

State of California
AIR RESOURCES BOARD

Resolution 05-66

December 9, 2005

Agenda Item No.: 05-12-3

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 05b-25, entitled "FreedomAir-Commercial Demonstration Project w/ Long Beach Transit," has been submitted by Rotec Design Ltd in response to the 2005 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 05b-25, entitled "FreedomAir-Commercial Field Demonstration Project w/ Long Beach Transit," submitted by Rotec Design Ltd, for a total amount not to exceed \$225,000.

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 05b-25, entitled "FreedomAir-Commercial Field Demonstration Project w/ Long Beach Transit," submitted by Rotec Design Ltd for a total amount not to exceed \$225,000.

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 \$225,000.

I hereby certify that the above is a true and correct copy of Resolution 05-66, as adopted by the Air Resources Board.

Lori Andreoni, Clerk of the Board

ATTACHMENT A

Innovative Clean Air Technologies (ICAT) Grant Proposal:

“FreedomAir-Commercial Field Demonstration Project w/ Long Beach Transit”

Background

Rotec has developed a technology, which it refers to as FreedomAir. FreedomAir is a reciprocating air pump which bolts on to a diesel engine and enables a four-stroke engine to operate in what Rotec calls a TwinStroke cycle. The TwinStroke cycle is similar to a two-stroke cycle in that combustion and power occur once per piston stroke. The TwinStroke cycle allows the host engine to produce the same power with smaller explosions performed twice as often (compared to the unmodified four-stroke engine). With FreedomAir-equipped engines, 50 percent less fuel is burned in each combustion event, but the number of combustion events is doubled. This, coupled with the excess air that is pumped into the combustion chamber by FreedomAir, causes combustion to be much leaner overall than usual. The lower combustion temperatures and pressures due to the reduced amount of fuel burned in each cycle results in about 70 percent less NOx formation, while the leaner combustion results in about 80 percent lower particulate emissions.

Objective

The objective is to demonstrate the emissions reduction benefits, performance characteristics, and retrofit capability of the FreedomAir technology on an in-use heavy duty diesel engine.

Methods

Rotec will retrofit a heavy duty diesel engine with the FreedomAir technology and then test in the laboratory the retrofitted engine back-to-back against a similar unmodified engine to document the emissions reduction benefits of the technology. Rotec will then install a modified engine into a transit bus operated by the Long Beach Transit District to further demonstrate the emission reduction capabilities and the performance capabilities of the technology.

Expected Results

It is expected that the FreedomAir technology will achieve NOx and PM emission reductions of about 70 percent, and 80 percent, respectively, during the demonstration.

Significance to the Board

A successful demonstration would provide an additional technology that could be retrofitted to heavy-duty diesel engines to meet regulatory requirements.

Applicant: Rotec Design, Ltd

Project Period: December 9, 2005, to December 31, 2007

Principal Investigator: Mark D. Stefl

ICAT Funding: \$225,000

Co-funding: \$375,000

Past Experience with this Principal Investigator:

None.

Prior ICAT Funding to 2005

Year	2004	2003	2002
Funding	0	0	0

BUDGET SUMMARY

Rotec Design, Ltd.

“FreedomAir-Commercial Field Demonstration Project w/ Long Beach Transit”

<u>Direct Costs and Benefits</u>	<u>ICAT</u>	<u>Total</u>
1. Labor	\$ 29,500	\$149,900
2. Employee Fringe Benefits	\$ 0	\$ 37,350
3. Subcontractors	\$ 40,000	\$165,000
4. Equipment	\$ 0	\$ 16,500
5. Travel and Subsistence	\$ 7,300	\$ 37,200
6. Materials and Supplies	\$148,200	\$157,200
7. Other Direct Costs	<u>\$ 0</u>	<u>\$ 0</u>
Total	\$ 225,000	\$563,150
 <u>Indirect Costs</u>		
1. Overhead	\$ 0	\$ 36,850
2. Other Indirect Costs	<u>\$ 0</u>	<u>\$ 0</u>
Total	<u>\$ 0</u>	<u>\$ 36,850</u>
Total Project Costs	\$225,000	\$600,000