

**APPENDIX D. FIELD CAMPAIGNS FOR NON-ROUTINE SPECIAL INTENSIVE STUDIES<sup>3,4</sup>**

Network	Lead Agency <sup>1</sup>	Number of Sites	Initiated	Measurement Parameters	Location of Information and/or Data	Notes
CalNex 2010	NOAA and CARB (with CEC)	1 ship, 2 aircraft, Several supersites	2010	Primary pollutants (CO, NO, NO <sub>2</sub> , SO <sub>2</sub> , NMHC, CO <sub>2</sub> , NH <sub>3</sub> , PM, VOC, black carbon, and greenhouse gases); Secondary species: O <sub>3</sub> , CH <sub>2</sub> O, aldehydes, PAN, HNO <sub>3</sub> , NO <sub>3</sub> , N <sub>2</sub> O <sub>5</sub> , sulfuric acid, hydroxyl and peroxy radicals, aerosol size distribution and chemical composition; Other parameters (H <sub>2</sub> O, aerosol properties, radiation, and meteorological parameters).	<a href="http://www.esrl.noaa.gov/csd/calnex/whitepaper.pdf">http://www.esrl.noaa.gov/csd/calnex/whitepaper.pdf</a> <a href="http://www.arb.ca.gov/research/fieldstudy2010/fieldstudy2010.htm">http://www.arb.ca.gov/research/fieldstudy2010/fieldstudy2010.htm</a>	This is to be a joint field study of atmospheric processes over California and the eastern Pacific coastal region that emphasizes the interactions between air quality and climate change issues, including those affecting the hydrologic cycle. The study will constitute one of a series of comprehensive regional air quality and climate assessments conducted by NOAA with expansion of CARB's leadership of California air quality studies. It will complement the ongoing CEC regional climate change studies and will bring together specialized, complementary resources such that the outcome will be able to address important scientific questions that have an impact on environmental policy. Airborne (NOAA WP-3D Orion, NOAA Twin Otter Remote Sensing Aircraft), ship (NOAA R/V Ronald H. Brown), on-going ground-based instrument packages (upper-air observations, ground-based chemical measurements), and satellite observations (MODIS, GOES) will be employed. The collaboration of agencies will link short-term data gathered during the field program to extensive surface observations, long term data sets, and California's advanced modeling capabilities for both regional air quality and climate.
Arctic Research of the Composition of the Troposphere from Aircraft and Satellites (ARCTAS / POLARCAT)	NASA (with various universities & research institutions)	3 aircraft 1 monitoring site	2008 (spring / summer)	Primary pollutants (CO, NO, NO <sub>2</sub> , SO <sub>2</sub> , NMHC, CO <sub>2</sub> , NH <sub>3</sub> , PM, VOC, black carbon, and greenhouse gases); Secondary species: O <sub>3</sub> , CH <sub>2</sub> O, aldehydes, PAN, HNO <sub>3</sub> , NO <sub>3</sub> , N <sub>2</sub> O <sub>5</sub> , sulfuric acid, hydroxyl and peroxy radicals, aerosol size distribution and chemical composition; Other parameters (H <sub>2</sub> O, aerosol properties, radiation, and meteorological parameters)	<a href="http://www.polarcat.noaa.gov/activities/nasa-arctas/arctas_wp.pdf">http://www.polarcat.noaa.gov/activities/nasa-arctas/arctas_wp.pdf</a> & <a href="#">data workshop</a>	ARCTAS is a study of the impact of air pollution and forest fires on the arctic climate that integrates measurements from multiple aircraft and satellites. It has four major scientific themes: (1) long range transport of pollution to the Arctic including arctic haze, tropospheric ozone, and persistent pollutants such as mercury; (2) boreal forest fires and their implications for atmospheric composition and climate; (3) aerosol radiative forcing from arctic haze, boreal fires, surface deposited black carbon, and other perturbations; and (4) chemical processes with focus on ozone, aerosols, mercury, and halogens. ARCTAS is part of a larger interagency and international IPY effort collectively identified as POLARCAT which is intended to execute a series of aircraft experiments following pollution plumes as they are transported into the Arctic.
Texas Air Quality Study II (2005 - 2006)	Texas	17	2006	O <sub>3</sub> , NO <sub>x</sub> , NO <sub>y</sub> , SO <sub>2</sub> , Haze, Visibility, CO, VOC, Solar Radiation, Surface Meteorology, Upper Air	<a href="http://www.utexas.edu/research/ceer/texaqsII/PDF/12-12-04%20Projected%20Surface%20Sites_tbl.pdf">http://www.utexas.edu/research/ceer/texaqsII/PDF/12-12-04 Projected Surface Sites_tbl.pdf</a>	Researchers from universities, state and federal agencies, private industry, and local governments are joining forces to conduct a major field study to address air quality issues in the eastern half of Texas. The study, planned for a period extending from April 2005 through October 2006, will examine regional ozone formation, transport of ozone and ozone precursors, meteorological and chemical modeling, issues related to ozone formation by highly reactive emissions, and particulate matter formation. It is anticipated that the information from the study will be the scientific basis used for developing State Implementation Plans (SIPs) for ozone (with concentrations averaged over 8 hours), regional haze, and, if necessary, for fine particulate matter (particulate matter less than 2.5 microns in diameter, PM <sub>2.5</sub> )

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<p>2006 Texas Air Quality Study/ Gulf of Mexico Atmospheric Composition and Climate Study (TexAQS/GoMACCS)</p>	<p>NOAA</p>	<p>1 ship, 2 aircraft</p>	<p>2006</p>	<p>O3, NO, NO2, NOy, VOCs, CO2, CO, SO2, HNO3, NH3, other reactive pollutants, aerosols, meteorological parameters &amp; upper air</p>	<p><a href="http://esrl.noaa.gov/cs/d/2006/">http://esrl.noaa.gov/cs/d/2006/</a></p>	<p>For TexAQS 2006, the NOAA air quality component will investigate, through airborne and sea-based measurements, the sources and processes that are responsible for photochemical pollution and regional haze during the summertime in Texas. The focus of the study will be the transport of ozone and ozone precursors within the state and the impact of the long-range transport of ozone or its precursors.</p>
<p>Intercontinental Chemical Transport Experiment - North America (INTEX-B) -- Intercontinental Transport and Chemical Transformation (ITCT/IGAC)</p>	<p>NASA</p>	<p>3 aircraft</p>	<p>2006</p>	<p>O3, NO, NO2, NOy, VOCs, CO2, CO, SO2, HNO3, NH3, other reactive pollutants, aerosols, meteorological parameters, altitude -- NOAA aircraft</p>	<p><a href="http://cloud1.arc.nasa.gov/intex-b/">http://cloud1.arc.nasa.gov/intex-b/</a></p>	<p>After MILAGRO, NASA continued investigating the export of pollutants from large urban areas, this time focusing on the influence of Asian pollutants on North America, through a second airborne field element of INTEX-B in collaboration with NSF and NCAR to characterize transport and evolution of Asian pollution to North America and beyond and determine implications for regional air quality and climate;</p>
<p>Megacity Initiative: Global and Local Research Observations (MILAGRO)</p>	<p>NSF, DOE, NASA, MCE2, and other US and Mexican institutions</p>	<p>6 aircraft, 3 supersites, mobile laboratories, flux tower, mobile units and other measurement platforms.</p>	<p>2006</p>	<p>Primary pollutants (CO, NO, NO2, SO2, NMHC, CO2, NH3, PM, VOC, black carbon, and greenhouse gases); Secondary species: O3, CH2O, aldehydes, PAN, HNO3, NO3, N2O5, sulfuric acid, hydroxyl and peroxy radicals, aerosol size distribution and chemical composition; aerosol optical properties; radiation, and meteorological parameters.,</p>	<p><a href="http://www.eol.ucar.edu/projects/milagro/">http://www.eol.ucar.edu/projects/milagro/</a> <a href="http://www.mce2.org/">http://www.mce2.org/</a></p>	<p>The export of air pollutants from urban to regional and global environments is a major concern because of wide-ranging potential consequences for human health, cultivated and natural ecosystems, visibility degradation, weather modification, changes in radiative forcing, and tropospheric oxidizing capacity. During the spring of 2006 a highly integrated atmospheric field experiment was performed over and around North America. The Megacity Initiative: Local and Global Research Observations (MILAGRO), <a href="http://www.eol.ucar.edu/projects/milagro/">http://www.eol.ucar.edu/projects/milagro/</a>, resulted through a highly coordinated collaboration between NSF (through MIRAGE-Mex), DOE (through MAX-Mex), NASA (through INTEX-B) and MCE2 (through MCMA-2006) and a variety of research institution in the U.S. and Mexico and involved ground and air borne activities centered on Mexico City, Mexico during March 2006. MILAGRO goals were greatly facilitated and enhanced by a number of concurrent and coordinated national and international field campaigns and global satellite observations. The goals of MILAGRO are: -To study the extent, persistence, and transformation of Mexico City pollution plumes; -To relate atmospheric composition to sources and sinks; -To quantify radiative properties and effects of aerosols, clouds, water vapor &amp; surfaces; -To map anthropogenic and biogenic emissions; -To achieve science-based validation of satellite observations of tropospheric composition</p>
<p>International Consortium for Atmospheric Research on Transport and Transformation (ICARTT)</p>	<p>NOAA (with various other agencies and research institutions)</p>	<p>Multiple aircraft and other measurement platforms</p>	<p>2004</p>	<p>Surface sites and networks, mobile platforms (aircraft and ship) and satellite data were used for measurement parameters; see <a href="http://www.esrl.noaa.gov/csd/ICARTT/fieldoperations/">http://www.esrl.noaa.gov/csd/ICARTT/fieldoperations/</a> for detailed information</p>	<p><a href="http://www.esrl.noaa.gov/csd/ICARTT/index.shtml">http://www.esrl.noaa.gov/csd/ICARTT/index.shtml</a></p>	<p>ICARTT was formed to study the sources, sinks, chemical transformations and transport of ozone, aerosols and their precursors to and over the North Atlantic Ocean. Groups in North America and Europe had independently developed plans for field experiments in the summer of 2004 that shared many of the same goals and objectives in overlapping study areas; the plans were aimed at developing a better understanding of the factors that shape air quality in their respective countries and the remote regions of the North Atlantic. ICARTT was formed to take advantage of this synergy by planning and executing a series of coordinated experiments to study the emissions of aerosol and ozone precursors and their chemical transformations and removal during transport to and over the North Atlantic. The combined research conducted in the programs that make up ICARTT focus on <b>regional air quality</b>, <b>intercontinental transport</b>, and <b>radiation balance</b> in the atmosphere.</p>

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<p>Intercontinental Chemical Transport Experiment - North America (INTEX-NA) -- Intercontinental Transport and Chemical Transformation (ITCT/IGAC)</p>	<p>NOAA</p>	<p>aircraft, sondes, satellites</p>	<p>2004</p>	<p>O3, NO, NO2, NOy, VOCs, CO2, CO, SO2, HNO3, NH3, other reactive pollutants, aerosols, meteorological parameters, altitude -- NOAA aircraft</p>	<p><a href="http://cloud1.arc.nasa.gov/intex-na/desc.html">http://cloud1.arc.nasa.gov/intex-na/desc.html</a></p>	<p>INTEX-NA is an integrated atmospheric field experiment performed over and around North America. It seeks to understand the transport and transformation of gases and aerosols on transcontinental/intercontinental scales and their impact on air quality and climate. A particular focus in this study is to quantify and characterize the inflow and outflow of pollution over North America. The main constituents of interest are ozone and precursors, aerosols and precursors, and the long-lived greenhouse gases. INTEX-NA is part of a larger international ITCT (Intercontinental Transport and Chemical Transformation) initiative. INTEX-NA goals are greatly facilitated and enhanced by a number of concurrent and coordinated national and international field campaigns and satellite observations. Synthesis of the ensemble of observations from surface, airborne, and space platforms, with the help of a hierarchy of models is an important goal of INTEX-NA.</p>
<p>New England Air Quality Study (NEAQS) -- Intercontinental Transport and Chemical Transformation (ITCT) 2004</p>	<p>NOAA</p>	<p>4 site, 1 ship, 2 aircraft, profiler network</p>	<p>2004</p>	<p>O3, NO, NO2, NOy, VOCs, CO2, CO, SO2, HNO3, NH3, other reactive pollutants, aerosols, meteorological parameters &amp; upper air</p>	<p><a href="http://esrl.noaa.gov/cs/d/2004/">http://esrl.noaa.gov/cs/d/2004/</a></p>	<p>NOAA continues a joint regional air quality and climate change study combining elements of the previous NEAQS study and the Intercontinental Transport and Chemical Transformation (ITCT) research activity to focus on air quality along the Eastern Seaboard and transport of North American emissions into the North Atlantic. The major NOAA assets (the two aircraft and the ship) are deployed in a manner that supports the objectives of both components.</p>
<p>East Tennessee Ozone Study (ETOS)</p>	<p>NOAA</p>	<p>15+</p>	<p>2003</p>	<p>O3, Surface Meteorology</p>	<p><a href="http://www.arl.noaa.gov/etos_122005.php">http://www.arl.noaa.gov/etos_122005.php</a></p>	<p>ETOS 2003 developed a regional ozone database to include both mean hourly averages and hourly histograms of individual measurement readings. The 2003 study period (based on scoping studies 1999 - 2002) provides a regional view to supplement Tennessee's regulatory network and serves as a demonstration and evaluation/validation database for various operational and developmental air quality forecast model components. The full scope of ETOS 2000 is continuously under planning and review, and is refined each year using the previous year's analysis and experience to focus on particular issues within the East Tennessee region.</p>
<p>Mexico City Metropolitan Area (MCMA-2003)</p>	<p>MIT and CAM</p>	<p>Mobile laboratory, supersite, flux tower and several mobile units.</p>	<p>2003-2003</p>	<p>Gases and aerosols, OH and HOx radicals, fluxes of selected VOCs, water vapor, and CO<sub>2</sub>, microscale meteorological parameters.</p>	<p><a href="http://www.mce2.org/">http://www.mce2.org/</a></p>	<p>The MCMA-2003 measurements in April 2003 were a joint effort of the Massachusetts Institute of Technology (MIT) and the Mexican Metropolitan Environmental Commission (CAM). Objectives of this project were to update and improve the MCMA emission inventory and to improve knowledge of the chemistry, dispersion, and transport of pollutants emitted to the MCMA atmosphere. This was preceded by an exploratory mission conducted in February 2002 study using the existing monitoring network and an instrumented mobile laboratory periodically stationed at selected monitoring sites as well as cruised along city streets.</p>

Texas Air Quality Study (TexAQS) 2000	Texas	~20	2002	O3, NOx, PM2.5/PM10, CO, SO2, VOCs, Surface Meteorology	<a href="http://www.utexas.edu/research/ceer/texaqs/visitors/about.html">http://www.utexas.edu/research/ceer/texaqs/visitors/about.html</a>	The study is designed to improve understanding of the factors that control the formation and transport of air pollutants along the Gulf Coast of southeastern Texas. Six weeks of intensive sampling, including measurements of gaseous, particulate, and hazardous air pollutants, are made at approximately 20 ground stations, located throughout the eastern half of the state. Experts in meteorology, atmospheric chemistry, and other areas of science study the formation, composition, and day-night cycles of ozone and particulate matter, as well as how these pollutants are affected by weather.
Texas Air Quality Study (TexAQS) 2000 Field Campaign	NOAA	2 aircraft	2002	O3, CO, CO2, SO2, NO, NO2, NOy, PAN, HNO3, NH3, VOCs, Solar Radiation, Meteorological Parameters, aerosols	<a href="http://www.utexas.edu/research/ceer/texaqs/visitors/about.html">http://www.utexas.edu/research/ceer/texaqs/visitors/about.html</a>	Additional sampling in TexAQS 2000 is carried out with specially equipped aircraft that can detect air pollutants very quickly, at very low concentrations.
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Bay Region Atmospheric Chemistry Experiment (BRACE)	NOAA	1 aircraft	2002	NO3, NH4, O3, SO2, NOx, CO, trace metals, particulates	<a href="http://www.dep.state.fl.us/secretary/news/2002/02-039.htm">http://www.dep.state.fl.us/secretary/news/2002/02-039.htm</a>	The Florida Department of Environmental Protection (DEP), with the support of a team of federal, state, local, university and private scientists (including NOAA) conducted a month-long series of intensive studies to determine the level of influence of nitrogen deposited into Tampa Bay from local and regional sources of air pollutants on water quality. During the Bay Region Atmospheric Chemistry Experiment (BRACE), NOAA operated a research aircraft over the Tampa Bay region to collect air quality measurements of the many atmospheric forms of nitrogen and related pollutants that may potentially influence the water quality of Tampa Bay.
New England Air Quality Study (NEAQS) 2002 -- AIRMAP	NOAA	4	2002	O3, NOx, NOy, SO2, CO, VOCs, PM2.5, Precipitation Chemistry, Surface Meteorology	<a href="http://airmap.unh.edu/data/">http://airmap.unh.edu/data/</a>	AIRMAP is a research program focused on atmospheric chemical and physical observations in rural to semi-remote areas of New Hampshire with the goal of understanding inter-relationships in regional air quality, meteorology, and climatic phenomena. Research goals are to: (1) document and analyze current trends in the regional air quality of New England which is affected by transport from upwind regions of the U.S. and Canada and by local emission sources; (2) document and analyze current and past (the last 100 years) synoptic-to-local meteorological patterns, features, and extreme events in New England; and (3) numerically simulate the coupled evolution of atmospheric transport and chemistry in New England using various modeling tools.
New England Air Quality Study (NEAQS) 2002	NOAA	1 ship, 2 aircraft	2002	O3, NO, NO2, NOy, VOCs, CO2, CO, SO2, HNO3, NH3, other reactive pollutants, aerosols, meteorological parameters & upper air	<a href="http://esrl.noaa.gov/cs/d/NEAQS/">http://esrl.noaa.gov/cs/d/NEAQS/</a>	The NOAA component of this multi-institutional effort addresses the analysis of existing climate data, and the development of new air quality monitoring programs. A background of information is to be developed that addresses New England's changing climate and air quality so as to improve understanding of the relationship between air quality and weather and determine the causes of climate change in New England

Intercontinental Transport and Chemical Transformation (ITCT) 2002 Activities	NOAA	1 site, 1 aircraft	2002	CO <sub>2</sub> , CO, CH <sub>4</sub> , SO <sub>2</sub> , O <sub>3</sub> , SF <sub>6</sub> , N <sub>2</sub> O, CFCs, Aerosols, Solar Radiation, Surface Meteorology & Upper Air -- surface. O <sub>3</sub> , NO, NO <sub>2</sub> , NO <sub>y</sub> , VOCs, CO <sub>2</sub> , CO, SO <sub>2</sub> , HNO <sub>3</sub> , NH <sub>3</sub> , other reactive pollutants, aerosols, meteorological parameters & upper air -- aircraft	<a href="http://esrl.noaa.gov/cs/d/ITCT/2k2/">http://esrl.noaa.gov/cs/d/ITCT/2k2/</a>	This field program, scheduled for spring 2002 to investigate the composition of air masses along the Pacific coast of North America, is part of the Intercontinental Transport and Chemical Transformation (ITCT) research activity of the International Global Atmospheric Chemistry Program (IGAC) Program. Goals of this field study are to: characterize the chemical composition of the air masses coming ashore at the West Coast; explore the composition of these air masses as they are transported inland; and investigate the alteration in composition associated with the addition of emissions from U.S. West Coast sources. The NOAA WP-3D aircraft is to deploy a wide array of instrumentation for the in situ measurement of gaseous and aerosol parameters plus radiation and remote aerosol sensing by LIDAR. The Trinidad Head baseline observatory characterizes chemical composition of marine boundary layer at the U.S. West Coast and provides linkage between composition measurements and radiative properties of the aerosols. The NOAA ETL Laboratory network of 915-MHz radar wind profilers that are deployed in California provide additional meteorological information.
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**APPENDIX D. FIELD CAMPAIGNS FOR NON-ROUTINE SPECIAL INTENSIVE STUDIES (continued)**

TRANsport and Chemical Evolution over the Pacific (TRACE-P)	NASA	2 aircraft	2001 (2 months)	O <sub>3</sub> , NO, NO <sub>2</sub> , N <sub>2</sub> O, CH <sub>4</sub> , SO <sub>2</sub> , NH <sub>3</sub> , CO, CO <sub>2</sub> , aerosols, PAN, HNO <sub>3</sub> , aldehydes, peroxides, speciated hydrocarbons, other pollutants, meteorological parameters	<a href="http://www-gte.larc.nasa.gov/gte fld.htm#TRACE">http://www-gte.larc.nasa.gov/gte fld.htm#TRACE</a>	TRACE-P is part of a series of aircraft missions aimed at better understanding of global tropospheric chemistry, and more specifically in this case, the effects of outflow from the Asian continent on the composition of the global atmosphere. Objectives are to determine: (1) pathways for outflow of chemically and radiatively important gases and aerosols, and their precursors, from eastern Asia to the western Pacific; and (2) the chemical evolution of the Asian outflow over the western Pacific, and the ensemble of processes that control this evolution. Approximately 20 aircraft measurement flights involving horizontal and vertical profiles for a total of over 300 hours were supported by surface based measurements and soundings.
Aerosol Characterization Experiments - Asia (ACE-Asia)	NSF	sites, ships, aircraft, satellites	2001 (spring)	aerosol chemical, physical, and radiative properties and radiative fluxes, meteorological parameters	<a href="http://saga.pmel.noaa.gov/Field/aceasia/ACEAsiaDescription.html">http://saga.pmel.noaa.gov/Field/aceasia/ACEAsiaDescription.html</a>	The Aerosol Characterization Experiments (ACE) are designed to increase understanding of how atmospheric aerosol particles affect the Earth's climate system. ACE-Asia took place during the spring of 2001 off the coast of China, Japan and Korea which includes many types of aerosol particles of widely varying composition and size. These particles include those emitted by human activities and industrial sources, as well as wind-blown dust. Data from ACE-Asia is improving understanding of how atmospheric aerosols influence the chemical and radiative properties of the Earth's atmosphere.
Central California Ozone Study (CCOS) <sup>2</sup>	California	100+ sites, 6 aircraft, profilers, sondes	2000	O <sub>3</sub> , VOC, NO <sub>x</sub> , NO, NO <sub>y</sub> , CO, PM <sub>10</sub> , PM <sub>2.5</sub> , solar radiation, surface meteorology, upper air	<a href="http://www.arb.ca.gov/airways/">http://www.arb.ca.gov/airways/</a>	For the summer season, this study collected meteorological and air quality data for the central section of California in 2000. Planes and weather balloons collected data at ground level and aloft. The data collected is used to improve the understanding of the role of meteorology on the formation and behavior of air pollutants and their precursors and emission sources and patterns. The information gathered will be used to develop an improved modeling system that will be used in preparing plans to attain the new federal 8-hour ozone standard, as well as to update the Clean Air Plan to attain the state ozone standard.

California Regional Particulate Air Quality Study (CRPAQS) <sup>2</sup>	California	~60	1999 to 2001	PM2.5, PM10, nephelometer, with some sites adding SO4/NO3, OC/EC, NO2, NOy, PAN, SO2, surface meteorology	<a href="http://www.arb.ca.gov/airways/">http://www.arb.ca.gov/airways/</a>	The California Regional PM10/PM2.5 Air Quality Study is a comprehensive public/private sector collaborative program to provide an improved understanding of particulate matter and visibility in central California. It is intended to evaluate both the national and State air quality standards for PM10 and PM2.5. The field programs consisted of 14 months of monitoring throughout the San Joaquin Valley (SJV) and surrounding regions, as well as intensive monitoring during summer, fall, and winter seasonal periods.
<a href="#">Southern Oxidant Study (SOS) 1999 Field Campaign -- Nashville</a>	NOAA	3 sites, 4 aircraft	1999	O3, NO, NO2, NOy, VOCs, aerosols, Surface Meteorology & Upper Air (profiler), ozonesonde -- surface O3, NO, NO2, NOy, VOCs, CO2, CO, SO2, HNO3, NH3, other reactive pollutants, aerosols, meteorological parameters, altitude -- aircraft	<a href="http://esrl.noaa.gov/cs/d/SOS99/">http://esrl.noaa.gov/cs/d/SOS99/</a>	The Southern Oxidants Study (SOS), in collaboration with other organizations and programs, conducted this major Field Campaign during June/July 1999. The Nashville/Middle Tennessee region measurements focused on an improved understanding of the processes that control the formation and distribution of fine particles and ozone. Three study themes were: Local vs. regional contrasts, Ozone and PM formation in plumes, and diurnal cycle in chemistry and meteorology. These themes were addressed through a series of coordinated measurements involving instrumented aircraft and a ground-based network of chemistry and meteorological measurements.
<b>APPENDIX D. FIELD CAMPAIGNS FOR NON-ROUTINE SPECIAL INTENSIVE STUDIES (continued)</b>						
PM Supersite Program	EPA	2 Phase I Sites 7 Phase II Sites	1999	Measurement may include: PM2.5, PM10, TSP, SO4, NO3, EC, OC, light absorption & extinction, O3, CO, NOx, NO, NO2, NOy, HNO3, NH3, VOCs, Carbonyls, PAH, major ions and elements, surface and upper air meteorology	<a href="http://www.epa.gov/ttn/amtic/supersites.html">http://www.epa.gov/ttn/amtic/supersites.html</a>	In response to Executive and Congressional mandates and recommendations from the National Research Council a "Supersites Conceptual Plan" was developed and implemented. Atlanta and Fresno were selected as initial Phase I sites and as a result of a competitive process Baltimore, Fresno, Houston, Los Angeles, New York, Pittsburgh, and St. Louis were selected for Phase II. Goals generally were to characterize particulate matter, support health effects and exposure research, and conduct methods testing. Extensive monitoring, data analysis, and publication continued to 2005 with the preparation of a Final Report for each city.
Big Bend Regional Aerosol and Visibility Observational (BRAVO) Study	NPS/EPA	38 fixed, 6 tracer sites	1999	SO2, SO4, PM2.5, NO3, NH4, major ions and elements, nephelometer, transmissometer, meteorological parameters & upper air, PFC tracer	<a href="http://www.dri.edu/Home/Features/text/BRAVO.htm">http://www.dri.edu/Home/Features/text/BRAVO.htm</a>	The BRAVO study was conducted for four months during 1999 with the primary objective of identifying the causes of haze in the Big Bend National Park located in West Texas. This very large, collaborative study enlisted numerous participants with sponsorship from federal/State agencies, private industry, and research organizations. The BRAVO study utilized data from a 38-site network to characterize spatial and temporal aerosol patterns in the atmosphere. In addition, upper-air measurements and extensive optical measurements of light scattering and absorption were made. Because monitoring and source characterization activities were conducted only in the United States, the study design included additional monitoring and tracer studies along the U.S./Mexican border.

Indian Ocean Experiment (INDOEX)	UCSD	6 sites, 2 ships, 5 aircraft, satellites	1999 (4 months)	O3, NO, NO2, VOCs, CO2, CO, SO2, HNO3, NH3, other reactive pollutants, trace gases, aerosols, meteorological parameters & upper air	<a href="http://data.eol.ucar.edu/codiac/projs?INDOEX">http://data.eol.ucar.edu/codiac/projs?INDOEX</a>	The Indian Ocean Experiment (INDOEX) addresses questions of climate change through collection of in-situ data on the regional cooling effect of sulfate and other aerosols. The project's goal is to study natural and anthropogenic climate forcing by aerosols and feedbacks on regional and global climate. INDOEX field studies occur where pristine air masses from the southern Indian Ocean including Antarctica and not-so-clean air from the Indian subcontinent meet over the tropical Indian Ocean to provide a unique natural laboratory for studying aerosols. Scientists collect data from the water surface through the lower stratosphere, on the aerosol composition, reactive atmospheric gases, solar radiation fluxes, wind and water vapor distribution. To this end, investigators use multiple aircraft, ships and island stations over the Arabian Sea and the Indian Ocean.
Eulerian Model Evaluation Field Study (EMEFS)	Canada	~135	1998	O3, NO2, SO2, NH3, HNO3, major ions,	<a href="http://www.msc-smc.ec.gc.ca/natchem/particles/n_emefs_e.html">http://www.msc-smc.ec.gc.ca/natchem/particles/n_emefs_e.html</a>	Under EMEFS, air and precipitation chemistry data were collected daily for two years over much of the eastern United States and Canada to provide data for assessing the performance of acid deposition and other regional scale models.
Aerosol and Visibility Evaluation Research ( <i>Investigación sobre Materia Particulada y Deterioro Atmosférico</i> , IMADA-AVER)	DOE, IMP and other US and Mexican institutions	Several surface sites around the city	1997	Comprehensive gases, aerosol and meteorological measurements	<a href="#">Narsto data archive</a>	This study conducted comprehensive meteorological and air quality measurements in the Mexico basin and provided important insights on the meteorology and composition of particulate matter.
NARSTO-Northeast 1995	Multiple	559	1995	O3, NO, NOx	<a href="http://www.narsto.org/section.src?SID=9">http://www.narsto.org/section.src?SID=9</a>	Measurements were made during the NARSTO-Northeast 1995 intensive field campaign during the period May through September. One-hour average O3, NO, and NOx measurement results are reported for ground surface monitoring stations operated by various agencies including EPA AIRS, CASTNet, ESE, Harvard University, NYSEG, PEPCO, and the University of Maryland.

**APPENDIX D. FIELD CAMPAIGNS FOR NON-ROUTINE SPECIAL INTENSIVE STUDIES (continued)**

SOS Nashville/Middle Tennessee Ozone Study	TVA	116	1994-1995	O3, SO2, NO, NOy, and CO, VOC, Surface Meteorology, rawinsonde and ozonesonde releases, and a radar profiler/radar acoustic sounding system. -- surface Airborne ozone and aerosol lidar – aircraft	<a href="http://www.ncsu.edu/sos/pubs/sos2/State_of_SOS_2.pdf">http://www.ncsu.edu/sos/pubs/sos2/State_of_SOS_2.pdf</a>	This ozone-focused field study was carried out in the 11-state region surrounding Nashville/Middle Tennessee, beginning with a 3-week exploratory study during the summer of 1994 and culminating in a six-week field measurement campaign June/July 1995. Measurements were taken at 116 ground-based and tall building and tower-based chemical and meteorological measurement sites and a series of six airborne chemical measurement platforms. The most significant feature of the Nashville/Middle Tennessee Ozone Study was a coordinated series of 40+ aircraft studies to measure physical and chemical characteristics of urban and industrial plumes. (Note: an earlier ozone-focused set of field studies was also conducted in the Atlanta, GA area during the summers of 1990 - 1992.)
Mexico City Air Quality Research Initiative (MARI)	IMP and DOE Los Alamos National Lab	Ground sites, aircraft	1990-1994	surface and vertical profile observations of meteorology and pollutants	<a href="#">Narsto data archive</a>	The MARI project consisted of four campaigns between 1990 to 1994, emphasizing surface and vertical profile observations of meteorology and pollutants in support of MARI's air quality modeling activities

North Atlantic Regional Experiment (NARE)	NOAA	various sites, 1 ship	1993	O3, NO, NO2, NOx, NOy, VOC, Surface Meteorology	<a href="http://www.igac.noaa.gov/newsletter/24/introduction.php">http://www.igac.noaa.gov/newsletter/24/introduction.php</a>	The NARE program measured the type and amount of air pollutants being transported from the North American continent to the Northern Atlantic Ocean. Since the Northeast United States and Nova Scotia, Canada are the last land locations as air masses move out over the ocean, measurements were made a number of land and island sites in Maine, Nova Scotia, and Sable Island. Acadia National Park participated in this study
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Footnotes:

1. EPA -- Environmental Protection Agency  
 NASA -- National Aeronautics and Space Administration  
 NOAA -- National Oceanic and Atmospheric Administration  
 NPS -- National Park Service  
 NSF -- National Science Foundation  
 CARB -- California Air Resources Board  
 CEC -- California Energy Commission  
 UCSD -- University of California San Diego (Scripps Institution of Oceanography)
2. This study is part of the Central California Air Quality Studies (CCAQS) which comprise the California Regional Particulate Air Quality Study (CRPAQS) and the Central California Ozone Study (CCOS). CCAQS is a multi-year effort of meteorological and air quality monitoring, emission inventory development, data analysis, and air quality simulation modeling. Prior studies in California included: Southern California Ozone Study (SCOS97) -- 1997; Integrated Monitoring Study (IMS95) -- 1995; San Joaquin Valley Air Quality Study (SJVAQS) -- 1990; SARMAP Ozone Study -- 1990; Southern California Air Quality Study (SCAQS) -- 1987.
3. Historically, there have been many other field studies in the 1960's - 1990's that are not reflected in this table that involve both fixed monitoring sites and aircraft; well known examples include Regional Air Pollution Study (RAPs), Large Power Plant Effluent Study (LAPPES), Northeast Corridor Regional Modeling Program (NECRMP), Northeast Regional Oxidant Study (NEROS), Persistent Elevated Pollutant Episode (PEPE), and Lake Michigan Ozone Study (LMOS).
4. In addition to the air monitoring networks and related studies detailed in this table that are primarily concerned with lower tropospheric air pollution, there are a large number of observations and studies conducted by NASA, NOAA and others that address such topics as (1) upper tropospheric and stratospheric ozone and aerosols, (2) cloud processes, and (3) validation experiments for satellite observations. These studies include but are not limited to:
  - Stratospheric Tropospheric Exchange Project (STEP) -- 1987
  - Airborne Antarctic Ozone Experiment (AAOE) -- 1987
  - Airborne Arctic Stratospheric Experiment (AASE) -- 1989
  - Airborne Arctic Stratospheric Experiment II (AASE2) -- 1992
  - Stratospheric Photochemistry Aerosols and Dynamics Experiment (SPADE) -- 1993
  - Airborne Southern Hemisphere Ozone Experiment / Measurements for Assessing the Effects of Stratospheric Aircraft (ASHOE/MAESA) -- 1994
  - Stratospheric Tracers of Atmospheric Transport (STRAT) -- 1995-1996
  - Tropical Ozone Transport Experiment (TOTE) and Vortex Ozone Transport Experiment (VOTE) -- 1995-1996
  - Subsonic Aircraft: Contrail and Clouds Effects Special Study (SUCCESS) -- 1996
  - Photochemistry and Ozone Loss in the Arctic Region in Summer (POLARIS) -- 1997
  - Subsonic Assessment: Ozone and Nitrogen Oxide Experiment (SONEX) -- 1997
  - Texas Florida Underflights A (TEFLUN) -- 1998
  - The Third Convection and Moisture Experiment (CAMEX 3) -- 1998
  - TRMM Brazil Validation Experiment (TRMM-LBA) -- 1999
  - TRMM Kwajalein Validation Experiment (KWAJEX) -- 1999
  - Nauru 1999 Field Campaign -- 1999
  - South African Fire-Atmosphere Research Initiative 2000 (SAFARI) -- 2000
  - SAGE III Ozone Loss and Validation Experiment (SOLVE) -- 1999-2000
  - ERAST Predator-B RPV Homepage (ERAST) -- 2000

- CAMEX 4 The Fourth Convection and Moisture Experiment (CAMEX 4) – 2001
- East Pacific Investigation of Climate (EPIC) 2001 Field Program – 2001
- The Cirrus Regional Study of Tropical Anvils and Cirrus Layers-Florida Area Cirrus Experiment (CRYSTAL FACE) – 2002
- The SAGE III Ozone Loss and Validation Experiment (SOLVE II) – 2003
- The Aura Validation Experiment (AVE) – 2004
- The Intercontinental Chemical Transport Experiment – North America (INTEX-NA) – 2004
- The Aura Validation Experiment Houston (AVE Houston) – 2004
- North American Monsoon Experiment (NAME) – 2004
- Winter Storms Reconnaissance Program 2004 (WSR2004) – 2004
- Polar Aura Validation Experiment (PAVE) – 2005
- The Tropical Cloud Systems and Processes Mission (TCSP) – 2005
- UAS Flight Demonstration Project 2005 – 2005