State of California
AIR RESOURCES BOARD

Resolution 06-49

December 7, 2006

Agenda Item No.: 06-11-2

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 proposal Number 86, entitled "Retrofit SCR for NOx Emissions Reduction Using Crystalline Matrix Storage for Ammonia," has been submitted by Extengine Transport Systems, LLC, in response to the 2006 Innovative Clean Air Technologies (ICAT) Program solicitation;

WHEREAS, the proposal has been independently reviewed for technical and business merit by highly qualified individuals; and

WHEREAS, the Research Division staff and the Executive Officer and Deputy Executive Officers have reviewed and recommend for funding:

> Proposal Number 86, entitled "Retrofit SCR for NOx Emission Reduction Using Crystalline Matrix Storage for Ammonia," submitted by Extengine Transport Systems, LLC, for a total amount not to exceed $157,000.

NOW, THEREFORE BE IT RESOLVED, that the Air Resources Board, pursuant to the authority granted by Health and Safety Code Section 39703, hereby approves the following:

> Proposal Number 86, entitled "Retrofit SCR for NOx Emission Reduction Using Crystalline Matrix Storage for Ammonia," submitted by Extengine Transport Systems, LLC, for a total amount not to exceed $157,000.

BE IT FURTHER RESOLVED, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and agreements for the efforts proposed herein, and as described in Attachment A, in an amount not to exceed $157,000.

I hereby certify that the above is a true and correct copy of Resolution 06-49, as adopted by the Air Resources Board.

Lori Andreoni

Lori Andreoni, Clerk of the Board

ATTACHMENT A

Innovative Clean Air Technologies (ICAT) Grant Proposal:

"Retrofit SCR for NOx Emission Reduction Using Crystalline Storage Matrix for Ammonia"

Background

Extengine Transport Systems is the process of commercializing a new method of storing ammonia in a solid magnesium hexa-ammine chloride block for selective catalytic reduction (SCR) systems used to reduce NOx emissions from combustion equipment. The solid ammonia storage system is called AdAmmine. The storage of ammonia in a solid matrix instead of a high pressure gas or liquid allows about three times as much ammonia to be stored on board of a vehicle or engine using SCR to reduce NOx emissions.

Objective

The objective of the project will be to demonstrate the effectiveness and feasibility of solid ammonia storage in vehicles using SCR systems to reduce NOx emissions.

Methods

Extengine will first demonstrate the solid ammonia storage system in an SCR system used by an engine operated over an engine dynamometer. The ammonia storage system will then be demonstrated in the field on two engines using SCR. The replacement/recharge frequency of the solid ammonia storage system will be monitored.

Expected Results

It is expected that the project will demonstrate the feasibility of using solid ammonia storage in motor vehicles that use SCR as a NOx emissions control technology.

Significance to the Board

The demonstration of the solid ammonia storage technology would increase the feasibility of SCR as a NOx emissions control technology to comply with ARB regulations.

Applicant: Extengine Transport Systems, LLC

Project Period: April 2007 to April 2008

Principal Investigator: Richard R. Carlson

ICAT Funding: $157,000 (ARB: $78,500, SCAQMD: $78,500)

Co-funding: $181,269

Past Experience with This Principal Investigator:

None.

Prior ICAT Funding to 2006

Year	2005	2004	2003
Funding	0	0	0

BUDGET SUMMARY

Extengine Transport Systems, LLC

"Retrofit SCR for NOx Emission Reduction Using Crystalline Matrix Storage for Ammonia"

Direct Costs and Benefits	**ICAT**	**Total**
1. Labor	$ 41,000	$ 49,206
2. Employee Fringe Benefits	$ 12,000	$ 15,062
3. Subcontractors	$ 87,000	$192,000
4. Equipment	$ 0	$ 3,000
5. Travel and Subsistence	$ 12,000	$ 19,500
6. Materials and Supplies	$ 3,500	$ 5,500
7. Other Direct Costs	$ 1,500	$ 2,500
Total	$157,000	$286,768
Indirect Costs		
1. Overhead	$ 0	$ 29,371
2. Other Indirect Costs	$ 0	$ 22,130
Total	$ 0	$ 51,501
Total Project Costs	**$157,000**	**$338,269**

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Amminex

Amminex is the inventor of the AdAmmine solid ammonia storage system. Amminex will prepare the ammonia storage systems for retrofit on the engine that will be tested on the dynamomter and for the vehicles that will be tested in the field demonstration. Amminex will also provide assistance during the dynamometer testing and field demonstration. The dynamometer testing performed to verify the emissions equivalency of the AdAmmine system with a system using compressed ammonia will be performed at Olson-Ecologic Engine Testing Laboratories.

DIRECT COSTS AND BENEFITS		**ICAT**	**Total**
1.	Labor	$67,000	$97,000
2.	Employee Fringe Benefits	$20,000	$28,000
3.	Subcontractors	$ 0	$ 0
4.	Equipment	$ 0	$ 6,000
5.	Travel and Subsistence	$ 0	$ 18,000
6.	Materials and Supplies	$ 0	$ 5,000
7.	Other Direct Costs	$ 0	$ 3,000
	Total Direct Costs	$87,000	$157,000
INDIRECT COSTS			
1.	Overhead	$ 0	$ 20,000
2.	Other Indirect Costs	$ 0	$ 15,000
	Total Indirect Costs	$ 0	$ 35,000
TOTAL SUBCONTRACTOR COSTS		$87,000	$192,000

(notes)