

State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 05-75

December 8, 2005

Agenda Item No.: 05-12-2

WHEREAS, the Air Resources Board has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2604-250, entitled "CO₂ Emission Quantification from Vehicle Air Conditioning Operation in California-Specific Conditions", has been submitted by California State University, Northridge;

WHEREAS, the Research Division staff has reviewed and recommended this proposal for approval; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

Proposal Number 2604-250 entitled "CO₂ Emission Quantification from Vehicle Air Conditioning Operation in California-Specific Conditions", submitted by California State University, Northridge, for a total amount not to exceed \$400,000.

NOW, THEREFORE BE IT RESOLVED, that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendation of the Research Screening Committee and approves the following:

Proposal Number 2604-250 entitled "CO₂ Emission Quantification from Vehicle Air Conditioning Operation in California-Specific Conditions", submitted by California State University Northridge, for a total amount not to exceed \$400,000.

BE IT FURTHER RESOLVED, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in an amount not to exceed \$400,000.

I hereby certify that the above is a true
and correct copy of Resolution 05-75, as
adopted by the Air Resources Board.

Lori Andreoni, Clerk of the Board

ATTACHMENT A

“CO₂ Emission Quantification from Vehicle Air Conditioning Operation in California-Specific Conditions”

Background

In the Board's recently adopted greenhouse gas regulation, credits are awarded for a limited group of air conditioning (A/C) system modifications that reduce CO₂ emissions (“indirect emissions”) during operation. The value of the credits is now based only on estimates from vehicle simulation modeling because a reliable and comprehensive test method has not been developed for measuring the impact that vehicle A/C system operation has on CO₂ emissions under "real-world" conditions. Since actual measured test values representative of real-world operation are likely to be more accurate and encompassing than model estimates, it is desirable to develop an appropriate vehicle test and credit certification procedure.

Objective

The project's objective is to develop a whole vehicle test procedure for measuring the impact that vehicle A/C system operation has on CO₂ emissions in "real-world" California operating conditions. It is intended that the resulting procedure can then be incorporated into ARB's greenhouse gas regulation and will be used to quantify CO₂ emission reductions from technological advances in A/C system design and from features that reduce vehicle solar load.

Methods

The project methodology consists of two major parts: 1) Acquisition of data on operator behavior and A/C system operation from vehicles operating in California under a wide range of climate and traffic conditions; to be conducted by the principal investigator (PI) at California State University, Northridge (CSUN); and, 2). Developing, analyzing and verifying options for vehicle and A/C system testing, including an add-on test procedure to the existing FTP, based on the data from CSUN, for determining with regulatory rigor the indirect CO₂ emissions due to A/C system operation under California-specific conditions; to be conducted by the co-investigators at University of Illinois, Urbana-Champaign (UIUC).

Expected Results

Staff expects that the project will develop a viable test procedure that will enable ARB to realistically replicate “California average” conditions (weather, driving conditions, etc.) during emissions testing of vehicles with A/C. The procedure will also be designed to accommodate upcoming technological innovations that could reduce CO₂ emissions, including modifications consistent with superior A/C systems. Such an ideal test would allow the regulation to apply realistic credit to new technological innovations that reduce CO₂ emissions

Significance to the Board

An improved test procedure would provide increased accuracy in making estimates of the mobile A/C contribution to California's GHG inventory, an important tool in developing climate change policy. This improved procedure could also be used to enhance the current estimates vehicle manufacturers now are allowed to use to meet their GHG requirements under the recently approved regulations resulting from AB1493.

Contractor:
California State University Northridge

Contract Period:
24 months

Principal Investigator (PI):
Timothy Fox, Ph.D.

Contract Amount:
\$400,000

Basis for Indirect Cost Rate:
The State and CSU Northridge have agreed to a ten-percent indirect cost rate.

Past Experience with this Principal Investigator:
The PI has 3 years experience in over-the-road vehicle testing focused on radiator and ozone-reduction catalysts as applied to A/C condensers. He has a further 8 years experience supervising alternative fueled and hybrid electric vehicle development/demonstrations for DOE/SAE/Big Three sponsored University Student Design Competitions as faculty advisor with significant focus on hybrid electric vehicle air conditioning. He designed and developed CSUN's temperature-humidity environmental test chamber, with automotive chassis dynamometer. He worked for 6 years on NASA-sponsored Space and Solar Simulation, developing an infra-red solar/thermal simulation capability for environmental testing of spacecraft in thermal vacuum environments (such space simulation testing required complex data acquisition systems with over 300 measurement channels per test).

Prior Research Division Funding to CSUN:

| Year | 2005 | 2004 | 2003 |
|---------|------|------|------|
| Funding | \$0 | \$0 | \$0 |

BUDGET SUMMARY

California State University, Northridge

“CO₂ Emission Quantification from Vehicle Air Conditioning Operation in California-Specific Conditions”

DIRECT COSTS AND BENEFITS

| | | |
|-----|------------------------------------|------------------------------|
| 1. | Labor and Employee Fringe Benefits | \$ 102,041 |
| 2. | Subcontractors | \$ 147,709 |
| 3. | Equipment | \$ 13,535 |
| 4. | Travel and Subsistence | \$ 6,200 |
| 5. | Electronic Data Processing | \$ 0 |
| 6. | Reproduction/Publication | \$ 0 |
| 7. | Mail and Phone | \$ 0 |
| 8. | Supplies | \$ 33,461 |
| 9. | Analyses | \$ 0 |
| 10. | Miscellaneous | <u>\$ 72,400¹</u> |

Total Direct Costs \$ 375,346

INDIRECT COSTS

| | | |
|----|-------------------------------------|-------------|
| 1. | Overhead | \$ 24,654 |
| 2. | General and Administrative Expenses | \$ 0 |
| 3. | Other Indirect Costs | \$ 0 |
| 4. | Fee or Profit | <u>\$ 0</u> |

Total Indirect Costs \$ 24,654

TOTAL PROJECT COSTS

\$ 400,000

¹ Costs include vehicle-dealer installation support and vehicle maintenance, fuel costs to operate test fleet, modem/cell phone communication link between CSUN and vehicles on the road, stipends, four test vehicle leases and environmental temperature-humidity chamber test fees.

Attachment 1

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Air Conditioning Research Center, University of Illinois

Description of subcontractor's responsibility: The subcontractor will provide an assessment of mobile a/c system operation and correlation with measured operating environment parameters.

DIRECT COSTS AND BENEFITS

| | | |
|-----|------------------------------------|-----------------|
| 1. | Labor and Employee Fringe Benefits | \$ 122,490 |
| 2. | Subcontractors | \$ 0 |
| 3. | Equipment | \$ 0 |
| 4. | Travel and Subsistence | \$ 4,000 |
| 5. | Electronic Data Processing | \$ 0 |
| 6. | Reproduction/Publication | \$ 540 |
| 7. | Mail and Phone | \$ 450 |
| 8. | Supplies | \$ 4,800 |
| 9. | Analyses | \$ 0 |
| 10. | Miscellaneous | <u>\$ 2,000</u> |
| | Total Direct Costs | \$ 134,280 |

INDIRECT COSTS

| | | |
|----|-------------------------------------|------------------|
| 1. | Overhead | \$ 13,429 |
| 2. | General and Administrative Expenses | \$ 0 |
| 3. | Other Indirect Costs | \$ 0 |
| 4. | Fee or Profit | <u>\$ 0</u> |
| | Total Indirect Costs | <u>\$ 13,429</u> |

TOTAL PROJECT COSTS \$ 147,709