Cooperative Research and Development Agreement (CRADA) Final Report

Report Date: 05/01/2024

In accordance with Requirements set forth in the terms of the CRADA, this document is the CRADA Final Report, including a list of Subject Inventions. It is to be forwarded to the DOE Office of Scientific and Technical Information upon completion or termination of the CRADA, as part of the commitment to the public to demonstrate results of federally funded research.

Parties to the Agreement: Lawrence Berkeley National Laboratory and Defense Advanced Research Projects Agency

CRADA number: FP00013635

CRADA Title: High-Precision Low-Cost Micro Birdbath Resonating Gyroscope

Responsible Technical Contact at Berkeley Lab: Melanie Sonsteng

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Sponsoring DOE Program Office(s): The Cyclotron Road program is sponsored by DOE AMMTO. This fellow's project was sponsofred by DOD DARPA.

LBNL Report Number: LBNL-2001579

OSTI Number:
[SPO to complete]

Joint Work Statement Funding Table showing DOE funding commitment:

DOE Funding to LBNL	(100,000 from DARPA)
Participant Funding to LBNL	0
Participant In-Kind Contribution Value	100,000.00
Total of all Contributions	200,000.00

Provide a list of publications, conference papers, or other public releases of results, developed under this CRADA:
(Publications must include journal name, volume, issue, Digital Object Identifier)
None.

Provide a detailed list of all subject inventions, to include patent applications, copyrights, and trademarks:
(Patents and patent applications are to include the title and inventor(s) names. When copyright is asserted, the Government license should be included on the cover page of the Final Report)
None.

Executive Summary of CRADA Work:

As part of the Cyclotron Road program, Enertia Microsystems Inc. (EMI) investigated a high-performance micro mechanical resonator called the micro birdbath resonator and a high-precision micro electromechanical systems (MEMS) gyroscope called the birdbath resonator gyroscope (BRG). The BRG is a novel fused-silica MEMS gyroscope. The BRG can obtain significantly greater accuracy, comparable size, and comparable cost with MEMS gyroscopes made of silicon that are currently on the market.

Summary of Research Results:

The team fabricated and evaluated the fused-silica micro birdbath resonator and the birdbath resonator gyroscope (BRG). The team built and evaluated the electromechanical characteristics of micro birdbath resonators, and the performance of the birdbath resonator gyroscope (BRG) in harsh environmental conditions. The project work involved assessing and exploring solutions for the key technical risks and challenges including the fabrication of micro birdbath resonators with high mechanical quality factor and high mechanical symmetry, formation of small and uniform capacitive gaps, hermeticity and vacuum level of the vacuum package, and accuracy of the control algorithm.