Advanced LIGO United Kingdom (ALUK) Group is comprised of three United Kingdom members of the German-British GEO Consortium and their collaborators. It is itself

a member of the LIGO Scientific Collaboration. The objective of ALUK is to contribute to the design, construction and operation of Advanced LIGO, as enabled by a PPARC grant award for this purpose. The wider objectives of GEO are to develop necessary technologies for advanced gravitational wave detectors and to analyze the resulting data. GEO is funded by several German and British agencies, primarily the Max Planck Gesellschaft (MPG) in Germany and the Particle Physics and Astronomy Research Council (PPARC) in the United Kingdom. ALUK is funded by PPARC, with additional contributions from the participating universities.

ALUK consists of the following participants and collaborators:

University of Glasgow: University Project Sponsor: Professor Jim Hough; Principal Investigator: Professor Kenneth Strain; Work Package Manager: Dr. Caroline Cantley

University of Birmingham: University Project Sponsor: Professor Mike Cruise; Principal Investigator and Work Package Manager: Dr. Alberto Vecchio

Cardiff University: Director of Research and Consultancy: Geraint W. Jones; Principal Investigator: Professor B. Sathyaprakash

Collaborators in this project are:

CCLRC: The Council for the Central Laboratory of the Research Councils, Rutherford Appleton Laboratory. Sub-grant for Glasgow to provide overall project management, engineering design, procurement and construction services. Head of Sales Contracts: Mr. Tony Wells; Project Manager: Mr. Justin Greenhalgh

University of Strathclyde: The University Court of the University of Strathclyde, 16 Richmond Street, Glasgow G1 1XQ. Collaborator: Dr. Nicholas Lockerbie

3. **Advanced LIGO International Partners**

Advanced LIGO is the second phase in the LIGO program of gravitational wave detection and observation. The LIGO program first phase includes an initial, three-interferometer detector currently in operation. Upon completion of the phase one observation program, the initial detectors will be replaced by the Advanced LIGO set of three detectors with increased sensitivity and flexibility. The Advanced LIGO Project is the effort to design, build, install and test those enhanced detectors. It is being pursued as an international collaboration. Lead funding for Advanced LIGO will be provided by the U.S. National Science Foundation and lead responsibility for Advanced LIGO design and implementation will be provided by the LIGO Laboratory, under a Cooperative Agreement with the NSF.

International Partners in Advanced LIGO participate in the development, construction and integration of Advanced LIGO, through in-kind contributions provided in project-to-project agreements. In return, International Partners are granted data rights and roles in the governance of the Advanced LIGO Project commensurate with their contributions, as determined by the Advanced LIGO Project Director. The particular roles, responsibilities, and rights of ALUK, as an Advanced LIGO International Partner, are given in detail in the following sections.

4. Responsibilities with respect to Funding Agencies

All parties entering into this Memorandum of Understanding will be responsible for ensuring that all aspects of the activities under this MOU are consistent with the requirements of their agreements with the funding agencies. The LIGO Laboratory is responsible for meeting the terms of its Cooperative Agreement with the NSF, including obtaining NSF approval of certain collaborative Memoranda of Understanding. All Memoranda of Understanding will be provided to NSF for their information. Similarly, ALUK will be responsible to ensure that all aspects of the activities under this MOU are consistent with the requirements under its grant with PPARC and GEO.

5. Partner Contributions to Advanced LIGO

As an International Partner in Advanced LIGO, the ALUK Group will provide expertise, support, and equipment in the spirit of the proposal document "Exploring the Dark Side of the Universe – Proposal for UK Involvement in Advanced LIGO" (version 2, November 2002) and any subsequent revisions. Principal elements of this proposal are the delivery of test mass suspensions and a subset of the test mass substrates for integration into the Advanced LIGO detectors. The exact scope of work will be negotiated between LIGO and ALUK during the design phase as interfaces are defined, performance requirements are formalized, and delivery schedules are base-lined.

All equipment supplied by ALUK will be consistent with negotiated parameters, including interfaces, technical performance, and schedule. All equipment supplied by ALUK under this MOU for installation in the Advanced LIGO detectors will become property of Caltech to use in the installation of Advanced LIGO. From the time at which equipment is delivered to LIGO in a condition ready for installation, all maintenance, repair and adjustment costs will be the responsibility of LIGO. LIGO Laboratory will ensure that all equipment provided by ALUK will not be used for other than its intended purpose for the duration of the Advanced LIGO Project. Use of the equipment for other purposes between the time of delivery for installation and the acceptance of the detectors at the end of the Advanced LIGO Project requires the express consent of ALUK. ALUK will not be responsible for the decommissioning of equipment or its removal from Advanced LIGO after its period of usefulness has expired.

6. Partner Management Role in Advanced LIGO

As an International Partner in Advanced LIGO, ALUK will be granted a role in the management of the development, design, construction, integration, and testing of, and the planning for observations with Advanced LIGO through established structures. In particular:

- Individual members of ALUK will have opportunities equal to those of LIGO Laboratory staff to serve as subsystem leaders, subsystem scientists and other Advanced LIGO Project roles.
- ALUK will be allocated membership(s) on the Advanced LIGO Core Committee, the principal management body of the Advanced LIGO Project, commensurate with their project responsibilities and as determined by the Advanced LIGO Project Director. This will ensure that ALUK will be fully informed of and can participate in management decisions regarding design and construction status, integration and testing activities, and the Project planning for astrophysical observation and instrument configuration.
- ALUK will have representation on the Advanced LIGO Change Control Board and will participate in all consideration of changes in budget, schedule, scope or technical performance affecting Advanced LIGO.

- ALUK representatives will be invited for all major meetings affecting Advanced LIGO, including the LIGO Program Advisory Committee, and periodic NSF reviews of LIGO.
- The LIGO Oversight Committee is constituted such that four stakeholders are allocated seats on the committee. At present these are allocated to PPARC, the Max Planck Gesellschaft, the University of Wisconsin-Milwaukee, and Louisiana State University. If the number of stakeholders increases, the allocation of seats will be reviewed, and it may become necessary to rotate the membership of the committee among the stakeholders.

7. Partner Rights and Responsibilities with Respect to LIGO Data

As an International Partner in Advanced LIGO, ALUK will have full rights to all data from Advanced LIGO. The rights to data, analysis, publication and dissemination of LIGO results accrue through its participation in the LSC. These rights, and the corresponding responsibilities, are documented in the LSC Charter and By-laws, LIGO-M010213-01-M, and include a commensurate role in the governance of the LSC. Publication and publicity for results should meet LSC policy, where appropriate. The Partners will ensure that, wherever practicable, all publications or other outputs from or related to work performed under this MOU will acknowledge the Partners and the funding sources.

8. Intellectual Property

The rights to intellectual property developed under this Memorandum of Understanding using LIGO Laboratory resources will be subject to the National Science Foundation Grant Policy as indicated in Section 730, Intellectual Property.

A. In the event a patentable invention is conceived or first actually reduced to practice (built and tested) during the work of a member(s) of the ALUK Group at LIGO Laboratory facilities, he/she will:

- i) make prompt disclosure of the invention to the Director of the LIGO Laboratory; and
- ii) cooperate with LIGO Laboratory and supply all information and execute all papers including invention reports, records of invention, patent applications and powers of attorney, necessary and proper to fulfill the obligations of the LIGO Laboratory to the U.S.

Government sponsor.

B. The ownership of inventions conceived solely by members of the ALUK Group at LIGO facilities shall be owned by the ALUK according to their internal agreements, although the LIGO Laboratory shall be granted a license to use such invention for noncommercial research purposes at LIGO facilities. Inventions that are conceived by both members of the ALUK Group and LIGO Laboratory staff as part of the LIGO project shall be jointly owned and any income from commercial licensing shall be shared in proportion to the number of joint inventors from each institution.

In all other regards, the rights to intellectual property developed by members of the ALUK Group under this Memorandum of Understanding will be in accordance with the policies of their organizations.

9. Management and Support of Staff

Each party to this agreement continues to be responsible for all personnel management and support costs of its own staff, including travel costs associated with the activities under this agreement. Exceptions for the support by one institution for travel costs incurred by members of another institution may be allowed by mutual agreement of the affected institutions.

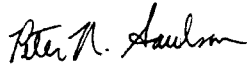
10. MOU Terms of Agreement

This Memorandum of Understanding will remain in force through the design, fabrication and integration phase of the Advanced LIGO Project. ALUK may terminate the collaboration with three month's notice with no continuing obligation for the Advanced LIGO Project; in this case, any designs, analyses, and documentation carried out to date in the context of the ALUK planned contribution will be shared with LIGO for LIGO's further use, and equipment donated by ALUK to LIGO at the time of the termination remains with LIGO to be used by LIGO as LIGO sees fit. Data rights and publication rights in LIGO continue to be governed by the nature of participation by ALUK institutions in the LIGO Scientific Collaboration. By mutual consent, new members may be added when they sign this MOU. Signing this MOU does not constitute a legally binding agreement.

11. List of Signatures:


Jay Marx
LIGO Laboratory Director

28 March 2006
Date



Peter Saulson
LIGO Scientific Collaboration Spokesperson

28-March-2006
Date



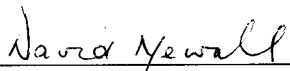
~~David Shoemaker~~
Advanced LIGO Project Leader

27-March-2006
Date



Jeff Down
Particle Physics and Astronomy Research Council

18 April 2006
Date



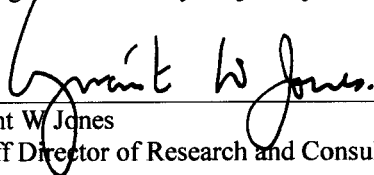
David Newall
Secretary of Court of the University of Glasgow

4 May '06
Date



Mike Cruise
Birmingham University Project Sponsor

21/4/06
Date



Geraint W Jones
Cardiff Director of Research and Consultancy

28 April, 2006.
Date