



**National Aeronautics
and Space Administration**

**February 25, 2000
AO 00-OSS-01**

Announcement of Opportunity

Space Interferometry Mission Science Team and Key Projects

**Notice of Intent Due:
Proposals Due:**

**March 27, 2000
May 26, 2000**

THE SPACE INTERFEROMETRY MISSION (SIM)
SCIENCE TEAM AND KEY PROJECTS

Announcement of Opportunity
Soliciting Proposals
for Basic Research in Space Science

AO 00-OSS-01
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SPACE INTERFEROMETRY MISSION SCIENCE TEAM AND KEY PROJECTS ANNOUNCEMENT OF OPPORTUNITY

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ANNOUNCEMENT OF OPPORTUNITY
SPACE INTERFEROMETRY MISSION
KEY PROJECT AND MISSION SCIENTIST INVESTIGATIONS

1. DESCRIPTION OF OPPORTUNITY

The National Aeronautics and Space Administration (NASA) solicits proposals for science investigations with the Space Interferometry Mission (SIM). This solicitation requests two kinds of proposals: Key Project science proposals for which the Principle Investigators (PI's) of the selected proposals will be members of the SIM Science Team, and various Mission Scientist proposals for smaller scale investigations for which the selected PI's will be also members of the SIM Science Team with additional special responsibilities (see Section 2.3). As described further in Section 1.2, this Announcement of Opportunity (AO) solicits proposals for scientific investigations utilizing approximately 60% of the total observing time for SIM. Except for very small amounts of observing time (less than 5%) that might be retained by the Project, all the observing time for SIM will be openly solicited and competed via this and subsequent announcements.

Up-to-date information about SIM may be found on the mission's Web site at <http://sim.jpl.nasa.gov>. This site will include frequently asked questions (FAQ's) about both SIM and this AO. It is the responsibility of proposers to be familiar with this information as modified through the due date for proposals.

1.1 PROPOSAL OPPORTUNITY PERIOD AND SCHEDULE

Announcement of Opportunity release.....	February 25, 2000
Notice of Intent to propose due	March 27, 2000
Proposal submittal due by 4:30 p.m. Eastern Daylight Time.....	May 26, 2000
Letters of endorsement for non-U.S. participation due	June 26, 2000
Announcement of Selections (target)	August 2000
Award of funding (target).....	September 2000

1.2 RELATIONSHIP TO OTHER OPPORTUNITIES

1.2.1 Future Solicitations

At present, it is expected that there will be a second solicitation for science investigations whose selected PI's will become members of the SIM Science Team, including additional Key Project investigations. This solicitation will take place about two years before the launch of SIM. In addition, this future solicitation is expected to include opportunities for guest observers who will carry out research programs that require substantially less time than the Key Projects, and that can be undertaken by an individual or very small team. The primary reason for a second solicitation of Key Projects is to take advantage of evolving scientific knowledge, including

results from missions to be launched over the next few years. A third solicitation after the launch of SIM may occur if this is necessary and appropriate to fully subscribe the expected observing time.

1.2.2 Relationship to the SIM Preparatory Science Program

NASA intends to release NASA Research Announcements (NRA's) for the SIM Preparatory Science Program, to which members of the SIM Science Team, both teams and individuals, may respond. These NRA's are for long-lead time but relatively low cost research that may be necessary to accomplish the primary science goals of SIM. Notable among the possible objectives that are solicited by these NRA's are the study, and perhaps determination, of the SIM grid stars. Individuals working on the SIM Preparatory Science Program are not assigned observing time. It is assumed that over the next few years that the SIM Science Team will take over most, if not all, activities of the Preparatory Program.

2. ANNOUNCEMENT OBJECTIVES

The objective of this Announcement is to select the initial group of science investigations whose PI's will form the SIM Science Team. This Team will carry out most of the scientific duties and observations associated with the primary science mission of the Space Interferometry Mission, and, in addition, this Team will be significantly involved in the development phases of the mission.

The strategic goal of the SIM science program is to undertake investigations that cannot be carried out by any other mission in the current Space Science Strategic Plan, including the Explorer and Discovery Programs, other likely ground-based programs, and/or missions and facilities sponsored by non-U.S. agencies.

In addition, SIM seeks to enhance public awareness of and appreciation for space science and space exploration. Consequently, and in accord with established space science policy, the SIM program will carry out a comprehensive Education and Public Outreach (E/PO) program in which all selected SIM Science Team members will be strongly encouraged to participate actively (Section 2.8).

Collaborations with Historically Black Colleges and Universities and other Minority Educational Institutions in proposed investigations are strongly encouraged, as are collaborations with non-NASA agencies and non-U.S. institutions that clearly enhance the science return of SIM and/or help support the proposals to this AO.

Participation is open to all categories of organizations, foreign and domestic, including educational institutions, industry, nonprofit organizations, NASA centers, and other Government agencies.

2.1 SCIENTIFIC OBJECTIVES OF THE SPACE INTERFEROMETRY MISSION

The capabilities of the Space Interferometer Mission (SIM) are defined by two guiding scientific goals (see also Table 1):

1.) Carry out a census of nearby stars searching for planetary systems. This census would be sensitive to the astrometric signals induced by planets as small as a few times the mass of the Earth orbiting the nearest stars. This goal requires that SIM be able to make differential astrometric measurements relative to background stars over a ~ 1 deg Field of Regard with a precision of $< 3 \mu\text{as}$ (micro-arcsec). The SIM project presently expects SIM to achieve a single measurement accuracy of $1 \mu\text{as}$ in a single measurement, which is approximately the amplitude of the motion induced in a solar-type star 3 pc away by a 1 Earth mass planet orbiting at 1 AU.

The narrow angle mode can also be used to make differential proper motion or parallax measurements of objects located in clusters or other small areas. However, the accuracy of the measurement will degrade from the differential limit of $< 3 \mu\text{as}$ up to the nominal wide angle limit (see below) as the field angle increases from 1 deg up to the full 15 deg Field of Regard.

2.) Carry out a program of astrophysical research using global astrometry. Typical areas of astrophysical research are described in the report entitled “The Decade of Discovery in Astronomy and Astrophysics” (the so-called Bahcall report) published by the National Research Council (1991) and in the Final Report of the SIM Science Working Group (SIMSWG) available at http://sim.jpl.nasa.gov/ao_support/simswg_report.html. The science, the instrument performance assumptions, and possibly other criteria described in these reports may not match the actual or anticipated performance of the SIM instrument. Where they are different, the information in this AO takes precedence. In addition to the general goals referred to in the above mentioned reports, specific areas of astrophysical interest for wide angle astrometry include determining the distances to Cepheids, following the center of light of micro-lensing systems, and measuring parallaxes of nearby galaxies.

Table 1: SIM Key Science Requirements		
	Minimum Requirement	Goal
<i>Narrow Angle Astrometry</i>	$3 \mu\text{as}$ amplitude (1 sigma) in a single measurement over a 1 deg FOV. Target and four reference stars as faint as $V=12$ mag in < 1 hr for a measurement in one orientation	$1 \mu\text{as}$ amplitude (1 sigma) in a single measurement over a 1 deg FOV. Target and four reference stars as faint as $V=12$ mag in < 1 hr for a measurement in one orientation
<i>Global Astrometry</i>	Better than $30 \mu\text{as}$ (1 sigma) at end of 5 year mission over the entire sky for stars brighter than $V=20$ mag.	$4 \mu\text{as}$ (1 sigma) at end of 5 year mission over the entire sky for stars brighter than $V=20$ mag.

At this early stage in the development of the project, the wide-angle performance of SIM is less well determined than its narrow angle performance. The actual on orbit performance that can be anticipated for SIM will only be known at the end of 2001 at the earliest, and, at this time, NASA is only committed to delivering the capabilities listed as “Minimum Requirements” in Table 1. **Nevertheless, proposals should be written assuming that the performance goals (i.e., the values under Goals in Table 1) will be met.**

As Table 1 and Section 2.7 indicate, the time to achieve these observational goals depends on the brightness of the target, ranging from a minimum of about 5 minutes for stars brighter than V~9 magnitudes to approximately 4 hours for objects as faint as V~20 magnitudes. Detailed procedures for determining observing time requirements are available from the SIM project (<http://sim.jpl.nasa.gov/>). The total number of targets SIM will be able to observe depends on the distribution of target brightnesses, the total number of measurements needed to complete a program on a particular target (i.e., approximately 10 measurements over a year on each of two orthogonal axes to determine parallax and proper motion, and up to 100 measurements over 5 years to search for planets with a wide range of periods), the efficiency of the observatory, and the amount of time spent calibrating the absolute reference grid with respect to approximately 4,000 stars and 100 quasars. It is estimated that about 10,000 individual objects could be observed during the course of SIM's five-year nominal mission. Because of the need for significant preparatory work in specifying the final target lists, it is expected that approximately half of the individual targets will be selected through this solicitation with the majority of the remainder to be selected in a second solicitation about two years before launch.

2.2 TECHNOLOGY OBJECTIVES OF THE SPACE INTERFEROMETRY MISSION

In addition to meeting the scientific goals outlined above, SIM must accomplish certain technical milestones (Table 2). SIM must develop the technique of interferometry as a new tool for space astronomy in preparation for future missions such as the Terrestrial Planet Finder (TPF). Also in support of TPF, SIM must demonstrate rotational synthesis imaging and starlight nulling but shall not be required to provide capabilities of general scientific utility in these areas.

Table 2: SIM Key Technology Requirements	
<i>Use of Interferometry Techniques</i>	Demonstrate a space interferometer system (with long baseline and operating at visible wavelengths) having the capability of active path-length stability control and path-length knowledge consistent with the astrometric goals of Table 1.
<i>Demonstration of Synthesis Imaging</i>	Provide "uv-plane" coverage adequate to image up to 50 point sources located within the ~1" (arc-sec) primary beam of a single telescope, e.g., for imaging the core of a globular cluster.
<i>Demonstration of Starlight Nulling</i>	Active path-length control and nulling instrumentation adequate to reduce the intensity of light from a star in a spectral bandwidth of not less than 20% by a factor of 10^4 for periods as long as 1 hour.

The utility of SIM for scientific imaging will depend on the "uv-plane" coverage possible with the final layout of the SIM siderostats (Section 2.7), which is not yet fully defined. This final layout will be determined by many factors of which imaging capability is only one. Thus, SIM "imaging" might consist of no more than model fitting with a relatively few parameters to visibility data at a few baselines and orientations, e.g., to determine the positions and brightness of multiple (up to about 50) point sources within the primary beam or to measure diameters and other properties of binary systems.

Astrometry in fields that appear "crowded" to SIM will require data on a range of baseline lengths and additional analysis software to correctly process multiple star signatures. Proposers whose science objectives include potentially crowded fields should be aware of this complication and indicate both the data required, as well as the analysis methods to address this complication.

Similar uncertainties apply to the scope of SIM's nulling capability. Because of these uncertainties in the design and performance of SIM, **proposals whose primary science goals are imaging or nulling measurements are NOT being solicited through this AO.** It is recognized, however, that astrometry in complex fields or studies of binary stars represents a grey area between astrometry and limited uv-plane imaging. However, proposals for crowded field astrometry or studies of binary stars are certainly appropriate for this AO. Later AO's may solicit projects with a more broadly based imaging or nulling component as more complete knowledge of SIM's capabilities becomes available.

2.3 CONSTITUTION AND DUTIES OF THE SIM SCIENCE TEAM

The SIM Science Team is expected to consist of up to 15 individuals chosen through this AO and to be constituted before the SIM System Requirements Review (scheduled for September 2000). The exact number of individuals will depend in part upon the number of proposals selected, the perceived requirements of the SIM Project, and on programmatic and budgetary considerations. The Science Team membership is likely to be augmented at various times in the future as a result of subsequent solicitations (Section 1.2.1).

The Science Team will be made up of the SIM Project Scientist, the Principal Investigators (PI's) of each of the selected Key Project teams (Section 2.4), the E/PO Scientist, the Data Scientist(s), the Instrument Scientist(s), the Interdisciplinary Scientist(s), the Imaging and Nulling Scientist, and *ex officio* nonvoting members of the SIM Project. All members of the Science Team except for the SIM Project Scientist, who is the Chair of the Science Team, the *ex officio* members, and any members who might be appointed directly by NASA Headquarters will be determined through the science investigations selected by this or subsequent solicitations. Through its chairman, the Science Team will advise the SIM project and report to the SIM Program Scientist at NASA Headquarters on all aspects of the SIM Mission.

The Principal Investigators (PI's) of each of the selected Key Project investigation teams will be a member of the SIM Science Team and will represent the interests and requirements of that particular Team's investigation. The Key Project teams will also undertake various supporting duties as may be requested by the Project Scientist and the Science Team. Such duties may include development of software, external evaluation of the Project, outreach to the general science community, formulation and implementation of the SIM E/PO program (See section 2.8), or other endeavors related to the SIM mission. The number of Key Project team investigations will be determined on receipt of acceptable proposals of merit, with as many as eight expected to be selected in response to this AO. Proposals for Key Projects must include an estimate of required observing time. It is expected that each Key project investigation will receive up to 10% of the available observing time (Note: Each 1% of the SIM observing time is expected to be approximately 50 hours/year. This does not include calibration or engineering time).

In addition to the Key Project Science Investigations, proposals for smaller scale science investigations from individuals are also solicited, whose selected PI's will bring the experience and skills described below of the Mission Scientist Positions to the SIM Science Team. Therefore, proposals for these positions must contain both an acceptable science investigation and a clear description of the skills, knowledge, and commitment that the prepares would offer in fulfilling the role of these positions (see also Section 4.2 and section D of Appendix B). The descriptions of the roles of these positions given below are indicative and not inclusive, e.g.; proposers are encouraged to consider roles other than indicated that would add to the SIM program.

The Education and Public Outreach Scientist will have the responsibility to develop, coordinate, and integrate the participation of the Key Project Teams and other mission scientists in the overall SIM Project E/PO program. In this role, the E/PO scientist will make inputs to and play a significant role in the planning, implementation, and oversight of the overall SIM E/PO program. Additionally, the E/PO Scientist will coordinate the professional outreach and advocacy functions for the SIM project and the Science Team. Proposers for the E/PO scientist position must submit a science investigation, as well as the E/PO portion of the proposal. Appendix D contains further information and guidance on the E/PO portion of the proposal. Assuming the submission of an acceptable proposal of merit, the selected investigation will be allocated up to 1% of the available observing time with SIM over the primary mission lifetime.

The Data Scientist(s) will have major responsibilities advising the project in the areas related to data reduction tasks such as software used by the Project and Key Project Investigators. Data reduction of the astrometric grid will be a major undertaking, comparable to the reduction of the Hipparcos data set. Data scientists will provide scientific and technical guidance to the ISDC (Interferometer Science Data Center) for SIM related software. Data scientists will work with instrument scientists and the SIM interferometer instrument development team to devise algorithms and calibration techniques, to provide insight into computationally efficient algorithms, to run test cases at their home institutions, and to work with the SIM project's "SIM-SIM" activity, which is an end to end simulation of SIM that will include simulations of interferometer imperfections such as imperfect alignment, diffraction, vibrations, and thermal variations, starting from photons entering the entrance aperture, to raw data from the detectors

through to a global astrometric solution of five years of data. Assuming the submission of acceptable investigations of merit, a minimum of two Data Scientists may be selected through this AO. Each selected investigation will be allocated up to 1% of the available observing time with SIM over the primary mission lifetime.

Instrument Scientists will have major responsibilities to advise the project regarding hardware-related issues. Such issues may involve working with one of the SIM testbed teams to develop new control algorithms for nanometer control, to work with the micro-arcsec testbed teams to analyze data from the testbed, help identify sources of instrumental or systematic error, and devise solutions in optics, calibration procedures, real-time software, or analysis software. These major testbeds are now coming into operation and will be operated by the project until well into the construction phase of the spacecraft. Proposers should try to be as detailed as possible as to those technical areas in which they have interest and expertise. Assuming the submission of acceptable proposals of merit, a minimum of two Instrument scientists may be selected through this AO, and each selected investigation will be allocated up to 1% of the available observing time with SIM over the primary mission lifetime.

Interdisciplinary Scientists are individuals with notable and broad scientific expertise, who will extend the relevance of SIM into new and innovative areas of scientific investigation. Assuming the submission of acceptable proposals of merit, no more than two Interdisciplinary Scientists may be selected through this AO, and each selected investigation will be allocated up to 1% of the available observing time with SIM over the primary mission lifetime.

The Imaging and Nulling (I/N) Scientist will have major responsibilities to ensure that the SIM's imaging and nulling technology demonstration requirements will be met. The I/N Scientist will be expected to define how the available data from SIM can be effectively used to perform precision astrometry in fields that appear "crowded" to the SIM instrument. Proposers to this position should be aware that the instrument imaging capability has not been defined in detail. In particular, it is likely that only limited uv-plane coverage will be available. The I/N Scientist will develop a strategy to optimize the technology return from SIM's imaging and nulling demonstrations for input to future interferometry missions. Proposers should note that because of the uncertainties in the design and performance of SIM, especially with regard to imaging and nulling performance, **proposals whose primary science goals require imaging or nulling measurements are NOT being solicited through this AO**. Depending on receipt of acceptable proposals of merit, one Imaging and Nulling Scientist may be selected through this AO, and the selected investigation will be allocated up to 1% of the available observing time with SIM over the primary mission lifetime.

The Project Scientist and the Deputy Project Scientist are appointed by JPL from among JPL personnel and are not solicited via this proposal. These individuals, as well as other scientists formally working on the SIM Project, may propose through this solicitation or later ones to participate fully in a Key Project proposal in any capacity.

Individuals may submit more than one proposal to be considered for different positions. Such proposals may propose the same science investigation or may propose different sets of scientific objectives.

2.4 DEFINITION OF SIM KEY PROJECTS

This AO solicits proposals for Key Project science investigations for SIM which are expected to make up a major fraction of the total observing time for this mission. Key Projects selected here and in subsequent solicitations are the main method for allocating SIM observing time and are expected to make up well in excess of 50% of the total observing for this mission. The content of the Key Project program will be determined largely by recommendations obtained through the peer review process. As a guide to preparing proposals, the expected characteristics of a Key Project may be summarized as follows:

1. A science program of extremely high merit and priority as judged via the peer review process. Proposers are encouraged to read the current SIM Reference Documents, available on the SIM Web site, as well as other materials cited therein (see Appendix C for a listing and directions).
2. A relatively large program, requiring a significant fraction of the available observing time. There is no restriction on the amount of observing time for which a team may propose, but it is expected at this time that most Key Projects will require between 5%–10% of the available time over the lifetime of the mission. However, groups and individuals should not hesitate to propose Key Projects that may require less time than this estimate: the most important criterion for selection will be scientific merit.
3. Individuals on the team who bring significant expertise and commitment to the SIM science program. Note that NASA does not expect that large teams are necessarily required to carry out most Key Projects. The adequacy and commitment of the team members are the critical factors.

Proposers should note that, regardless of the merit of proposals submitted in response to this AO, no more than approximately 60% of the available observing time for SIM will be allocated for investigations selected through this first AO. It is in the interest of the Project that a significant proportion of the observing time be reserved for future solicitations.

Groups preparing to propose in response to this AO should take note of the growing NASA concern about “team inflation,” in which a very large number of individuals appear on a single proposal. This AO requires detailed descriptions of the duties of each key named individual on a proposal, which will be part of the evaluation criteria. Proposals submitted without sufficient details of the duties of each named individual may be returned to the prepares(s) as unresponsive to this AO.

Depending upon the results of the peer review, as well as programmatic and budgetary considerations, NASA reserves the right to select all or parts of proposals, as well as to request the merging or coordination of competing teams in accordance with the provisions of Section 2 of Appendix A to this AO.

2.5 BUDGET RESOURCES AVAILABLE FOR SIM PARTICIPATION

Individuals and groups proposing in response to this AO should use the following information as approximate guidelines, i.e., neither as requirements nor as constraints. Within the guidelines of the total funding available to support the SIM Science Teams and Key Projects, it can be expected that there will be variations in the funding requirements of different individuals and teams.

Participation in the SIM Project through this Announcement may extend for as much as a decade past the selection date, which NASA recognizes make accurate budget projections very uncertain. Therefore, detailed long-range budgets are not requested of proposers, and total proposed costs are given a reduced--but not zero--priority in the selection criteria. NASA and the Project will negotiate the details of the final budget for the winning proposals based not only on peer review recommendations but also on programmatic considerations and on the total available resources. Given the reduced requirements for details of the proposed budgets, the entire budget description should be no more than five pages for teams and no more than two pages for individuals (see Appendix B).

Proposed budgets must begin with FY 2001 (October 1, 2000) and extend through the conclusion of the prime mission phase at five years after launch, that is, through FY 2011. There is no requirement to produce a constant level of funding, nor are proposers required to request funding through the entire development and operation of SIM. Budgets details should provide for the first three years with an indication of the expected evolution of the budget in the following years.

Individuals proposing to one of the Mission Scientist positions on the SIM Science Team will normally be expected to work on the Project at an average of about 25% of their professional time. This fraction is expected to vary considerably during the mission lifetime. As a guideline, the SIM Project is currently budgeting on the order of \$100K per year per winning individual Mission Scientist proposal averaged over the lifetime of the project. This budget is expected to include items such as postdoctoral and/or graduate student support, travel, summer salary, and computer support. Note that postdoctoral/graduate student support is expected to be in direct support of the SIM Project. Moreover, personnel supported by this program may be assigned directly to the SIM Project or to the Interferometry Science Data Center, as agreed to by negotiation with the grant recipient.

NASA expects to support up to eight Key Project Investigations, each consisting of about eight individuals, with each individual on the team funded at about the level outlined above for the Mission Scientist positions, with a target of on the order of \$500K per year per team averaged over the lifetime of the mission. Principal Investigators of Key Projects are not expected to obtain the majority of their salary through this opportunity. Not all team members are required to be funded at the same level (or at all). However, a detailed description of the duties of each named Investigator in the proposal is required.

2.6 ROLE OF THE INTERFEROMETRY SCIENCE DATA CENTER

NASA Headquarters has decided to establish an Interferometry Science Data Center (ISDC). The ISDC will coordinate its activities with the SIM Science Team and will be the primary point of contact for the general scientific community in its use of SIM, either as future Guest Observers or as users of the SIM data archive. After launch, the ISDC will also help implement the SIM Educational/Public Outreach (E/PO) program in coordination with NASA Headquarters and the SIM E/PO Scientist selected through this solicitation.

For the purposes of this opportunity, proposers should assume that the ISDC will have the responsibility during operation of the SIM mission for producing and delivering high quality data products and supporting materials. That is, Key Project proposers, as well as Mission Scientist proposers, are expected to describe their science program in detail, but may assume that the ISDC will produce the data products. In practice, members of the winning Key Project teams are expected to assist significantly with development of the ISDC data products, including software and other reduction and analysis tools. Indeed, personnel from the Science Team may be assigned to work directly at the ISDC, as negotiated among Science Team members and the SIM Project.

All data of scientific value from SIM observations will be placed in the public domain by the ISDC within twelve months of the release of these data to the PI's selected here and in subsequent solicitations. Since data from SIM observations will be accumulated over periods from weeks to years, the specific date on which data is "released" to a PI will depend on the scientific objective for which it was obtained. Therefore, in order to effect a timely release of data to the public domain and to maintain the proprietary interests of the PI's, the SIM Science Team and the SIM Project, in consultation the ISDC, will decide before the data are obtained how to determine when data will be released to the public. Only in exceptional cases would data obtained early in the mission not be released until after the end of the mission.

2.7 BACKGROUND AND DESCRIPTION OF THE SIM MISSION

The Space Interferometry Mission (SIM) is a space-based, 10 meter baseline optical Michelson interferometer. In wide-angle mode, SIM is being designed for up to 4 microarcseconds precision absolute-position measurements of stars—with parallaxes to comparable accuracy—at the end of a five-year mission. The expected proper-motion accuracy is about 2 microarcseconds per year, corresponding to a transverse velocity of 10 meters per second at a distance of 1 kiloparsec. In narrow-angle mode (1-microarcsecond expected accuracy), SIM will search for planetary companions to nearby stars by detecting their astrometric 'wobble.'

Within each 'tile,' which is a 15-degree-wide field (referred to as the field of regard), SIM will take multiple relative measurements of the separations of 'grid stars.' Wide-angle astrometry is performed by combining the relative positions of the grid stars in overlapping tiles and constructing an astrometric grid covering the entire sky. Narrow angle astrometry uses reference stars within the field of regard. The superior performance of SIM is achieved when the science and reference stars fit within a ~1 degree field of view.

2.7.1 INSTRUMENT OVERVIEW

Measuring accurate positions via interferometry reduces, for SIM, to the problem of measuring the interferometer baseline and the optical pathlength difference. The spacecraft architecture incorporates seven or eight siderostats, six of which are used at any one time with one or two redundancy spares. A switchyard allows light from any siderostat to be directed into any delay line that enables interferometer measurements at a number of different baseline lengths ranging up to 10 meters.

At any one time, two of the siderostat pairs observe bright guide stars to stabilize the optical system while a third pair observes the science target. A beam combiner interferes the starlight arriving from the two siderostats in each interferometer. White light interference fringes form when the optical path-lengths of both arms are equal. To make this equalization possible, an optical delay line is added to one arm of the interferometer in order to extend or shorten the optical path of that arm as needed. Tracking the fringe corresponds to measuring the position of the delay line, which is the fundamental astrometric quantity measured by SIM. External and internal metrology gauges measure the baseline length and starlight optical path lengths. Information from the guide star internal metrology gauges and fringe detectors is used to help stabilize the science target observations, and the external metrology truss measures the orientations of the reference and science baselines with respect to each other.

A summary of the key instrument and mission parameters and performance goals (see section 2.1) is given below.

Baseline	10 m
Wavelength range	0.4 – 0.9 μm
Astrometric Field of Regard (FOR)	15° x 15°
Astrometric Narrow Angle Field of View	1°
Imaging Field of View	1.4 arcsec
Sun exclusion angle	50° for two position angles 90° apart
Detector	Si CCD
Orbit	Earth-trailing solar orbit
Mission Duration	5 years (launch mid-2006)
Astrometric (wide-angle) accuracy	4 μas end-of-mission
Limiting magnitude	V = 20
Astrometric (narrow-angle) accuracy	1 μas in 1 hour
Imaging Resolution	10 milliarcsec

2.7.2 MISSION TIMELINE AND OPERATIONS

Following orbit insertion, the two unfolding sections of the spacecraft and the sunshade will be deployed. Spacecraft systems will be checked out and tracking data collected to precisely determine the actual orbit achieved. Checkout and calibration of the interferometer will then commence and continue for several months.

From the end of this calibration period through 2011, SIM will perform nearly continuous science observations over the entire celestial sphere. Pointing of the spacecraft will be performed using reaction wheels, with small reaction control system thrusters used to desaturate the reaction wheels. The nominal viewing axis is kept at least 50 degrees away from the Sun to protect the viewing optics from heating. The spacecraft's velocity will be determined to sufficient accuracy to correct for stellar aberration using ranging and Doppler data obtained by 34 m Deep Space Network (DSN) ground stations. Data will be recorded onboard and downlinked during these tracking passes.

2.7.3 ADDITIONAL SUPPORT RESOURCES FOR PROPOSERS

A number of resources are available that provide relevant information for planning astrometric observations via the SIM web site, including estimates of observing time required to achieve a specific end-of-mission accuracy for global astrometry programs. For information specific to this Announcement of Opportunity, see the Website <http://sim.jpl.nasa.gov/research-ops.html>. Proposers may also consult the SIM general Website at <http://sim.jpl.nasa.gov>.

2.8 EDUCATION/PUBLIC OUTREACH

NASA expects education and public outreach to be a significant part of each NASA flight program and research discipline, and strongly encourages space science researchers to engage actively in education and public outreach as an important component of their NASA-supported professional activities. In order to achieve this goal, OSS has developed a comprehensive approach for making education at all levels (with a particular emphasis on K–14 education) and the enhancement of public understanding of space science integral parts of all of its missions and research programs. The two key documents that establish the basic policies and guide all OSS education and outreach activities are a strategic plan entitled *Partners in Education: A Strategy for Integrating Education and Public Outreach Into NASA's Space Science Programs* (March 1995), and an accompanying implementation plan entitled *Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy* (1996). Both can be accessed by selecting "Education and Outreach" from the menu on the OSS homepage at Internet URL <http://spacescience.nasa.gov> (See Appendix C), or from Dr. Jeffrey Rosendhal, Office of Space Science, Code S, NASA Headquarters, Washington, DC 20546-0001, USA.

In accord with these established OSS policies, Education and Public Outreach (E/PO) will be an integral element of the Space Interferometry Mission Program, and 1–2% of the total program budget will be allocated to education and outreach.

All selected, NASA-funded, scientific participants will be expected to become actively involved in planning and implementing the SIM Mission E/PO program. OSS expects that individual participating scientists (including members of their supporting team) will spend an average of approximately 5% of their supported time, as part of their normal ongoing involvement with the mission, supporting Education/Public Outreach activities. Such activities may include, but not be limited to: developing ideas for creative and worthwhile educational materials; preparing written background information suitable for primary and secondary school educational resources; and/or preparing portions of their mission's data for use in educational and public outreach materials. Science Team Member proposals must include an explicit statement in the proposal that proposers are committed to participate in E/PO on this basis and must budget appropriately for such work as part of their proposal.

As a focal point for these activities, the SIM Mission has decided to solicit in this AO a scientist whose explicit function on the SIM Science team will be to coordinate and integrate the activities of the SIM Science Team with the overall SIM E/PO program (see Section 2.3). Appendix D of this AO provides further information and guidance for the preparation of E/PO Scientist proposals.

2.9 INTERNATIONAL PARTICIPATION

NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included (unless otherwise noted in the NASA research opportunity). 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.

All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NASA research opportunity. 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 may be considered if a significant reduction in the cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received. Foreign sponsors may, in exceptional situations, 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..

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, the NASA Office of External Relations will arrange with the foreign sponsor for 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.

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

1. An exchange of letters between NASA and the foreign sponsor agency or funding institution; or
2. A formal Agency-to-Agency Memorandum of Understanding (MOU).

Proposals which include international participation, whether through involvement of the foreign nationals and/or involvement of foreign entities 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 international participation. The discussion must describe in detail the proposed international participation and is to include, but not be limited to, whether or not the approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or where 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 any implications for the schedule. Information regarding U.S. export regulations is available at <http://www.pmdtc.org> and <http://www.bxa.doc.gov>. Proposers are advised that under U.S. law and regulation, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered “Defense Articles” on the United States Munitions List, and are subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

2.10 REFERENCE FOR FURTHER INFORMATION

Questions about this AO and/or the Space Interferometry Mission may be directed to the NASA Space Interferometry Mission Program Scientist:

Dr. Philippe Crane
Research Program Management Division
Code SR
Office of Space Science
NASA Headquarters
Washington DC 20546-0001
Telephone: (202) 358-0377
E-mail: pcrane@hq.nasa.gov

2.11 UPDATES TO THE AO

Any updates to this AO will be posted on the OSS Research Opportunities Web site, accessible through the OSS Homepage at Internet URL <http://spacescience.nasa.gov>. It is the responsibility of interested proposers to check this site periodically for pertinent information.

3. PROPOSAL SUBMISSION INFORMATION

3.1 TECHNICAL AND SCIENTIFIC INQUIRIES

Inquiries of a scientific or technical nature should be directed to the SIM Program Scientist at the address given in Section 2.10 above. Inquiries are preferred in writing and may be sent by fax or E-mail (the character string “SIM AO” [without quotes] should be included in the subject line of all E-mail transmissions).

Technical inquiries, which may be referred by the Program Scientist to the SIM Project Office for response, will have the questions and replies posted on the SIM Web page “Frequently Asked Questions” (FAQ) section. The cut-off for technical inquiries is two weeks prior to the proposal due date given in Section 1.1.

3.2 NOTICE OF INTENT TO PROPOSE

NASA strongly encourages all prospective proposers to submit a Notice of Intent (NOI) in accordance with the schedule in Section 1.1. Proposers must prepare and submit this NOI according to the instructions found at the World Wide Web address TBD*. Proposers without access to the Web, or who experience difficulty in using this site, may contact: TBD *.

*NOTE: These addresses will be provided no later than March 20, 2000, by OSS Electronic Notification and by Amendment posted to this NRA on its website, or by contacting one of the points of contact listed below:

To the extent that the preparer knows the following information by the due date, the Notice of Intent should include:

- (a) Names, addresses, telephone numbers, E-mail addresses, and fax numbers of (1) the Principal Investigator; (2) any Co-Investigators; and (3) as appropriate, the lead representative from each organization (industrial, academic, educational, nonprofit, and/or Federal) expected to be included in the proposal team; and
- (b) Title of the proposed investigation, an indication of which type of investigation it will be (see Section 2.2), and a brief statement of the expected scientific objectives and potential for contributing to education and outreach.

3.3 FORMAT AND CONTENT OF PROPOSALS

3.3.1 General Information

Appendix A contains general NASA guidance for proposals that is binding unless specifically amended in the body of this AO or in the mission-specific Guidelines for Proposal Preparation (Appendix B). In order to facilitate evaluation, NASA requires a uniform proposal format for all proposals submitted in response to this AO. The proposal format can be found in the appropriate Guidelines for Proposal Preparation (Appendix B) where other, important guidance for preparing proposals is also given. Failure to follow the outline or the page count limits in the appropriate Guidelines for Proposal Preparation (Appendix B) may result in reduced ratings during the evaluation process, or in extreme cases, could lead to rejection of the proposal without review.

3.3.2 Specific Guidelines for Non-U.S. Proposers

Proposals from outside the United States must conform to the uniform proposal format specified in Appendix B. The proposal must be submitted according to the instructions in Section 3.3.1. In addition, one copy of the proposal and the letters of endorsement must be sent to the addresses in Section 3.4 according to the schedule in Section 1.1.

If review and endorsement are not possible before the announced closing date, sponsoring non-U.S. agencies may, in exceptional situations, forward a proposal without endorsement to NASA's Space Science and Aeronautics Division, Code IS, along with the date when a decision on endorsement can be expected. No proposal will be reviewed by NASA without endorsement from the appropriate government agency.

Proposers from non-U.S. institutions are not required to submit a Cost Proposal unless U.S. individuals seeking NASA support are involved in the proposal. A non-U.S. prepares must, however, submit a Management Proposal. If the proposal seeks NASA support, both Management and Cost Proposals must be signed by the U.S. individual and certified by the U.S. individual's institution in accordance with Section 3.1. Similarly, non-U.S. individuals who plan to participate as Co-Investigators on a U.S. proposal must have such participation endorsed by their appropriate government agency.

All proposals from non-U.S. institutions will undergo the same evaluation and selection process as those originating in the United States. For those non-U.S. proposals selected, NASA will arrange with the sponsoring agencies for participation on a cooperative, no exchange of funds basis, in which NASA and the sponsoring agencies will each bear the cost of discharging its separate responsibilities, including travel and subsistence for its own personnel.

3.4 SUBMISSION INFORMATION AND CERTIFICATIONS

A Cover Page/Proposal Summary must be completed via the Web-based form to be found at <http://props.oss.hq.nasa.gov>. This form can be filled and edited over a period of time, but must be completed and printed in time to procure original signatures of the PI and Authorizing Official of the sponsoring institution authorized to certify institutional support and sponsorship of the investigation and of the management and financial parts of the proposal. This printed Cover Page must be submitted in hard copy with the proposal by the due date. No changes should be made to the printed hard copy; all edits must be accomplished via the Web form. Note that the requested proposal summary may be released by NASA on a publicly accessible date base, so it should not contain material that is considered proprietary or confidential by the proposers.

Note: The authorizing signature of a U.S. institution now also certifies that the proposing institution has read and is in compliance with the three required certifications printed in full in Appendix F at the end of this AO. NASA does not, therefore, require institutions to separately submit these certifications with the proposal.

Non-U.S. proposals must be signed by an official of the sponsoring agency that certifies support and sponsorship of the proposed investigation. The non-U.S. proposal shall include a letter of endorsement signed by an institutional official from each organization expecting to provide critical, no-exchange-of-funds contributions of hardware, software, facilities, services, etc. This official must certify institutional support and sponsorship of the investigation, as well as concurrence in the management and financial parts of the proposal.

3.5 QUANTITY

Proposers must provide 20 copies of their proposal, plus the original signed proposal on or before the deadline given in Section 1.1.

3.6 SUBMITTAL ADDRESS

All proposals, both U.S. in origin and from international proposers must be received at the following address by the deadline given in Section 1.1:

SIM AO Support Office
TBD *
Washington, D.C. 20024
USA
Point of contact for commercial delivery:
TBD *

Furthermore, one copy (over and above the 35 copies) of any proposal that includes any non-U.S. participants and/or institutional and governmental commitments must be sent to NASA Code IS at the address listed in Section 3.4.

*NOTE: These addresses will be provided no later than March 20, 2000, by OSS Electronic Notification and by Amendment posted to this NRA on its website, or by contacting one of the points of contact listed below:

3.7 DEADLINE

The organization at the submittal address must receive all proposals by 4:30 p.m. EDT, by the closing date specified in Section 1.1. NASA will treat all proposals received after the closing date in accordance with NASA's provisions for late proposals (Appendix A, Section 7).

3.8 NOTIFICATION OF RECEIPT

NASA will notify the proposers in writing or by E-mail that their proposals have been received. Proposers not receiving this confirmation within two weeks after submittal of their proposals should contact the SIM Program Scientist.

4. PROPOSAL EVALUATION AND SELECTION

4.1 EVALUATION AND SELECTION PROCESS

NASA will subject all proposals submitted in response to this AO to a preliminary screening to determine their compliance to its constraints, requirements, and guidelines of the AO. Proposals not in compliance will be returned without further review.

Using the criteria given below, the remaining proposals will then be assessed by an evaluation team made up of panels of peers of the proposers in scientific, technical, management, Education/Public Outreach, and other areas. NASA may also seek to supplement the knowledge and expertise of the panels by obtaining reviews submitted by mail.

Once the panel evaluations are complete, an *Ad Hoc* Subcommittee of the Space Science Steering Committee (see below), composed wholly of Civil Servants, will convene to consider the evaluation results. This Subcommittee will categorize the proposals in accordance with procedures required by NASA FAR Supplement Part 1872.0 according to the Categories defined below:

Category I. Well conceived and scientifically and technically sound investigation pertinent to the goals of the program and the AO's objectives and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that the investigation can be delivered on time and within budget. Investigations in Category I are recommended for acceptance and normally will be displaced only by other Category I investigations.

Category II. Well conceived and scientifically or technically sound investigations that are recommended for acceptance, but at a lower priority than Category I.

Category III. Scientifically or technically sound investigations that require further development.

Category IV. Proposed investigations that are recommended for rejection for the particular opportunity under consideration, whatever the reason.

The Space Science Steering Committee, which is composed wholly of NASA Civil Servants and appointed by the Associate Administrator for Space Science, will then conduct an independent assessment of the entirety of the AO solicitation and review processes and products regarding both their compliance to established policies and practices, as well as their completeness, self-consistency, and adequacy of all materials related thereto, including recommendations for selection tendered by the SIM Program Scientist.

After this review, the Steering Committee will submit the final evaluations and categorizations to the Selection Official who will make the final selections based on the evaluation factors outlined in Section 4.2. The Associate Administrator for Space Science will be the Source Selection Official for this opportunity and will make the final decision in consultation with the OSS Science Program Director for the Astronomical Search for Origins and Planetary Systems. It should also be noted that, in accordance with Section 2 of Appendix A, NASA reserves the right to select only a portion of a proposer's investigation and/or to invite his/her participation with other investigators in a joint investigation. In that case, all affected proposers will be given the opportunity to accept or decline such partial acceptance and/or participation with other investigators.

4.2 EVALUATION CRITERIA

The fundamental aim of the NASA investigation acquisition process is the identification of scientific ideas that are tested and verified by unique instrumental and/or analytical capabilities that best suit the overall scientific and cost objectives of the SIM program as described in this AO. Successful implementation of the SIM program requires that, in addition to scientific and technical merit, the investigations be achievable within the established boundary conditions of cost and schedule.

The evaluation criteria below will be used to evaluate and categorize proposals as described in Section 4.1. The evaluation factors, which are described more fully in the subsections below, are:

- The intrinsic scientific merit of the proposed investigation;
- The feasibility of the proposed approach for implementation, including technical risk, cost; and
- The competence and experience of the Principal Investigator, investigation team, and sponsoring institution(s).

For Key Project proposals, the first of these criteria is weighted at about two thirds of the total. The second two are about equally weighted at about one sixth each of the total. For all Mission Scientists proposed contributions to the SIM mission and to the SIM Science Team (see Section 2.3) will serve as an additional evaluation criterion; for these positions, the scientific merit and the proposed contributions will be each roughly equally weighted at about one third of the total for each. The last two bulleted criteria make up the remainder of the evaluation for the Mission Scientist positions and are roughly equally weighted at about one sixth each.

In addition to the specific evaluation criteria, NASA and OSS consider that the commitments to public education, outreach, and new technology, if applicable, are very important. In the case of equally meritorious proposals, the commitment to these elements will be considered in formulating the final recommendation to the Selecting Official.

4.2.1 Scientific Merit and Relevance to Mission Objectives

The goals and objectives of the proposed investigation will be assessed to determine the intrinsic scientific merit of the proposed investigation and its relevance to the specific opportunity described in this AO. The evaluation will include an assessment of the degree to which the proposal offers an original and compelling scientific investigation that addresses the SIM science objectives.

To evaluate the scientific merit, the goals and objectives of the proposed investigation will be assessed to determine its impact on space science as a whole and, in particular, on the science objectives of the SIM mission (see Section 2.1). This evaluation will include the responsiveness and the relevance of the proposed investigation to the established SIM mission objectives. A major element in the evaluation will be whether the data that are to be gathered will be sufficient to complete the proposed investigation. An important element of this criterion is the long term value of the data base that any proposed observations will produce for enabling broad science investigations beyond those specifically proposed, with emphasis on investigations relevant to the stated science objectives of the NASA Office of Space Science and of the SIM mission.

4.2.2 Feasibility, Technical Risk, and Cost

The proposals will be evaluated to determine if the scientific goals can be achieved within the constraints of SIM baseline performance, available observing time, and financial resources. The expected SIM performance, and level of financial resources are given earlier in this AO. The available observing time is not a fixed constraint, but expected requirements for Key Projects, and allocations for Mission Scientists are also found elsewhere in this AO. Another important factor in the feasibility will be the requirements for preparatory observations or research to define the target list.

4.2.3 Competence and Experience of the Investigator, Investigation Team, and Sponsoring Institution(s)

The competence and relevant experience of the prepares and all proposed investigative team members will be evaluated as an indication of their ability to carry the investigation (including the proposed role, where appropriate, as a SIM Science Team member) to a successful conclusion and the commitment of the proposer's institution, as measured by the willingness of the institution to provide the necessary support (logistics, facilities, etc.) to ensure that the investigation can be completed satisfactorily. An important element of this criterion is that the role and responsibility of each identified Co-Investigator in the proposal must be provided in the proposal (see Section 2.4 and Section 1 of Appendix B).

4.2.4 Contributions to the SIM Project and to the SIM Science Team

Proposals for the Mission Scientist must describe how they can provide the expertise and skills mentioned in the description of the various Mission Scientist positions found in Section 2.3. Proposals for the E/PO Mission Scientist must specifically address the proposer's approach towards developing and implementing a long-term co-coordinated SIM E/PO program. Further guidance is given in Appendix D. The roles foreseen in section 2.3 for the Mission Scientist positions should be viewed as indicative of a possible set of skills and expertise these individuals might contribute to the project and the Science Team. Proposers are encouraged to consider different skills in addition to or instead of those suggested in Section 2.3.

5. IMPLEMENTATION

NASA will notify the PI's of the selected investigations immediately by telephone, followed by formal written notification. This formal notification will include any issues noted during the evaluation that may require resolution. NASA will notify all other proposers in writing that their investigations were not selected. All proposers will be offered a debriefing. Such debriefings may be conducted by telephone or, if the Principal Investigator prefers, may be conducted in person at NASA Headquarters. NASA funds may not be used to defray travel costs by the prepares for a debriefing.

It is anticipated that Jet Propulsion Laboratory will negotiate and award contracts to implement the selected investigations.

6. CONCLUSION

The Space Interferometry Mission will provide unparalleled opportunities for scientific investigations as well as leading the way to the future of interferometry as a scientific tool. It will also generate broad public interest in searching for Earth-like planets and NASA's long term goals in this area. We invite your participation in this important and exciting scientific program.

Anne L. Kinney
Science Program Director
Astronomical Search for Origins
And Planetary Systems

Edward J. Weiler
Associate Administrator
for Space Science

LIST OF APPENDICES

Appendix A.	General Instructions and Provisions
Appendix B.	Detailed Guidelines for Proposal Preparation
Appendix C.	Bibliography of Relevant Reports and Applicable Documents
Appendix D.	Education and Public Outreach Scientist Proposals
Appendix E.	Regulations Governing the Procurement of Foreign Goods or Services
Appendix F.	Certifications

APPENDIX A

GENERAL INSTRUCTIONS AND PROVISIONS

1. INSTRUMENTATION AND/OR GROUND EQUIPMENT

By submitting a proposal, the investigator and institution agree that NASA has the option to accept all or part of the offeror's plan to provide the instrumentation or ground support equipment required for the investigation, or NASA may furnish or obtain such instrumentation or equipment from any other source as determined by the selecting official. In addition, NASA reserves the right to require use of Government instrumentation or property that subsequently becomes available, with or without modification, that meets the investigative objectives.

2. TENTATIVE SELECTIONS, PHASED DEVELOPMENT, PARTIAL SELECTIONS, AND PARTICIPATION WITH OTHERS

By submitting a proposal, the investigator and the organization agree that NASA has the option to make a tentative selection pending a successful feasibility or definition effort. NASA has the option to contract in phases for a proposed investigation and to discontinue the investigative effort at the completion of any phase. NASA may desire to select only a portion of the proposed investigation and/or that the individual participates with other investigators in a joint investigation. In this case, the investigator will be given the opportunity to accept or decline such partial acceptance or participation with other investigators prior to a NASA selection. Where participation with other investigators as a team is agreed to, one of the team members will normally be designated as its leader or contact point. NASA reserves the right not to make an award or cancel this Announcement of Opportunity at any time.

3. SELECTION WITHOUT DISCUSSION

The Government intends to evaluate proposals and award contracts without discussions with offerors. Therefore, each initial offer should contain the offeror's best terms from a cost or price and technical standpoint. However, the Government reserves the right to conduct discussions, if later determined by the Contracting Officer to be necessary.

4. NONDOMESTIC PROPOSALS

The guidelines for proposals originating outside of the United States are the same as those for proposals originating within the United States, except that the additional conditions described in Section 2.9 of the AO shall also apply.

5. TREATMENT OF PROPOSAL DATA

It is NASA policy to use information contained in proposals and quotations for evaluation purposes only. While this policy does not require that the proposal or quotation bear a restrictive

notice, offerors or quoters should, in order to maximize protection of trade secrets or other information that is commercial or financial and confidential or privileged, place the following notice on the title page of the proposal or quotation and specify the information, subject to the notice by inserting appropriate identification, such as page numbers, in the notice. In any event, information (data) contained in proposals and quotations 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.

RESTRICTION ON USE AND DISCLOSURE OF PROPOSAL AND QUOTATION INFORMATION (DATA)

The information (data) contained in (insert page numbers or other identification) of this proposal or quotation 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 for other than evaluation purposes; provided, however, that in the event a contract is awarded on the basis of this proposal or quotation, the Government shall have the right to use and disclose this information (data) to the extent provided in the contract. This restriction does not limit the Government's right to use or disclose this information (data), if obtained from another source without restriction.

6. STATUS OF COST PROPOSALS

The investigator's institution agrees that the cost proposal submitted in response to the Announcement is for proposal evaluation and selection purposes, and that, following selection and during negotiations leading to a definitive contract, the institution may be required to resubmit or execute all certifications and representations required by law and regulation. Because awards are expected to be in the form of JPL subcontracts, submission of a Standard Form (SF) 1411 Contract Pricing Proposal Cover Sheet is not required.

7. LATE PROPOSALS

The Government reserves the right to consider proposals or modifications thereof received after the date indicated for such purpose, if the selecting official deems it to offer NASA a significant technical advantage or cost reduction. (See NFS 18-15.412.)

8. SOURCE OF SPACE INVESTIGATIONS

Investigators are advised that candidate investigations for space missions can come from many sources. These sources include those selected through the Announcement of Opportunity, those generated by NASA in-house research and development, and those derived from contracts and other agreements between NASA and external entities.

9. DISCLOSURE OF PROPOSALS OUTSIDE THE GOVERNMENT

NASA may find it necessary to obtain proposal evaluation assistance outside the Government. Where NASA determines it is necessary to disclose a proposal outside the Government for evaluation purposes, arrangements will be made with the evaluator for appropriate handling of the proposal information. Therefore, by submitting a proposal, the investigator and institution agree that NASA may have the proposal evaluated outside the Government. If the investigator or institution desires to preclude NASA from using an outside evaluation, the investigator or institution should so indicate on the cover. However, notice is given that if NASA is precluded from using outside evaluation, it may be unable to consider the proposal.

10. EQUAL OPPORTUNITY

For any NASA contract resulting from this solicitation, the clause at FAR 52.222-26, Equal Opportunity, shall apply.

11. PATENT RIGHTS

A. For any NASA contract resulting from this solicitation awarded to other than a small business firm or nonprofit organization, the clause at NFS 18-52.227-70, New Technology, shall apply. Such contractors may, in advance of a contract, request waiver of rights as set forth in the provision at NFS 18-52.227-71, Requests for Waiver of Rights to Inventions.

B. For any NASA contract resulting from this solicitation awarded to a small business firm or nonprofit organization, the clause at FAR 52.227-11, Patent Rights--Retention by the Contractor (Short Form), (as modified by NFS 18-52.227-11) shall apply.

12. RIGHTS IN DATA

Any contract resulting from this solicitation will contain the Rights in Data - General clause: FAR 52.227-14.

DETAILED GUIDELINES FOR PROPOSAL PREPARATION

1. GENERAL GUIDELINES

All documents must be typewritten in English, use metric and standard astronomical units, and be clearly legible. Submission of proposal material by facsimile (fax), electronic media, videotape, or floppy disk is not acceptable. No proposal may reference a World Wide Web site for any data or material needed for completeness of understanding of the proposal, although Web sites may be used as bibliographic references.

In order to allow for recycling of proposals after the review process, all proposals and copies must be submitted on plain white paper only (e.g., no cardboard stock or plastic covers, no colored paper, etc.). Proposers are requested not to use three-ring binders. Photographs and color figures are permitted if printed on recyclable white paper only. The original signed copy (including Cover Page printed from the Web, and non-U.S. endorsements) should be bound in a manner that makes it easy to disassemble for reproduction. Except for the original, two-sided copies are preferred. Every side upon which printing appears will be counted against the page limits.

Single- or double-column format is acceptable. In complying with the page limits, no page should contain more than 45 lines of text and the type font should not be smaller than 12-point (i.e., less than or equal to 15 characters per inch). Figure captions should be in 12 point. Smaller font is allowed within figures and in the cost table. Proposals may include no more than four fold-out pages (28 x 43 cm; i.e., 11 x 17 inches). All pages other than fold out pages shall be 8.5 x 11 inches or A4 European standard.

Proposals should be organized with readily identified sections. Table B-1 and Table B-2 give restrictions on page count for the various sections for the two types of proposals.

1.1 Key Project Team Proposals

All pertinent information necessary for a sound scientific and technical assessment of the proposed investigation must be contained within the page limits given below for proposals. No appendices other than those in Table B-1 are permitted. Budgets are required for U.S. investigations only.

Table B-1: Page Limits for Key Project Team Proposals

<u>Section</u>	<u>Page Limits</u>
Cover Page/Proposal Summary	Printed Web Form
Table of Contents	1
Executive Summary	2
Science Investigation and Technical Description	17
Education/Public Outreach Statement of Participation	1
Cost and Budget	5
<u>Appendices:</u> (no others permitted) Resumes (2 pages for PI, 1 page for each other investigator) Individual Duties and Responsibilities (1/2 page per person) Letter(s) of Endorsement International Agreement(s) Reference List (as required) Acronyms List (optional) Statement(s) of Work (SOW)	No page limit, but small size encouraged

1.2 Mission Scientist Proposals

All pertinent information necessary for a sound scientific assessment of the proposed investigations must be contained in the stated number of pages or less of the main body of the proposal. No appendices other than those in Table B-2 are permitted. Cost and Budget sections are required for U.S. investigations only.

Proposals for the E/PO Scientist Position should refer to Appendix D for further guidance and supporting information.

A. Cover Page/Proposal Summary

All proposals must be prefaced by an integrated *Cover Page/Proposal Summary* that contains important, required information (see below). This item is produced by first entering the requested information electronically through a World Wide Web site (<http://props.oss.hq.nasa.gov>) and then printing out this form by the prepares. Note: A sample of this Web form may be printed out at any time for preliminary inspection and the only valid format for submission of this item is through the Web. The printed copy of the electronically submitted form is then used to obtain original signatures of the PI and an official from the proposing institution to submit with the original copy of the proposal. In addition, reproductions of this original *Cover Page/Proposal Summary* are used to preface the required printed copies of the proposal.

B. Table of Contents

The proposal shall contain a table of contents, which will not be counted against the page limit. This table of contents should parallel the outlines provided below.

Table B-2: Page Limits for Mission Scientist Proposals

<u>Section</u>	<u>Page Limits</u>
Cover Page/Proposal Summary	Printed Web Form
Table of Contents	1
Executive Summary	1
Science Investigation and Technical Description	10
Education/Public Outreach Statement of Participation	1
Cost and Budget	2
Description of Mission Scientist Functions for the named positions in Section 2.3 of this AO.	8
<u>Appendices:</u> (no others permitted) Resumes (2 pages) Letter(s) of Endorsement Reference List (optional) Statement(s) of Work International Agreement(s) Acronyms List (optional)	No page limit, but small size encouraged

C. Executive Summary

The executive summary should provide an overview of the investigation, including its scientific objectives, educational and societal opportunities, and cost plan. If the proposal is for a Mission Scientist position, this summary should indicate the specific position on the Science Team the prepares seeks to occupy (see Section 2.3 in the main body of the AO).

D. Science Investigation

D.1 Key Project Proposals

Detailed observing programs are not required in response to this AO. However, the science section must describe the scientific objectives of the proposed investigation, including the value of the investigation to space science and the SIM mission. It must provide a general discussion of the targets, the scientific products, and how the science products and data will be used to fulfill the scientific objectives. A discussion of how the science data will be obtained, including a plan for delivery of the products to the team, and the individuals responsible for the data delivery, must also be provided.

Scientific Objectives. This section must consist of a discussion of the goals and objectives of the investigation, their value to the goals of the Origins Theme, and their relationships to past, current, and future investigations and missions. It should describe the history and basis for the proposal and discuss the need for such an investigation. This far in advance of the launch of SIM, there are significant uncertainties about overall mission performance. Such uncertainties must be reflected in the uncertainties in a proposed scientific investigation and will be taken into account by the peer review. That means that proposals should use the performance goals of Table 1 of Section 2 of the main body of this AO to predict the scientific return, but must demonstrate how the scientific return would degrade if these goals are not entirely met. For these reasons, a detailed observing program is not solicited from the proposers, but rather an overview of such a program, with examples of possible targets, plausible observing schemes, criteria for selection, and observing time estimates.

Science Measurements. The measurements to be taken in the course of the mission, the data to be returned, and the approach that will be taken in analyzing the data to achieve the scientific objectives of the investigation must be discussed. This description must identify the experiments to be performed (astrometry, proper motions, imaging, etc.), the quality of the data required (resolution, coverage, pointing accuracy, measurement precision, etc.), and the quantity of data to be returned (bits, images, volume, etc.). Estimates of the number of observations and the amount of observing time required must also be provided.

D.2 Mission Scientist Proposals

Science Objectives and Measurements. Scientific investigations are being solicited for Mission Scientist positions on the SIM Key Project Science Team. Proposers must describe, in a similar manner as for the Key Projects, their plans to use up to the order of 1% of the SIM observing time (see Section 2.3 in the main body of the AO).

Roles and Responsibilities as a Mission Scientist. This section of the proposal must clearly state the knowledge, skills, and experience the prepares brings to qualify for the Mission Scientist position of interest (see Section 2.3 and Appendix D in the case of the E/PO Scientist). Then the prepares should clearly state how these qualities would contribute to the success of the SIM Mission, being as specific as possible and using references to published or ongoing activities as may be appropriate. This material should include any innovative ideas the prepares would use to advance the successful achievement of the role as a Mission Scientist and of the overall SIM Program.

Individuals may propose for more than one Mission Scientist position on the SIM Science Team, by submitting multiple proposals. In this case, the same scientific investigation may be proposed but each proposal must be complete in itself.

E. Cost Plan

The cost plan in real year dollars must provide information on the anticipated costs for all phases of the investigation. These costs shall be consistent with the program funding guidelines in

section 2.5 of this AO. A detailed cost proposal is required for the first three years of the program. Acceptable elements of the cost plan may be: salaries and benefits for personnel, travel costs, costs for preparatory science investigations and/or observing, and computer facilities. For the purposes of NASA and Project planning, an annual inflation rate of 3% should be assumed. Table B-3 provides a template for the overall funding for all phases. Separate tables should be included for each major subcontract. A detailed breakout of the funding elements in the template for the first three years is required.

It is anticipated that during the period of performance of the proposed mission, NASA will implement full cost accounting for NASA Centers or other Government laboratories. To plan for this, proposers must include all contributions provided by NASA Centers, including Civil Servant services, as well as the cost for the use of Government facilities and equipment. All direct and indirect costs associated with the work performed at NASA Centers must be fully costed and accounted for in the proposal. NASA employees must work with their respective NASA Centers to develop estimates for these costs.

F. Appendices

The following additional information is required. This information can be included as Appendices to the proposal, and, as such, will not be counted within the specified page limit.

Resumes. Provide short resumes for all named personnel using the page limits indicated in Tables B-1 and B-2.

Letters of Endorsement. Letters of endorsement must be provided from all organizations participating in the investigation. Letters of endorsement should be signed by both the lead representative from each organization represented on the team (if appropriate), and by institutional and Government officials authorized to commit their organizations to participation in the proposed investigation.

Individual Duties and Responsibilities. The duties and responsibilities of each named investigator must be described and the contribution to the proposal elucidated using the page limits indicated in Tables B-1 and B-2.

Statements of Work for Each Contract Option. Provide draft Statement(s) of Work for all potential contracts with NASA that clearly define all proposed deliverables (including science data) for each option, potential requirements for Government facilities and/or Government services, and a proposed schedule for the entire mission.

International Agreement(s). Draft International Agreement(s) are required for all nondomestic partners in the investigation.

Table B-3: TOTAL COST FUNDING PROFILE TEMPLATE
(Costs in Real Year Dollars)

Item	FY01	FY02	FY03	FY04	FY05	FY06	...	FY11	Total
Salaries and Benefits									
Equipment									
Travel									
Supplies									
Subcontracts									
Other (specify)									
Facilities and Administrative									
Cost to NASA (Total)	\$	\$	\$	\$	\$	\$	\$	\$	\$

References List. Proposals may provide, as an appendix, a list of reference documents and materials used in the proposal. The documents and materials themselves cannot be submitted except as a part of the proposal.

APPENDIX C

BIBLIOGRAPHY OF RELEVANT REPORTS AND APPLICABLE DOCUMENTS

The SIM Bibliography includes documents available electronically via the Internet, as well as paper copy. Proposers are requested to access the document electronically where possible. Only limited paper copies of documents are available. Please note that not all documents are available via the SIM Bibliography, but access information is provided. It is incumbent upon the preparers to ensure that the documents used in proposal preparation are of the date and revision listed in the Announcement of Opportunity or this Appendix. The SIM Bibliography is accessible on the World Wide Web at the SIM AO homepage at <http://sim.jpl.nasa.gov>.

Office of Space Science Strategies and Policies The Space Science Enterprise Strategic Plan: Origins, Evolution, and Destiny of the Cosmos and Life (November 1997)

This document is a concise statement of the goals and outlook of NASA's Space Science Enterprise. It is a compilation of the major ideas described in more detail in the context of the overall NASA Strategic Plan. <http://spacescience.nasa.gov/strategy/1997/>

Partners in Education: A Strategy for Integrating Education and Public Outreach into NASA's Space Science Programs (March 1995)

This document describes the overall strategy for integrating education and public outreach into NASA's space science programs. <http://spacescience.nasa.gov/edu/educov.htm>

Implementing the Office of Space Science (OSS) Education/Public Outreach Strategy (October 1996)

This document describes the overall approach to implementing the education and public outreach strategy of the Office of Space Science. http://spacescience.nasa.gov/edu/imp_plan.htm

OSS Explanatory Guide for Education and Public Outreach Criteria

The Guide provides answers to questions frequently asked by members of the space science community who are preparing an education and public outreach segment to an OSS proposal. http://ssibroker.colorado.edu/broker/eval_criteria/Guide/

OSS Integrated Technology Strategy (April 1994)

This document describes efforts to manage technology infusion into future space science missions and to promote technology transfer to the private sector.

Space Science Supporting Documents

NAS/NRC Report: A New Science Strategy for Space Astronomy and Astrophysics (1997)

Report of the Task Group on Astronomy and Astrophysics. A study undertaken by the Space Science Board to determine the principal scientific issues that the discipline of space science

would face during the period 1995–2015. <http://www.nationalacademies.org/ssb/tgsamenu.html>

Procurement-related Information. Electronic versions only are available for the following:

Federal Acquisition Regulations (FAR) General Services Administration

<http://www.arnet.gov/far>

NASA FAR Supplement Regulations

<http://www.hq.nasa.gov/office/procurement/regs/nfstoc.htm>

NASA Financial Management Manual

<http://www.hq.nasa.gov/fmm/>

APPENDIX D

EDUCATION AND PUBLIC OUTREACH

As indicated in Section 2.3 of this Announcement of Opportunity, NASA has decided to create the special position of Education and Public Outreach (E/PO) Scientist for the Space Interferometry Mission (SIM). In this capacity, the SIM E/PO Scientist will play a significant role in the planning, implementation, and oversight of the overall mission E/PO program and in orchestrating the E/PO activities of the SIM Science Team. The decision to establish such a position as a key part of the mission Science Team directly reflects the importance NASA places on E/PO being an integral part of this program and the prospects for broad public interest in the scientific results from this mission.

Proposals for the E/PO Mission Scientist position must describe the proposer's approach to planning, implementing, and evaluating a broad program of education and outreach activities based on the science and technology of SIM and to carrying out the functions described in Section 2.3. A detailed plan for carrying out a specific education and public outreach program is not required in response to this Announcement. The actual SIM E/PO program (including how the program is to be organized) will be defined as part of the general set of Science Team activities following selection. Rather, it is expected that the proposals will describe the unique education and public outreach opportunities presented by SIM and the proposer's approach and qualifications for realizing those opportunities. The proposer's approach to organizing the SIM E/PO program, establishing partnerships and collaborations with appropriate education and outreach organizations and institutions in order to achieve a program of national scope, to involving SIM Science Team Members (as well as future guest observers) in the planning and implementation of the mission E/PO program, and to disseminating and evaluating the products and activities resulting from the SIM E/PO program should also be addressed in the proposal. Where appropriate, illustrative examples should be given of possible programs, opportunities for alliances, roles for science team members, plans for dissemination of results, and specific approaches for evaluating the quality, effectiveness, and impact of the SIM E/PO program. It is expected that the SIM E/PO program to be implemented as an integral element of this mission will support, be consistent with, and advance OSS's overall approach to education and public outreach as described in the Education and Public Outreach Strategic and Implementation Plans referenced in Section 2.8 and Appendix C. Based on the substantial resources available for carrying out the SIM E/PO program, it is also expected that the program will have a breadth and depth commensurate with the available resources and be multi-faceted in nature addressing a number of different aspects of education and outreach. Proposals must explicitly demonstrate how the proposed approach will accomplish both these goals.

Determination of the “Contributions to the SIM Project and SIM Science Team” for this position (to be used in the determination of the overall merit of the proposal as described in Section 4.2) will be based on the following specific criteria each of which will have equal weight:

- The proposer’s understanding of and approach to carrying out all aspects of the role of the SIM E/PO Scientist;
- The prospects of the proposed approach for producing a multifaceted, education and public outreach program of national scope that is closely linked to and takes advantage of the unique science and technology of SIM and that is consistent with and supports the implementation of the OSS E/PO Strategy;
- The prospects of the proposed approach for leveraging resources through the establishment of partnerships and collaborations with education and public outreach organizations across the country;
- The proposer’s demonstrated or planned strong linkages to the education community as the basis for playing a major role in developing the SIM education and public outreach program and assuming the responsibilities of the SIM E/PO Scientist.

Assistance for the Preparation of Education and Public Outreach Proposals

NASA OSS has established a nationwide infrastructure of space science education and outreach groups whose purpose is to directly aid space science investigators in identifying and developing high quality E/PO opportunities. This infrastructure provides the coordination, background, and linkages for fostering partnerships between the space science and E/PO communities, and the services needed to establish and maintain a vital national, coordinated, long-term OSS E/PO program. Of particular interest to proposers to this AO are two elements of this system (which are also described in more detail in the OSS education/outreach implementation plan referred to in Appendix C):

1. Four OSS science theme-oriented E/PO "Forums" to help orchestrate and organize in a comprehensive way the education/outreach aspects of OSS space science missions and research programs and provide both the space science and education communities with ready access to relevant E/PO programs and products; and
2. Five regional E/PO "Broker/Facilitators" to search out and establish high leverage opportunities, arrange alliances between educators and OSS-supported scientists, and help scientists turn results from space science missions and programs into educationally-appropriate activities suitable for regional and/or national dissemination.

Prospective proposers are strongly encouraged to make use of these groups to help identify suitable E/PO opportunities and arrange appropriate alliances. Proposers should be careful to note that these Forums and Broker/Facilitators have been established to provide help, but the responsibility for actually developing E/PO programs and writing proposals is that of the preparer. Points of contact and addresses for all of these E/PO Forums and Broker/Facilitators may be found by opening "Education and Public Outreach" from the menu of the OSS homepage at <http://spacescience.nasa.gov>. This link can also be used to access the "Explanatory Guide to the Office of Space Science Education and Public Outreach Evaluation Criteria" which contains answers to a number of frequently asked questions concerning OSS's overall approach to education and public outreach.

APPENDIX E

REGULATIONS GOVERNING THE PROCUREMENT OF FOREIGN GOODS OR SERVICES

The following Federal Acquisition Regulation (FAR) clauses cover the purchase of foreign goods and services and may be included in contracts resulting from this Announcement of Opportunity. The prepares is directed to the Federal Acquisition Regulation and the NASA FAR Supplement for further information on these regulations.

- 52.225-3 Buy American Act -- Supplies (January 1994)
- 52.225-7 Balance of Payments Program (April 1984)
- 52.225-9 Buy American Act -- Trade Agreements -- Balance of Payments Program (January 1994)
- 52.225-10 Duty-Free Entry (April 1984)
- 52.225-11 Restrictions on Certain Foreign Purchases (May 1992)
- 52.225-17 Buy American Act -- Supplies Under European Community Agreement (May 1995)
- 52.225-18 European Community Sanction for End Products (May 1995)
- 52.225-19 European Community Sanction for Services (May 1995)
- 52.225-21.1 Buy American Act -- North American Free Trade Agreement Implementation Act -- Balance of Payments Program (January 1994)

APPENDIX F

CERTIFICATIONS

The following pages contain, for reference only, copies of the three currently required Certifications. Note that the signature of the Authorizing Institutional Representative on the Cover Page submitted with the proposal now verifies that the proposing organization complies with these Certifications; therefore, these Certifications do not have to be independently signed and submitted as in previous Announcements of Opportunity.

**Certification Regarding Debarment, Suspension, and
Other Responsibility Matters**

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).

- (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.

Certification Regarding Lobbying

- (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 subcontracts 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.

**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.