J2.6 USE OF A MOBILE LABORATORY TO CHARACTERIZE IN-USE VEHICLE AND OTHER EMISSION SOURCES IN MEXICO CITY METROPOLITAN AREA.

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Recent technological advances have allowed the development of robust and rapid response (~1 s) instrumentation with high sensitivity which can be deployed on a variety of platforms. Air quality measurements from a mobile platform offer the potential to more readily identify sources and to measure emissions under actual conditions.

Aerodyne Research (ARI) has been deploying advanced technology instrumentation onboard their mobile laboratory which has been used for a range of air quality measurement projects in the US and Mexico. These studies have been designed to characterize emission fluxes from urban and industrial sources and to characterize ambient air pollutant distributions in cities as large as Boston, New York, and Mexico City (Lamb et al., 1995; Shorter et al., 1997; Shorter et al., 1998; Jiménez et al., 2000; Shorter et al., 2001).

During the Spring of 2003 the ARI mobile laboratory was deployed during the Mexico City Metropolitan Area field campaigned (MCMA, 2003). This study has been performed in collaboration with the Integrated Program on Urban, Regional, and Global Air Pollution Program directed by Dr. L.T. Molina of the Massachusetts Institute of Technology (MIT). The MCMA-2003 field measurement campaign is a multi-national effort and involved a highly instrumented "supersite" located at the National Center for Environmental Research and Training (Centro Nacional de Investigación y Capacitación Ambiental or CENICA).

The ARI mobile lab housed a number of state-of-the-art fast response instruments for gas and particle measurement. A schematic of the mobile Lab is shown in Figure 1. Gas phase instruments included a quantum cascade tunable infrared laser differential absorption spectrometer (QC-TILDAS) for NH_3, a TILDAS for NO_2 and formaldehyde and a total nitrogen oxide (NOy) measurement as well as a CO_2 measurement (important for vehicle emission measurements). A proton transfer reaction mass spectrometer (PTR-MS) was used for measurement of oxygenated and aromatic volatile organic carbon (VOC) compounds.

Particulate pollutants were also measured and included size and composition of non-refractory particle mass (PM, using an aerosol mass spectrometer), PAH, surface area, PM2.5 and particle number density.

Additional, slower response (10-60 s) instruments included a UV absorption SO_2 monitor, an aethelometer, a customized gas chromatographic instrument to measure peroxy acetyl nitrate (PAN) and related organic peroxy nitrates (Argonne National Laboratory), and a customized impactor to collect fine particles for subsequent synchrotron X-ray analysis provided by Pacific Northwest National Laboratory. This suite of instruments allowed a wide range of experiments to be pursued during the spring 2003 campaign.

The measurement goals for the mobile laboratory in the MCMA 2003 study included characterizing emission ratios from in-use vehicles (vehicle chase experiments) from heavy-duty diesel trucks, diesel buses, colectivos, taxis, and selected light duty trucks and cars. The mobile lab also operated in an area mapping mode to characterize and to identify pollutant sources in and around the Mexico City area. Several fixed site deployments were made at the Pedregal and La Merced RAMA monitoring sites and the Santa Ana boundary site.

Preliminary results from the mobile lab will be presented which highlight the elevated pollutant levels typical of the Mexico City area and the high vehicle emission ratios observed for NOx, formaldehyde and PM containing organic carbon. Mexico City vehicle emission ratios will be compared to vehicle emission ratios previously

measured with the mobile lab in New York City and in Boston. It is hoped that the results from this study will help provide a scientific basis for devising emissions control strategies to reduce exposure to harmful pollutants in the MCMA and also provide insights to air pollution problems in other megacities, including large urban centers in the US.

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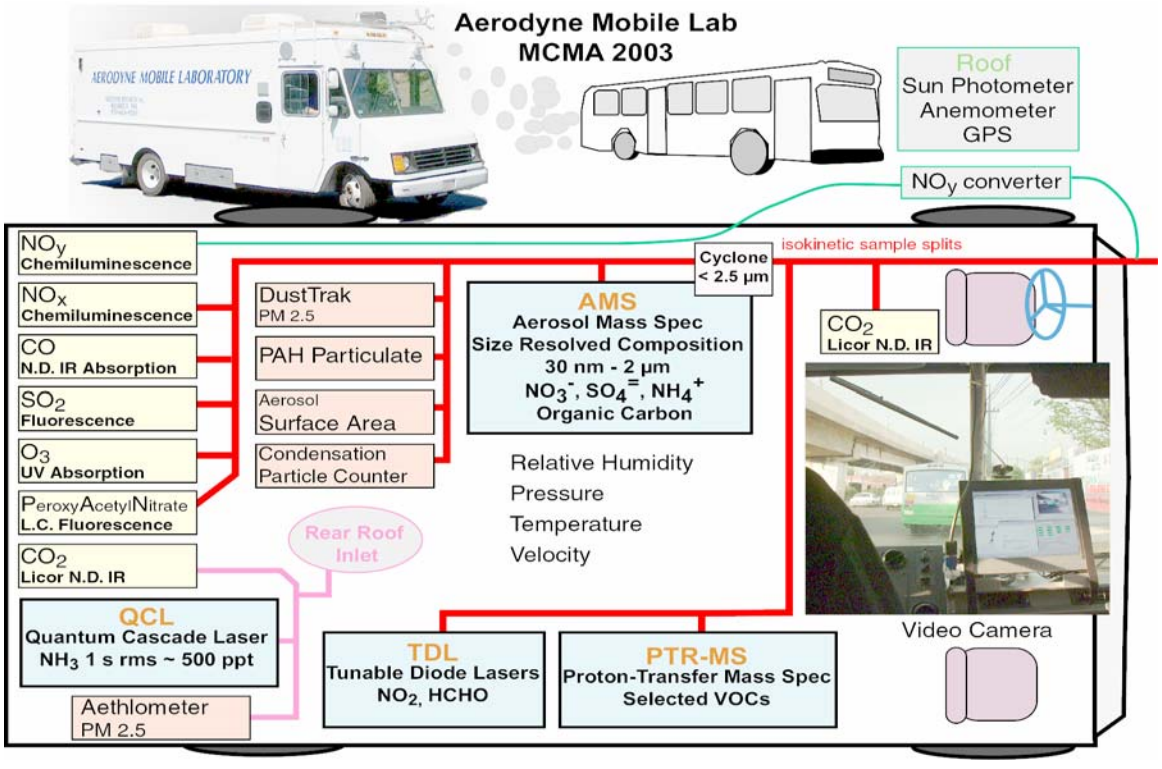

Figure 1. Aerodyne Research Mobile laboratory as deployed in the Mexico City Metropolitan Area 2003 Field Campaign for area mapping of gas and particle pollutant concentrations and on-road measurement of in-use vehicle emission ratios.