



**National Aeronautics and
Space Administration**

December 24, 1997

NRA-97-MTPE-16

RESEARCH ANNOUNCEMENT

**INVESTIGATIONS TO ADDRESS THE RADIATIVE IMPACT OF
AEROSOLS ON THE EARTH'S CLIMATE**

Letters of Intent Due January 23, 1998

Proposals Due February 24, 1998

**INVESTIGATIONS TO ADDRESS THE RADIATIVE IMPACT OF
AEROSOLS ON THE EARTH'S CLIMATE**

**NASA Research Announcement
Soliciting Research Proposals
for
Period Ending
February 24, 1998**

**NRA 97-MTPE-16
Issued December 24, 1997**

**Office of Mission to Planet Earth
National Aeronautics and Space Administration
Washington, DC 20546**

RESEARCH ANNOUNCEMENT FOR THE SOLICITATION OF INVESTIGATIONS TO ADDRESS THE RADIATIVE IMPACT OF AEROSOLS ON THE EARTH'S CLIMATE

Introduction

The overall objective of NASA's Mission to Planet Earth Strategic Enterprise is to develop understanding of the total Earth system and the effects of natural and human-induced changes on the global environment. The Science Division of the Office of Mission to Planet Earth (MTPE) supports research and analysis that would promote and increase the use of remotely sensed information for detecting and evaluating environmental status and change at both regional and global scales. This NASA Research Announcement (NRA) invites scientific studies focused on developing an understanding of aerosol radiative forcing of climate. The principal investigators of these studies will be invited to participate on a science team to coordinate their research plans, share information and guide development of an aerosol climatology. Proposals submitted in response to this announcement will be competing for about \$2 million in Fiscal Year 1998 funds. This level of funding will support a science team of approximately 15 to 20 investigations.

In September 1996 NASA issued the first Mission to Planet Earth Science Research Plan, which outlines the NASA Earth system science objectives and research strategy in terms of five major science themes, namely, Seasonal-to-Interannual Climate Variability and Prediction, Long-Term Climate: Natural Variability and Change Research, Atmospheric Ozone Research, Land-Cover and Land-Use Change Research, and Natural Hazards Research and Applications. These themes, which were selected in coordination with the U.S. Global Change Research Program, address the range of contemporary global environmental scientific issues of both scientific and policy concern. The study of radiative forcing by atmospheric aerosols is a climate change scientific issue consistent with NASA's mission and the science objectives of MTPE.

Further information about the Mission to Planet Earth programs, the Mission to Planet Earth Science Research Plan, and about the framework for integrating the Nation's environmental monitoring and research networks and programs as proposed by the Committee on Environment and Natural Resources (CENR) of the National Science and Technology Council (NSTC), Office of Science and Technology Policy (OSTP), are available electronically; see Appendix B for relevant URL addresses.

Objective

The objective of this NRA is to solicit proposals leading to quantitative assessment of radiative forcing caused by atmospheric aerosols during the 20 year period of satellite observations. Atmospheric aerosols, or fine particles, appear to play an important role in global climate change. Natural variations of aerosols, especially due to episodic eruptions of large volcanoes, are recognized as a significant climate forcing, that is, a factor that alters the planetary radiation balance and thus may cause a global temperature change. In addition, there are several ways in which human activities are altering the amount and geographic distribution of atmospheric aerosols, and thus possibly affecting climate. This NRA is concerned with the climate forcing due to changing aerosol concentration and properties, both the direct radiative forcing by aerosols and the indirect radiative forcing caused by effects of changing aerosols on cloud properties. These climate forcings due to changes of aerosols are not determined well, especially in the case of aerosols produced through human activity. Indeed, aerosols are one of the greatest sources of uncertainty in

interpretation of climate change of the past century and in projection of future climate change.

The large uncertainty that aerosols introduce in our understanding of climate change is illustrated by the Intergovernmental Panel on Climate Change published in Climate Change 1994: Radiative Forcing of Climate Change (see IPCC, 1995). Furthermore, the National Research Council has recommended a research plan in its Aerosol Radiative Forcing and Climate Change (see NRC, 1995) which also contains background material that is useful in establishing the rationale for the present NRA.

To understand the radiative impact of aerosols on climate, measurements are needed of the variation of the spatial distribution of aerosol, expressed by the optical thickness or mass concentration. Also required is knowledge of aerosol absorption, scattering, vertical profiles, size distributions, compositions, and surface area. These properties may have important diurnal variations. Frequent global measurements of the variation of the aerosol spatial distribution and some key properties are only achievable by Earth observations from space. The series of observations from research and operational satellites over the past two decades, and plans for a multi-national expanded series of Earth satellite systems are anticipated to be of benefit to studies proposed for this solicitation.

Quantification of the effects of aerosols on the global climate requires the combination of: (i) the space-based monitoring of aerosol properties; (ii) surface-based monitoring of indices related to aerosol properties, and (iii) intensive field campaigns. Only satellite monitoring can achieve the global coverage with the necessary spatial resolution needed to measure such inhomogeneous fields as aerosols. The second observational element, the surface-based monitoring, augments the capabilities of the space-based retrievals and verifies the quality of the satellite determinations. As inference of aerosol properties from space with the desired accuracy is difficult, surface-based observations are considered a crucial supplement to the success of the space-based program.

Scope

In order to make efficient use of resources available for this solicitation, its scope has been constrained to address a limited set of topics. The geographic scope of this NRA is global as is required to understand climate change. Satellite observations provide an essential contribution to aerosol/climate investigations because of their global coverage and the uniformity of their measurements in space and time. NASA (and other agencies) have made a large investment in space-based measurements capable of detecting aerosols, as well as investments in field campaigns and global numerical models relevant to aerosol studies. Satellite measurements of interest to this announcement range over the past approximately 20 years and will continue into the future through the NASA Earth Observing System (EOS) Program. Extraction of quantitative aerosol information of the accuracy needed for climate forcing applications is difficult and may require innovative data analysis techniques, coordinated use of aerosol or transport models, and use of surface-based and airborne measurements.

The scope of this announcement includes development of algorithms to retrieve aerosol physical characteristics from existing and upcoming satellite measurements. In most cases, systematic application of these algorithms to satellite data will be the responsibility of a planned aerosol climatology processing facility. Establishment of this facility will be handled internally by NASA. The present NRA can also support investigations that assimilate retrieved aerosol characteristics or satellite measurements directly, together with other forms of aerosol and atmospheric information to produce a

more complete characterization of the spatially dependent aerosol radiative forcing. The objective is to produce aerosol data needed for climate (and other) studies, but not to use the resources of the present announcement to support more general climate modeling studies. It is assumed that physical (and possibly chemical) models of the atmosphere will play a key role in defining global distributions of various aerosol types. Investigations which demonstrate the use of models for this purpose are considered within the scope of this announcement. Development of the data assimilation approaches and application of the aerosol climatology data may be made at the home institution of the investigators but, processing of large volume satellite data sets should take place at the aerosol climatology processing facility.

For practical reasons many of the previously flown satellite instruments were primarily designed to measure stratospheric aerosols. Successors to those instruments and satellite experiments to be launched as early as 1998 as part of the EOS Program, will attempt to extend that remote sensing capability to the troposphere. Building upon this investment, this NRA is a relatively modest focused aerosol research initiative to use existing capabilities, or capabilities planned for the next few years, to make quantitative assessments of the climate forcing caused by aerosols through their modification of short wavelength (solar) and long wavelength (terrestrial) fluxes.

Tropospheric aerosols are a major source of uncertainty in decadal global climate change and warrant the greater portion of the research effort supported by this NRA. The effort needed to complete the definition of stratospheric aerosol parameters using satellite data collected for the past two decades is currently supported and will provide the research community with a valuable aerosol data set for climate studies. Limited support may be provided by the present NRA for improving stratospheric aerosol data sets, to the degree that it contributes to improved definition of aerosol radiative forcing of climate.

A significant number of aerosol/radiation measurements have been made in the last few years as part of multi-platform field campaigns. For those field campaigns in which there is NASA sponsorship, both data and results are available to the broader research community. However, proposals to conduct large multi-platform field experiments are not within the scope of the present solicitation.

Implementation Approach - Aerosol Radiative Forcing Science Team

In order to accomplish the objectives of this NRA, an Aerosol Radiative Forcing Science Team will be formed, including the principal investigators of each of the successful proposals. This team will provide scientific guidance for a strategic approach toward definition of aerosol radiative forcing, encourage appropriate collaboration among research groups, and provide guidance to an aerosol satellite climatology project. This science team may also include researchers who are already funded by NASA or other US agencies for aerosol research. Such persons may submit a letter proposal describing their investigation and providing a proposed budget which allows them to participate in the activities of the science team. Further, it is anticipated that the team would have enough breadth to include *in situ* measurement experts. These individuals may participate in the analysis of *in situ* data collected in past field experiments and advise on the design of future field experiments to be supported by research announcements. Collaboration with other relevant US agencies and with participation of international aerosol researchers is strongly encouraged, although NASA cannot support investigations proposed by non-US institutions.

Science Team Responsibilities and Corresponding Expertise

Guide development of aerosol climatology

A major responsibility of the science team selected in response to this NRA will be to provide guidance for the development of a climatology of aerosol radiative forcing. Interpretation of satellite measurements will form the basis of the climatology for the reasons discussed previously. Systematic application of aerosol retrieval algorithms to satellite radiances is envisaged in forming the aerosol climatology. The task of extracting twenty-year aerosol records from satellite measurements involves substantial data processing. It will be necessary to run and rerun algorithms for the full period of measurements, and eventually to run algorithms using data from more than one instrument. This data processing will be handled by a project to be established at a NASA center with the appropriate institutional resources, associated science and data management expertise needed to produce the climatologies. Through this research announcement, investigators are encouraged to propose candidate algorithms to be applied to the full period of satellite measurements, for estimation of parameters of significance to the aerosol climatology. The processing center will utilize the algorithms recommended by the science team to produce the satellite element of the aerosol data set. The aerosol data set and eventually the aerosol radiative forcing data set will be based on multiple satellite data streams, the combination of satellite and aerosol model results where appropriate, surface-based aerosol measurement networks and other data available from the research community.

Combined use of satellite and other aerosol information

Proposals are also invited for investigations with innovative approaches for combining satellite data with data from other sources to augment the information content of the derived climatology. The strategic approach adopted in this NRA is one that leads to definition of aerosol radiative forcing on a global scale for the available, approximately 20-year period of satellite observations. The derived climatology would include aerosol changes, or “events”, caused by natural occurrences such as volcanic eruptions and desert dust episodes, and long-term changes of anthropogenic induced emissions, such as biomass burning. It is recognized that determination of the aerosol properties with adequate precision is exceedingly difficult. The required aerosol information will depend upon appropriate combinations of satellite data, models, field measurements and surface monitoring. These considerations also apply to investigation of the effect of aerosols on clouds, i.e., indirect aerosol climate forcing, as well as direct aerosol forcing. Collaborative efforts are encouraged which are focused on defining direct and indirect aerosol radiative forcings and include researchers having these various specialties.

Identify and address radiative forcing by significant aerosol types

To the extent practical, aerosol climatologies are to be obtained for each of the major aerosol types. The underlying assumption here is that aerosols can be grouped into classes of similar composition and having similar chemical and physical characteristics, most relevant of these being optical characteristics. Understanding aerosol radiative forcing depends upon having data for all aerosol types undergoing significant change. Priority should be given to aerosol types which have the most significant impact on climate. Volcanic aerosols already provide two major events in the 20 year period of satellite data available. Proposals which focus on more precise definitions of the volcanic aerosol direct, and perhaps indirect, radiative forcings are encouraged. However, it is recognized that some investigations in this area have ongoing NASA or other agency support.

Investigators receiving support in this area may propose to be members of the science team and be funded under this solicitation for their participation in science team activities only, i.e., travel, etc.

Soil dust aerosols, both natural and anthropogenic, are perhaps a major radiative forcing, but remain poorly defined. Proposals are encouraged for early attention to this aerosol type. Sulfates have been a focus of study for the past few years (see Appendix A); In parallel with the approach taken for existing investigations on volcanic aerosols, ongoing funded investigations in this area may simply propose team membership. Carbonaceous aerosols are among the potentially most important tropospheric climate forcings. Proposals are also encouraged which emphasize achieving a better understanding of the properties and temporal changes of organic aerosols. The science team formed should help provide scientific guidance in prioritization of research focus among different aerosol types.

Quantify uncertainties in estimated aerosol radiative forcings

Emphasis will be placed on quantifying the uncertainty in estimated aerosol radiative forcings. Present knowledge of the spatial and temporal distribution of tropospheric aerosol properties is so poor that practically useful uncertainty measures on the resulting aerosol forcing are absent. A strategy is sought for combining satellite and *in situ* data with global modeling in order to constrain uncertainty on such forcing within useful limits. Candidate aerosol climatologies must be subjected to validation tests, including comparisons with surface and *in situ* data, that confirm the quantitative usefulness of the data for climate forcing applications.

Exploitation of existing aerosol data sets from previous field studies

The success of this aerosol climate forcing research project will depend upon complementary field studies. There is need both to exploit more fully existing field data sets and to design new field experiments focused on aerosol radiative forcing. Data from existing field studies will provide a starting point for modeling studies that help define uncertainties and needed observations. This NRA covers the use of existing field data sets.

The present NRA does not cover the detailed development and execution of future field experiments. Research announcements may be issued in subsequent years to provide support for field studies, if needed, as an integral component of the strategy of investigation. The science team formed by the present NRA may advise on the need for these future field studies. Through the action of this science team and the NASA program affiliation, planning of future field experiments will be coordinated as closely as possible with the activities of other U.S. agencies and international organizations.

Observational Plan

Space-Based Aerosol Related Observations

Retrospective Satellite Measurements

Measurements applicable to aerosol studies, have been made by a series of satellites since the launch of Nimbus - 7, in 1978. It is anticipated that this data base will be used in the development of a global aerosol climatology and complementary climate variable data sets such as global temperature and moisture fields. Potential sensors considered suitable for this solicitation are listed in Table 1.

TABLE 1. Present satellite sensors potentially applicable for remote sensing of aerosol and radiative forcing

Sensor/Agency	Launch Date	Spectral Channels l, mm	Comments
AVHRR/NOAA	since 1979	4 bands [0.64] [0.83] [3.75] [11.5]	Nadir viewing scanner, operational
TM-Landsat/NASA	since 1982	6 bands [0.47-2.20]	Nadir viewing scanner
MSS-Landsat/NASA	since 1971	4 bands [0.55-0.90]	Nadir viewing scanner
VISSR- GOES/NOAA	since 1975	1 band [0.66]	Geostationary, operational
SAGE I, II/NASA	since 1979	7 bands [0.38-1.08]	Solar occultation
TOMS-Nimbus 7 /NASA	since 1978	2 bands [0.34-0.38]	Nadir viewing scanner
OCTS-ADEOS/ NASDA	1996-97	9 bands [0.41-0.86] and 3.9	Nadir viewing scanner
POLDER-ADEOS/ CNES-NASDA	1996-97	8 bands [0.44-0.91] 3 polarized bands multiview angles	Nadir viewing scanner
ERBE- ERBS & NOAA/ NASA	1984/1998	3 broad channels [0.3 - 50] [0.3 - 5] [8 - 12]	Low resolution nadir scanner
SeaWiFS-SeaStar/ NASA	1997	8 bands [0.41-0.86]	Nadir viewing scanner
LITE/NASA	1993	3 laser wavelengths [1.06] [0.53] [0.35]	Nadir viewing lidar on the Space Shuttle

Future satellite missions of interest to this solicitation

During the period of performance covered by this solicitation, observations from several new instruments will become available and are expected to allow more precise monitoring of aerosols from space. Several previously flown instruments will be launched again as needed to sustain the continuity of records. These instruments include AVHRR and VISSR on operational platforms, GLI and POLDER on ADEOS II (1999) and TOMS. Information on future instruments of potential use in remotely sensing aerosol properties is given in Table 2.

Table 2. Future satellite sensors potentially applicable for remote sensing of aerosol

Sensor/Agency	Launch Date	Spectral Channels l, mm	Comments
MODIS-EOS AM1 & PM1/ NASA	1998	12 bands [0.41-2.10] and 3.96	Nadir viewing scanner
MISR-EOS AM1/ NASA	1998	4 bands [0.47-0.86] 9 view angles	Multiple angle viewing
MERIS-ENVISAT/ ESA	1999	15 bands [0.40-1.02]	Nadir viewing scanner
GLI-ADEOS II/ NASDA	1999	12 bands [0.41-2.10]	Nadir viewing scanner
CERES-TRMM EOS AM1 & PM1/ NASA	1997/1998 /2000	3 broad channels [0.3 - 50] [0.3 - 5] [8 - 12]	Low resolution nadir scanner
SAGE III-Meteor/ NASA	1998	9 bands [0.29-1.55]	Solar occultation

The Earth Observing System (EOS)

As indicated in Table 2, EOS measurements for atmospheric aerosol include three primary instruments: (i) spectral measurements in the short wavelength and long wavelength spectral regions from MODIS, (ii) multi-angle and spectral measurements at selected wavelengths in the visible and near-infrared from MISR, and (iii) polarization measurements from the visible to shortwave infrared from EOSP. MODIS is designed to fly on the EOS AM-1 and PM-1 platforms, with daily global coverage. The at-launch derived aerosol parameter from this instrument is the spectrally dependent aerosol optical thickness. Over oceans MODIS will also obtain information on the aerosol size distribution, namely the ratio of the concentration of micron to submicron particles, and the specific size of the dominant aerosol mode. Over land, the only determination that can be made is whether the dominant mode is of micron or submicron size.

Multi-angle measurements at four visible and near-infrared spectral bands from MISR on the EOS AM-1 platform will provide weekly global coverage. The angular and spectral measurements will be used to derive the aerosol optical thickness and loading over land and ocean. With the help of an aerosol climatology to remove some of the indeterminacy of the aerosol properties from space observations, the MISR aerosol retrieval will distinguish among many common particle "types" that represent constraints on a combination of particle shape, size distribution, and composition.

Since changes in column-integrated radiances are weakly dependent on aerosol properties, making reliable retrieval of these properties difficult, improvements in measurement capability from current satellite systems is highly desirable to further advance our understanding of the role of tropospheric aerosols on climate. Advances from current systems are planned for the EOS missions through the use of improved radiometric accuracy and calibration (MODIS, MISR), multi-wavelength capability over a wider spectral range (MODIS, MISR), and multi-angle looks at the same scene (MISR). A

necessary component for improving the determination of tropospheric aerosol properties from space is a ground-based sunphotometer and sky radiance network.

Complementary radiation and cloud measurements

It has been predicted that the effect of aerosols on clouds will be manifested by changes in cloud particle size distribution, which in turn will change the amount of sunlight reflected. Links between cloud particle sizes and bulk properties of clouds such as cloud lifetime, cloud top altitude, cloud thickness, and liquid water content, could greatly alter the ways in which aerosols affect the Earth's radiation budget. Such links are anticipated, but evidence for these links may come only from long-term monitoring of cloud systems. Innovative approaches to quantifying the indirect effect of aerosols on clouds are sought through this solicitation. To accomplish this objective it is anticipated that the cloud properties to be monitored are hydrometeor size, amounts of water and ice, the vertical extent of the cloud, and the fractional cloud cover of the cloud systems. Since all of these properties affect the way in which clouds affect the Earth's energy budget, these properties are expected to be monitored as part of the plans for EOS.

Surface-Based Observations

To supplement satellite retrievals, surface networks designed for long-term observations have been developed and have been in operation for a few years. The networks include stations located in regions with different climate regimes and aerosol sources. Measurements made at each site include the physical and chemical properties of aerosols and the column-integrated aerosol optical thickness. Radiometric measurements include direct-beam transmitted irradiance, diffusely scattered radiance and polarization, and total irradiance. Surface and balloon measurements of meteorological state variables, such as temperature, humidity, and wind, are also necessary. The following two networks are internationally supported and will provide the needed measurements:

1. The NASA Aerosol Robotic Network (AERONET) has been established to provide a long-term network of automatic stations at diverse locations globally to measure the spectral attenuation of solar irradiance and the spectral, angular scattering of sky light with frequency and accuracy sufficient for integration with satellite measurements (see Holben et al., 1995). The NASA strategy in EOS is to complement the global distribution of aerosol properties derived from Earth-orbiting satellites on a daily or twice daily basis with ground-based measurements at approximately 100 stations worldwide. These observations will provide measurements of the diurnal cycle of aerosol concentration and optical properties, as well as supply statistics on some of the missing optical properties needed to analyze the spaceborne data. Other aerosol properties will be derived from chemical measurements and sampling by scientists worldwide.
2. The World Climate Research Program (WCRP) has established a Baseline Surface Radiation Network (BSRN), to measure surface shortwave and longwave radiative fluxes. It includes sun-photometer measurements of direct-beam solar flux for monitoring long-term trend of atmospheric aerosol optical thickness. These surface observation networks are very important for studying the aerosol trends in different regions and seasons, for periodically calibrating and validating satellite retrievals of aerosol properties, and for validating aerosol parameterizations and radiative transfer calculations.

Field Observations

Data sets exist from dedicated, multiplatform field observation campaigns designed to complement the surface and space-based observations of tropospheric aerosols. In such field campaigns measurements are conducted from surface sites, ships, aircraft, balloons, and satellites. These multi-platform measurements provide much more complete information than single platform measurements for the verification of aerosol parameterizations and radiative transfer calculations. The roles of these campaigns include: (i) intercalibration of spectral, angular, and polarimetric sensors on aircraft with their spaceborne counterparts, (ii) in situ measurement of the optical and microphysical properties of the atmospheric aerosol, especially, aerosol size distribution and, where possible, the single-scattering albedo, and (iii) providing an opportunity to confirm a closure of radiative transfer models of the transmission, reflection, and absorption of the Earth-atmosphere system with nearly simultaneous surface and spaceborne observations of sky radiance, aerosol properties, and radiative flux. These campaigns have carefully coordinated with the international scientific community, and focus on particularly important aerosol climatological regimes (e.g., sulfate aerosol from the east coast of the US and China, biomass burning aerosol in the tropics, Sahelian dust outbreaks from Africa), as well as aerosols especially difficult to detect (Arctic haze, continental haze layers). Examples of recent and planned aerosol field campaigns are given in Table 3.

The approach to assessing the adequacy of our understanding of the aerosol characteristics and processes is to conduct "closure field experiments". In these experiments, a set of aerosol chemical, physical, and optical properties, as well as atmospheric conditions are measured. A measured aerosol parameter is compared with the same parameter computed from models using the other simultaneously measured parameters. The comparison will provide us information on the degree of our understanding of aerosol dynamics and radiative transfer. The measured parameters include the vertical distributions of aerosol chemistry, size distribution, scattering and absorption extinction coefficients, scattering function, radiative fluxes, as well as vertically integrated quantities, such as column optical thickness and surface radiative flux. For the case of studying the aerosol and cloud interaction, cloud droplet concentration, size distribution, CCN, and albedo are measured.

Table 3. Recent aerosol related multi-platform field campaigns

Campaign	Objective	Location/Date	Measurement Platforms
SCAR-A, B, C Smoke, Clouds And Radiation	Role of aerosols, produced by biomass burning, on radiation fluxes, cloud radiation properties, and global climate	A-US east coast/'93 B-Brazil/'95 C-California/'94	NASA ER-2 U.Wash.C131A Banderante Surf. Rad. (CIMEL)
ACE - 1 Southern Hemisphere Aerosol Characterization Experiment	Document chemical, physical, and radiative properties of aerosol in remote marine atmosphere	Cape Grim, Australia Nov. Dec., 1995	NCAR C-130 NOAA ship Aus. ship
TARFOX Tropospheric Aerosol Radiative Forcing Observational Experiment	Determine radiative impacts, chemical, physical, and optical properties of aerosols over western Atlantic from US urban and industrial sources	Wallops Island, VA July, 1996	NASA ER-2 UK MRF C-130 U.Wash.C131A Modified Cessna GOES-8, NOAA-14, ERS-2, LANDSAT
ACE-2 North Atlantic Regional Aerosol Characterization Experiment	Determine and understand properties of aerosol in anthropogenically modified atmos. of North Atlantic and assess radiative forcing	Canary Islands June-July, 1997	UK MRF C-130 CIRPAS-RPA (US) Citation-II (NL) Merlin-IV (FR) Falcon-20 (DE) NOAA ship

Proposal Submission and Selection Schedule

Proposals may be submitted at any time during the period ending December 24, 1997, but not later than 4:30 p.m., e.s.t. on Tuesday, February 24, 1998. Proposals received after that date will be handled in accordance with NASA policy concerning late proposals (NFS 1815.412). Proposals will be peer reviewed by approximately April 30, 1998. If accepted, they will be integrated into the FY98 research program beginning approximately June 1, 1998.

Appendix C contains the basic guidance needed for preparation of proposals in response to an NRA. Appendix D provides guidance for foreign participation. Appendix E includes required certifications and proposal cover sheet, which must be completed and returned to NASA with any proposal submitted in response to this NRA.

All prospective proposers to this announcement are strongly encouraged to submit a letter of intent no later than 4:30 PM on January 23, 1998. This will allow us to organize our peer review staff to adequately support the proposal review process. This letter of intent is

available electronically via the Internet at URL <http://www.mtpe.hq.nasa.gov/LOI/form.html>. The URL for co-investigator information is <http://www.mtpe.hq.nasa.gov/LOI/coi.html>. It is requested that these electronic letter of intent forms be used by all prospective proposers, although those lacking access to the Internet may submit a letter by fax to (202) 554-3024 with the following information:

- PI and CoI names and addresses (including Zip + 4)
- Title of proposal
- Contact information (phone and fax numbers and electronic mail address) for PI
- A brief summary of the proposed research (Please limit this to no more than 3000 characters)

Identifier: NRA-97-MTPE-16

Submit Letters of Intent and Proposals to:

Aerosol NRA
Code Y
400 Virginia Avenue SW, Suite 700
Washington, DC 20024

For overnight mail delivery purposes only the recipient telephone number is (202) 554-2775.

Copies Required: 10

Selecting Official: Director, Science Division

Obtain Additional Information From: Dr. Robert J. Curran

NASA Headquarters, Code YS
Washington, DC 20546
Tel.: (202) 358-1432
Fax: (202) 358-2770
e-mail: Robert.Curran@hq.nasa.gov

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

W. F. Townsend
Acting Associate Administrator
Office of Mission to Planet Earth

References

Intergovernmental Panel on Climate Change (Climate Change 1994: Radiative Forcing of Climate Change, eds. J. T. Houghton, et al., Cambridge University Press, 339 pp., 1995).

National Research Council research program plan Aerosol Radiative Forcing and Climate Change (J.H. Seinfeld et al., National Academy Press, 161 pp., 1995)

Holben, B. N., T. F. Eck, I. Slutsker, A. Setzer, A. Pereira, E. Vermote, J. A. Reagan, Y. J. Kaufman, and D. Tanré, 1995: Sunphotometer network measurement of aerosol properties in the Brazilian Amazon. Submitted to *Remote Sens. Environ.*

Enclosures:

Appendix A, "Reports of NASA Sponsored Workshops of Relevance to this NASA Research Announcement"

Appendix B, "Relevant URL Addresses"

Appendix C, "Instructions for Responding to NASA Research Announcements"

Appendix D, "Guidelines for Foreign Participation"

Appendix E, "Required Certifications and Cover Sheet"

Appendix A. Reports of NASA Sponsored Workshops of Relevance to this NASA Research Announcement

Tropospheric Aerosol Interdisciplinary Research Program Workshop; November, 1995

In 1992, NASA established the Tropospheric Aerosol Interdisciplinary Research Program to address the suggestion that the direct and indirect radiative effects of sulfate and other aerosols in the troposphere may, on a global basis, significantly offset the radiative effects of increases in greenhouse gases. This program, which provided a substantial increase in NASA's efforts on tropospheric aerosols, over that contained in existing research and analysis programs, covered nearly the entire spectrum of the aerosol-climate related issues. These issues included precursor emission, transformation, transport, aerosol-cloud interaction, instrument and satellite technology, observation strategy, radiative forcing, and climatic impact. The research results of this program have been published in the relevant scientific journals and are available through an extensive workshop report published in March, 1996.

The report of the Tropospheric Aerosol Interdisciplinary Research Program workshop includes a listing of related research sponsored by several national and international aerosol research programs and satellite aerosol climatology projects, as well as summaries and recommendations of the workshop sub-sessions. Related programs sponsored by other US agencies includes: a task level listing the Department of Energy sponsored research on atmospheric aerosols through the Atmospheric Radiation Measurement program and the Atmospheric Chemistry Program and a similar listing of the 1995 aerosol-related awards by National Science Foundation Atmospheric Chemistry Program. This report is available through anonymous ftp by taking the following steps:

- 1) "ftp climate.gsfc.nasa.gov"
- 2) user name: "anonymous"
- 3) password : your complete e-mail address
- 4) "cd /pub/chou"

A hard copy of this report may be obtained by writing Dr. Ming-Dah Chou, Code 913, Goddard Space Flight Center, Greenbelt, MD 20771.

Aerosol Workshop; June, 1997

More recently, a workshop on atmospheric aerosols was held at the NASA Goddard Institute for Space Studies on June 2-3, 1997. The overall direction of that workshop was to address how best to use satellite data, global models and analysis to advance our understanding of aerosol (direct and indirect) climate effects.

The recommendations from that workshop were used to form the basis for the present NRA. The report from this workshop is available on the World Wide Web at the following address:

<http://www.giss.nasa.gov/meetings/aerosols97/>

This workshop report is also available in Microsoft Word format via anonymous ftp through either of the following procedures:

- 1) Direct your Web browser to download
"ftp://ftp.giss.nasa.gov/pub/meetings/aerosols97/aerosol_word51.doc"

or

- 1) connect by ftp to "ftp.giss.nasa.gov"
- 2) user name: "anonymous"

- 3) password : your complete e-mail address
- 4) "cd /pub/meetings/aerosols97"
- 5) "get aerosol_word51.doc"

A hard copy of this report may be obtained by writing Dr. James Hansen,
Goddard Institute for Space Studies, 2880 Broadway, New York, NY 10025.

Appendix B. Relevant URL addresses:

1. NASA/MTPE Home Page

<http://www.hq.nasa.gov/office/mtpe/>

2. Mission to Planet Earth Science Research Plan

<http://www.hq.nasa.gov/office/mtpe/draftsciplan/mtpe-srp.htm>

3. MTPE/EOS Project Science Office Home Page

<http://eospsso.gsfc.nasa.gov/>

4. OSTP/NSTC/CENR publication: Integrating the Nation's Environmental Monitoring and Research Networks and Programs: A Proposed Framework. 117 pp. (March 1997)

<http://www.epa.gov/cludygxb/>

Appendix C:INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

(JANUARY 1997)

(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.

(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).

(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.** A proposal or modification received after the date or dates specified in an NRA may be considered if doing so is in the best interests of the Government.

(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) **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: GUIDELINES FOR FOREIGN PARTICIPATION

NASA accepts proposals from entities located outside the U.S. in response to this NRA. Proposals from non-U.S. entities should not include a cost plan. Non-U.S. proposals, and U.S. Proposals that include non-U.S. participation, must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the non-U.S. participant is proposing. Such endorsement should indicate the following points: (1) The proposal merits careful consideration by NASA; and (2) If the proposal is selected, sufficient funds will be made available by the sponsoring foreign agency to undertake the activity as proposed.

Proposals, along with the requested number of copies and Letter of Endorsement must be forwarded to NASA in time to arrive before the deadline established for this NRA. In addition, one copy of each of these documents should be sent to:

NASA Headquarters
Office of External Relations
Mission to Planet Earth Division, Code IY
Washington, DC 20546
USA

Any materials sent by courier or express mail should include the street address 300 E Street, S. W., and substitute 20024 for the indicated ZIP code.

All proposals must be typewritten in English. All non-U.S. proposals will undergo the same evaluation and selection process as those originating in the U.S. Non-U.S. proposals and U. S. Proposals that include non-U.S. participation, must follow all other guidelines and requirements described in this NRA. Sponsoring non-U.S. agencies may, in exceptional situations, forward a proposal without endorsement to the above address, if review and endorsement are not possible before the announced closing date. In such cases, however, NASA's Mission to Planet Earth Division of the Office of External Relations should be advised when a decision on the endorsement is to be expected.

Successful and unsuccessful proposers will be contacted directly by the NASA Program Office coordinating the NRA. Copies of these letters will be sent to the sponsoring government agency.

Appendix E
REQUIRED CERTIFICATIONS AND COVER SHEET

Certification Regarding Debarment, Suspension, and Other Responsibility Matters Primary
Covered Transactions

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 34 CFR Part 85, Section 85.510, Participant's responsibilities. The regulations were published as Part VII of the May 26, 1988 Federal Register (pages 19160-19211). Copies of the regulation may be obtained by contracting the U.S. Department of Education, Grants and Contracts Service, 400 Maryland Avenue, S.W. (Room 3633 GSA Regional Office Building No. 3), Washington, DC. 20202-4725, telephone (202) 732-2505.

- (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 from covered transactions 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 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.

Organization Name PR/Award Number or Project Name

Name and Title of Authorized Representative

Signature Date

ED Form GCS-008 (REV.12/88)

Certification Regarding Drug-Free Workplace Requirements

Grantees Other Than Individuals

This certification is required by the regulations implementing the Drug-Free Workplace Act of 1988, 34 CFR Part 85, Subpart F. The regulations, published in the January 31, 1989 Federal Register, require certification by grantees, prior to award, that they will maintain a drug-free workplace. The certification set out below is a material representation of fact upon which reliance will be placed when the agency determines to award the grant. False certification or violation of the certification shall be grounds for suspension of payments, suspension or termination of grants, or governmentwide suspension or debarment (see 34 CFR Part 85, Sections 85.615 and 85.620).

This grantee certifies that it will provide a drug-free workplace by:

- (a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;
- (b) Establishing a drug-free awareness program to inform employees about -
 - (1) The dangers of drug abuse in the workplace;
 - (2) The grantee's policy of maintaining a drug-free workplace;
 - (3) Any available drug counseling, rehabilitation, and employee assistance programs, and
 - (4) The penalties that may be imposed upon employees for drug abuse violations in the workplace;
- (c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);
- (d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will -
 - (1) Abide by the terms of the statement; and
 - (2) Notify the employer of any criminal drug statute conviction for a violation occurring in the workplace no later than five days after such conviction;
- (e) Notifying the agency within ten days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such conviction;
- (f) Taking one of the following actions, within 30 days of receiving notice under subparagraph (d)(2) , with respect to any employee who is so convicted -
 - (1) Taking appropriate personnel action against such an employee, up to and including termination; or
 - (2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency;
- (g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraph (a), (b), (c), (e), and (f).

Organization Name

PR/Award Number or Project Name

Name and Title of Authorized Representative

Signature

Date

ED 80-0004

CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements.

The undersigned certifies, to the best of his or her knowledge and belief, 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 any 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 entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal 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 this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit 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.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000 for each such failure.

Signature and Date

Name and Title of Authorized Representative

Organization Name

CERTIFICATION REGARDING DEBARMENT,
SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY
MATTERS (MAR 1996)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that--

(i) The Offeror and/or any of its Principals--

(A) Are * are not * presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have * have not *, within a three-year period preceding this offer, 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) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are * are not * presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision (a)(1)(i)(B) of this provision.

(ii) The Offeror has * has not *, within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

Organization Name

PR/Award Number or Project Name

Name and Title of Authorized Representative

Signature

Date

CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO
INFLUENCE
CERTAIN FEDERAL TRANSACTIONS (APR 1991)

The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989,--

(1) No Federal 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 on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) 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 on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of \$100,000 shall certify and disclose accordingly.

Signature and Date

Name and Title of Authorized Representative

Organization Name

Proposal Cover Sheet
NASA Research Announcement 97-MTPE-16

Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator:

Name: _____

Department: _____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

Name	Institution	Telephone
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget:

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

Total: _____

Authorizing Official: _____
(Name) (Institution)