State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 09-64

December 9, 2009

Agenda Item No.: 09-10-1

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 2687-265, entitled "AMAX-DOAS Trace Gas Column Observations from Research Aircraft Over California," has been submitted by University of Colorado at Boulder;

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

WHEREAS, the Air Resources Board will fund this proposal for a total amount $549,999; and

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

> Proposal Number 2687-265 entitled "AMAX-DOAS Trace Gas Column Observations from Research Aircraft Over California," submitted by University of Colorado at Boulder, for a total amount not to exceed $549,999.

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 2687-265 entitled "AMAX-DOAS Trace Gas Column Observations from Research Aircraft Over California,"," submitted by University of Colorado at Boulder, for a total amount not to exceed $549,999.

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 $549,999.

I hereby certify that the above is a true and correct copy of Resolution 09-64, as adopted by the Air Resources Board.

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Lori Andreoni, Clerk of the Board

ATTACHMENT A

"AMAX-DOAS Trace Gas Column Observations from Research Aircraft Over California"

Background

The proposed project is ARB support of a collaborative research effort with NOAA, the CalNex 2010 field campaign that will address scientific questions related to the mitigation of both air pollution and climate change.

Despite improvements in emission control technologies, fine particles remain a serious pollution problem in urban areas of California. Both the South Coast Air Basin (SoCAB) and San Joaquin Valley (SJV) frequently exceed California health-based particle concentration standards. Aerosols also significantly impact climate, visibility, and deposition of toxics and nutrients to the ground. Recent results show that secondary organic aerosol (SOA) is a larger fraction of particulate matter than had been recognized. The chemical species to be measured by this research are important to predicting rates of photochemical processing for both ozone and aerosols.

Motivation to study vertical column amounts of nitrogen dioxide (NO_2) is due to several gaps in understanding that limit ability to model the atmosphere. Atmospheric models may overpredict the amount of NO_2 in urban areas compared to satellite observations. At times, modeled NO_2 decreases much too rapidly downwind of urban source regions, either due to a lower effective NO_2 lifetime in models compared to the atmosphere or missing (regional) nitrogen oxides (NO_X) sources in the models.

The atmospheric chemistry of formaldehyde (HCHO) and glyoxol (CHOCHO) is also relevant to urban air quality and public health. Formaldehyde is a known carcinogen, and its photolysis produces radicals that lead to formation of secondary oxidation products. Glyoxal is mutagenic and forms HO_X radicals upon photolysis. Understanding sources of formaldehyde and glyoxal supports policy and planning to reduce concentrations of ozone and SOA through strategies that reduce production of radicals that contribute to their formation.

Objective

The objective of the proposed research is to provide horizontal and vertical distributions of nitrogen dioxide, formaldehyde, glyoxal, and aerosol optical depth primarily in the SoCAB and SJV of California during the CalNex 2010 field campaign. These measurements will be used to improve understanding of chemical processing leading to formation of ozone and aerosols, and to constrain and improve atmospheric models. In particular, the combination of formaldehyde and glyoxal concentration will be of value to constrain the modeled oxidative capacity of the atmosphere and the rate of formation of secondary organic aerosols. The results will also be used to validate and improve the utility of satellite data for air quality applications.

Methods

This proposed project is to deploy the University of Colorado Airborne Multi AXis Differential Optical Absorption Spectrometer (DOAS) instrument (CU AMAXDOAS) on

the NOAA Optical Remote Sensing TwinOtter research aircraft during the eight-week CalNex period and following for an additional four weeks. The CU AMAXDOAS will measure pollutant concentrations in and above the boundary layer, probing directly the horizontal and vertical distributions of boundary layer columns of nitrogen dioxide (NO_2), formaldehyde (HCHO), and possibly glyoxal (CHOCHO) (or sulfur dioxide (SO_2) on selected flights) over the SoCAB, SJV, and ocean. The measurement results will be used to test and constrain atmospheric models, validate satellite measurements, and provide improvements for models and validated satellite data for better management of air resources.

Expected Results
The research results are expected to significantly improve our understanding of the composition, emission sources, and photochemical processing of ambient gases relevant to formation of ozone and organic aerosols throughout California. The information to be generated is needed for the development of optimal climate change and air pollution mitigation strategies.

Significance to the Board
Understanding sources of formaldehyde and glyoxal is relevant to policy decisions intended to reduce ozone and secondary organic aerosol formation. Glyoxal and other a-dicarbonyls, are deemed responsible for SOA production equal to the sum of SOA formed from monoterpenes, sesquiterpenes, isoprene, and aromatics also on global scales.

Contractor:
University of Colorado at Boulder

Contract Period:
36 months

Principal Investigator (PI):
Professor Rainer M. Volkamer

Contract Amount:
$549,999

Cofunding:
The proposed project is an ARB contribution to CalNex 2010, which is a collaborative study with the National Oceanic and Atmospheric Administration (NOAA) to address scientific questions which bear upon the ability to formulate policy related to mitigation of air pollution and climate change. NOAA is contributing resources and direct funding to CalNex conservatively estimated at $15,000,000. The NOAA contributions include a dedicated research vessel and multiple research aircraft, ground support, planning, and direct funding of contracted measurements.

Basis for Indirect Cost Rate:

The University of Colorado is providing a ten percent (reduced) indirect cost rate, equal to the rate that University of California and the UC system have agreed to provide for ARB.

Past Experience with this Principal Investigator:
Professor Volkamer has conducted extensive research relevant to the proposed project, some of which has been sponsored the NOAA partner in CalNex 2010. Professor Volkamer has successfully deployed the CU AMAXDOAS on the NOAA Twin Otter research aircraft which will be used for CalNex 2010. His past theoretical and observational work has provided significant advances in understanding of atmospheric chemistry of the oxidative capacity of the atmosphere for ozone formation and formation of secondary organic aerosol. He has developed methods to observe glyoxol in the atmosphere and has conducted field measurements that provided new understanding of the precursors and sources of glyoxol formation.

Prior Research Division Funding to University of Colorado at Boulder:

Year	2008	2007	2006
Funding	$0	$0	$0

B U D G E T S U M M A R Y

Contractor: University of Colorado, Boulder

"AMAX-DOAS trace gas column observations from research aircraft over California"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 395,008	
2.	Subcontractors	$ 12,870	
3.	Equipment	$ 21,000	
4.	Travel and Subsistence	$ 56,280[1]	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 200	
7.	Mail and Phone	$ 350	
8.	Supplies	$ 9,000	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 7,200	
	Total Direct Costs		$501,908
INDIRECT COSTS			
1.	Overhead	$ 48,091	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$48,091
TOTAL PROJECT COSTS			**$549,999**

[1] Because this is a field study with multiple campaigns to take place aboard an airborne research unit, it requires multiple airfares as well as per diem, car rental, and lodging for a total of 75 travel-days.

Attachment 1

S U B C O N T R A C T O R S' B U D G E T S U M M A R Y

Subcontractor: Original Code Consulting

Description of subcontractor's responsibility: The subcontractor will work in collaboration with Professor Volkamer to develop software and data acquisition and control hardware integration for the AMAX-DOAS instrument. In particular, their work will focus on integrating the existing code for control of a stepper motor into a new control system, assistance with development of analysis code to be used with the acquired data and ongoing routine maintenance of the data acquisition and control software.

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	12,870	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	0	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	0	
9.	Analyses	$	0	
10.	Miscellaneous	$	0	
	Total Direct Costs			$12,870
INDIRECT COSTS				
1.	Overhead	$	0	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs			$0
TOTAL PROJECT COSTS				**$12,870**