

Lumatrex, Inc.

**PROPOSAL FOR THE PREPARATION OF A TECHNICAL
REPORT DOCUMENTING METHODS OF PROPELLER CUT
ANALYSIS BASED ON THE USE OF PHOTOGRAPHS OF CUTS
AND SCARS ON CARCASSES AND LIVING ANIMALS**

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Proposal No.: 050403

April 3, 2005

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This document proposes the preparation of a technical report documenting improved methods and computational tools for using photographs of living animals and carcasses as well as direct measurements of carcasses for analyzing the scars and cuts resulting from propeller strikes on various species of marine mammals. These methods and computational tools have already been developed with the support of Speed Drill Software, Inc. and Lumatrex, Inc. and are currently used by the primary researcher to ascertain the physical characteristics of propellers that create observed scars and cuts, to gain insight into the types of vessels involved in fatal and nonfatal propeller strikes on various species of marine mammals, and to gain insight into the reactions of the animals immediately before and during the accident. The intent of the resulting report will be to provide other researchers with access to these improved methods and computational tools.

BACKGROUND

Marine mammal species worldwide are being injured or killed by propeller strikes and collisions with vessels. The analysis of cuts and scars left by propellers can help provide information regarding the types of vessels involved in propeller strikes on specific species and the operational characteristics of these vessels which may be contributing factors. In specific cases, it may also be possible to gain insight into the behavior of the animals just before and during the accident. Current methods of analyzing propeller cuts rely on direct measurement of cut dimensions taken during necropsies and on the shapes of cuts. These methods are generally unreliable, inaccurate, and lead researchers to draw incorrect conclusions. These methods are also generally limited to fatal wounds on

carcasses and do not allow researchers to investigate the nonfatal wounds seen on living animals.

CURRENT STATUS OF RESEARCH

The research that is the subject of the proposed technical report was initiated in the early months of 2001 and has been supported in its entirety by Speed Drill Software, Inc. and Lumatrex, Inc. Development of the methods and computational tools was completed by the end of 2004. Amy Knowlton of the New England Aquarium (NEAq) assisted in locating suitable test cases in the right whale necropsy RKB-1424 and a non-fatal vessel strike on right whale 2425. Both of these accidents were reported incidents, and the specifics of the vessels involved were well documented.

Appropriate documents and photographs of necropsy RKB-1424 were provided for analysis in early March of 2005. The size of the propeller involved in this incident was withheld until the analysis was completed. Photographs of the injured adult right whale 2425 were provided for analysis in late March of 2005. The analysis of this non-fatal accident was conducted as a blind test of the methods developed by the key researcher and all additional information was withheld until after the analysis was completed. An evaluation of the propeller cuts documented in each of these cases was performed by the primary researcher, and the results of those two evaluations are included as attachments to this proposal. These evaluations are also available at:

<http://www.lumatrex.com/RKB1424Evaluation.htm>

and

<http://www.lumatrex.com/RW2425Evaluation.htm>

The methods developed during this research effort use the position and size of propeller cuts visible in photographs for evaluation and do not rely on complex hydrodynamic variables such as propeller pitch and slip. These new methods are reliable and allow researchers to determine the diameter of the propeller, the number of blades on the propeller, the approximate pitch of the propeller, the direction of propeller rotation, the approach direction of the vessel, the relative advance coefficient of the vessel, and changes in the relative speed of the vessel and/or the animal during the accident. If the accident is a witnessed event and the speed of the vessel and rotation speed of the propeller are known, the actual speed of the animal at the point each cut is created can be calculated.

These methods can be applied to photographs of propeller cuts and scars on carcasses as well as on living animals. This will allow researchers to properly evaluate data included in existing and future necropsy reports and to collect data on nonfatal propeller strikes on living animals. This has long been considered a difficult if not impossible task on most species of marine mammals, however initial applications of these methods demonstrate

that this can be done simply, efficiently, and accurately without making direct contact with the animals. This will allow researchers to compare the specific details of fatal verses nonfatal propeller strikes.

PROPOSED TECHNICAL REPORT

The proposed technical report will include the mathematical and geometric derivation of methods and computational tools for analyzing propeller scars and cuts observed in photographs of living individuals as well as carcasses of marine mammals. These derivations will be used to develop the underlying theory and will be presented in detail sufficient to establish the validity of the resulting methods of analysis. This effort will provide other researchers with a theoretical foundation for expanding on the results of the study.

The right whale necropsy report RKB-1424 and the non-fatal vessel strike on right whale 2425 will be included as case studies to demonstrate the effectiveness and validity of these methods and computational tools in a practical applications. These accidents are witnessed events, and the level of documentation available regarding the physical characteristics and operation of the vessels involved make them uniquely suitable for this purpose.

DELIVERABLES

All results, methods and computational tools developed in the course of the research phase of the study will be included in a technical report presented in Microsoft Word or PDF format. The final report will initially be published, with the key researcher recognized as the author of the study and with appropriate recognition of the funding organizations, in a publication or journal selected by the key researcher. Any subsequent publication of the final report will also recognize the key researcher as the author of the study and will provide appropriate recognition of the funding organizations. One copy of the final report will be submitted to each of the funding organizations on CD-ROM media. The key researcher will be free to reference the study and the final report as the result of his personal efforts, develop derivative studies based on this effort, and develop and publish additional reports based on this effort.

KEY RESEARCHER

James L. Wood is the Principal Researcher for Lumatrex, Inc. He is the key researcher responsible for the development of the methods and computational tools which will serve as the basis for the technical report proposed here.

TIMELINE

Preparation of the proposed technical report will commence as soon as funding becomes available which should be no later than June 1, 2005. Based on the estimated level of effort required for the preparation of the report and assuming the required level of funding is available, it is expected that the report would be completed approximately four (4) months following the initiation of work.

FUNDING RECEIVED TO DATE

Speed Drill Software, Inc. and Lumatrex, Inc. (\$145,000.00) - From early 2001 through June 2002 Speed Drill Software, Inc. supported the research that is the subject of the proposed report. In July of 2002 this company's identity was changed to Lumatrex, Inc. and from that time through February 2005 Lumatrex, Inc. has supported this effort by providing the key researcher's time, providing computer hardware, purchasing necessary software, and funding necessary travel expenses.

REQUESTED FUNDING

This proposal seeks grants from multiple sources to be combined to total \$32,000.00 for the purpose of preparing a technical report for peer review and publication. Funding should be available and work should commence no later than May 1, 2005. This will allow the final document to be finished and available for publication by late summer or early fall 2005.

REFERENCES

Wood, James L., (2005) "Evaluation of Sabreline 42 Express Propeller Strike on Right Whale 2425 off Cumberland Island, Georgia on 10 March 2005 – Field Number: Living Animal," unpublished work included with this proposal and also available at: <http://www.lumatrex.com/RW2425Evaluation.htm>

Wood, James L., (2005) "Evaluation of USCG Cutter Point Francis Propeller Strike on Right Whale Calf - Field Number: RKB-1424," unpublished work included with this proposal and also available at: <http://www.lumatrex.com/RKB1424Evaluation.htm>

Wood, James L., (2001) "A Simple and Effective Method for Analyzing Propeller Marks on Manatee in Brevard County, Florida, USA," peer reviewed but unpublished work available at: <http://www.lumatrex.com/SimplePropellerMarkAnalysis.htm>

PROPOSED BUDGET

Key Researcher's labor	\$29,500.00
Travel Expenses	1,750.00
Miscellaneous materials cost	<u>750.00</u>
Total Requested Funding	\$32,000.00

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