PNGV NOx Sensors and Systems for Engine Management

Final Report
CRADA No. TC-0357-92

Date: December 18, 1996

TACT: E&E

Revision: 1

A. Parties

The project is a relationship between the Lawrence Livermore National Laboratory (LLNL) and General Motors, AC Rochester Division.

University of California
Lawrence Livermore National Laboratory
PO Box 808, L-795
Livermore, CA 94551

General Motors, AC Rochester Division
1300 North Dort Highway
Flint, MI 48556

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B. Project Scope

Lawrence Livermore National Laboratory and General Motors' AC Rochester Division formed an agreement to reduce emissions of nitrogen oxides from automobiles by developing a fiber-optic pressure sensor integrated into a spark plug and a new spark plug material with improved thermal conductivity and anti-fouling characteristics. These improvements will help the U.S. auto industry's global competitiveness by improving fuel economy and reducing exhaust emissions. The reconfigured DOE Complex will benefit from enhanced process control by meeting safety requirements that limit worker exposure to chemicals and radiation in automated facilities.

C. Technical

Milestones and Deliverables

	Completion Date	
	Scheduled	Actual
1. Laboratory prototypes of pressure fiber-optic sensor.	12/93	01/94
2. Laboratory model of aluminum nitrate spark plug.	07/94	
3. Laboratory prototype of micro-machined pressure fiber optics sensor.**	08/94	08/94
4. Breadboard control electronics, field test.	12/94	12/94
5. Prototype tests in concert with GM.	08/95	
6. Packaging of sensor and control electronics.	12/95	

** Change: 1) GM decided not to embed the sensor in a spark plug. 2) Decided to use micro machining.

D. Partner Contribution

- The Engine Cylinder Pressure Sensor Built into Spark Plug overall design was worked on and tested for method development at General Motors.
- General Motors performed preliminary dielectric strength analysis on combustion synthesis samples.
- General Motors/ACR investigated heater substrates with rolled tape YSZ electrolyte for linear oxygen sensor.

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E. Documents/Reference List

Quarterly reports of the following dates:

3/31/94, 6/30/94, 9/30/94, 12/31/94, 3/31/95, 6/30/95

Subject Invention

IL-9689-C, Low-Cost Optic Pressure Sensor, by Sang K. Sheem, disclosure submitted 2/27/95. Provisional patent application submitted to the US PTO.

F. Acknowledgment

Participant's signature of the final report indicates the following:

- 1) The Participant has reviewed the final report and concurs with the statements made therein.
- 2) The Participant agrees that any modifications or changes from the initial proposal were discussed and agreed to during the term of the project.
- 3) The Participant certifies that all reports either completed or in process are listed and all subject inventions and the associated intellectual property protection measures attributable to the project have been disclosed or are included on a list attached to this report.
- 4) The Participant certifies that if real property was exchanged during the agreement, all has either been returned to the initial custodian or transferred permanently.
- 5) The Participant certifies that proprietary information has been returned or destroyed by LLNL.

Carl Miller	Sang Sheem
General Motors	Lawrence Livermore National Laboratory
AC Rochester Division	
Date	Date
2 April 97	3/13/97

- Attachment I - Final Abstract
- Attachment II - Project Accomplishments Summary
- Attachment III - Final Quarterly Report

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not included.
financial data removed.

NO_x-Sensors and Systems for Engine Management

Final Abstract Attachment I CRADA No. TC-0357-92

Date: 1/10/97

Revision:

Lawrence Livermore National Laboratory and General Motors' AC Rochester Division formed an agreement to reduce emissions of nitrogen oxides from automobiles by developing a fiber-optic pressure sensor integrated into a spark plug and a new spark plug material with improved thermal conductivity and anti-fouling characteristics. These improvements will help the U.S. auto industry's global competitiveness by improving fuel economy and reducing exhaust emissions. The reconfigured DOE Complex will benefit from enhanced process control by meeting safety requirements that limit worker exposure to chemicals and radiation in automated facilities.

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Project Accomplishments Summary (Attachment II) CRADA No. TC-0357-92

Date:

Revision:

A. Parties

The project is a relationship between the Lawrence Livermore National Laboratory (LLNL) and General Motors, AC Rochester Division.

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B. Background

General Motors maintains headquarters in Detroit, Michigan. Their AC Rochester Division, located in Flint, Michigan, supplies automotive components to General Motors. U.S. auto industries are looking to improve fuel economy and reduce exhaust emission with a sensor integrated into a spark plug and a new spark plug material with improved thermal conductivity and anti-fouling characteristics.

C. Description

Lawrence Livermore National Laboratory and General Motors, AC Rochester Division, formed an agreement to reduce emissions of nitrogen oxides from automobiles by developing a fiber-optic pressure sensor integrated into a spark plug and a new spark plug material with improved thermal conductivity and anti-fouling characteristics. These improvements will help the U.S. auto industry's global competitiveness by improving fuel economy and reducing exhaust emissions. The reconfigured DOE Complex will benefit from enhanced process control by meeting safety requirements that limit worker exposure to chemicals and radiation in automated facilities.

D. Expected Economic Impact

The expected benefits from this project are to reduce automobile emissions of nitrogen oxides by developing cost-effective approaches to monitoring and control, and to enhance the industry's competitiveness worldwide by improving fuel economy and reducing exhaust emissions.

E. Benefits to DOE

The Department of Energy (DOE) is expected to benefit from enhanced process control with combustion monitoring sensors throughout the DOE complex, cost-shared development with industry, and the establishment of LLNL as a national resource for sensor technologies for transportation industries. Expansion of LLNL's understanding of atomic-level materials and processes.

F. Industry Area

Transportation.

G. LLNL Point of Contact for Project Information
Sang Sheem, (510) 423-7509.

H. Company Size and Point(s) of Contact
Carl Miller (810) 257-7402, General Motors, AC Rochester Division
General Motors has 745,000 employees worldwide.

I. Project Examples
Manufacturing method and design in General Motors' possession.

J. Release of Information
I have reviewed the attached Project Accomplishment Summary prepared by Lawrence Livermore National Laboratory and agree that the information about our CRADA may be released for external distribution.

Carl Miller
General Motors, AC Rochester Division

2 April 97
Date