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RESEARCH ANNOUNCEMENT

**EXPERIMENTAL AND THEORETICAL STUDIES OF TRANSPORT AND
CHEMICAL EVOLUTION OVER THE PACIFIC (TRACE-P)**

**Letters of Intent Due February 28, 2000
Proposals Due March 28, 2000**

OMB Approval No. 2700-0087

**EXPERIMENTAL AND THEORETICAL STUDIES OF TRANSPORT AND
CHEMICAL EVOLUTION OVER THE PACIFIC (TRACE-P)**

**NASA Research Announcement
Soliciting Research Proposals
for
Period Ending
March 28, 2000**

**NRA 00-OES-01
Issued January 28, 2000**

**Office of Earth Science
National Aeronautics and Space Administration
Washington, DC 20546**

RESEARCH ANNOUNCEMENT FOR EXPERIMENTAL AND THEORETICAL STUDIES OF TRANSPORT AND CHEMICAL EVOLUTION OVER THE PACIFIC (TRACE-P)

This NASA Research Announcement (NRA) solicits proposals for experimental investigations and theoretical studies that will comprise a comprehensive experiment entitled Transport and Chemical Evolution over the Pacific (TRACE-P). TRACE-P is part of NASA's Global Tropospheric Experiment (GTE). The GTE is an element of the Tropospheric Chemistry Program, a Research and Analysis (R&A) program within the Research Division of NASA's Earth Science Enterprise (ESE).

The goal of the GTE is to contribute substantially to scientific understanding of human impacts on the chemistry of the global troposphere. Changes in chemical composition of the troposphere on a global scale, linked to human activities, have been well documented during the last two decades and have given rise to considerable concern that they will lead to changes in the earth's climate and a decrease in global air quality as population increases and economic activity expands.

NASA has unique capabilities with which to study changes in the chemistry of the global troposphere. The GTE has provided a scientific management structure for bringing these capabilities to bear in an effective manner. The major thrust of the GTE to date has been to utilize NASA's DC-8 and P-3B aircraft, based at the NASA Dryden Flight Research Center (DFRC) and the NASA Wallops Flight Facility (WFF), respectively, to carry multi-instrument payloads into regions of the troposphere where natural processes and/or human impacts are believed to be particularly significant in controlling chemical composition. Previous GTE missions have obtained data in diverse environments, such as the Amazon rain forest in Brazil, the tropical South Atlantic Ocean, the Alaskan tundra, the northern Canadian wetlands, the western Pacific Ocean just off the Asian continent, and the tropical Pacific Ocean. Data from all of the GTE missions, including PEM West-A and -B have been released to the public. Instructions for accessing the data are provided in Appendix A. Instructions for obtaining a list of publications that summarize past results of GTE are also provided in Appendix A.

In 1991 and 1994, the GTE utilized the NASA DC-8 aircraft in two measurement campaigns, named the Pacific Exploratory Mission in the West-A and -B (PEM WEST-A and -B). These experiments were exploratory in nature and had a variety of objectives, one of which was to detect and study the Asian plume in times of strong and weak outflow. They revealed significant seasonal and geographic effects in the chemistry and transport of air emerging from Asia.

In the years since these earlier experiments were conducted, interest has increased in the question of the origin, chemistry, and fate of the pollution plume emerging from Asia, which is rapidly growing in both population and economic activity. The Pacific Basin is a part of the world where the air quality is still less polluted by human activities than is, for example, the North Atlantic Basin, but it will be impacted by the pollution plume

emerging from Asia. Energy use in eastern Asia has increased by 5% per year during the last decade, and this rate of increase will likely continue for the next two decades. Combustion of fossil fuels is the main source of energy in Eastern Asia. Emission of nitrogen oxides from combustion sources there is expected to increase almost five-fold from 1990 to 2020, resulting in substantial impacts. Experiments conducted along the West Coast of North America have already found enhanced combustion tracers in numerous air masses undergoing rapid transport from the west. For example, enhanced PAN, non-methane hydrocarbons, and O₃ (up to 90 ppbv) have been observed in multiple layers between 3-6 km height during one period with rapid trans-Pacific transport (see web site references in Appendix A).

Aircraft missions, strongly integrated with both ground-based and satellite-based observations and model studies, can now provide a very detailed understanding of the dynamical and chemical processes affecting the atmospheric composition. The aircraft mission will contribute to a more detailed understanding of the dynamic and chemical processes that are modifying the atmospheric environment downstream from Asia. The ground-based and satellite-based measurements over the long term will provide the necessary information to better understand the evolution of the Asian outflow over long temporal and large spatial scales. Finally, the modeling investigations will integrate the information from the various platforms into a new contextual framework to examine quantitatively the ensemble of processes that control the evolution of the Asian outflow.

The NASA GTE will conduct TRACE-P in the early spring of 2001. It will be a comprehensive experiment that will utilize both the DC-8 and the P3-B with the appropriate instrument payloads to examine the chemical composition, transport, and chemical evolution of air as it moves from Asia out across the Pacific Ocean. TRACE-P will take full advantage of recent improvements in instrumentation. The strong focus on two major scientific objectives - chemistry of the air emerging from Asia and the chemical evolution of that air as it moves away from Asia - will enable a deeper understanding of these phenomena than was possible from the PEM-West missions. The use of two aircraft will allow for coordinated flight plans tailored to the two major objectives.

The projected time period of TRACE-P will allow an unprecedented degree of integration between the suite of experimental and theoretical investigations in TRACE-P with new satellite observations that will be available by 2001 and with other aircraft-based and ground-based experiments that are planned for the same time period. The new satellite observations will include, for example, global CO profiles and methane columns from MOPITT (see Appendix G for explanations of the abbreviations and acronyms) on the Terra satellite; global aerosol information from MODIS and MISR on Terra, from a QuikTOMS instrument, and, assuming stability of the existing platform, some upper tropospheric aerosol information from SAGE; tropospheric ozone columns from TOMS and GOME; and nitrogen dioxide columns from GOME. The European ENVISAT is scheduled to be flying at that time and will include SCIAMACHY, which will extend the GOME objectives beyond ERS-2.

TRACE-P will be a part of the Asia Pacific Regional Experiment (APARE) of the International Global Atmospheric Chemistry (IGAC) program. APARE may also include ACE-ASIA, a major airborne and ground-based experiment (focussed on aerosol chemistry and transport) under consideration by the U.S. National Science Foundation, other U. S. government agencies, and several international partners. APARE will also include an aircraft-based atmospheric chemistry experiment funded by Japan's NASDA that would extend the measurement period beyond that planned for TRACE-P. APARE also includes relevant ground-based measurements applicable to the goals of TRACE-P in Japan, Korea, Taiwan, Hong Kong, and the People's Republic of China (PRC).

The CHINA-Metro-Agro-Plex (CHINA-MAP) experiment is a joint project between NASA and the PRC that is currently obtaining ground-based measurements in the Yangtze River delta with the goal of understanding the effects of increasing amounts of air pollution on Chinese agriculture. These measurements may continue into the TRACE-P time period and provide additional opportunities for data integration.

The purpose of this NRA is to solicit proposals for (1) the experimental investigations that will comprise the payloads to be carried by the two aircraft and (2) the process-oriented theoretical studies based on the data to be acquired. Proposals are also solicited to provide analyses of meteorological information available from existing worldwide meteorological measurements, from modeling, and from instruments aboard the aircraft. The meteorological analyses to be proposed should be directed primarily toward the characterization of the air masses in which the aircraft operate with respect to their origin and transport. Proposals that seek to provide meteorological measurements during the mission are not solicited by this NRA and will be non-responsive to it.

A high degree of integration of the airborne and ground-based observations both with satellite data and with modeling investigations is an important element of TRACE-P, and indeed, is required in order to meet the major objectives. Experimental and theoretical investigations that are proposed in response to this NRA should emphasize such integration to the maximum extent possible.

Experimental investigations to be proposed should be based largely on existing capabilities and should be capable of operation aboard the aircraft. They should have detection limits low enough to operate in the clean air regions of the western Pacific, and sufficient dynamic range to operate in more polluted regions near the continent. Proposals that seek extensive instrument development are not solicited by this NRA. Guidance on the performance required of the experimental investigations can be found in Appendix A. Guidance on the types of experimental measurements that are needed aboard the two aircraft is also provided in Appendix A. Experimental investigators may propose for participation aboard one or both aircraft.

Theoretical investigators solicited by and selected through this NRA will be expected to provide in-field guidance for the detailed implementation of the mission during its operation and in-depth analysis of the results during the first one to two years after the

mission. Proposals that require extensive model development will be non-responsive to this NRA.

NASA supports model development and theoretical studies of atmospheric chemistry through its Atmospheric Chemistry Modeling and Analysis Program (ACMAP). Selections of focussed theoretical investigations for TRACE-P will be strongly coordinated with the activities supported by ACPMAP.

The selected experimental and theoretical investigators will form a Science Team that will carry out final planning and implementation of the mission. The Science Team will be chaired by a Mission Scientist, who will be assisted by one or more Deputy Mission Scientist(s). A Mission Meteorologist will be selected for each of the two airplanes. The Mission Meteorologist will be responsible for meteorological forecasting for the flight operations and for providing input on the origins and destinations of the air masses encountered during the flights.

Proposals for Mission Scientist and Mission Meteorologist(s) are solicited, but such proposals should be a part of a broader experimental, theoretical, or data analysis proposal to participate in the TRACE-P mission. Proposers for Mission Scientist will be assumed to be willing to serve as Deputy Mission Scientist, unless they state otherwise. Appendix B includes special instructions for experimental or theoretical proposals that include a Mission Scientist or Mission Meteorologist role.

Implementation of the TRACE-P mission will require experimental investigators to be at either Wallops Flight Facility for the P-3B integration or the Dryden Flight Research Facility for the DC-8 integration and to travel with the aircraft during the mission. Theoretical investigators should be prepared to accompany the Trace-P mission during deployment. A total of 3-4 months is estimated to be required, of which about 45 days will be required for the TRACE-P deployment. The remaining time will be required for integration and off-loading of experiments.

Proposals that would require the acquisition of significant computer hardware and software in order to complete the proposed investigations are not solicited by this NRA. Proposals for extensive instrument development, model development, and long term ground-based measurements will be non-responsive to this NRA. Proposals for experimental investigations that clearly lack the required measurement sensitivity (see Appendix A) or that are unsuitable for operation aboard aircraft will also be non-responsive.

Proposals for ground-based or ship-based experiments that would provide important data for integration with the aircraft investigations are invited, but NASA does not expect to provide research ship support, nor is a long-term ground-based monitoring project a part of the TRACE-P mission. Appendices A and B contain further information on the ground-based data that will be provided by NASA through the GTE Project Office. Augmentations to these plans may be proposed in response to this NRA.

NASA expects to manage the GTE TRACE-P experiment through a project office at the Langley Research Center. Proposals for project management or logistics support will be non-responsive to this NRA.

Participation in this program is open to all categories of domestic and foreign organizations, including educational institutions, industry, nonprofit institutions, NASA research centers, and other government agencies. Applications for participation in this program can be made through submission of a proposal to the Research Division of the ESE, NASA Headquarters, Washington, D.C. After a review and evaluation of the proposals received, a selection of the experimental and theoretical investigations to be supported will be made by the Director of the Research Division. Financial support of the selected U.S. investigations will be provided by NASA.

The proposal review will be conducted during April through June, 2000, with selection anticipated by June 30, 2000. A letter of intent to submit a proposal can be submitted by February 28, 2000. To allow adequate time for evaluation and selection, proposals must be submitted by March 28, 2000. Participation by non-U.S. investigators is encouraged within the specific guidelines outlined in Appendices B, C, and D.

Funds for the TRACE-P project have not yet been appropriated. NASA expects to carry out this project within current guidelines for the ESE's R&A program without any enhancements to those guidelines. The total cost of the GTE-TRACE-P project is estimated to be \$18 million dollars over a 2-3 year period that will include preparation for the project, execution of the field measurements phase, and post-mission analysis of the data.

Appendix A provides the technical description of the TRACE-P mission and a prioritized list of the measurements required to meet the scientific objectives of TRACE-P. It also provides further information on the crucial role of models in meeting the mission objectives and additional information on other programs that offer opportunities for integration with TRACE-P.

Important proposal guidelines specific to this Research Announcement can be found in Appendix B, including detailed instructions on submission of estimates for travel expenses, shipping costs, and other expenses incidental to participation in a large project to be conducted in the field and aboard aircraft. Appendix B contains instructions on how to obtain information about the DC-8 and P-3B aircraft capabilities and the requirements for experiments operated aboard them.

Appendix C provides general instructions for responding to all NASA Research Announcements and general guidelines for the submission of proposals by foreign investigators. Appendix D provides a required Proposal Cover Sheet and certain required Certifications. Appendix E provides information and instructions regarding the submission of Letters of Intent. Appendix F provides a required Budget Summary Form. Explanations for the abbreviations and acronyms are provided in Appendix G.

Prospective investigators are urged to read the information in the Appendices and to follow the applicable specific guidelines therein carefully. Proposals should be made for the period of time necessary to carry out the investigation, but awards will generally not be made for a length of time greater than three years.

Identifier : NRA-00-OES-01

Proposals should be sent to:

TRACE-P NRA
400 Virginia Avenue SW
Suite 700
Washington, DC 20024
USA

Proposals sent by express or commercial delivery service should use (202) 554-2775 as the contact telephone number. Proposals submitted to NASA Headquarters will cause a delay in their receipt; therefore, please adhere to the instructions noted above. Mail proposals from outside the United States of America should be submitted according to the information in Appendix B, Section VIII.

Selecting Official: Director, Research Division, Earth Science Enterprise (ESE)

Additional technical information may be obtained from:

Dr. Jack A. Kaye
Director, Research Division, ESE
Code YS
NASA Headquarters
Washington, D.C. 20546
Tel: 202-358-0757 Fax: 202-358-2770
Email: jkaye@hq.nasa.gov

or

Mr. Richard J. Bendura
GTE Project Manager
Mail Stop 483
NASA Langley Research Center
Hampton, VA 23681-2199
Tel: 757-864-5830 Fax: 757-864-5841
Email: r.j.bendura@larc.nasa.gov

Your interest and cooperation in participating in this opportunity are appreciated.

Ghassem Asrar
Associate Administrator
Office of Earth Science

Enclosures:

- Appendix A, "Technical Description of the Transport and Chemical Evolution over the Pacific (TRACE-P) Mission"
- Appendix B, "Specific Guidelines for Proposers to this Announcement"
- Appendix C, "Instructions for Responding to NASA Research Announcements"
- Appendix D, "Required Certifications and Cover Sheet"
- Appendix E, "Instructions Regarding Letter Of Intent"
- Appendix F, "Budget Summary"
- Appendix G, "Glossary of Terms"

APPENDIX A

TECHNICAL DESCRIPTION OF THE TRANSPORT AND CHEMICAL EVOLUTION OVER THE PACIFIC (TRACE-P) MISSION

OVERVIEW

TRACE-P is an aircraft-based experiment to be conducted over the western Pacific Ocean as part of NASA's Global Tropospheric Experiment (GTE) in March-April 2001. The experiment is designed to achieve better understanding of how the outflow from the Asian continent affects the chemical composition of the global atmosphere. It will be conducted as a component of the APARE project of IGAC and will include important ground-based and aircraft-based investigations by international partners, including Japan, Korea, the Peoples Republic of China, Taiwan, and Hong Kong.

The mission has two strongly focussed scientific objectives:

- 1. to determine the chemical composition of the Asian outflow over the western Pacific in spring in order to understand and quantify the export of chemically and radiatively important gases and aerosols, and their precursors, from the Asian continent; and**
- 2. to determine the chemical evolution of the Asian outflow over the western Pacific in spring and to understand the ensemble of processes that control the evolution.**

To meet these objectives will require a suite of both measurements and modeling investigations, together with a sampling strategy that will also enable studies of a number of very important scientific issues embedded within the major objectives. These include, but are not limited to: (1) the relative contributions of ozone/water vapor photochemistry, acetone photochemistry, and peroxide photochemistry to the distribution of odd hydrogen species in the troposphere; (2) the roles of the convective transport of surface-generated NO_x , lightning, and the downward transport of NO_x from the stratosphere in the odd nitrogen budget in the upper troposphere; and (3) analyses of the likely impact of trans-Pacific traverses of air masses either on oxidant distributions along the West Coast of the United States or on concentrations of precursors of photochemical smog. The TRACE-P data, in conjunction with measurements planned by other APARE programs and new satellite observations of aerosols, will also enable studies of the role of chemical reactions on the surface of aerosol particles in controlling the chemical composition of the Asian outflow, the interactions of different types of aerosol particles, and their relative distributions.

TRACE-P will use the NASA DC-8 (ceiling 12 km) and the NASA P-3B (ceiling 7 km) in its aircraft-based component. The principal bases of operation are expected to be Yokota Air Base (near Tokyo, Japan) and Hong Kong. It will build on the heritage of the previous GTE Pacific Exploratory Missions - West (PEM-West A and B) conducted over

the western Pacific in August-September 1991 and February-March 1994. The PEM-West missions were exploratory, with multiple objectives achieved from a single aircraft; TRACE-P will extensively characterize the Asian outflow to allow for quantitative interpretation. In addition, TRACE-P will take advantage of numerous developments in aircraft instrumentation over the past decade including in particular those that measure HO_x, NO_x, sulfur species, aerosols, and UV actinic fluxes. Ten years have elapsed between PEM-West A and TRACE-P, during which time the Asian emissions have grown considerably, e.g., 70% for NO_x. Secular changes in the composition of the Asian outflow should be apparent between the PEM-West and TRACE-P missions.

Data from the PEM-West missions are available at the following web site:

http://www-gte.larc.nasa.gov/gte_arch.htm

Scientific results obtained from the PEM-West data have been reported in two special sections of *The Journal of Geophysical Research* (vol. **101**, no. D1, January 20, 1996, and vol. **102**, no. D23, December 20, 1997). A complete list of publications from the GTE missions is maintained at:

http://www-gte.larc.nasa.gov/gte_pubs.htm

Preliminary planning for TRACE-P has been conducted in workshops that resulted in a "white paper" describing the mission, which can be found at:

<http://www-gte.larc.nasa.gov/trace/tracep.html>

The white paper also contains references to the scientific literature on the expected atmospheric consequences of economic activity in Asia, on what is known of the atmospheric chemistry and meteorology of the East Asia/Northern Pacific region, and on recent instrument developments in atmospheric chemistry that will be helpful in meeting the objectives of TRACE-P. Potential responders to this NRA are urged to review the material at these web sites, which will be very helpful in designing appropriate experimental and theoretical investigations.

The primary motivation for TRACE-P is the rapid industrialization presently taking place in Asia. Energy use, principally fossil fuel combustion, in eastern Asia has increased substantially over the past decade and it, NO_x, and other pollutants, are expected to continue to increase as development proceeds. This presents a unique opportunity to observe the time-dependent atmospheric impact of what is essentially an ongoing major industrial revolution. Long-term observations from ground sites and satellites can provide continuous monitoring of the temporal trend of atmospheric composition but are limited in spatial coverage (in the case of ground sites) or in the suite of species measurable (in the case of satellites). Focussed aircraft missions complement surface and satellite observations by providing detailed investigations of the dynamical and chemical processes affecting atmospheric composition over rather broad geographical regions.

Integration of aircraft, satellite, and ground-based studies will be a defining characteristic of TRACE-P. This synthesis will be possible because of the availability of both important new satellite data in 2001 and complimentary data from APARE which will include a number of other airborne and ground-based measurements. TRACE-P will also require a very strong coupling between experimental investigations and modeling studies. The modeling studies will provide critical tools for detailed flight planning; in-field, quick-look data analysis; and for post-mission data analyses. Taken together, the full suite of measurements and modeling investigations will enable the TRACE-P team to reach the major objectives, especially when combined with large-scale models capable of integrating the ground-based, aircraft-based, and satellite-borne data.

The first objective of TRACE-P is to identify the major pathways for Asian outflow over the western Pacific, and to chemically characterize the outflow in a way that provides a basis for quantitative model analysis of export from the Asian continent. A number of 3-D chemical tracer models have been used in recent years to examine Asian influence on global atmospheric composition (see references in the TRACE-P white paper). TRACE-P will provide the information needed to test these models. We expect the Asian chemical outflow over the western Pacific to represent a complicated superposition of contributions from different Asian source regions and from long-range transport of European and North American pollution. The Asian emissions themselves represent a mix of contributions from fossil fuel combustion, other industrial activities, biomass burning, vegetation sources, and soil dust. Scavenging of soluble aerosols and gases during wet convective transport out of the boundary layer modifies the composition of the outflow, and unusually strong stratosphere-troposphere exchange around the Japanese jet further complicates the interpretation of the outflow. The use of two aircraft in TRACE-P will allow the sampling of a range of Asian outflow pathways in different regions and at different altitudes, as is needed to support quantitative analyses of export from the Asian continent.

The successful linking of aircraft and ground-based measurements with 3-D model products and continuous satellite observations is critical to the generalization and quantitative interpretation of the limited aircraft and ground-based observations in terms of export fluxes. Aircraft measurements alone will not allow quantitative assessment of the Asian outflow because of statistical sampling limitations. This is particularly true in the highly variable polluted atmosphere of the TRACE-P study region. The TRACE-P measurements are designed to provide the necessary tests and constraints for the model and satellite data. The latter can then be used to place the aircraft observations in a broader context and to allow seasonal estimates of export fluxes.

The second major objective of TRACE-P is to better understand the chemical evolution of the Asian outflow over the west Pacific, focusing on tropospheric O₃ and aerosols. The processes involved in this evolution include photochemistry, heterogeneous chemistry, gas-to-particle conversion, aerosol growth, scavenging, and subsidence to the marine boundary layer followed by rapid removal of some species by deposition. Different patterns of evolution are expected depending on the direction of outflow (tropics vs. high latitudes); the altitude (boundary layer vs. free troposphere); the presence of soil dust,

soot, or other chemically active aerosols in the outflow; and the contributions from natural sources including lightning and stratospheric intrusions. Previous studies (see references in the TRACE-P white paper) have pointed out that strong UV radiation and heterogeneous chemistry involving dust aerosols may play an important role in modifying the chemical composition of the Asian outflow over the western Pacific. A strong integration of TRACE-P aircraft and ground-based data, with data from satellites, and data from other APARE projects, such as ACE-ASIA, will be essential to enable the analytical studies needed to address this objective.

The March-April flight period for TRACE-P was selected after consideration of several factors (see references in the TRACE-P white paper). Spring is the season of maximum Asian outflow over the north Pacific, due to a combination of active convection over the continent and the presence of persistently strong westerlies. In summer, deep convection often exports Asian air to the upper troposphere above 12 km; while outflow at lower altitudes in that season is deflected to polar latitudes by the circulation around the Pacific High. In winter, a significant fraction of the Asian outflow may head south rather than east. Spring affords the best opportunity to not only sample Asian outflow, but also the emissions associated with biomass burning from the northern tropics (as indicated by a March-May maximum in tropospheric ozone measured over Hong Kong). Long-range transport of Asian dust over the north Pacific is also at a maximum in spring. Photochemistry over the western Pacific is active from February to March, and intensifies with the advance of the spring season.

FLIGHT PLAN

Nominal flight tracks for the two TRACE-P aircraft are shown in Figure 1. The nominal plan is for the aircraft to operate out of two sites: Yokota Air Force Base (near Tokyo, Japan) and Hong Kong. As shown in Figure 1, these two bases of operations are well situated to sample Asian outflow over the full range of latitudes from 10N to 50N. Specific objectives of the flights out of Hong Kong will include sampling biomass burning pollution from southeast Asia, tropical inflow and outflow, and industrial outflow from the Pearl River Delta, which is one of China's fastest growing regions. Specific objectives for the flights out of Yokota Air Base will include outflow of pollution from northern China, Korea, and Japan; long-range transport of European and North American pollution in the westerlies; dust outbreaks; and the effect of stratospheric influences, combined with continental outflow in the Japanese jet.

The sampling of outflow in flights from Yokota Air Base and Hong Kong will use wall patterns (Figure 2a and 2b) with each aircraft flying stacked patterns of horizontal legs perpendicular to the outflow and separated by a few km altitude. Regions of outflow will be identified on a day-to-day basis using meteorological and chemical tracer model forecasts. The length of a typical wall will be ~1000 km in order to provide a representative sampling of the outflow that can be used to test predictions from 3-D chemical tracer models. The wall pattern may be repeated over the duration of the flight to improve the statistics and also to assess photochemical aging of reactive species as part of the process studies. The two aircraft will be used to sample different outflow regions

on any particular day; typically the P-3B will focus on low altitudes and the DC-8 on high altitudes. Since outflow at different altitudes may be geographically and temporally separated, the DC-8 and the P-3B will in general cover different horizontal flight tracks and may not fly on the same days or out of the same operational base.

Chemical aging of the Asian outflow over the western Pacific will be examined with flights extending east from Hong Kong and Yokota Air Base, and most specifically with DC-8 flights using Guam as an overnight stop (Figure 1). These flights will sample Asian outflow having traveled a few days over the western Pacific. Under conditions of steady westerly outflow, transects between Yokota Air Base and Guam may be used to revisit air previously sampled close to the China coast on flights south of Yokota Air Base or north of Hong Kong (Figure 1). A generic pattern for the chemical aging flights is shown in Figure 3. Specific patterns will be guided by meteorological and chemical forecasts in the field. Near-Lagrangian sampling, in collaboration with other research programs that may be operating in nearby regions at the same time, will be attempted if the opportunity presents itself.

The TRACE-P plan is to allocate 160 and 172 flight hours to the DC-8 and P-3B aircraft, respectively, including test and transit flights. More hours will be allocated for the P-3B to account for the longer transit time to the study region. Sorties out of Hong Kong and Yokota Air base will include both 8-hour and 10-hour flights. A nominal breakdown of integration, test flight, and deployment schedules is shown in Table 1. The DC-8 will conduct four sorties out of Hong Kong and seven out of Yokota Air Base, while the P-3B will conduct four sorties out of Hong Kong and six out of Yokota Air Base. The DC-8 sorties will include one return flight to Guam (to be counted as two sorties).

These flights plans, apart from the total flight hours to be allocated are included here for broad guidance only. The selected investigators will be organized into a Science Team, which will develop the final, detailed flight plans that would best achieve the scientific objectives of the TRACE-P mission.

FLIGHT MEASUREMENT PRIORITIES

Priority measurements for the DC-8 and the P-3B are listed in Table 2. The priorities reflect the focus of the mission on radiatively important species, photochemical oxidants, sulfur, and aerosols. The priorities assigned to the various measurements are based upon the scientific objectives of TRACE-P. Chemical tracers of air masses are also included in the list. Priority 1 measurements are of greatest importance, and a failure of one of these measurements before the mission begins or in the field during the mission would seriously reduce the likelihood of meeting mission objectives. Based on known instrument sizes and capabilities from other measurement programs, all Priority 1 and 2 requirements, and perhaps a few Priority 3 requirements, can be accomplished from the aircraft. Priority 4 measurements will be considered only from investigations that also address a Priority 1 or 2 measurement. Priority 5 refers to measurements that address a very important science issue, but for which instruments that are known to be adequate for the task have not been demonstrated from an aircraft platform. Consideration will be

given to selecting at least one Priority 5 instrument for each aircraft, if acceptable proposals are offered.

The instrument detection limits and time resolutions quoted in Table 2 are minimum requirements below which the instrument will be considered non-responsive to the objectives of the mission. Performance beyond these minimum requirements in terms of speed, precision, accuracy, and specificity will be an important consideration in the selection of the aircraft payload. The size of the instrument will also be a factor. Smaller, lighter instruments are obviously preferred for aircraft measurements at a given performance level.

GROUND-BASED AND SATELLITE-BASED MEASUREMENTS

Measurements from both ground-based and satellite-borne instruments will help to place the aircraft TRACE-P observations in a broader temporal and spatial framework. There is a strong emphasis in APARE on ground-based measurements, a large suite of such measurements will be obtained by the international participants in APARE. These measurement projects, along with TRACE-P and ACE-ASIA are coordinated through the APARE Steering Committee and are funded by the various national governments. The APARE data most relevant to TRACE-P will be available through the GTE data archive and TRACE-P data in turn will be made available to APARE, after an initial data validation period. Species of special interest include ozone, aerosols, CO, and hydrocarbons. Asian partners, within the framework of APARE, will play a leading role in the obtaining these surface-based measurements. Proposals to augment the APARE ground-based measurements prior to, during, and following the TRACE-P field campaign are appropriate for this NRA.

Ozonesondes have proved to be particularly valuable measurements in past GTE missions. TRACE-P will include a program of intensified launches at six established ozonesonde sites in Hong Kong [Chan et al., 1998], Japan (Naha, Kagoshima, Tateno, Sapporo), and Taiwan (Cheng-Kung). Ozonesondes will be launched once a week from March 2000 to March 2002 (1 year before to 1 year after the mission) and twice a week during the mission. The ozonesondes will be launched from the different sites on the same days, and if possible at the same times. The GTE role in these measurements consists of providing additional ozonesondes to enable the greater frequency of measurements. This activity is financially feasible for TRACE-P because it is leveraged by the capabilities already in place at these established ozonesonde sites. Proposals for further enhancements to the ozonesonde measurements are also appropriate in response to this NRA.

The 2001 time frame promises to offer a large array of satellite measurements, most of which have not been available to past GTE missions. This will provide an opportunity for an unprecedented degree of integration of satellite and in-situ data, which will greatly enhance the prospects of meeting the major TRACE-P objectives. Satellite measurements of aerosol optical depths over the oceans will continue to be available operationally from the Advanced Very High Resolution Radiometer (AVHRR) and the

Sea-viewing Wide Field-of-view Sensor (SEAWIFS). They will be of considerable value for day-to-day flight planning and for post-mission interpretation of the TRACE-P observations. New satellite observations will include, for example, global CO profiles and methane columns from MOPITT on the Terra satellite; global aerosol information both from MODIS and MISR (on Terra) and from a QuikTOMS instrument; and, assuming continued platform operations, some upper tropospheric aerosol information from SAGE. Tropospheric ozone columns from TOMS and both tropospheric ozone and nitrogen dioxide columns from GOME will be available. The European ENVISAT, which will include SCIAMACHY, is scheduled to be flying at that time and will extend the GOME objectives beyond ERS-2, while adding additional capabilities. Proposals to utilize these measurements in an integrated manner with the aircraft- and ground-based data are particularly appropriate in response to this NRA.

Day-to-day flight planning in the field will require high-quality meteorological forecasts and back-trajectory analyses. Chemical and aerosol forecasts using 3-D model simulations with forecast weather and trajectory analyses will be of considerable value for guiding the aircraft towards outflow regions and for planning chemical aging flights. These 3-D models can provide an integrated analysis of the outflow from the Asian continent that includes the effects of emissions, boundary layer dynamics and chemistry, convective pumping, and long-range transport from Europe and North America. Both mesoscale and global models should be engaged in this role. Continued development and improvement of emission inventories for the Asian continent is critical in that context. The availability of dust reports and aerosol lidar data in the field will also be important. Considering that a major goal of TRACE-P is to provide the observations needed for testing the simulation of Asian outflow in 3-D chemical tracer models, the use of these models in the flight planning stage both before and during the mission is of considerable value. Additional modeling support will be needed in the field for quick analysis of the aircraft observations using a combination of statistical approaches, 0-D photochemical box models, and aerosol models.

OTHER AIRCRAFT PROGRAMS

The Aerosol Characterization Experiment - Asia (ACE-Asia) aircraft mission is currently planned to be in the field concurrently with TRACE-P. ACE-Asia will study the outflow of aerosols and aerosol precursors from Eastern Asia to the Pacific. Its objectives are to characterize the physical, chemical, and radiative properties of Asian aerosols that impact the Pacific atmosphere and to quantify the processes needed to model these properties. ACE-Asia will involve 2 years of observations from a surface network, in addition to springtime intensive observations with aircraft and ships in 2000 and 2001. Since the goals of TRACE-P and ACE-Asia are very complementary, collaboration will take place to the extent possible while maintaining the integrity and independence of each mission. Details of the collaboration will be worked out between the science teams for the two missions. The collaboration could take several forms: joint flights planned to maximize opportunities or aerosol-related measurements, reciprocal representation at planning meetings, and joint flight operations, including Lagrangian experiments.

Additional information about ACE-Asia can be found at:

<http://saga.pmel.noaa.gov/aceasia>

The NASDA (National Space Development Agency of Japan) plans to conduct an aircraft campaign in May, 2001. Previous NASDA aircraft campaigns have used a Gulfstream-2 aircraft to investigate biomass burning and continental outflow in southeast Asia in different seasons. The species to be measured during the next aircraft campaign to be named PANDA (Pacific Atmospheric Niche Derived from Asia) include several that will also be measured in TRACE-P. Measurements will be made over the same general region as TRACE-P for about 60 total flight hours. This experiment will effectively extend the TRACE-P data to May and will significantly enhance the understanding of the seasonal progression of the outflow from continental Asia along with the associated photochemistry.

Data from experiments that may be conducted by others prior to, during, and following the TRACE-P time would be of great value for investigating the long-range transport and chemical evolution of the Asian outflow sampled with the TRACE-P aircraft. By utilizing real time forecasting and modeling, it should be possible to identify air masses which could be sampled in the Western Pacific and, 4-6 days later, upon arrival to the west coast of North America. Close collaboration would be sought with any experiments along the West Coast of the United States and joint analysis of any such data would be an appropriate research topic in TRACE-P.

Table 1. Nominal flight hour allocations for the DC-8 and P-3B

Activity	DC-8		P-3B	
	# of flights	Flight Hours	# of flights	Flight Hours
Test Flights	3 (5 hr ea.)	15	3 (5 hr ea.)	15
Transit to Hong Kong	2 ^a	16	4 ^b	33
Hong Kong Sorties	2 (10 hr ea.)	20	2 (10 hr ea.)	20
	2 (8 hr ea.)	16	2 (8 hr ea.)	16
Transit: Hong Kong to Yokota Air Base, Japan	1	8	1	10
Yokota Air Base Sorties	3 (10 hr ea.)	30	2 (10 hr ea.)	20
	4 (8 hr ea.)	32	4 (8 hr ea.)	32
Return Transit	3 ^c	23	4 ^d	25
TOTAL FLIGHT HOURS		160		171

- a. Dryden Flight Research Center - Hawaii (8 h); Hawaii - Hong Kong (8 h)
- b. Wallops Island - Dryden (7 h); Dryden - Hawaii (7.5 h); Hawaii - Guam (10.5 h); Guam - Hong Kong (8 h)
- c. Yokota Air Base - Guam (8 h); Guam - Hawaii (8 h); Hawaii - Dryden (7 h)
- d. Yokota Air Base - Anchorage (10 h); Anchorage - Seattle (8 h); Seattle - Wallops Island (7 h)

Table 2. Measurement Requirements for the DC-8 and P-3B Instrumentation				
Species/Parameter	Detection Limit(a)	Time Resolution	DC-8 Priority	P-3B Priority
O ₃ (in situ)	3 ppbv 1 ppbv(b)	1 sec	1	1
NO	3 pptv 1 pptv(b)	1 min 10 sec(b)	1	1
H ₂ O(c)	3 ppmv	1 min 10 hz(b)	1	1
CO	5 ppbv	1 sec	1	1
Atmospheric State Parameters (d)	aircraft standard	1 sec	1	1
Vertical Winds(d)	10 cm/sec	10 hz	NA	2
remote ozone (nadir and zenith)	5 ppbv	Z<500 m X<60 km	1	NA
remote aerosol (nadir and zenith)	scattering ratio .02 @ 600 nm	Z<60 m X<500 m	2	3 (nadir)
Range-resolved remote water vapor	0.01g/kg	Z≤ 500m X≤70km	2	NA
PAN	5 pptv	5 min	2	2
HNO ₃	5 pptv	5 min	2	2
H ₂ O ₂	10 pptv	5 min 1 min(b)	2	2
CH ₃ OOH	10 pptv	5 min	2	2
Speciated Hydrocarbons (C ₂ -C ₈)	20 pptv	5 min	2	2
Halocarbons	2 pptv	5 min	2	2
OH	1x 10 ⁵ molec/cm ³	5 min	2	2
HO ₂	1x10 ⁷ molec/cm ³	5 min	2	2
NO ₂	5 pptv	1 min	2	2
CO ₂	0.5 ppmv (e)	1 min	2	2
N ₂ O	0.5 ppbv (e)	1 min	2	2
CH ₄	20 ppbv (e)	1 min	2	2

Table 2 (con'd). Measurement Requirements for the DC-8 and P-3B Instrumentation				
Species/Parameter	Detection Limit(a)	Time Resolution	DC-8 Priority	P-3B Priority
Acetone	50 pptv	5 min	2	3
Spectrally resolved nadir & zenith actinic flux for J-value determination	0.1 $\mu\text{W}/\text{nm}/\text{cm}^{-2}$ 280 nm - 420 nm @ 1nm resloution	30 sec	2	2
J{O(¹ D)}	2×10^{-4} /s	30 sec	2	2
J{NO ₂ } (d) (nadir & zenith)	1×10^{-4} /s	30 sec	2	2
SO ₂	5 pptv	5 min 1 min(b)	2	2
Lightning events (d)	range 400 km	<3 min hold time	2	2
CH ₂ O	50 pptv	5 min 1 min(b)	2	2
Aerosols size/ number distribution	10 nm - 20 μm	5 min per scan	2	2
Aerosol composition (ionic analysis)	5 pptv	10 min 5 min(b)	2	2
Range-resolved remote temperature sounding	2 K	1 km	2	NA
Black Carbon	0.1 $\mu\text{g}/\text{m}^3$	5 min	3	2
In situ aerosol light scattering coefficient	$10^{-7}/\text{m}$	10 sec	3	3
Organic nitrates (Alkylnitrates)	6 pptv	5 min	3	3
Condensation Nuclei	$10/\text{cm}^3$	10 sec	4	2
Ultra fine aerosols	size range 3-15 nm	5 min	3	2
DMS	1pptv	5 min	3	3
H ₂ SO ₄ (g)	2×10^5 molec/ m^3	5 min	3	2
Alcohols	20 pptv	5 min	3	3

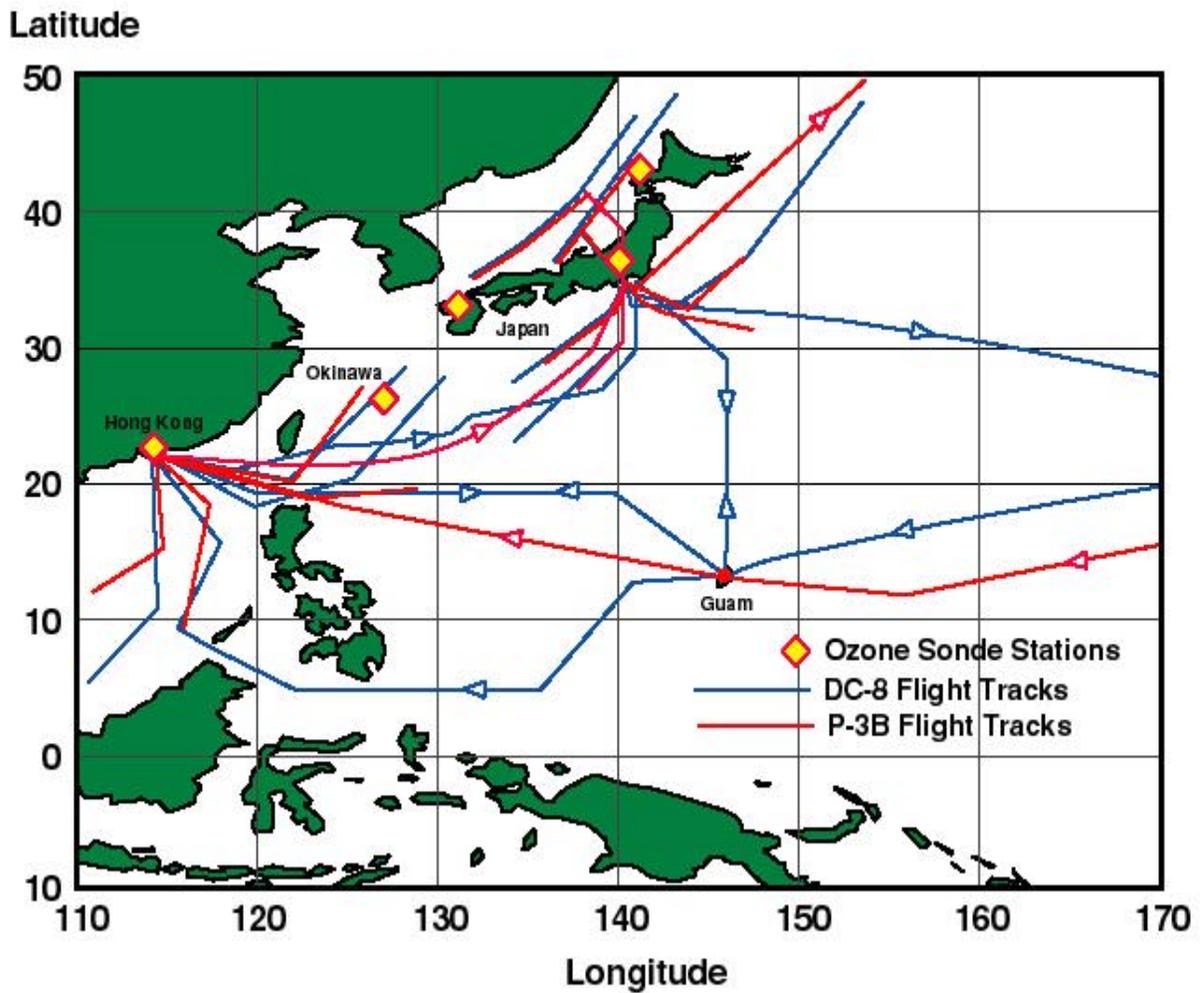
Table 2 (concl'd). Measurement Requirements for the DC-8 and P-3B Instrumentation

Species/Parameter	Detection Limit(a)	Time Resolution	DC-8 Priority	P-3B Priority
organic acids	10 pptv	5 min	3	3
²²² Rn	0.05 Bq/SCM	5 min	3	NA
²¹⁰ Pb	0.1 Bq/SCM	10 min 5 min ^(b)	3	NA
⁷ Be	1.0 Bq/SCM	10 min 5 min ^(b)	3	NA
NH ₃	10 pptv	5 min	3	3
Column content of trace gases (e.g., CO)	Species –dependent (specify)	10 min 5 min ^(b)	3	3
Isotopic content of water vapor	Isotope-dependent (specify)	10 min 5 min ^(b)	3	3
MSA(g)	2 x 10 ⁵ molec/cm ⁻³	1 min	4	4
DMSO(g)	2 x 10 ⁶ molec/cm ⁻³	1 min	4	4
HNO ₄	5 pptv	5 min	5	5
RO ₂	0.1 pptv	5 min	5	5
>C ₁ - Aldehydes	20 pptv	5 min	5	5
C ₃ - ketones	20 pptv	5 min	5	5
Ethene/Propene	2 pptv	1 min with real time output	5	5
Size Resolved Single Particle Chemical Composition	Species-dependent (specify)	<1 min	5	5
Range-resolved measurement of other chemical species (listed above)	Species-dependent (specify)	5 min	5	5

Description of priority ratings and footnotes for Table 2.		
Rating	Description	Meaning
1	Mission Critical	The measurement is essential to the interpretation of data related to the objectives of mission.
2	Very Important	The measurement is important to several scientific issues being addressed by the mission.
3	Important	The measurement is important to some scientific aspects of the mission. Space requirements of instrument will be a prime consideration for inclusion in the payload.
4	Less Important	Measurements would be useful but information not considered critical to interpretation of mission results. A measurement at this level will be considered only if it utilizes an instrument used also to make another measurement at the priority 1 or 2 level.
5	New Technology/ Very Important Measurement	Measurements involving instruments that represent the application of new technologies/approaches to measuring species of very high scientific interest. Measurement involves technical risk, but consideration will be given to including at least one such measurement in the payload.

- (a) Detection limit at S/N=2
- (b) Preferred characteristics
- (c) Water vapor at 1min resolution will be provided by the GTE Project Office
- (d) Provided by GTE Project Office
- (e) Precision of measurement

Nominal Flight Tracks for the NASA Aircraft During the APARE/TRACE-P Mission



Trace-P/NASA/IFI/Tika comb. - 059

Figure 1. Nominal TRACE-P flight tracks.

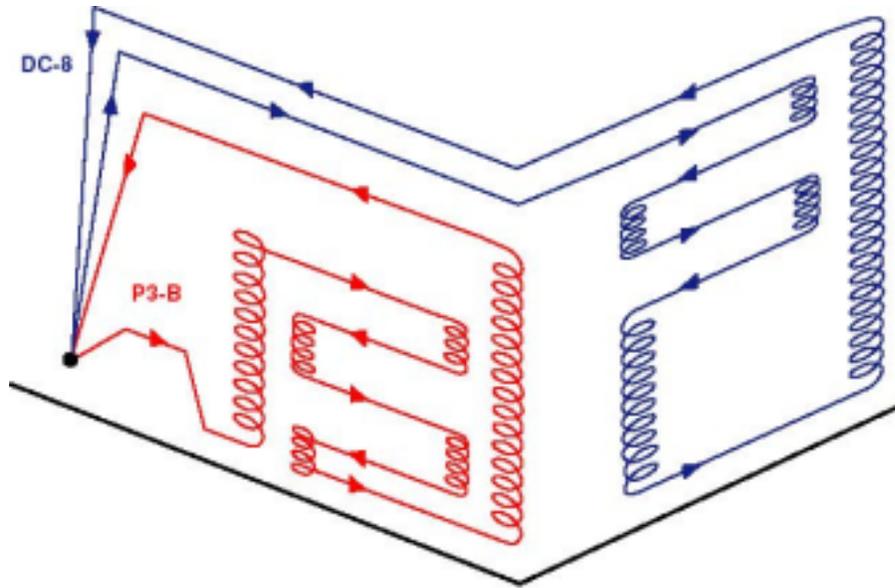


Fig.2a

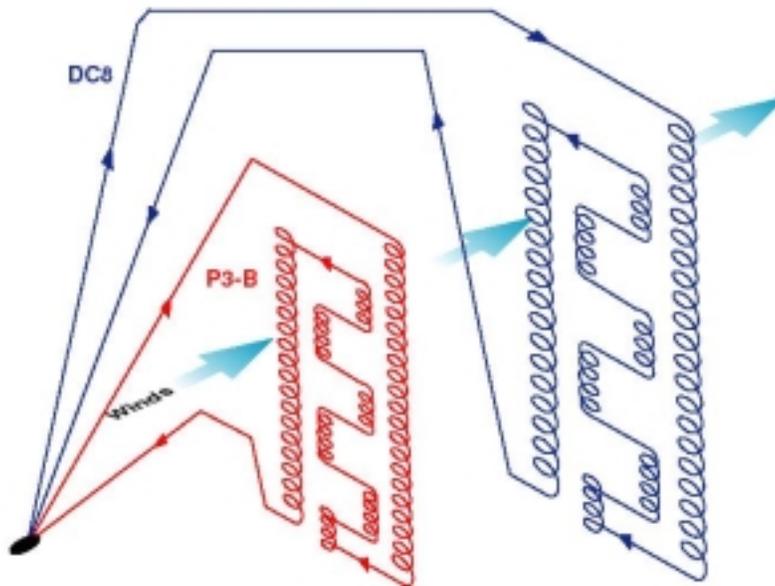


Fig. 2b

Figure 2a and b. Typical wall flight patterns for the DC-8 and P-3B in TRACE-P

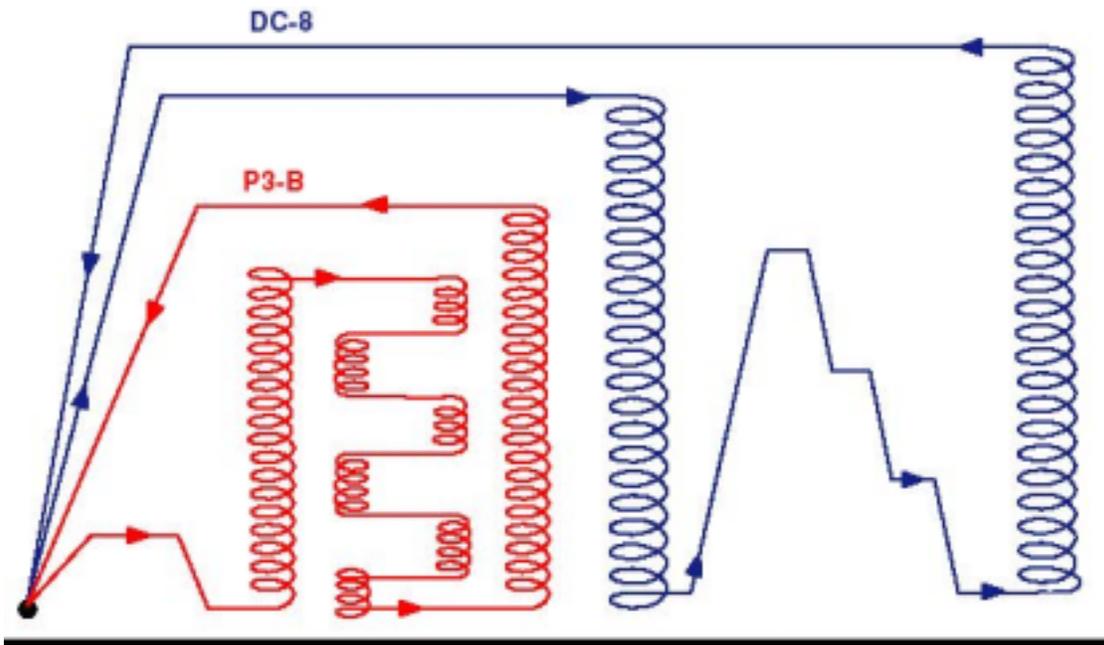


Figure 3. Typical chemical aging flight pattern for the DC-8 and P-3B in TRACE-P

APPENDIX B

SPECIFIC GUIDELINES FOR PROPOSERS TO THIS ANNOUNCEMENT PROPOSAL CONTENT, SUBMISSION, AND EVALUATION INFORMATION

I. PURPOSE

These guidelines contain general and specific information regarding the submission of proposals in response to this NRA. Suggested formats and mailing information for submission of proposals for research related to this program are also provided. Appendix C contains general instructions for responding to NASA Research Announcements. Where conflicts exist between this appendix and Appendix C, this appendix shall be the controlling document.

II. GUIDELINES FOR PARTICIPATION

This Research Announcement solicits proposals for experimental investigations aboard either the DC-8 or P-3B aircraft, or both, that address objectives of the TRACE-P mission as set forth in Appendix A. It also solicits proposals for theoretical investigations and data analysis to be performed with the data that will be acquired and for ground-based investigations as described in Appendix A. A strong integration of airborne, ground-based, and satellite-based data, with modeling investigations will be needed to meet the mission objectives. Proposals are also solicited for the roles of Mission Scientist and Mission Meteorologist(s) as defined in this NRA, but such proposals should be submitted only as a part of a broader experimental or theoretical investigation that will address the objectives of the TRACE-P mission.

Proposals for experimental investigations that would require extensive instrument development are not solicited, nor are proposals for extensive model development nor the acquisition of major computer hardware and software. Proposals for project management or logistics support are also not solicited by this NRA.

Proposals for ground-based and ship-based investigations that would support the objectives of TRACE-P may be submitted, but NASA does not expect to provide research ship support or to establish a long-term ground-based monitoring capability under this NRA. Proposals in these areas should, therefore, take advantage of existing facilities or facilities that might be provided by other agencies or other governments at the time and place of the TRACE-P aircraft operations.

Participation is open to all categories of domestic and foreign organizations, but proposers from non-U.S. organizations will not be eligible to receive NASA funding, except that NASA will integrate selected foreign experiments onto the designated aircraft and will pay all costs associated with operation of the aircraft. Applications for participation in this program can be made through submission of a proposal to the

Research Division of Earth Sciences Enterprise (ESE), National Aeronautics and Space Administration Headquarters, Washington, DC. After a review and evaluation of the proposals received, a selection of the experimental and theoretical investigations to be supported will be made by the Director of the Research Division. NASA will provide financial support for the selected U.S. investigations.

III. SCHEDULE

A letter of intent to submit a proposal may be submitted by February 28, 2000. To allow adequate time for evaluation and selection, proposals must be submitted by March 28, 2000. The proposal review will be conducted from mid-April through June, 2000, with selection anticipated by June 30, 2000. Funding is anticipated to begin on or after July 1, 2000. Late proposals will be considered only if the selecting official deems them to offer NASA a significant technical advantage or cost reduction.

IV. GENERAL INFORMATION ON GTE AND TRACE-P

This section provides information on the management structure and functions of the GTE Project Office, which may impact the development and costing of research proposals.

A. Program Management

The TRACE-P mission will be a research project within the NASA Global Tropospheric Experiment, managed and funded through the Tropospheric Chemistry Program in the Earth Science Enterprise (ESE). The Program Manager for the Tropospheric Chemistry Program will serve as the TRACE-P Program Manager providing oversight to ensure that the research activities of TRACE-P are in concert with the objectives of the ESE. The Program Manager will be the point of contact for coordinating the research activities of TRACE-P with other collaborating U.S. and foreign agencies. The Program Manager will be an *ex officio* member of the TRACE-P Science Team.

B. Project Management

The TRACE-P project activities will be managed by the GTE Project Office at NASA's Langley Research Center (LaRC). The GTE Project Manager will be responsible for the overall management and coordination of resources provided to meet the scientific objectives of the TRACE-P mission. These responsibilities will include (a) interaction with the Tropospheric Chemistry Program management and the management of other collaborating agencies and science teams; (b) overall direction of project planning, schedules, and field operations; (c) providing for the timely transmittal of all data collected by the project into a public archive at LaRC and dissemination of the data through CD ROMS, support of journal publication (and other appropriate means) of the results; and (d) acquisition and reporting of base measurements in support of the mission goals. The Project Manager will be assisted by the Mission Scientist, Deputy Mission

Scientist, Mission Meteorologist(s) and by a project staff. The Project Manager will be an *ex officio* member of the TRACE-P Science Team.

C. TRACE-P Science Team

The TRACE-P Science Team will be composed of (1) the Principal Investigators for experimental proposals approved for the DC-8 and/or for the P-3B components of the mission, (2) any ground-based principal investigators that may be selected, and (3) the selected theoretical investigators. The term of participation on the Science Team will continue as long as the approved research continues.

The Science Team will be chaired by the Mission Scientist or Deputy Mission Scientist. Individuals proposing an experimental or theoretical investigation may also propose to serve as Mission Scientist or Deputy Mission Scientist.

The Science Team will determine its own structure and method for interactions among Team Members and the DC-8 and P-3B aircraft operators to achieve the mission objectives and the goals of the GTE TRACE-P mission. The Science Team and the Project Manager will develop detailed plans to conduct the TRACE-P mission to meet the objectives given in this NRA. The Science Team will also be responsible for establishing a data management and data protocol plan that will promote the timely publication and dissemination of scientific results in accordance with data handling policies of the ESE. The data policy for ESE projects requires that data be made available to the public after a brief period of exclusive use by science teams for validation of the data, which for the TRACE-P mission shall be 6 months after return from the field deployment.

D. National and International Cooperation

The TRACE-P project will coordinate its field studies through the International Global Atmospheric Chemistry (IGAC) project, a core project of the International Geosphere Biosphere Program (IGBP). Foreign participation or collaboration will be on a cooperative (no exchange of funds) basis only, and coordinated through the IGAC.

Accepted foreign experiments will be integrated by NASA onto the appropriate aircraft, and NASA will bear all costs of operating the aircraft. The guidelines for foreign proposals are described in Section VIII of this appendix.

E. Logistical Support Provided by NASA

During the field deployment of TRACE-P, the GTE Project Office will provide the logistical arrangements and funding for shipping investigator equipment to and from the investigator's laboratory and the aircraft integration site, and to and from the investigator's laboratory and the intensive field deployment sites. For the P-3B and DC-8

aircraft, the intensive sites are anticipated to be Hong Kong and the Yokota Air Base, Fussa, Japan. Advanced shipments, of items such as compressed gases to each of the intensive sites will be *via* surface transportation. Because of the limited weight and space capacity of the DC-8 and P-3B, air shipments of supporting equipment to Hong Kong and Yokota will be provided by the GTE Project Office.

The Project Office will arrange for hotel accommodations at each deployment site, and meeting rooms and field laboratory facilities as required at each intensive deployment site. The Project Office will also make arrangements for common expendables, such as liquid nitrogen and dry ice. Specialized expendables such as calibration gases are to be supplied by the respective investigator teams.

Travel costs associated with participation of the non-NASA U.S. Principal Investigators in planning meetings will be provided through the GTE Project Office. Travel costs directly attributed to the field deployment of TRACE-P will also be provided through the GTE Project Office for non-NASA U.S. participants. Travel costs for NASA employees will be covered by their respective home Centers. Shipping costs for all U.S. investigator teams will be covered through the GTE Project Office. In order for the Project Office to estimate the resources that will be required to cover these costs, proposers are requested to provide certain information described in Section V.I. of this Appendix.

Foreign investigators must bear their own costs for all travel and shipping.

F. Data Products/Archive

The Project Office will serve as a central repository and distribution center for all data products obtained during the TRACE-P mission. The Project Office, in conjunction with the respective aircraft Mission Managers, will provide a set of standard "housekeeping" parameters aboard each aircraft, including ambient temperature, dew point temperature, winds, and aircraft position (see Table 2, Appendix A). The Project Office will provide a data system aboard each aircraft, which will facilitate distribution of these data aboard the aircraft in real time. The Project Data System will also offer the capability of displaying selected information from investigators aboard the respective aircraft.

The Project Office will maintain a mission data archive for distribution among the Science Team. The mission archive will consist of all data acquired as part of the TRACE-P mission. Each investigator team will be responsible for submitting preliminary field results to the Project Office within 24 hours after each flight for distribution to the Science Team during the mission. Final validated measurements from the mission must be submitted to the Project Office within 6 months after completion of the field deployment phase. The project office will be responsible for submitting the TRACE-P data archive to the Langley Distributed Active Archive Center, which will be the repository for all of the mission data.

The Project Office, with the Mission Meteorologist(s), will provide for the acquisition and distribution to the Science Team meteorological data supporting the mission

objectives. These data will include meteorological products for flight planning and post-mission products to support analysis and publication of results.

V. PROPOSAL CONTENT AND FORMAT

The content of the proposal should provide sufficient detail to enable a reviewer to assess the value of the proposed research, its relation to the TRACE-P objectives, and the probability that the investigators will be able to accomplish the stated objectives within the requested resources. The technical part of the proposal should be limited to the equivalent of 15 single-spaced typewritten pages. An additional four pages will be allowed for proposals that include a proposal to serve as Mission Scientist or Mission Meteorologist to allow a description of the activities proposed in those roles. Each proposal should contain the following materials assembled in the order given.

A. Cover Letter:

Each proposal should be prefaced by a cover letter (Appendix D) signed by an official of the investigator's organization who is authorized to legally bind the organization to the proposal and its content. The cover letter should refer to the GTE TRACE-P Program. Proposals to serve as Mission Scientist or Mission Meteorologist must include a separate budget line to support that role.

B. Title Page:

The title page should contain the following:

1. A short descriptive title for the proposed effort.
2. Name of the proposing organization(s).
3. Names, full addresses, telephone numbers, e-mail address, and affiliations of the Principal Investigator and all Co-Investigators.
4. Date of submission.
5. Total cost.

C. Abstract Page:

This shall contain a brief statement of the objective of the proposed effort, the measurements planned, and method of approach.

D. Table of Contents

E. Description of Proposed Research:

This section should include:

1. An introduction:
This should clearly define the scientific objectives of the proposed effort. Background material, the scientific justification, and rationale for the effort should be included.

2. A description of the proposed work:
This description should be a full statement of work proposed with the key elements clearly identified and related to each other. The methods or approaches to be used should be clearly described and, as appropriate, the advantages of the selected methods or approaches over alternative ones should be discussed. The planned measurements and/or anticipated results should be identified, and their relation to the stated research objectives should be discussed.
3. A discussion of the importance of the anticipated results:
This discussion should be within the context of the goals of this program as outlined in the NRA.

F. Management Approach:

The Management Plan should outline the specific responsibilities of the Principal Investigator (PI) and all other members of the group, and indicate the relationships of these responsibilities within the group. The Management Plan should also identify modeling tools available to the investigators and computer usage plans. The plan should identify what contractor and/or non-institutional support is anticipated and who will be providing it.

G. Cost Plan (U.S. proposals only):

The cost plan should be prepared according to the guidelines of the institution submitting the proposal. Separate budgets should be shown for each 12-month, or partial year. Do not identify funding requirements by U.S. Government fiscal year. A separate budget should be submitted for any proposed activities as Mission Scientist or Mission Meteorologist activities. Cost plan(s) should include:

1. Cost estimates for direct labor, including individual staff-months and rates for all personnel.
2. Estimated costs for computer services.
3. Travel costs.
Include only those trips necessary for attendance at non-TRACE-P scientific meetings, *etc.* Travel costs related to field operations and TRACE-P Science Team meetings will be reimbursed through the GTE Project Office, except for NASA civil services employees, and should be estimated in Section I. The names of all personnel involved in field deployment should be given in an accompanying appendix to the proposal along with their anticipated deployment schedule. For NASA civil service employees, the signature of their management on the proposal indicates a willingness to support necessary travel for the mission from funds appropriated for civil service travel.

4. Overhead rates and costs.
5. Other costs, with explanation.
Itemize items over \$500. Shipping costs should not be estimated here. Instead, estimate shipping requirements as indicated in Section VI. Costs for shipping will be reimbursed through the GTE Project Office.
6. Contribution from any cost-sharing plan or other support for the proposed research.
7. Itemized list of the amount of any contractor or other non-institutional related activities to be supported as part of the proposed investigation.
8. Current research funding from other sources, including level of the funding and the title or brief description of the supported research.
9. Total cost of support being requested from NASA under this program.

H. Enclosures:

Include appropriate descriptions of available facilities, brief resumes of investigators (2-3 pages per person), bibliographies and such other materials, as necessary. The use of binders for proposals and enclosures is discouraged.

I. Logistical Support Requirements

All proposals should include an appendix describing and defining in detail the logistical requirements associated with the proposed investigation. As a minimum this appendix should provide information relative to the airborne instrumentation, field personnel required, and shipping. The minimum requirements should be defined in each of the following areas.

1. Airborne Instrumentation
Space, power, cooling and/or air flow, window access, weight, and other aircraft resources required by each airborne instrument will be important considerations in the selection of the ensemble of instruments to meet the objectives of the respective components of TRACE-P. Each investigation should as a minimum define: (1) the amount of rack space that will be required; (2) power required (e.g., 110v, 220v, 3-phase, 60hz, 400hz, and 28vdc); (3) description of inlets/exhausts and/or optical window(s) required; (4) size and number of compressed gas bottles, coolers, pumps, etc., that will required to be mounted external to the rack space defined in (1) above; and (5) cooling flow rate and temperature required to sustain continuous operations under all flight conditions. **As a general guideline, one footlocker size container (24x24x40 inches), weighing no more than 150 lbs., will be allocated to each investigator team for storage of spare parts for instruments aboard the DC-8. It is anticipated that as a result of space and weight limitations, there will be no space**

available aboard the P-3B for spare parts containers. All P-3B spare parts containers will be shipped to the deployment sites via a dedicated air cargo shipment. The proposal should clearly define the volume and weight of all equipment/supplies that will be required to support the deployment of each investigator team, whether shipped on the DC-8, in advance, or coincident with the deployment of the DC-8 and P-3B.

Information regarding the size of instrument racks, power, and general operation of instrumentation aboard the DC-8 and P-3B aircraft can be obtained by contacting:

Mark Pestana
Mission Manager
NASA Airborne Science Program
mark.pestana@mail.dfrc.nasa.gov
(661)258-2519
Fax (661)277-7746

NASA Dryden Flight Research Center
DFRC / Y
MS 1623H
P.O.Box 273
Edwards AFB, CA 93523-0273

Mr. Richard Bradford
NASA Wallops Flight Facility
Mail Code 546.W
Wallops Island, VA 23367 USA

E-mail: bradford@pop800.gsfc.nasa.gov
Phone: 757-824-1509
Fax : 757-824-2135

for P-3B information.

2. Personnel/Travel

The number of individuals required to operate the proposed instrumentation during flight operations, and the number, if any, of additional non-flight personnel required during the field deployment of TRACE-P should be defined along with their proposed schedule for integration and deployment. The GTE Project Manager will be responsible for allocation of investigator seats aboard the DC-8 and P-3B aircraft.

3. Shipping

An estimate of the volume and weight of the equipment that will be

required to be shipped to each respective integration site should be provided. In addition, an estimate of the volume and weight of additional equipment or special items, such as compressed gases, that will be required to be shipped to each intensive deployment site should be identified. The only intensive sites will be Hong Kong and Yokota Air Base. No shipments will be made to overnight sites.

4. Miscellaneous

Special requirements, such as, the need for liquid nitrogen, dry ice, etc., at the integration sites and/or during the TRACE-P deployment should be defined. Other non-standard operating procedures and requirements should also be discussed. No supplies will be provided at the overnight sites.

J. Certifications

Certifications Regarding Drug-Free Workplace Requirements, Regarding Debarment or Suspension, and Regarding Lobbying are attached, and must be completed.

VI. EVALUATION CRITERIA

The following criteria replace paragraph (i) of Appendix C, and will be used in decreasing order of importance in evaluating proposals.

1. The overall scientific merit of the investigation, including:
 - (a) The technical feasibility of accomplishing the stated scientific goals of the proposed investigation; and
 - (b) The relevance of the proposed research to the TRACE-P mission's goals and objectives.

2. The competence and relevant experience of the principal investigator and any collaborators as an indication of their ability to carry the investigation to a successful conclusion within the requested resources and Project Schedule.

3. The reputation and interest of the investigator's institution and the willingness of the institution to provide the necessary support to ensure that the investigation can be completed satisfactorily.

4. The cost of the proposed effort including consideration of the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds.

VII. PROPOSAL SUBMISSION INFORMATION

Ten copies of the proposal should be submitted. One copy should bear original signatures. Letters of Intent and Proposals must be typewritten in English, and they should be sent to:

TRACE-P NRA
400 Virginia Avenue SW
Suite 700
Washington, DC 20024 USA

Any materials sent by courier or express delivery should list the recipient telephone number as (202) 554-2775.

Foreign proposers should submit an additional copy to the Office of External Affairs, Earth Research Division, as indicated in Section VIII. All proposals must be received before the established closing date; those received after the closing date will be treated in accordance with NASA's provisions for late proposals (FAR Supplement 18-15-412, paragraphs A and B).

VIII. FOREIGN PARTICIPATION

NASA invites foreign participation in TRACE-P in response to this NRA. Important provisions for foreign participation can be found in Appendix C. NASA will bear the cost of integration and flight hours for selected foreign airborne investigations. Foreign investigators will be responsible for all other costs of their investigation, including shipping and travel, as described in Appendix D.

The Letter of Intent, Proposal, along with the requested number of copies, and Letter of Endorsement, must be forwarded to the address provided above in time to arrive before the deadline established for this NRA

IX. REQUIRED CERTIFICATIONS

Included with this NRA are certain required certifications and a proposal cover sheet and Budget Summary Form. One set of these completed forms must be included with the original signature version of all proposals.

APPENDIX C

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

Part 1852.235-72
NASA Federal Acquisition Regulations (FAR) Supplement (NFS)
Version 89.90, Effective March 11, 1997.

Accessible at URL
<http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm>,
open Part 1852.228 to 1852.241 from menu.

(SEPTEMBER 1999)

(a) General.

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in

response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held

in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and

the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions.

NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

(b) NRA-Specific Items. Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

(2) Restriction on Use and Disclosure of Proposal Information. Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

Notice

Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to

use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) Abstract. Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

(4) Project Description.

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in

progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated.

Principal emphasis should be on the first year of work, and the description should distinguish clearly

between the first year's work and work planned for subsequent years.

(5) Management Approach. For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) Personnel. The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal

publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) Facilities and Equipment.

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that

typically can be used for research and non-research purposes should be explained.

(8) Proposed Costs (U.S. Proposals Only).

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic

and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and

engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

(9) Security. Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

(10) Current Support. For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

(11) Special Matters.

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

(d) Renewal Proposals.

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are

expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal

proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) Length. Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as

attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) Joint Proposals.

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) Late Proposals. Proposals or proposal modifications received after that latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

(h) Withdrawal. Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) Evaluation Factors.

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) Evaluation Techniques. Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) Selection for Award.

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.

(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

(l) Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted, proposals from foreign entities should not include a cost plan unless the proposal involves collaborations with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/ sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA,, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Foreign sponsors may, in exceptional situation, forward a proposal without endorsement if the endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the foreign sponsor will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- (i) An exchange of letters between NASA and the foreign sponsor; or
- (ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

(m) Export Control Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.

(1) Foreign proposals and proposals including foreign participation must include a section discussing compliance with U.S. export laws and regulations, e.g., 22 CFR Parts 120-130 and 15 CFR Parts 730-774, as applicable to the circumstances surrounding the particular foreign participation. The discussion must describe in detail the proposed foreign participation and is to include, but not be limited to, whether or not the foreign participation may require the prospective proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement

or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for, or if not, the projected timing of the application and any implications for the schedule.

Information regarding the U.S. export regulation is available at <http://www.pmdtc.org> and <http://www.bxa.doc.gov>. Proposers are advised that under U. S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered “Defense Articles” on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

(n) Cancellation of NRA. NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.

APPENDIX D

REQUIRED CERTIFICATIONS AND PROPOSAL COVER SHEET

NASA Research Announcement 00-OES-01

Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator:: _____

Department: _____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

Name	Institution & E-mail Address	Address & Telephone
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget:

1st Year: _____ 2nd Year: _____ 3rd Year: _____ Total: _____

Please check the appropriate box and complete the following if proposal to serve as

a **Mission Scientist** or **Mission Meteorologist is included:**

BUDGET:

1st Year: _____ 2nd Year: _____ 3rd Year: _____ Total: _____

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in this *Cover Sheet/Proposal Summary* in response to this Research Announcement, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- confirms compliance with all provisions, rules, and stipulations set forth in the two Certifications contained in this NRA [namely, (i) *Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs, and (ii) Certifications, Disclosures, And Assurances Regarding Lobbying and Debarment & Suspension*].

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Institutional Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____

Telephone: _____ Facsimile: _____

E-mail: _____

**Certification of Compliance with the NASA Regulations Pursuant to
Nondiscrimination in Federally Assisted Programs**

The (*Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant "*) hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

this assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and that the United States shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

CERTIFICATIONS, DISCLOSURES, AND ASSURANCES REGARDING LOBBYING AND DEBARMENT & SUSPENSION

1. LOBBYING

As required by Section 1352, Title 31 of the U.S. Code, and implemented at 14 CFR Part 1271, as defined at 14 CFR Subparts 1271.110 and 1260.117, with each submission that initiates agency consideration of such applicant for award of a Federal contract, grant, or cooperative agreement exceeding \$ 100,000, the applicant must **certify** that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit a Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

2. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

As required by Executive Order 12549, and implemented at 14 CFR 1260.510, for prospective participants in primary covered transactions, as defined at 14 CFR Subparts 1265.510 and 1260.117—

(1) The prospective primary participant **certifies** to the best of its knowledge and belief, that it and its principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.

(2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

APPENDIX E

INSTRUCTIONS REGARDING LETTER OF INTENT

All prospective proposers are strongly encouraged to submit a letter of intent in response to this announcement. This will allow us to alert a peer review staff to adequately cover the proposal review process. This letter of intent is available electronically via the Internet at URL: <http://www.earth.nasa.gov/LOI>. We urge you to use these electronic letter of intent forms unless you do not have access to the Internet. In that case, we will accept a FAX copy sent to 202-554-3024 with the following information:

- PI and Co-I names and addresses, (including Zip + 4);
- Title of proposal;
- Telephone number;
- Fax number;
- Email address; and
- A brief summary of what you plan to propose (Please limit this to no more than 3000 characters).

APPENDIX F

BUDGET SUMMARY

For period from _____ to _____

- Provide a complete Budget Summary for year one and separate estimated for each subsequent year.
- Enter the proposed estimated costs in Column A (Columns B & C for NASA use only).
- Provide as attachments detailed computations of all estimates in each cost category with narratives as required to fully explain each proposed cost. See Instructions For Budget Summary on following page for details.

	A	<u>[NASA USE ONLY]</u>	
		B	C
1. <u>Direct Labor</u> (salaries, wages, and fringe benefits)	_____	_____	_____
2. <u>Other Direct Costs:</u>			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other	_____	_____	_____
3. <u>Facilities and Administrative Costs</u>	_____	_____	_____
4. <u>Other Applicable Costs:</u>	_____	_____	_____
5. <u>SUBTOTAL--Estimated Costs</u>	_____	_____	_____
6. <u>Less Proposed Cost Sharing</u> (if any)	_____	_____	_____
7. <u>Carryover Funds</u> (if any)			
a. Anticipated amount :	_____		
b. Amount used to reduce budget	_____	_____	_____
8. <u>Total Estimated Costs</u>	_____	_____	XXXXXXXX
9. APPROVED BUDGET	XXXXXXX	XXXXXXXX	_____

INSTRUCTIONS FOR BUDGET SUMMARY

1. Direct Labor (salaries, wages, and fringe benefits): Attachments should list the number and titles of personnel, amounts of time to be devoted to the grant, and rates of pay.
2. Other Direct Costs:
 - a. Subcontracts: Attachments should describe the work to be subcontracted, estimated amount, recipient (if known), and the reason for subcontracting.
 - b. Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and rates of pay (not to exceed the equivalent of the daily rate for Level IV of the Executive Schedule, exclusive of expenses and indirect costs).
 - c. Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested to be made as a direct charge under this award must include the equipment description, how it will be used in the conduct of the basic research proposed and why it cannot be purchased with indirect funds.
 - d. Supplies: Provide general categories of needed supplies, the method of acquisition, and the estimated cost.
 - e. Travel: Describe the purpose of the proposed travel in relation to the grant and provide the basis of estimate, including information on destination and number of travelers where known.
 - f. Other: Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.
3. Facilities and Administrative (F&A) Costs: Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.
4. Other Applicable Costs: Enter total explaining the need for each item.
5. Subtotal-Estimated Costs: Enter the sum of items 1 through 4.
6. Less Proposed Cost Sharing (if any): Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment.
7. Carryover Funds (if any): Enter the dollar amount of any funds expected to be available for carryover from the prior budget period. Identify how the funds will be used if they are not used to reduce the budget. NASA officials will decide whether to use all or part of the anticipated carryover to reduce the budget (not applicable to 2nd-year and subsequent-year budgets submitted for award of a multiple year award).
8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.

APPENDIX G

GLOSSARY OF TERMS

ACE-ASIA	Aerosol Characterization Experiment – Asia
ACMAP	Atmospheric Chemistry Modeling and Analysis Program
APARE	Asia Pacific Regional Experiment
AVHRR	Advanced Very High-Resolution Radiometer
CHINA-MAP	China - Metro-Agro-Plex Experiment
DFRC	NASA Dryden Flight Research Facility
ENVISAT	European Environmental Satellite
ERS-2	European Remote-Sensing Satellite - 2
GOME	Global Ozone Monitoring Experiment
GTE	Global Tropospheric Experiment
IGAC	International Global Atmospheric Chemistry Program
LaRC	NASA Langley Research Center
MISR	Multi-Angle Imaging Spectroradiometer
MODIS	Moderate-Resolution Imaging Spectroradiometer
MOPITT	Measurements of Pollution in the Troposphere
NASDA	National Space Development Agency, Japan
NRA	NASA Research Announcement
PEM	Pacific Exploratory Mission
QuikTOMS	Total Ozone Mapping Spectrometer scheduled for flight on MicroStar Satellite in 800 km, sun-synchronous orbit with 10:30 am equatorial crossing; launch scheduled: August 15, 2000.
PANDA	Pacific Atmospheric Niche Derived from Asia
PRC	People's Republic of China
R&A	Research and Analysis Program
SAGE	Stratospheric Aerosol and Gas Experiment
SCHIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric Cartography
SEAWIFS	Sea-viewing Wide Fields-of-View Sensor
TOMS	Total Ozone Mapping Spectrometer
Terra	EOS Morning Crossing (Descending) Mission Satellite Platform
TRACE-P	Transport and Chemical Evolution over the Pacific
WFF	NASA Wallops Flight Facility