

**Attachment OPT to the
Memorandum of Understanding (LIGO-M060057-00-M)
between the
Embry-Riddle Gravitational Wave Astrophysics Group (ERGWAG)
and the
Laser Interferometer Gravitational Wave Observatory (LIGO)
August 15, 2005**

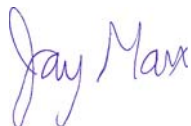
This Attachment OPT to the Memorandum of Understanding LIGO-M060057-00-M defines the role of the Embry-Riddle Gravitational Wave Astrophysics Group (ERGWAG) as a Member of the LIGO Scientific Collaboration (LSC) and a member of the Optics Development Group (ODG). The period of performance for the activities in this Attachment is from August 15, 2005 to August 15, 2006.

1. Optics Development Group – The Optics Development Group (ODG) is the scientific collaboration for defining and developing improvements in optics for use in advanced subsystems for the initial LIGO interferometers or in entirely new advanced interferometers. MOU Attachments define the roles and responsibilities of groups in this development group.
2. During the period August 15, 2005 to August 15, 2006, the members of ERGWAG Group will participate in ODG in the following areas:
 - a) *Optics Characterization* -- ERGWAG will do exploratory experimental research into composite test masses. The goal of this research is to develop high mass test masses for future interferometers by embedding a high-quality optical material such as fused silica within a ballast of inexpensive and readily available material, such as steel. As our understanding of how thermal noise has evolved it has become apparent that this approach is more promising than previously realized. The main challenge is to construct the interface between the optical material and the ballast material that does not lead to excessive thermal noise nor to non-gaussian creak noise during heating and cooling due to absorbed laser light. ERGWAG will begin the characterization of the interface region by learning to model contacts with a finite element analysis program like FemLab and comparing predicted loss with actual measured loss in clamped metal fibers like the initial LIGO suspension fibers. This research is therefore immediately applicable to the design of low-loss clamps for the Initial LIGO Upgrade planned after the S5 run. With this clamp research, ERGWAG intends to contribute directly to the upgrade effort.

3. Resource Sharing: 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. 2, as indicated below.
 - a) Research accommodations for ERGWAG group members while on LIGO research assignment at any LIGO Laboratory site,
 - b) Access to LIGO data in support through established LSC channels in support of this work.
4. Coordination and Reporting – ERGWAG Group will perform this research within the structures established by the LIGO Laboratory and the LSC where appropriate. In particular activities described in Item 2 will be carried out within the Optics Development Working Group of the LSC. Coordination will include keeping the Group leaders informed of activities and plans, reporting to the group at meetings and telecons, and through technical documents submitted to the LIGO Document Control Center.

In addition, an annual report will be submitted with the update to this Attachment, giving a summary status on research by topic as indicated in Item No. 2, 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. This Attachment will be updated at least annually with a plan of activities for the succeeding on-year period. These documents will be due one month before the close of the period of performance under this Attachment.
5. The research effort pursuant to this Attachment will be coordinated by Andri M. Gretarsson(ERGWAG Group) and the leader(s) of the ODG .

Approved:



Jay Marx
LIGO Laboratory Director

Andri M. Gretarsson
ERGWAG Principal Investigator



Peter Saulson
LSC Spokesperson

David Reitze
ODG Leader