



**Attachment SUS to the
Memorandum of Understanding LIGO-M060057-00
between the Embry-Riddle Gravitational Wave Astrophysics Group
(ERGWAG)
and the
Laser Interferometer Gravitational Wave Observatory (LIGO)
For The Period
August 15, 2007 - August 14, 2008**

This Attachment SUS to the Memorandum of Understanding LIGO-M060057-00 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 Isolation/Suspension/Thermal Noise Development Group (ISTNDG). The period of performance for the activities in this Attachment is from August 15, 2007 - August 14, 2008.

1. Collaboration

The Isolation/Suspension/Thermal Noise Development Group (ISTNDG) is the scientific collaboration for defining and developing instruments in optics for use in advanced subsystems for the initial LIGO interferometers or in entirely new advanced interferometers. MOU Attachment SUS defines the roles and responsibilities of workgroups in this development group.

2. Participation

During the period August 15, 2007 - August 14, 2008, the members of ERGWAG will participate in in ISTNDG in the following areas:

a. Coating Losses

The Embry-Riddle group will continue to characterize the level of Brownian thermal noise in Advanced LIGO by measuring quality factors of test samples and applying the results to the calculation the noise in Advanced LIGO. We will continue to be an active member of the coating research group within the LSC optics working group and will participate in the group's efforts to develop the final baseline coating for AdLIGO. Concurrently, we will work towards the identification of coating types offering an increase in sensitivity for possible AdLIGO upgrades.

The Embry-Riddle group will also continue the characterization of thermo-optic noise in Advanced LIGO. We will be upgrading the apparatus for measuring the relevant parameters (primarily dn/dT for the high index layers) to work at 1064 nm and hope to further reduce systematic effects. We will characterize the baseline

coating for AdLIGO but will also be testing promising coatings for possible AdLIGO upgrades, where many parameters including dn/dT, loss angle, optical loss, etc. must be improved simultaneously.

b. Suspension Design for Advanced LIGO

Short, detectable gravitational waves are expected to be rare events in an extremely large body of data. In that context, the characterization and reduction of "background" transients of technical origin is crucial. The Burst and Inspiral searches are particularly vulnerable. The class of possible transients originating in realistic interferometer suspensions are not well studied. In Advanced LIGO, sources of transients originating in the fused silica fibers themselves have been investigated in some depth [Gretarsson et al., Bilenko et al.]. Yet, we still know very little about the characteristics of transients coming from higher up in the Advanced LIGO suspensions. Similarly, in the context of Enhanced LIGO (which will likely use the same clamps and wire standoffs like Initial LIGO) stick-slip and rubbing of the metal wires in the clamp due to imperfect clamping conditions are a possible source of transients that is not well studied.

Initially, the Embry-Riddle group will study the role of suspension transients in a mock-up of the Enhanced LIGO suspension conditions. The level and distribution of non-gaussian events will be recorded as the suspension's pendulum mode is driven to amplitudes covering the typical range seen in the current interferometers. The code for analyzing transient rates, statistical distribution of transients, and the procedure for estimating the impact (or hopefully the lack of it) on the various signal searches will be developed at this stage. In the second stage of the project (which will probably occur after the current MOU period) transients from a full Advanced LIGO suspension will be investigated using violin-mode monitors in LASTI.

c. Other Contributions

Not Applicable

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.

Not Applicable

- b. Access to LIGO data through established LSC channels in support of this work.

LIGO will provide ERGWAG access to the full LIGO data stream (S5 onwards) through the usual LSC mechanisms. This is already necessary as part of attachment DAT, but is also needed as part of the current attachment. ERGWAG will be comparing the level of upconversion in S5, (later S6) data with the levels expected based on the outcomes of the fiber rubbing experiment described elsewhere in this attachment. S5 data will also be used initially to set a lower limit on the sensitivity required in the fiber-rubbing experiment.

4. Coordination and Reporting

ERGWAG will perform 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 Isolation/Suspension/Thermal Noise Development Group of the LSC.

This includes 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 one-year period. These documents will be due one month before the close of the period of performance under this Attachment.

5. Computer Code

All computer code delivered to the LSC under this Attachment must be developed in consultation with the LSC Data Analysis Software Working Group (DASWG) and archived, documented and reviewed as determined by that group.



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