

**National Aeronautics and
Space Administration**

December 7, 2001

NRA-01-OES-06

RESEARCH ANNOUNCEMENT

**ECOLOGICAL RESEARCH IN THE LARGE-SCALE
BIOSPHERE-ATMOSPHERE EXPERIMENT IN
AMAZÔNIA (LBA-ECO): PHASE II,
AND OPPORTUNITIES IN TERRESTRIAL
ECOLOGY**

Proposals Due – March 7, 2002

OMB Approval No. 2700-0087

**ECOLOGICAL RESEARCH IN THE
LARGE-SCALE BIOSPHERE-ATMOSPHERE EXPERIMENT IN AMAZÔNIA
(LBA-ECO): PHASE II,
AND OPPORTUNITIES IN TERRESTRIAL ECOLOGY**

**NASA Research Announcement
Soliciting Research Proposals
for
Period Ending
March 7, 2002**

**NRA-01-OES-06
Issued December 7, 2001**

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

I. PURPOSE OF THIS NASA RESEARCH ANNOUNCEMENT (NRA)

This National Aeronautics and Space Administration (NASA) Research Announcement (NRA) solicits proposals under its Terrestrial Ecology and Land Cover and Land Use Change Programs to continue, extend, or enhance ecological research being conducted as part of the Brazilian Ministry of Science and Technology-led Large Scale Biosphere-Atmosphere Experiment in Amazônia (LBA). The broad goal for cooperative ecological research within LBA, referred to as **LBA-ECO** (formerly known as LBA-Ecology) for the purposes of this announcement, is to improve our understanding of the effects of tropical forest conversion on ecosystem function and the sustainability of land use. The science question that provides focus for LBA-ECO is:

How do tropical forest conversion, re-growth, and selective logging, influence carbon storage, nutrient dynamics, trace gas fluxes, and the prospect for sustainable land use in Amazônia?

This question integrates research on the **response** of tropical ecosystems and their carbon cycling dynamics to global environmental change with research on the causes and **consequences** of land cover and land use change. Its focus on forest conversion stems from the recognition that land cover and land use change is the pre-dominant **forcing** of current global environmental change in tropical forest ecosystems. The above science question identifies regional issues that are best addressed through an approach integrating field research, airborne and satellite remote sensing, and modeling. It is directly relevant to NASA's Earth Science Enterprise (ESE) goal to develop a scientific understanding of the Earth system and its response to natural and human-induced changes (NASA, 2000a). Proposals for research that address the above science question are solicited in the thematic areas of:

- land cover and land use change,
- carbon dynamics,
- trace gas and aerosol fluxes, and
- nutrient dynamics and surface water chemistry.

Additionally, the NASA Terrestrial Ecology Program solicits proposals to conduct remote sensing-oriented **terrestrial ecology** research relevant to its goal of improving understanding of the structure and function of global terrestrial ecosystems, their interactions with the atmosphere and hydrosphere, and their role in the cycling of the major biogeochemical elements and water. Research areas to be emphasized in Fiscal Year 2002 (FY 2002) include:

- carbon cycle modeling and
- analysis of new satellite data and data product continuity to understand ecosystem variability and responses to global environmental change.

II. BACKGROUND

A. NASA'S EARTH SCIENCE ENTERPRISE (ESE)

ESE is NASA's research enterprise to study the Earth as an integrated system, emphasizing observations made from the unique perspective of space together with underlying laboratory, field, theoretical, and modeling research. ESE also supports research and development in applications that extend the use of ESE science, data, and technology beyond the scientific community.

ESE's new Research Strategy (NASA, 2000b) calls for research to address the following overarching question:

How is the Earth changing and what are the consequences for life on Earth?

The scientific strategy to address this immensely complex problem can be laid out as five fundamental questions, each raising a wide range of cross-disciplinary science problems:

- *How is the global Earth system changing? (Variability)*
- *What are the primary forcings of the Earth system? (Forcing)*
- *How does the Earth system respond to natural and human-induced changes? (Response)*
- *What are the consequences of change in the Earth system for human civilization? (Consequences)*
- *How well can we predict future changes to the Earth system? (Prediction)*

The five fundamental science questions above define a logical progression in the study of global change, but each question covers a range of topics too broad to serve as a guide for program implementation. For this purpose, more specific research questions have been formulated and prioritized under each of these questions (e.g., Variability). These second-tier research questions that are relevant to the **LBA-ECO** component of this NRA are listed below. The single, integrative science question for ecological research within LBA crosscuts and addresses all of the below questions, with emphasis on those in bold type. The designation in parentheses following each question identifies its priority under each of the five fundamental Earth science questions above (e.g., V3 is the third priority question under the second-tier "Variability" question).

- How are global ecosystems changing? (V3)
- **What changes are occurring in global land cover and land use, and what are their causes? (F2)**
- **How do ecosystems respond to and affect global environmental change and the carbon cycle? (R2)**
- **What are the consequences of land cover and land use change for the sustainability of ecosystems and economic productivity? (C2)**

- How well can cycling of carbon through the Earth system be modeled, and how reliable are predictions of future atmospheric concentrations of carbon dioxide and methane by these models? (P5)

The second-tier research questions that are relevant to the **terrestrial ecology** component of this NRA are V3, R2, and P5.

B. LBA

The Large Scale Biosphere-Atmosphere Experiment in Amazônia (LBA) is an international, multi-disciplinary cooperative research program led by Brazil which involves several countries. The Ministry of Science and Technology (MCT) in Brazil is leading the general coordination of LBA. The National Institute for Space Research (INPE) of Brazil has been designated by MCT as NASA's counterpart agency in Brazil for executing LBA. LBA was designed to provide new knowledge of the climatological, ecological, biogeochemical, and hydrological functioning of Amazônia, the impact of land use change on these functions, and the interactions between Amazônia and the entire Earth system. LBA is centered on two key questions that will be addressed through multi-disciplinary research, integrating studies in the physical, chemical, biological, and human sciences:

How does Amazônia currently function as a regional entity?

How will changes in land use and climate affect the biological, chemical, and physical functions of Amazônia, including the sustainability of development in the region and the influence of Amazônia on global climate?

In LBA emphasis is given to observations and analyses which will enlarge the knowledge base for Amazônia in seven general areas: Physical Climate, Carbon Storage and Exchange, Biogeochemistry, Atmospheric Chemistry, Land Surface Hydrology and Water Chemistry, Land Use and Land Cover, and Human Dimensions (Figure 1). LBA is described in more detail in the LBA Concise Experimental Plan (The LBA Science Planning Group, 1996) and on the LBA Home Page: http://www-eosdis.ornl.gov/lba_cpTec/. LBA-ECO addresses all seven of the LBA areas, but with greatest emphasis on Carbon Storage and Exchange, Biogeochemistry, and Land Use and Land Cover. Contributions in the other areas focus on enabling interdisciplinary collaborations across LBA and adding specific investigations requiring an ecological perspective. Under Atmospheric Chemistry, long-lived, radiatively important trace gases are studied regionally. Under Land Surface Hydrology and Water Chemistry limited research into the dynamics of surface water chemistry at watershed to regional scales is conducted. Under Human Dimensions, the causes of land cover and land use change are investigated. Under Physical Climate, water and energy fluxes are measured in conjunction with carbon dioxide fluxes at flux tower sites, and ecological and biogeochemical dynamics models compatible with climate models are developed and exercised. LBA-ECO is described in more detail in Appendix A and in the LBA-ECO

Experiment Plan, which can be found at: <http://lba-ecology.gsfc.nasa.gov/lbaeco/> (select "Experiment Plan" under "About the Project" on the sidebar).

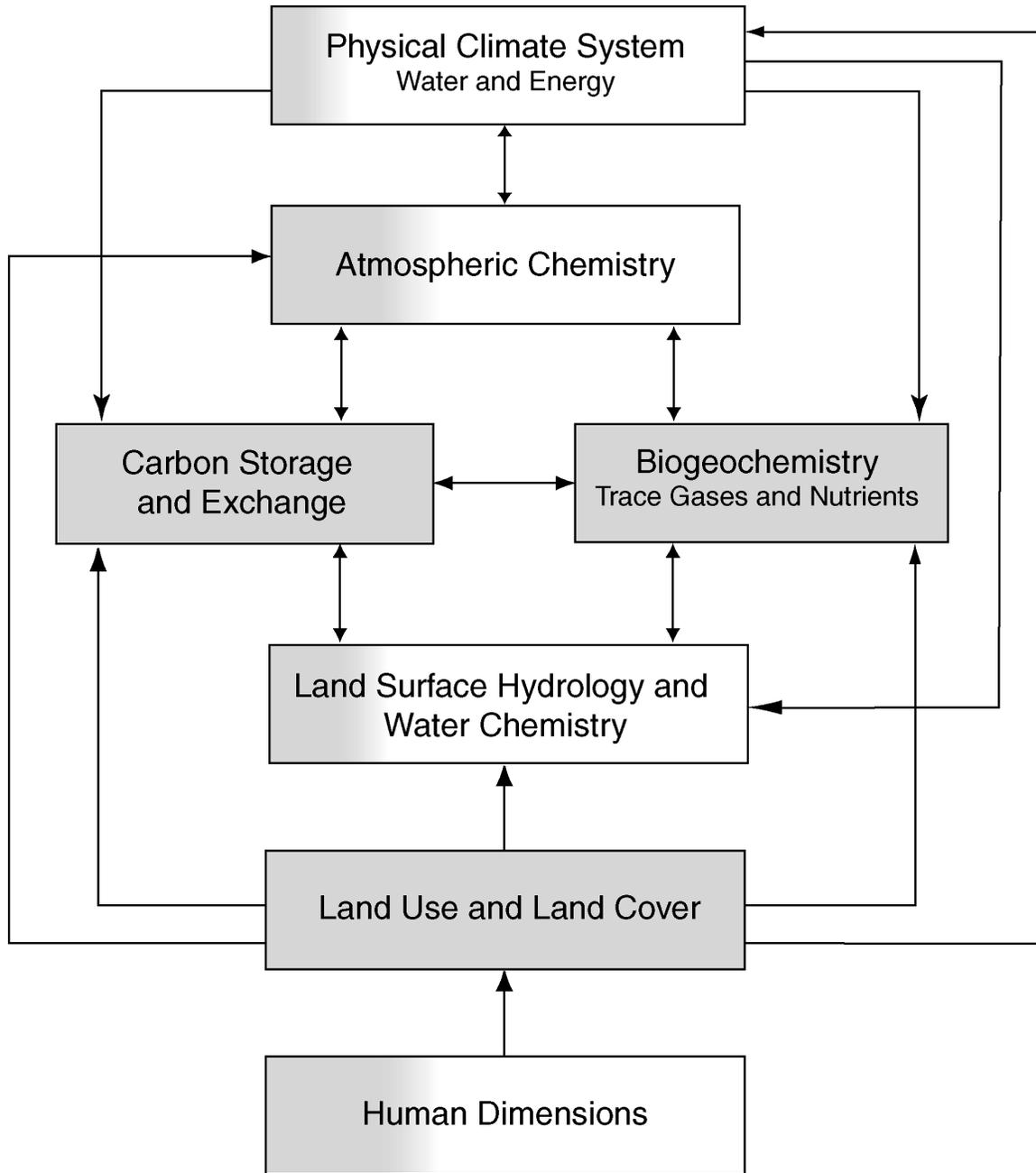


Figure 1. The seven LBA research areas, with those addressed by NASA LBA-ECO shaded in full or in part to reflect the extent of its contribution.

LBA is being implemented as a group of complementary research modules, each with its own subset of goals and objectives and funding sponsor(s). Brazil's contributions cover all research modules. The ecological research contributed by NASA under LBA-ECO constitutes one of these modules. LBA-ECO has been referred to in the past as "LBA-Ecology;" including in the current Implementing Arrangement between the U.S. and Brazil for this research module. Tropical Rainfall Measuring Mission – LBA (TRMM-LBA), Atmospheric Mesoscale Campaign (AMC), Cooperative LBA Airborne Regional Experiment (CLAIRE), European Studies on Trace Gases and Atmospheric Chemistry (EUSTACH), the Brazilian-European Study of the Carbon Cycle of Amazônia (CARBONCYCLE) and LBA-HYDROMET are examples of other existing or proposed modules. The plan for LBA is to conduct the research within these modules concurrently and to integrate them to the maximum degree possible through: (1) joint planning of the programs; (2) sharing of field sites, equipment, and logistical support; (3) exchange of data through the LBA Data and Information System (LBA-DIS); (4) development of simulation models that couple the key physical, chemical and biological processes operating at various space and time scales in Amazônia, and (5) joint synthesis and scientific integration of results. To support LBA policy, NASA desires and encourages strong interdisciplinary interactions and collaborations among LBA modules, and especially with complementary LBA-ECO research sponsored by Brazilian and European institutions. Additional information and publications concerning LBA can be found on the LBA Home Page.

LBA's major research modules initiated field activities in 1998, and most of them are planned to continue through 2003 or 2004. The LBA field design involves two regional transects that span land use intensity and climatic gradients, anchored in regions of the Amazon where forest conversion or selective logging have been major factors in shaping the landscape (Figure 2). Along each of these mega-transects are several primary, intensive research sites and more extensively distributed secondary research sites. The primary, intensive sites feature clusters of 2-4 eddy covariance flux towers. The tower clusters incorporate a local-scale gradient of land use, providing observations and process studies in each of the predominant land use types (e.g., primary forest, pasture or cropland, secondary forest, selective logging) at that location along the transect. Secondary sites feature less intensive instrumentation and process studies, but add essential, complementary investigations of other important land use types and climatic or edaphic variability. Continuous, near-continuous, or intermittent observations of a core set of measurements (e.g., CO₂ fluxes, trace gas fluxes, trace gas concentrations, micrometeorological conditions, radiation, aerosols, vegetation properties, and soil properties) are being made at the primary field sites over a period of 3-5 years. Additional observations and process studies, including manipulative experiments and chronosequence studies, are being conducted along the two transects. The LBA two-transect field design depends on the contributions from all LBA modules; only through cooperation, coordination, and effective sharing of infrastructure has Brazil been able to assemble the modules to implement this study design.

In 1997, NASA issued NRA-97-MTPE-02, soliciting three-year investigations for LBA-ECO research. Thirty-five investigations were selected to participate in LBA during

1998-2001, to be hereafter referred to as Phase I of NASA LBA-ECO. In addition, six additional LBA-ECO investigations were supported or sponsored through other established channels. These 41 investigations were subsequently approved for participation in LBA (see Appendix A, section IV for more information about the approval process).

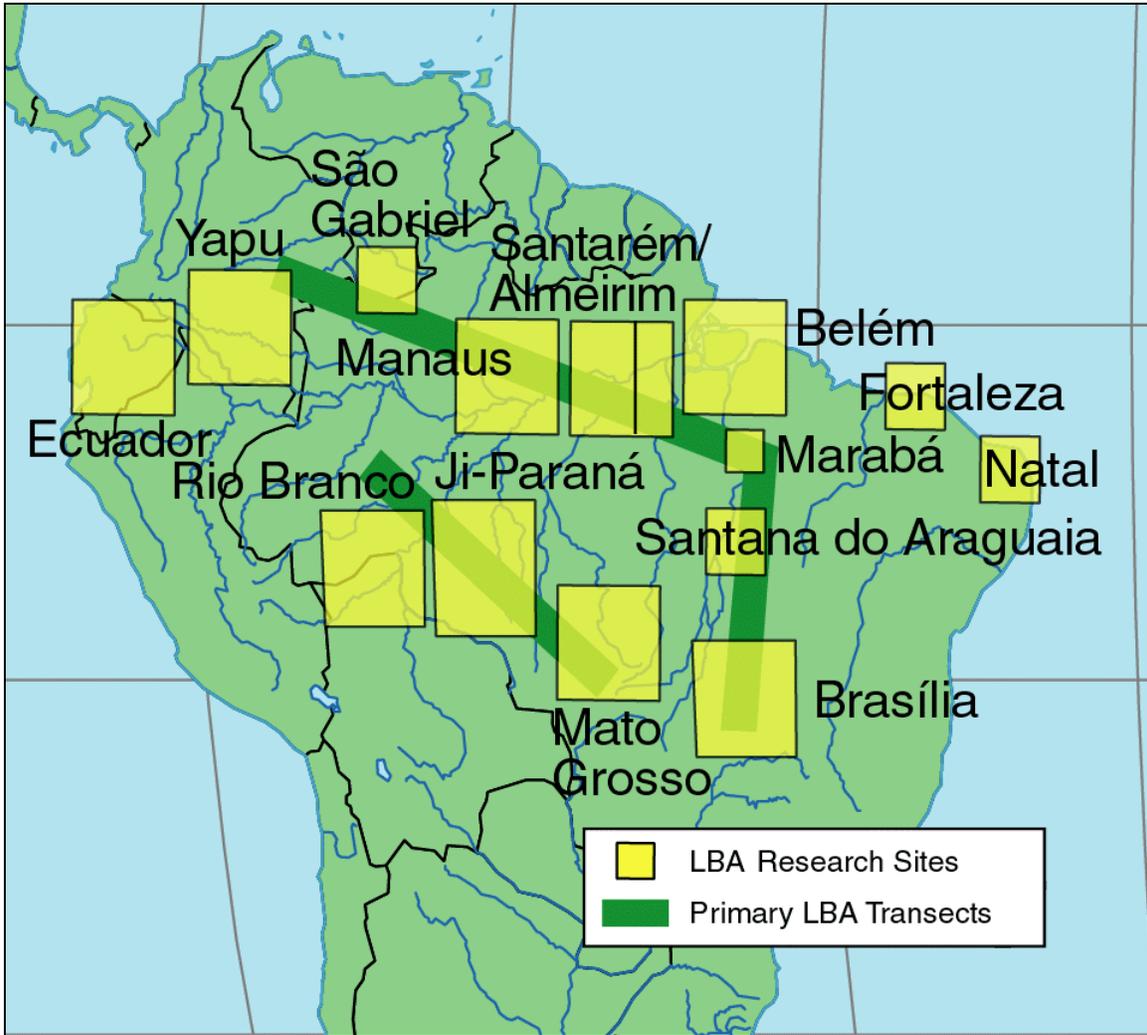


Figure 2. The LBA transects and research sites.

Detailed information about LBA-ECO investigations is provided at NASA's home page for the LBA-ECO Project (<http://lba-ecology.gsfc.nasa.gov/lbaeco/>). NRA-97-MTPE-02 contained the following language:

"Proposers to this announcement are advised to offer a six-year commitment to research within LBA-Ecology, but to only propose a detailed plan for 3 years of work, starting on or after December 1, 1997. Proposals for shorter periods are welcome. Annual progress

reports, to be reviewed internally, will be required. NASA intends to request continuation proposals, to be subject to full external peer review, for a 3 year or less period of performance during 2001-2003. It is anticipated that many of the original investigations will be successfully renewed in 2001, but that there also will be some turnover, opportunities for new investigators to propose, and probably opportunities for new questions to be addressed. Annual reporting and internal review will be required during this second performance period as well. In addition, if the need arises, resources permit, and host country approvals can be obtained, NASA may open LBA-Ecology to new investigations, including those requiring deployment of U.S. aircraft, through other future research announcements."

In 2000-2001, NASA solicited and selected six U.S. airborne science investigations to be proposed to Brazil as a contribution to LBA. Information about them can be found on the LBA-ECO Home Page. These new investigations have not yet been approved by MCT. NASA and MCT are now in the process of negotiating a new implementing arrangement in support of these U.S. airborne investigations, but it is unlikely the agreement will be completed and approved before proposals are due under this NRA.

This NRA now solicits the *continuation* and *new* proposals anticipated in 1997. The investigations to be selected under this NRA and conduct cooperative research during the period 2002-2004 will be hereafter referred to as Phase II of LBA-ECO. Several of the investigations added to LBA-ECO through other established channels will continue on their own schedules (including peer review every three years), bridging across Phases I and II of LBA-ECO.

III. RESEARCH OPPORTUNITIES

A. LBA-ECO

Proposals are sought within the LBA-ECO component of this NRA to address the LBA-ECO science question under these four LBA-ECO science themes, with a special emphasis on use and/or interpretation of remotely sensed observations to understand the effects of land conversion in Amazônia:

- land cover and land use change
- carbon dynamics
- trace gas and aerosol fluxes
- nutrient dynamics and surface water chemistry

Research to address these themes will fall under all five of the second-tier NASA Earth science questions listed in section II.A, but emphasis in LBA-ECO is on addressing the causes and consequences of land cover and land use change (second-tier questions F2 and

C2) and ecosystem response to and effects on global environmental change and the carbon cycle (second tier question R2).

Research under these themes should focus on providing regional, Amazon-wide analysis and quantification of land cover and land use changes, carbon sources and sinks, trace gas and aerosol fluxes and the controls on them, and the role of nutrients in sustainability. In Phase II of LBA-ECO, remote sensing and modeling are expected to play a dominant role in achieving a regional synthesis. However, to provide needed data and information for modeling, as well as to interpret and evaluate the remotely sensed data, key *in situ* observations and processes studies will need to be continued. Additionally, it is desirable to fill some critical gaps. These gaps are: 1) research in areas of recent land conversion with rapid change, including intensification of land use practices and urban expansion, and 2) quantifying important pools, processes, and fluxes of carbon, nutrients, trace gases, and aerosols in wetlands, including temporarily inundated or saturated areas; logged areas; and other important land use systems. Investigations that offer to fill these gaps in observations and process understanding at existing LBA study sites will be of high priority. Investigations that offer to establish new field sites to fill these critical gaps are also of interest, provided the sites are consistent with the overall LBA study design and are agreed to by Brazil, the scientific rationale for the new site is compelling, and resources permit. (See Appendix A, section II.A for more detailed information on relevant research under these themes.)

The types of activities sought for LBA-ECO under these themes include: 1) training and education; 2) assembly and synthesis of needed regional spatial databases; 3) extending the time series of field observations and process studies and making new observations to fill critical gaps; 4) synthesis of past results from case studies of land use change; 5) remote sensing data analysis, including exploitation of new data sets; 6) improved modeling and model testing with LBA data; and 7) overall synthesis and integration to directly answer the LBA-ECO science question (see section II.B of Appendix A for more information on activities sought). Effective use of new data from the Landsat 7, EOS Terra, and EOS Aqua satellites is expected, as is exploitation of data from previous satellite data records, current exploratory space missions, and LBA aircraft campaigns, especially the proposed 2002-2003 LBA-ECO U.S. airborne science campaigns.

All research under LBA-ECO will be expected to quantify errors and uncertainties associated with data, analytical approaches, and scientific interpretations.

The NASA ESE encourages educational activities within the context of its major projects. Training and education will be a particularly important component of each LBA investigation. The ESE educational goal is to stimulate public interest in and understanding of Earth system science and encourage young scholars to consider careers in science and technology (see p. 26 of the ESE Strategic Plan at: <http://www.earth.nasa.gov/visions/stratplan/index.html>). LBA's educational goals are to build capacity in South American institutions by increasing the number of LBA participants from Amazonian institutions and, ultimately, leaving in place a stronger research community in Amazônia. NASA recognizes the necessity of investing in

training and educational activities in order to achieve NASA's own objectives as well as to support LBA's training and education objectives for South American capacity enhancement. As part of NASA ESE's new education strategy, it is expected that a fraction of the resources (0.5-1%) available under each major project sponsored by NASA (i.e., LBA-ECO) will be devoted to educational activities that make use of the unique results from the project and maximize its contribution to Enterprise-wide educational activities. Proposed activities may involve either formal education or informal education or both. For LBA-ECO, activities in the U.S., Brazil, or other parts of South America all apply, and advanced training (i.e., Ph.D., post-doctoral, Ph.D.-track Masters, and state-of-the-art technical training) of host country researchers will be emphasized. It is expected that most LBA training and education activities will simultaneously contribute to LBA's and NASA's ESE training and education goals and involve resources well beyond the minimum fraction specified in ESE's education strategy. (see Appendix A, section II.B.1 for details). To improve Amazonian capacity, NASA strongly encourages each group to support training of Ph.D. students with ties to Amazonian institutions.

NASA anticipates funding approximately 30 proposals. The number of awards and funding levels across the four themes may not be equal. NASA's priorities for these themes are, in order from highest to lowest: carbon dynamics, land cover and land use change, trace gas and aerosol fluxes, and nutrient dynamics and surface water chemistry. Investments in the first two themes will be significantly greater than in the second two. Studies that utilize remotely sensed data to provide a regional perspective or synthesis will be favored. Research that proposes to continue or extend scientific observations, process studies, analyses, or modeling that was initiated under LBA-ECO Phase I and/or proposes to fill critical gaps in observational data sets or on-going analyses at existing LBA sites will generally receive priority over completely new activities at new sites. However, it is anticipated that some new sites and activities can be funded. All new sites and activities selected for funding will be subject to established LBA review and approval processes and must be approved by Brazil's MCT before field activities may commence.

All investigators desiring to submit successor proposals (i.e., renewal proposals for awards due to expire in Fiscal Year 2002) to continue current LBA-ECO investigations are strongly encouraged to submit proposals in response to this NRA.

Additional background and detailed information, including focused science questions, on the topics and activities desired for Phase II LBA-ECO research are provided in Appendix A, section II. Detailed requirements for proposal content and format are provided in Appendices A and B.

B. TERRESTRIAL ECOLOGY

The goal of ESE's Terrestrial Ecology Program is to improve understanding of the structure and function of global terrestrial ecosystems, their interactions with the atmosphere and hydrosphere, and their role in the cycling of the major biogeochemical

elements and water. In fiscal year 2002, the Terrestrial Ecology Program will devote most of the funding that becomes available through normal program turnover to support of the following research topics:

- carbon cycle modeling
- analysis of new satellite data and satellite data product continuity to understand ecosystem variability and responses to global environmental change

Research on these topics will fall under three of the second-tier NASA Earth science questions listed in section II.A. Variability in global ecosystems (second-tier question V3), ecosystem response to and effects on global environmental change and the global carbon cycle (second tier question R2), and modeling the cycling of carbon and predicting future atmosphere carbon dioxide and methane concentrations (P5) will be addressed. Each of these questions is of equal priority for this NRA.

Research on carbon cycle modeling should focus on advancing our ability to predict future atmospheric concentrations of carbon dioxide and methane or advancing ecosystem and biogeochemical cycling model capabilities to enable coupling with other Earth system component models. Carbon cycle research to prepare for the proposed North America Carbon Program (NACP), and relevant to NASA's ESE research strategy, also is encouraged. NASA will evaluate proposals received to conduct NACP preparatory research in consultation with the U.S. Global Change Research Program's (USGCRP) Carbon Cycle Interagency Working Group (<http://www.carboncyclescience.gov/>) and following the procedures detailed in Appendix B.

Satellite data analysis investigations are desired that offer important and innovative uses of new satellite data – especially that from EOS Terra – to address questions of ecosystem responses to and effects on global environmental change. With regard to the continuity of data products, NASA is interested in research investigations that analyze the relationships among AVHRR and MODIS data that are relevant to terrestrial ecology, that provide a means of inter-relating these data sets, and that anticipate similar needs for NPOESS Preparatory Project (NPP) and, ultimately National Polar-orbiting Operational Environmental Satellite System (NPOESS), data products. Development of new global data products needed for carbon cycle modeling and derived from existing observational data sets is also of interest. Development of satellite data sets in preparation for the proposed North America Carbon Program also is of interest.

Proposals to conduct research on other topics within the overall scope of the Terrestrial Ecology Program may be submitted, but funds have not been set aside specifically for such work and only the most highly rated and relevant of these proposals will be considered, as funds and priorities permit. All investigators desiring to submit successor proposals (i.e., renewal proposals for awards due to expire in Fiscal Year 2002) to continue current Terrestrial Ecology Program investigations are encouraged to respond to this NRA.

IV. GUIDANCE FOR PROPOSERS

A. AVAILABLE DATA SETS

NASA's Earth Science Enterprise has adopted commercial data purchases as a mainstream way of acquiring research-quality data, as these commercial capabilities become available. NASA encourages the use of commercially available data sets by Principal Investigators as long as it meets the scientific requirements and is cost-effective. When responding to a NASA Research Announcement the proposer should identify the commercial data sources intended for use and the associated cost. Information about data available under the Earth Science Scientific Data Purchase can be found at: <http://www.crsp.ssc.nasa.gov/databuy/dbmain.htm>

Costs for any other types of required data also should be identified in the budget request.

B. ELIGIBILITY

Participation in this NASA ESE research opportunity is open to all categories of domestic and foreign organizations, including educational institutions, industry, non-profit institutions, NASA research centers, and other government agencies and laboratories (including Federally Funded Research and Development Centers). This NRA specifically encourages successor proposals (i.e., renewal proposals for awards due to expire in Fiscal Year 2002) from current LBA-ECO and terrestrial ecology investigators as well as new proposals from investigators not previously involved in these programs.

Participation by non-U.S. institutions must be proposed within the specific guidelines described in Appendices A-C, which include a no-exchange-of-funds provision. Researchers at non-U.S. institutions are advised that unless access to NASA resources or facilities is desired, it is not necessary to propose in response to this NRA for participation in LBA; new LBA activities may be proposed through direct bilateral interactions with Brazil's MCT.

C. AVAILABLE FUNDS

Approximately \$6 million per year is available from NASA to address the research questions and activities identified in this announcement. NASA plans to select and fund approximately 30 proposals to contribute to the Brazilian MCT's LBA Project in the **LBA-ECO** research themes described above in section III.A and approximately 2-6 proposals to address the **terrestrial ecology** research called for in section III.B. These investigations may be proposed for a period of up to 3 years, with annual progress reporting and internal review. The funds and investigations for **LBA-ECO** will be in addition to the on-going investigations funded through other NASA channels that are out of phase with the main group of LBA-ECO investigations and those already programmed for the proposed 2002-2003 LBA-ECO U.S. aircraft campaign in Brazil.

Funds for ESE research in 2002 and beyond have not yet been appropriated; NASA expects to carry out this research within current guidelines for the ESE research and analysis program without any enhancements to those funds.

D. PROPOSAL SUBMISSION AND REVIEW

1. Proposal Content and Format

Details on the proposal format, content, and order of materials are provided in Appendix B and Appendix C. Proposers are urged to read the information in these appendices carefully and to follow the specific guidelines. Required information and plans specific to **LBA-ECO** are described in detail in Appendix A, section III and summarized in Appendix B, section II. **Proposers to the LBA component of this NRA are advised that proposals lacking Management Plans, Data Plans, Training and Education plans, or letters of collaboration from all collaborating institutions may be considered non-responsive and returned without review.**

2. Period of Performance

Proposals will be considered for periods of performance of up to three years.

3. Review Process

The review process and the evaluation criteria to be used are described in Appendix B, section III.

Final decisions will be made promptly and proposers will be notified either by electronic mail or surface mail, or both. Proposers will receive anonymous copies of the written evaluations for their proposals.

After NASA's selection for LBA-ECO has been announced, NASA and INPE will revise the LBA-ECO Experiment Plan to reflect any changes in NASA LBA-ECO research resulting from the selection of successor and new proposals. The revised Experiment Plan will then be presented to MCT for LBA Superior Committee review and concurrence. All new LBA sites and activities must be approved by Brazil's MCT before field activities may commence.

4. Proposal Submission Dates

Proposals may be submitted at any time during the period ending at: **4:30 p.m., EST, March 7, 2002**. Proposers are requested to submit two cover pages, one in **hard copy** with the full proposal and the other **electronically**. Instructions for electronic submission are provided in Appendix F. Electronic submission will ensure that accurate information about the proposal is captured in the NASA

databases and will speed the review process. If proposers do not have access to the Web, the hard copy version of the cover page will suffice.

Announcement of final selections for all components of this NRA is anticipated by no later than July, 2002. Award start dates for LBA-ECO are anticipated to be between July 1 and September 1, 2002. Start dates for terrestrial ecology are anticipated to be May 1, 2002, or later depending on what the proposal requests or the nature of the proposed work.

E. ADDITIONAL INFORMATION

Appendix A provides background and detailed technical information concerning the research requested under this NRA. Appendix B provides amendatory guidance to the general guidelines for responding to NASA Research Announcements contained in Appendix C specific to this NRA, information on required proposal format and content, and the proposal evaluation criteria. Appendix C also contains instructions for foreign participation in this opportunity. Appendix D contains examples of the proposal cover sheet, required institutional declarations, and a budget summary form. Appendix E provides the URL addresses for accessing World Wide Web home pages with information relevant to this NRA. If electronic access is not available to the prospective proposers, a hard copy of relevant reference(s) can be requested by calling (202) 358-3552 and leaving a voice mail message. Please leave your full name and address, including zip code, and your telephone number, including area code. Appendix F provides instructions for electronic submission of the proposal cover page. **Prospective investigators are urged to read the information in all of the appendices carefully and to follow the specific guidelines therein carefully.**

The following items apply only to this announcement.

Identifier: NRA-01-OES-06

Submit Proposals to: LBA / TE
NASA Peer Review Services, Code Y
500 E Street, Suite 200
Washington, DC 20024-2760

For overnight mail delivery purposes only the recipient telephone number is (202) 479-9030.

Number of Copies Required: 20

NASA Selecting Official: Director, Research Division
Office of Earth Science

Obtain Additional Information from: Dr. Diane E. Wickland (LBA and
Terrestrial Ecology)

Mail Code YS
NASA Headquarters
Washington, DC 20546-0001
Telephone: (202) 358-0245
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Dr. Garik Gutman (LCLUC in LBA)
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ggutman@hq.nasa.gov

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

Dr. Ghassem R. Asrar
Associate Administrator for
Office of Earth Science

Enclosures:

Appendix A - LBA-ECO: Background and Technical Description of Research Opportunities, Project

Management, and Special Proposal Requirements

Appendix B - Amendatory Guidance to the General Guidelines Contained in Appendix C and Applicable Only to this NRA and Instructions for Proposers

Appendix C - Instructions for Responding to NASA Research Announcements

Appendix D - Proposal Cover Sheet, Required Declarations, and Budget Summary Form

Appendix E - Electronic Addresses

Appendix F – Required Proposal Cover Pages

APPENDIX A
LBA-ECO: BACKGROUND AND TECHNICAL DESCRIPTION
OF RESEARCH OPPORTUNITIES, PROJECT MANAGEMENT, AND SPECIAL
PROPOSAL REQUIREMENTS

I. BACKGROUND

A. EARLY PLANNING FOR ECOLOGICAL COMPONENT OF LBA

The planning for LBA began in the early 1990's, with scientists from Brazil, the U.S., Europe, and other South American countries participating. The Manaus Workshop Report (Cerri et al., 1995) and its five synthesis papers published in *Ciencia e Cultura* (Fernandes et al., 1997; Keller et al., 1997; Nepstad et al., 1997; Richey et al., 1997; and Houghton, 1997) are the most detailed and definitive description of the ecological goals and research questions underlying LBA-ECO (see Appendix E for URL). Inspiration for the science objectives and research design was derived from several International Geosphere-Biosphere Programme (IGBP) Core Project plans, and, especially, the IGBP Terrestrial Transects Science Plan (Koch et al., 1995) and the IGBP/International Human Dimensions Programme (IHDP) Land-Use and Land-Cover Change (LUCC) Core Project plan (Turner, et al., 1995), primarily Foci 1 and 2. NASA's contribution to LBA-ECO is part of the U.S. Global Change Research Program (USGCRP), addressing goals under its carbon cycle science initiative and the biology and biogeochemistry of ecosystems theme (CENR, 2000).

B. ECOLOGICAL RESEARCH IN LBA TO DATE

The LBA-ECO Science Team was formed in 1997 with the selection of 35 teams of investigators under NRA-97-MTPE-02. Research was first initiated in mid-1998 and field studies began at the end of that year when Brazil and the US concluded their Implementing Arrangement for LBA-ECO (referred to as "LBA-Ecology" in the Implementing Arrangement) to cover a six-year period (three initial years with automatic extension for three additional years, unless either of the parties takes action to change it). Detailed plans for research in the first three years of LBA-ECO are described in the LBA-ECO Experiment Plan (found on the LBA-ECO Home Page at: <http://lba-ecology.gsfc.nasa.gov/lbaeco/> -- select "Experiment Plan" under "About the Project" on the sidebar) and, very briefly, below. In addition to the LBA-ECO Experiment Plan, the LBA-ECO Home Page provides many valuable documents describing the progress of LBA-ECO including reports from the annual Science Team meetings and many workshops held to discuss LBA-ECO research. In particular, a recent summary of LBA ecological research activities and progress to date in Phase I and a brief analysis of perceived research gaps and potential future research needs, entitled "LBA-Ecology Phase I Activities and Analysis" and the "LBA-Ecology Mid-Term Review" are posted there (select "Reports" under "Investigator Information" on the sidebar). **Persons submitting proposals to this NRA are strongly urged to consult the material in the LBA-ECO Experiment Plan, LBA-Ecology Phase I Activities and Analysis, and**

associated documentation available at the NASA LBA-ECO Project Home Page because much of this information will not be repeated herein.

Over the past three years, the LBA-ECO Science Team has been pursuing an integrated approach to the broad LBA-ECO science question:

How do tropical forest conversion, re-growth, and selective logging, influence carbon storage, nutrient dynamics, trace gas fluxes, and the prospect for sustainable land use in Amazônia?

This approach has involved synthesis of past results and data sets, modeling, remote sensing, Geographic Information System (GIS)-based analyses, new field observations, process studies, training and education, and synthesis and integration of existing data and new results. The science team has organized its research activities into four science themes: 1) Land Cover and Land Use Change, 2) Carbon Dynamics, 3) Trace Gas and Aerosol Fluxes, and 4) Nutrient Dynamics and Surface Water Chemistry. Under each thematic area intact forests and savannas, pastures, cultivated lands, and second growth and selectively logged forests are being examined.

The Land Cover and Land Use Change studies focus on the documentation of past and current land cover and land use changes throughout Amazônia and development of a capability to predict the location and magnitude of future land cover and land use changes in the region. The Carbon Dynamics studies involve the quantification of the carbon pools in vegetation and soils and the rates of carbon exchange among the atmosphere, vegetation, and soils, and the way in which these rates are altered by natural and human disturbances. The Trace Gas and Aerosol Fluxes theme studies focus on the quantification of the fluxes of trace gases between the surface and the atmosphere and the identification of the biological and physical factors that control these fluxes. Studies are comparing natural systems with managed land uses and systems recovering from human management. The Nutrient Dynamics and Surface Water Chemistry theme studies are focused on the quantification of nutrient pools and fluxes and relationships with land use and sustainability. Studies are quantifying the changes in surface water chemistry resulting from land cover and land use change. Nitrogen and phosphorus are the nutrients of major interest. For each of these thematic areas, scientific questions have been posed by the Science Team to motivate research tasks (see section II.A of this Appendix).

II. LBA-ECO PHASE II SCIENCE THEMES, QUESTIONS, AND ACTIVITIES

A. LBA-ECO SCIENCE THEMES AND QUESTIONS

Research in the pursuit of an integrated approach to answering the LBA-ECO science question will continue under each of the four LBA-ECO science themes. A number of detailed science questions, subsidiary to the overall LBA-ECO science question, have been posed and refined by the LBA-ECO Science Team. These questions will guide

NASA's LBA-ECO Phase II research. NASA will, of course, emphasize research to address these detailed questions that 1) contribute most directly to answering the overarching questions posed in NASA's ESE Research Strategy (as presented in section II.A of the main body of this NRA) and 2) is compatible with remote sensing approaches, regional analyses, and improving integrated Earth system models. The subsidiary questions are enumerated by theme below.

1. Land Cover and Land Use Change Science Questions:

LC-Q1 What are the rates and mechanisms of forest conversion to agricultural land uses, and what is the relative importance of these land uses?

LC-Q2 At what rate are converted lands abandoned to secondary forests; what is the fate of these converted lands, and what are the overall dynamic patterns of land conversion and abandonment?

LC-Q3 What is the area of forest that is affected by selective logging each year? How does the intensity of selective logging influence forest ecosystem function, thus altering forest regrowth and flammability?

LC-Q4 What are plausible scenarios for future land cover change in Amazônia?

Land cover and land use are key to documenting, understanding, and predicting ecosystem responses in Amazônia. LBA cannot succeed without adequate land cover data along with understanding of the dynamics of change in land cover and land use. Research in Phase II of LBA-ECO is expected to focus on providing a regional, Amazon-wide quantification of land cover and land use and an analysis of the changes that are occurring on a regional scale. Proposed research should develop new spatial data products and conduct synthetic and integrative analyses of past research results, including scaling-up of existing case studies of the socioeconomic and natural system forcings on land cover and land use change. Phase I of LBA-ECO did not address several important, contemporary land uses, and it is desirable to fill these gaps in Phase II. In addition to region-wide studies, more specific case studies of the following types of contemporary land cover and use changes are of interest (listed in rough order of priority): rapid changes in areas of recent land conversion, land degradation, the regional effects of urban expansion, and other important land use systems.

2. Carbon Dynamics Science Questions:

CD-Q1 What is the (climatically driven) seasonal and interannual variability of the carbon dioxide flux between the atmosphere and different land cover/use types?

CD-Q2 How do biological processes such as mortality and recruitment or succession following land use change influence the net annual carbon balance for different land cover and land use types?

CD-Q3 What are the relative contributions of fluxes from natural and disturbed ecosystems to the net Amazônia-wide flux? This question can be approached through a number of subsidiary questions:

CD-Q3a How do pools and fluxes of carbon and nutrients (in soils) of pasture/cropland change over time and what factors determine carbon gain or loss?

CD-Q3b How does selective logging change the storage and cycling of carbon in forests?

CD-Q3c What factors (biologically mediated, land use history, soil properties, etc.) control the rate of carbon sequestration in biomass and soils of regrowing forest?

CD-Q3d What portion of the Amazônia-wide carbon flux is from fire? How do ecosystems recover from fire? What are the relations between land management and fire occurrence/frequency?

Carbon dynamics research in Phase II of LBA-ECO should continue or extend Phase I research activities to quantify: 1) the magnitude of the carbon pools in vegetation and soils of intact forests and converted lands and 2) the rates of carbon exchange among the atmosphere, vegetation, and soils and how these rates are altered by large-scale disturbances and less obvious forest degradation. In Phase II of LBA-ECO, modeling and synthetic work that addresses the regional carbon budget will be emphasized. In order to quantify the regional carbon budget, LBA-ECO should advance the development of high quality spatial data sets that are necessary for synthesis and modeling. In many cases, quantitative analyses of carbon sources and sinks will depend upon understanding developed in related studies of hydrology, climate change, and nutrient cycling both within LBA-ECO and across all LBA components. Of primary interest are models and syntheses of the carbon budget that emphasize the reduction of uncertainties in the current understanding of regional carbon flux – especially those uncertainties related to logging, fire, regrowth, and recovery from disturbance – and its impact on climate change.

Also of high priority for Phase II are studies that propose to fill observational gaps at LBA flux tower sites to ensure that all needed driving and state variables and key physiological and ecological processes for models are measured. Studies that carefully evaluate the results from eddy covariance flux towers will be essential. Studies that test models with observations and compare observations from a variety of scales and techniques, from sites along the LBA transects, or from airborne carbon dioxide

concentration measurements, carbon dioxide flux measurements, and observations of the land surface to be obtained in the proposed 2002-2003 U.S. airborne remote sensing campaigns, are of special interest. Any new observational or process studies of carbon should be directed toward quantifying important pools and fluxes in wetlands, including temporarily inundated or saturated areas; logged areas; degraded lands; and other important land use systems along the LBA transects.

3. Trace Gas and Aerosol Flux Science Questions:

TG-Q1 How are fluxes of trace gases and aerosols between ecosystems (both upland and wetland) and the atmosphere of Amazônia affected by land cover and land use change?

TG-Q2 What is the (climatically driven) seasonal and inter-annual variability of trace gas and aerosol fluxes between the atmosphere and different land use and land cover types?

TG-Q3 Are losses and gains of carbon from Amazonian ecosystems in forms other than carbon dioxide (e.g. carbon monoxide, methane, volatile organic carbon, organic aerosol) of sufficient magnitude to influence ecosystem carbon balance?

Proposals to investigate trace gases and aerosols should offer to continue or extend Phase I research to: 1) quantify the fluxes between the biosphere and the atmosphere and 2) characterize the various factors controlling these fluxes. The trace gases of primary interest are methane and nitrogen oxides, for which natural and managed systems in the Amazon constitute a significant global source. In Phase II of LBA-ECO, modeling and synthetic work that addresses the regional sources and sinks of trace gases and aerosols and their impacts on the functioning of Amazônia will be emphasized. In order to quantify regional trace gas fluxes, LBA-ECO should advance the development of high quality spatial data sets that are necessary for synthesis and modeling. In many cases, analyzing and quantifying of trace gas fluxes will depend upon understanding developed in related studies of ecosystem productivity, hydrology, climate change, and nutrient cycles both within LBA-ECO and across LBA components. Of primary interest are models and syntheses of the trace gas and aerosol emissions that emphasize reducing major uncertainties in their magnitude and impacts on the system.

Also of high priority for Phase II are studies that propose to fill observational gaps in LBA to ensure that all needed driving and state variables and key physiological and ecological processes for models are measured. Priority will be accorded those trace gas and aerosol observational and process studies that: 1) ensure that the range of environmental conditions and land uses represented by the LBA transects are adequately characterized, 2) enable regional integration and scaling across gradients of environmental variation and patterns of disturbance, and 3) provide essential background for LBA airborne campaigns. Any new trace gas studies should be directed toward quantifying fluxes and the controlling processes in wetlands, including temporarily

inundated or saturated areas, and important land use systems. New aerosol studies to assess regional impacts of aerosols on ecosystem functioning (e.g., effects on productivity through changes in incident PAR or nutrient re-distribution) are of interest.

4. Nutrient Dynamics and Surface Water Chemistry Science Questions:

ND-Q1 How do stocks, cycling rates and budgets of carbon and important elements nitrogen, phosphorus, potassium, calcium, magnesium, and aluminum change under different land covers and land uses?

ND-Q2 Are nutrients major factors that control the rates of regrowth and carbon accumulation in abandoned pastures and regrowing secondary forests?

ND-Q3 What are the processes and consequences of atmospheric horizontal transport of nutrients (wind) on the nutrient stocks and cycles of ecosystems within the Amazon basin at various spatial and temporal scales? For example, what are the effects of Saharan dust inputs, losses and re-distribution due to fire, and links between physical climate models and nutrient cycling?

ND-Q4 How do changes in land use and climate alter the stocks, processes and fluxes of dissolved and particulate organic matter, nutrients, and trace gases from the uplands across the riparian zones and floodplains and down the channels of river corridors?

ND-Q4a How will the composition and quantity of nutrients and organic matter entering and being processed within streams be altered under different land-use change scenarios?

ND-Q4b Are there unique signatures that can be traced downstream?

ND-Q4c To what extent do intact riparian zones buffer streams against changes due to anthropogenic activities in surrounding uplands?

ND-Q5 What is the importance of periodically "wet" environments (from moist soils to standing and flowing waters) for the land and atmospheric balances of nutrients, carbon dioxide, trace gases, and water and energy on multiple scales?

Research on plant and soil nutrient dynamics and surface water chemistry should continue or extend Phase I research activities to quantify: 1) the magnitude of the nutrient pools in vegetation and soils of intact forests and converted lands, 2) the rates of

nutrient cycling within the system and of the ways these rates are altered by natural and human disturbances, and 3) changes in the dynamics of carbon and nutrients in response to land cover and land use change along gradients from well-drained uplands through wetlands, riparian zones, and into fluvial systems. Nitrogen and phosphorus are the nutrients of major interest. Studies should consider the regional importance of nutrient dynamics and the interactions between nutrient dynamics and land use including the potential limiting effects of nutrients on land use and sustainability. The linkage of carbon and nutrient cycles across a range of time scales should be considered in modeling and observational studies.

In Phase II of LBA-ECO, modeling and synthetic work that addresses the regional cycles of nutrients and nutrient controls on ecosystem productivity, trace gas fluxes, and the sustainability of land use will be emphasized. In order to quantify regional nutrient cycles, LBA-ECO should advance the development of high quality spatial data sets that are necessary for synthesis and modeling. In many cases, analyzing and quantifying nutrient cycles will depend upon understanding developed in related studies of hydrology, climate change, and ecosystem productivity both within LBA-ECO and across LBA components. Of primary interest are models and syntheses of the nutrient cycles that emphasize the reduction of uncertainties in our current understanding of regional ecosystem productivity, trace gas fluxes, and agricultural sustainability.

High priority also will be accorded those observational and process studies of nutrient dynamics that: 1) ensure that the range of environmental conditions and land uses represented by the LBA transects are adequately characterized, 2) enable regional mapping for topographic, soils, and other geographic variables and permit scaling across gradients of environmental variation and patterns of disturbance, and 3) provide the essential background for understanding trace gas production. Any new observational or process studies should be directed toward quantifying important pools, fluxes, and processes in important land use systems and logged areas. Any new surface water chemistry studies should focus on providing a larger regional context. They should consider the effects of changing land use, the relation of surface water chemistry to regional flow patterns, and the role of the extensive wetlands and temporarily inundated or saturated areas in Amazônia.

B. TYPES OF ACTIVITIES IN LBA-ECO

The research activities described in this section crosscut the science themes detailed above. Each type of LBA-ECO activity is relevant to most, if not all, of the science themes. It is anticipated that many proposals will address more than one science theme and most proposals will include more than one type of activity. The following types of activities are expected:

1. Training and Education

In addition to the research to provide a scientific basis for sustainable development in Amazônia, NASA's South American partners in the planning of LBA value the

opportunity that this major multi-disciplinary research program offers to enhance their internal research capacities. As explained in section III.A.2, below, Principal Investigators working in Brazil are required by Brazilian law to collaborate with a Brazilian institution. Capacity enhancement and training will be key to the involvement of Amazonian scientists and to the recruitment of students and technicians from the region, and are, therefore, explicit objectives for LBA. A near-term goal of LBA training and education activities is to increase the number of LBA participants from Amazonian institutions and to help them develop the necessary skills to effectively engage in LBA research. A long-term goal is to leave in place a stronger environmental and global change research community that is better prepared to grapple with the complex issues surrounding development in its own region.

Due to the breadth of topics addressed -- from space-based remote sensing, to nutrient cycling processes, to the drivers of land use change -- developing the specific capacity of host-country researchers will be addressed best within individual investigations. Thus, each LBA-ECO proposal submitted to NASA must include a Training and Education Plan (see section III.B.1 of this appendix) that explicitly addresses how the investigation will contribute to LBA training and education. Relevant activities might include recruiting/training of students and technicians at all levels -- especially the highest levels; developing and/or teaching short-courses on topics of relevance to LBA-ECO; developing course materials; participating in training workshops; engaging in exchanges of scientific personnel with South American institutions; transfer of appropriate technological skills and capabilities; developing a long-term educational or outreach relationship with an Amazonian educational or research institution; contributing to general skills enhancement programs to be organized by LBA, and/or provision of guest lectures and seminars. During Phase I of LBA-ECO, a typical minimum investment in training and education for an individual investigation consisted of sponsoring at least one graduate student from South America and participating in short-courses, seminars, and other educational activities. Individual investigations in Phase II of LBA-ECO will be expected to match or exceed this level of involvement in training and education and make a special effort to focus on advanced training (i.e., Ph.D., post-doctoral, Ph.D.-track Masters, and state-of-the-art technical training). To improve Amazonian capacity, NASA strongly encourages each group to support training of Ph.D. students with ties to Amazonian institutions. Investigators are likely to be most effective training and educating students from the Amazon region if they speak Portuguese and/or Spanish.

The NASA ESE encourages educational activities of the following types: 1) informal education to increase public awareness and understanding of how the Earth functions as a system and NASA's role in enabling development of that knowledge, 2) formal education to enable the use of Earth science information and results in teaching and learning at all levels of education (see NASA Implementation Plan for Education: <http://education.nasa.gov/implan/exec.html>), and 3) professional development to build capacity for productive use of Earth science results, technology, and information in resolving everyday practical problems. Educational activities will be selected in consultation with NASA's ESE Education Program and LBA Training and Education management representatives and will be implemented in coordination with the ESE

Education Implementation Office at NASA's Goddard Space Flight Center (GSFC) and the LBA Training and Education Committee.

2. Spatial Database Development

LBA spans a hierarchy of spatial scales. At the largest scale, that of the entire region of Amazônia, a database is being created to include many forms of survey data, both environmental and socioeconomic, and remote sensing imagery. This database will be available to all LBA scientists and used for direct analysis of relationships among data sets and to drive models that will endeavor to capture Amazon-wide system function and explore scenarios of future change for LBA. Additional data sets will need to be compiled to meet the needs of modeling and synthesis activities. Other data sets may need to be re-analyzed. In particular, improved spatial data on vegetation structure, biomass, phenology, and soil physics and chemistry are needed. While some of these data products may be beyond the scope of NASA's role in LBA-ECO to produce alone (e.g., a new detailed basin-wide soil survey), any studies that could provide access to better data or improved syntheses would be of great interest.

3. Field Observations and Process Studies

Proposals to conduct field observations and process studies should continue or extend work at LBA flux tower sites and at other sites along the two LBA transects. Relevant research activities include tower-based and chamber-based flux measurements, *in situ* observations of biophysical properties and ecosystem state properties, manipulative experiments, and characterization of chronosequences of land uses. Studies at any new sites that might be proposed must be carefully planned to fill major gaps or deficiencies in Phase I research (see section I.B of this Appendix and the LBA-ECO Experiment Plan for details on Phase I research activities).

Investigators proposing to provide measurements that will be repeated across field sites should be prepared to work with their fellow LBA Science Team members to develop standards and observational protocols, to regularly calibrate instruments, and to conduct instrument/measurement intercomparisons. This cooperation will be vital to ensure the quality and of the data to be collected and that data sets collected by different investigators can be integrated in a regional synthesis.

Investigators proposing research that involves laboratory analysis of biological materials, including soil, water, and air samples, collected in Brazil should make every effort to arrange to conduct those analyses in Brazil. Inclusion of costs for analysis of samples in Brazil and any needed enhancements of collaborating laboratory facilities should be explained in the cost plan. Sample export is possible, but is difficult, time-consuming, and uncertain. Sample export requests should be reserved for only those analyses that are not feasible in Brazil. NASA has been advised that requests for sample export will be considered on a case-by-case basis, and the burden of proof will be on the requesting investigator to prove the analyses are essential and cannot be performed

in Brazil. Any requirements for sample export should be called out in the Management Plan of the proposal.

4. Synthesis of Case Studies

The processes of land cover and land use change have been studied at the local scale using analysis of high spatial resolution (tens of meters) satellite data combined with intensive collection of *in situ* data. From these studies comes insight into the processes operating at the site or local level. NASA is now encouraging the scaling up of these LBA results to assess their regional significance. Multi-resolution satellite data (e.g., AVHRR or MODIS, Landsat or ASTER, and IKONOS) can facilitate this process. Proposals are desired to conduct synthesis research involving multi-resolution, comparative approaches that integrate results from multiple case or process studies and address the drivers or impacts of land cover change in Amazônia. These studies should be carried out in conjunction with analysis of multi-temporal, high-resolution satellite data to gain insight into the dynamics of deforestation, abandonment, and second-growth turnover. Where appropriate, they should make use of data from census documents and from new surveys and spatial databases to define the parameters that control local and regional land use strategies.

5. Remote Sensing Data Analysis

The LBA-ECO science themes described in section II.A above pose questions that can only be fully addressed using satellite and airborne remote sensing data. Local, mesoscale, and Amazônia-wide geo-referenced maps of remote sensing-derived land surface, meteorological, and atmospheric properties are being produced: 1) to characterize the regional landscape and its dynamics over the time record of the satellite, 2) to help place the study sites in their correct bioclimatological and geographic context, 3) to provide local to regional scale, spatially continuous data and/or time series of data to drive and evaluate models, and 4) for scaling studies to integrate, interpolate, and/or extend knowledge gained at the plot level to regional scales. Research that proposes innovative ways to merge data from sensors operating in differing spectral, spatial, and/or temporal domains is especially desirable. It is anticipated that the difficult questions being posed within LBA will require data from remote sensing instruments with differing capabilities and from a variety of ancillary data sources as well. Data fusion and data assimilation approaches are encouraged.

Research in Phase II of LBA-ECO should emphasize effective exploitation of relevant types of remotely sensed data currently or soon to become available. Satellite/sensor data sets available for LBA-ECO research include several with historical time series (i.e., Landsat and AVHRR), selected microwave data sets (especially the JERS-1 Global Rain Forest Mapping project Amazon image mosaics, SSM/I imagery, and topography from SRTM), hyperspatial imagery from IKONOS for LBA's primary and secondary study sites (already purchased for LBA under the NASA commercial data buy), new EOS Terra data products just becoming available (from MODIS, MISR, ASTER, MOPITT and CERES), and a limited amount of EO-1 imagery over selected LBA sites. EOS Aqua

(with MODIS, CERES, and AIRS) data should become available during the course of Phase II of LBA-ECO (see acronym list at the end of this Appendix). **Investigators proposing satellite data analysis should take care to specify how their satellite data will be obtained and, if necessary, to include its purchase in their budget.**

NASA has recently selected investigations for airborne remote sensing campaigns utilizing U.S. aircraft as a proposed contribution to LBA-ECO and is now in the process of discussing them with Brazil. It is unlikely that the new U.S.-Brazil implementing arrangement to cover these investigations will be completed before proposals are due under this NRA. Proposers are encouraged to offer use of the airborne data to be collected by U.S. aircraft, but should be aware that this airborne data collection is subject to the successful execution of this new implementing arrangement and obtaining all other necessary approvals for flights over Brazil. Airborne sensor data sets to become available through these proposed campaigns are the Airborne Visible-Infrared Imaging Spectrometer (AVIRIS) (on a low altitude aircraft), the Laser Vegetation Imaging Sensor (LVIS), the MODLAND Quick Airborne Looks System (MQUALS), atmospheric carbon dioxide concentrations, and carbon dioxide fluxes to the atmosphere measured using airborne eddy covariance methods. For details on planned airborne data acquisitions, consult the LBA-ECO Home Page.

Proposals for aircraft remote sensing investigations that utilize host country aircraft and continue or extend Phase I LBA-ECO observations will be considered under this NRA. Other airborne investigations, consistent with the goals of LBA-ECO, may be proposed, but proposers are cautioned such proposals must make a strong and compelling scientific case for a need for any airborne observations beyond those already selected. Any such proposals should consult NRA-00-OES-08 (in NASA's solicitation archive at: http://research.hq.nasa.gov/code_y/dynamic.cfm?op_fy=2001) for details on airborne remote sensing proposal requirements. All airborne investigations will, of course, be subject to compliance with all host country laws and approval processes.

6. Modeling

Both diagnostic and prognostic modeling approaches are desired in LBA. In Phase II of LBA-ECO, modeling research should focus on: 1) capturing and testing understanding derived from LBA-ECO local-scale process studies, 2) simulating Amazonian ecological and biogeochemical functioning, 3) scaling LBA-ECO observations and understanding from local to regional (and possibly global) scales, 4) predicting future ecosystem responses based on realistic scenarios of change, and 5) modeling the process of land use change and to predict future patterns. Models that operate at differing spatial (e.g., site or stand to entire Amazonian region) and temporal (minutes to centuries) scales are needed. Models should incorporate the effects of multiple interacting environmental changes, especially changes in land cover and land use and climate.

Modeling studies to generate regional estimates of net exchanges of carbon as well as certain nutrients (e.g., phosphorus), trace gases, and/or particulates are expected. Models that capture the effects of land use change and differing agricultural management

practices on soil fertility, the sustainability of agricultural production, and ecosystem function and fragmentation at local or regional scales are of special interest. Investigations that develop linkages among ecological, hydrological, climate, and socio-economic models in order to simulate current Amazonian ecosystem functioning or to project future functioning are desired. Ultimately, it will be the ability to model systems undergoing land-use change that will provide tools for both scientists and decision-makers to evaluate the potential consequences of different management practices, and to assess the consequences of policies that affect land-cover conversion. Thus, work to quantify uncertainties and evaluate models will be critically important in determining the utility of LBA modeling results and their successful application to sustainable development issues in Amazônia.

All modeling proposals should describe how uncertainties in model results will be characterized and how models will be evaluated.

7. Synthesis and Integration

Modeling is a key tool for scaling and integration of scientific understanding, and will be used for this purpose in LBA-ECO, but it is not the only approach. Analysis of relationships among spatial data sets, direct calculations based on areal extent of land cover types, and analysis of remote sensing imagery are other such approaches. Investigations that focus on synthesizing and distilling information to answer one or more of the questions enumerated in section II.A of this Appendix will be essential to the success of LBA. Research proposals to quantify Amazônia-wide budgets and fluxes, to understand regional ecosystem function, to elucidate the important drivers of land use change at regional scales, and to assess the role of Amazônia in global processes are of interest. Creation of integrated data products useful to more than one LBA investigator group is strongly encouraged. Whenever possible, it is desirable that data and data products that can be of use to multiple investigator teams and LBA components be produced early in Phase II of LBA-ECO. Groups proposing to share data and synthetic products should indicate when their work would be available to other groups and how that work will strengthen LBA Science Team efforts. It is anticipated that all modules of LBA will contribute to and collaborate in this area of synthetic and integrative research. **Quantification of uncertainties in these integrative studies will be essential.**

III. REQUIREMENTS FOR LBA-ECO PHASE II PROPOSALS

A. COLLABORATION REQUIREMENTS

1. General Collaborations

Proposers are encouraged to develop appropriate collaborations of all kinds. Combinations of U.S. and international scientists are encouraged, as are collaborations among scientists from government, industry, and academia. Joint, collaborative proposals are welcome, as are parallel proposals for complementary activities. Proposers

are cautioned to not create so broad or diffuse a collaboration that reviewers cannot evaluate the proposal at a reasonable level of technical detail or understand its management plan.

2. Host Country Collaborations

Brazilian law requires that scientists from outside of Brazil participating in scientific expeditions within Brazil have a Brazilian counterpart. According to this Brazilian law (Decree 98.830/90, explained in Portaria MCT 55/90), a Brazilian institution with recognized expertise in the research area must take responsibility for the participation of the foreign investigators (CNPq, 1993). For this reason, as well the obvious importance of involving scientists with needed expertise and familiarity with the local environment, proposers must offer a substantive scientific collaboration with Brazilian scientists and/or other host country scientists (if the work is in another Amazonian nation) in their responses to this announcement. Proposers should seek to work jointly with highly qualified host-country researchers and should provide evidence that they have taken appropriate measures to facilitate the involvement of their host country collaborators, including letters documenting the planned collaboration from the South American scientist's institution. Special efforts to engage scientists from Amazonian institutions are strongly encouraged. Proposers should plan for U.S.-host country investigator co-authorship in publications resulting from research conducted under LBA. **Proposals without host country collaborations will be considered not responsive to this NRA.** The quality and appropriateness of the host country collaboration will be a factor in the proposal review and selection process (see Appendix B, section III).

B. REQUIRED INFORMATION AND PLANS

1. Training and Education Plan

Each proposal submitted for participation in LBA-ECO is required to have a training and education component relevant to LBA's training and education objectives. Details on types of relevant activities are provided in section II.B.1 of this appendix. Each proposal also should describe how its training and education component contributes to NASA's ESE educational goal and provide details on its formal, informal, and/or professional development educational activities. Elements to be described should include rationale, objective, target audience(s), plan and schedule of activities, dissemination, evaluation, management, and fraction of total budget for training and education.

Training and educational activities should be detailed in a separate Training and Education Plan section of the proposal. The quality and appropriateness of the training and education plan will be a factor in the proposal review and selection process (see Appendix B, section III).

2. Data Plan

Each LBA-ECO proposal should provide a brief Data Plan section describing the investigator's commitment to the LBA Data Policy and plans for sharing data and for interacting with the LBA Data and Information System (LBA-DIS). This plan should describe the data to be collected and how it will be handled, processed, quality checked, and made available to other LBA investigators. The plan also should describe how any data products to be created or additional, ancillary data sets to be obtained will be shared with NASA, LBA, and the broader scientific and user communities. Procedures for delivering to Brazil the original data acquired in Brazil, as required by Brazilian law, prior to any data leaving the country must be detailed. A rough schedule for delivery of metadata and processed data products to the LBA-DIS should be provided. Early delivery of products useful for LBA Science Team synthesis activities is encouraged and should be noted in the schedule. Proposers should indicate whether they intend to make data available for sharing through their own web site, and how they will support that, or whether they wish to have the LBA-DIS nodes at ORNL or INPE/CPTEC do this for them (see section IV.E of this appendix). Estimates of the type and amount of data to be requested from the data system and/or other investigators and the desired time of delivery should be described. If data from other LBA investigations will be required, these measurements should be detailed in the Data Plan.

The quality, appropriateness, and responsiveness to LBA data policies and procedures, of the data plan will be a factor in the proposal review and selection process (see Appendix B, section III).

3. Management Plan

Each LBA-ECO proposal should include a Management Plan section that describes the roles and responsibilities of all investigators and collaborators and indicates the relationships among them. It should identify the lead host country counterpart(s) and his/her institution(s) and specify their roles and commitment to the investigation. It is important that responsibilities for scientific analysis and integration be described as well as responsibilities for measurements and field operations. Letters documenting the commitments of the host country lead(s) and their institution(s), and all other co-investigators and collaborators, should be appended to the proposal. **Proposals without such letters of commitment from host country counterparts and co-investigators may be considered non-responsive and returned without review.** The Management Plan also should identify what contractor and/or non-institutional support is anticipated and who will be providing it. A schedule for reporting results and publishing papers should be provided.

The quality, appropriateness, and responsiveness of the Management Plan will be a factor in the proposal review and selection process (see Appendix B, section III).

4. Past Research and Accomplishments

Each proposal should make a brief statement at the beginning of the Technical Plan section concerning relevant past research results and accomplishments. For those current

LBA Science Team members offering successor proposals, this section should: 1) detail the current status and results of the original LBA investigation, summarize accomplishments, and highlight scientific next steps; 2) describe past training and education work; 3) detail the status of data and metadata submissions to LBA-DIS; and 4) cite all LBA publications (to be included in list of references).

For those investigators offering new proposals (i.e., proposals that are not successors to previous LBA research) this section should: 1) describe past relevant research, 2) describe experience in tropical and/or Amazonian ecosystems, 3) describe relevant experiences as a member of a large interdisciplinary science team, and 4) cite relevant publications (to be included in list of references).

Past performance in data delivery, as documented in this statement, will be a factor in the proposal review and selection process (see Appendix B, section III). If the proposal is for a successor award to continue or extend current LBA research, LBA-DIS managers will be consulted in the proposal review and selection process to evaluate and verify past compliance with LBA data policies and procedures.

5. Integrative Science Information

A large, multi-disciplinary field program like LBA succeeds only when its integrated outcome well exceeds that of its individual investigations. Thus, research activities that contribute to the overall accomplishments of LBA, but may not be tightly justified within an individual investigation deserve recognition in the review and selection process. With this in mind, an opportunity is provided for proposers to add a section to the end of the proposal's Technical Plan describing how they plan to participate in LBA-wide synthesis and integration activities. This description should cover plans to incorporate the investigator's own results in the broader LBA synthesis. It should detail planned collaborations with other LBA investigators that will lead to enhanced integration of results. Any dependencies on other investigations, data sets, or activities for synthesis and integration should be noted; provided they are scientifically sound, these dependencies will be viewed as strengths in the review and selection process. Any activities undertaken within the technical plan to enhance synthesis and integration of LBA results, and that otherwise might not seem closely tied to activities within the proposed investigation, may be highlighted and justified in this section.

IV. LBA PROJECT IMPLEMENTATION AND MANAGEMENT

A. LBA PROJECT OFFICES

1. Brazil's LBA Central Office

The general coordination of LBA is under the responsibility of the Ministry of Science and Technology (MCT) of Brazil, through the Secretariat for Policies and Programs of Science and Technology. MCT has appointed an Organizing and Implementing

Committee (OIC) that is responsible for coordinating the implementation of LBA. OIC members are nominated by and responsible to the funding bodies and major participating institutions for each LBA module. The OIC will make decisions by consensus, balancing the operational needs, requirements, and scientific priorities for LBA with the available funding. It will coordinate the major infrastructure needs and field operations of LBA.

MCT has designated the Brazilian Space Research Institute (INPE) as the lead executing agency for LBA in Brazil. INPE has established the LBA Central Office at its Center for Weather Forecasting and Climate Study (CPTEC) facility in Cachoeira Paulista, São Paulo. The LBA Central Office is responsible for overall coordination and integration of LBA. Dr. Carlos Nobre is the Scientific Coordinator for all of LBA. Dr. Antonio Manzi, the LBA Officer, manages the Central Office. The LBA Central Office serves as NASA's liaison with the Government of Brazil in obtaining all necessary authorizations and approvals for NASA LBA-ECO activities.

The LBA Central Office has established regional offices (located in Manaus, Belém, Ji-Paraná, Santarém, and Brasília) to represent LBA within the Amazon region and to undertake specific, delegated responsibilities of the Central Office. All LBA investigations and independently funded modules are expected to coordinate their field activities through the LBA Central Office and Regional Offices, as appropriate.

Field site support is currently available at Belém, Caxiuana, Santarém, Ji-Paraná, Manaus, Brasília, and Acre.

2. LBA-ECO Project Office

NASA Headquarters has established an LBA-ECO Project Office responsible for the module it contributes to LBA. The LBA-ECO Project Office has two parts, one devoted to implementation and logistical support led by the Goddard Space Flight Center (GSFC) and one devoted to scientific coordination located at the University of New Hampshire. In coordination with the LBA Central Office, the NASA LBA-ECO Project Office arranges for logistical support and the installation of infrastructure, including a data and information management system (part of LBA-DIS). This Project Office is responsible for implementing operations at major LBA-ECO field sites, managing U.S. airborne science campaigns, and coordinating all implementation activities with the LBA Central Office and Regional Offices. The NASA LBA-ECO Project Office provides support for and coordination of all investigations selected for participation in LBA-ECO. The NASA LBA-ECO Project Office component at GSFC will be responsible for the technical administration of all research awards (grants, cooperative agreements, or interagency transfers) made under this NRA. The NASA LBA-ECO Project Office coordinates the scientific activities of the LBA-ECO Science Team, under the direction of the LBA-ECO Project Scientist located at the University of New Hampshire.

The LBA-ECO Project Office is led by:

Dr. Darrel Williams

and Dr. Michael Keller

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Proposers desiring specific information about the LBA-ECO Project are encouraged to contact Dr. Williams or Dr. Keller.

B. LBA SCIENCE TEAM MEMBERSHIP

1. LBA Science Team

All investigators selected by LBA sponsoring agencies to conduct research under LBA, and mutually agreed upon with Brazil, become members of the LBA Science Team. They will be expected to participate fully in all Science Team meetings and relevant activities. Investigators should plan for approximately one full LBA Science Team meeting every 18 months, with the next one scheduled for July 7-10, 2002.

LBA has a Science Steering Committee (SSC) composed of representatives of the participating scientific research investigations that are nominated by their sponsoring agency and invited by Brazil. The SSC is responsible for the scientific content, direction, and priorities within LBA. It is chaired by a Brazilian scientist, with co-chairs from Brazil, the U.S., and Europe. The current Chair is Dr. Flávio J. Luizão of the Brazilian Amazonian Research Institute (INPA). The current Co-Chairs are Drs. Pedro Leite da Silva Dias, Michael Keller and Pavel Kabat.

2. LBA-ECO Science Team

All investigators selected to conduct research under LBA-ECO will become members of the LBA-ECO Science Team. They will be expected to participate fully in all LBA-ECO Science Team meetings and activities and to budget accordingly. Investigators should budget for two five-day Science Team meetings in 2002 (one of which will be the full LBA Science Team meeting) and one five-day meeting per year thereafter, nominally in South America, and for travel to one or more small workshops per year (some in the U.S., some in South America or Europe) to advance collaborations on synthesis and integration across LBA. South American counterpart investigators become full members of the LBA-ECO Science Team and are expected to participate in all meetings. Unless the counterpart investigators have secured independent resources for travel to Science Team meetings and workshops, U.S. investigators should budget funds for their participation. Also, LBA strongly encourages the participation of students, particularly South American students, in science conferences and workshops. Investigators are strongly encouraged to plan for student participation in such events.

The LBA-ECO Science Team is led by the LBA-ECO Project Scientist. This Science Team bears the primary responsibility for the scientific content, direction, and priorities within LBA-ECO. The LBA-ECO Science Team, in close consultation with the LBA Science Team, the LBA Central Office, and the LBA-ECO Project Office, will be responsible for revising and updating the science plans for LBA-ECO. They will work with the LBA-ECO Project Scientist and Project Office staff to keep current the LBA-ECO Experiment Plan detailing the specific activities to be conducted during the execution of LBA-ECO. A major revision of the Experiment Plan, to be prepared jointly with INPE and mutually agreed upon by NASA and INPE, will be required as a result of the selections made through this NRA. It is expected that INPE will present the revised Experiment Plan to MCT for LBA Superior Committee review and concurrence. All new LBA sites and activities must be approved by Brazil's MCT before field activities may commence. It is also expected that new investigations will be presented to the LBA Science Steering Committee for their review and concurrence.

C. RESPONSIBILITIES OF LBA-ECO INVESTIGATORS

The following constitute a minimum set of requirements for membership on the LBA-ECO Science Team. These responsibilities were established in 1999 as a guide for new investigations proposing to become part of LBA and have been updated for this NRA.

1. Science Content

Participation on the LBA-ECO Science Team is open to scientists whose research falls under the LBA-ECO goal and the plans and scientific questions outlined in the Experiment Plan for LBA-ECO (i.e., participation in the LBA-ECO Science Team is not limited to NASA-sponsored investigations).

2. Collaboration with Host Country Scientists

Each LBA-ECO investigation is required to include an effective collaboration with one or more scientists from the South American host country for the study. Involvement of Amazonian scientists is strongly encouraged.

3. Participation in Science Team Activities

LBA-ECO is a team project. The purpose of uniting a team is to encourage mutual support and collaboration. The products of the team should be more valuable than the products of a similar number of individual investigations. In order to coordinate team activities, all investigators should participate in science team meetings and, where appropriate, small workshops. Investigators should work with the LBA-ECO Project office as well as the overall LBA Central Office to coordinate their activities.

For practical purposes and based on the history of NASA funding, the LBA-ECO team is divided into a number of sub-projects. For those projects with NASA funding, NASA

requests that at least one representative investigator from S. America and one from the US attend each full science team meeting (normally 1-2 per year). Support for this participation is budgeted by the investigators from grant funds. Research teams not funded by NASA also are expected to send representatives to these coordination meetings. Participation in LBA Science Team Meetings also is expected. Whenever possible, the NASA LBA Ecology Project Office will attempt to schedule meetings and workshops jointly with overall LBA events to minimize the costs and time involved in travel.

4. Participation in Education and Training

All LBA-ECO teams are required to participate in LBA-related training and education activities. There is no single formal requirement, however most teams will be involved in presenting seminars or short courses and training graduate students and technicians. The primary focus of training and education activities is advanced training (Ph.D., post-doctoral, Ph.D.-track Masters, and state-of-the-art technical training) of project participants from South America, particularly those from the Amazon region, but educational and outreach activities targeting other audiences are welcome.

5. Adherence to the LBA Data and Publication Policies

The LBA Science Steering Committee recommended data and publication policies are reproduced below (section IV.D of this appendix). The LBA-ECO Science Team endorsed these policies. All LBA-ECO participants should adhere to these policies. NASA-funded investigators must also follow NASA data policies as described below.

D. LBA DATA AND PUBLICATION POLICIES

Current NASA policy does not allow for any period of exclusive use by either an individual scientist or a Science Team. Further, NASA supports a practice of timely release (i.e., as soon as is reasonably possible) for public access to data within the overall LBA partnership. The overall LBA data policy, reproduced below, is less strict, allowing for a period of up to a year for data release to the public. LBA-ECO Science Team members are expected to adhere to both policies – using whichever is stricter as the overall guide.

LBA Data and Publication Policies, Approved by the LBA Science Steering Committee, May 13, 1998, Piracicaba, SP, Brazil

INTRODUCTION

LBA data polices are guided by the fundamental principle that cooperation and synergism should be maximized in all LBA activities. To ensure that all LBA participants have access to data in a timely manner and that appropriate credit is given to the investigators, there is a strong need for a definition of data policies that will be adopted by the entire LBA.

LBA data policies will guide data sharing, citation of data from other investigators, access to restricted data and promote the exchange of quality controlled / quality assured data. All LBA researchers must follow the national laws concerning export of all data gathered by foreign researchers of the various Amazonian countries, notably Brazil. The LBA home page and the project offices in Brazil can provide this information.

LBA data and publication policies:

- 1. Data generated by LBA will become public domain and will be permanently archived in Brazil. The LBA Data Information System (DIS) will provide tools for documenting, storing, searching and distributing these data.*
- 2. All LBA data should be available to all LBA researchers. Exceptions may be made in the case of raw or preliminary data, for which distribution can be restricted for a limited period of time.*
- 3. There will be no periods of exclusive rights to publish LBA results. Exceptions are possible for students where graduation requirements prohibit publication of results prior to acceptance of a Thesis.*
- 4. Individual investigators may make their own data more widely available at any time. Outside investigators may be given access to this data as soon as the data have been submitted to the LBA DIS, with some prudent time period for quality control.*
- 5. Each LBA module is responsible for establishing a time schedule for data exchange within the projects and data delivery to LBA DIS. The time limit for data delivery to LBA-DIS will be no more than one year.*
- 6. Data should be analyzed cooperatively by all scientists involved in obtaining them. Especially cooperation across disciplines and among South American, European and North American researchers should be encouraged. Publications resulting from work under LBA should be co-authored by all scientists who have participated substantially in the work, unless some participants choose not to be on the authors' list. The same applies to presentations at meetings. Special effort by each non-South American researcher should be put into integration of South American researchers in their work and in the publication of the results.*
- 7. Where data are used for modeling or integrating studies, the scientist collecting the data will be credited appropriately, either by co-authorship or by citation. Investigators using data provided by another investigator as a substantial component of a paper should offer the originating investigator co-authorship. In cases where data from other investigators are a minor contribution to a paper, the data should be referenced by a citation. Users of the data will always have to state the source of the data.*

8. *Specific constraints for certain data sources (e.g. satellite products, global meteorological analysis, etc) may be subject to copyright restrictions which are more limiting than this LBA data policy. It is up to the LBA-OIC to take the first steps in making contacts with officials and institutions in order to prepare specific agreements that will allow LBA scientists to use the data.*

9. *If conflicts do occur, they should be resolved at the level of the LBA modules.*

E. LBA DATA AND INFORMATION SYSTEM (LBA-DIS)

A data and information management system located at INPE/CPTEC – the LBA Data and Information System (LBA-DIS) – has been developed by INPE, with NASA's participation. The LBA-DIS holds, manages, and distributes LBA data and information. INPE is the repository for all LBA-DIS data and information, and NASA will have at its disposal copies of the system and of the data and information. The core of LBA-DIS is the archival and distribution system at INPE/CPTEC, and managed by the LBA Central Office, which has full responsibility for LBA data archival and distribution for decades to come. This LBA-DIS central node has mirror sites and supporting nodes in the U.S. and Europe. LBA-DIS activities, including those at other nodes are coordinated by the LBA-DIS Working group led by Mr. Luiz Horta, the LBA-DIS Officer.

As required by Brazilian law, the original data collected in Brazil must remain in Brazil (copies may be retained by foreign investigators). Additionally, NASA has agreed to ensure that copies of scientific data and results from LBA-ECO will be provided to INPE/CPTEC. **Deliveries of data and results to INPE/CPTEC to fulfill this NASA obligation should be detailed in the Data Plan section of LBA-ECO proposals.**

The NASA-designated long-term archive for ecological and biogeochemical data from field campaigns is the Distributed Active Archive Center (DAAC) at the Oak Ridge National Laboratory (ORNL). Thus, data collected through LBA-ECO will be archived and distributed at the ORNL DAAC as well as in Brazil.

An Internet-based approach for data and information management has been created for sharing scientific data within LBA. This aspect of LBA-DIS is distributed, consisting of LBA investigator web sites, LBA project and module web sites, the data archives at INPE/CPTEC and at the ORNL DAAC, and the Beija-flor system. The data sharing approach involves two major data and information management tools: Beija-flor and the LBA Metadata Editor (LME). By using World Wide Web, or simply "Web" technology, the combined capabilities of Beija-flor and the LME allow data and documentation to be stored on, and accessed from, the networked computers of individual scientists located around the world. In the case of large data sets, data need not be immediately available through web access to be part of the LBA-DIS. However, metadata must be present, and access should be provided through other mechanisms.

Currently, the LME facilitates the entry, editing, and storage of metadata in standard formats for use by Beija-flor. Metadata is the information that describes the

characteristics (e.g., geographic locations, parameter names, dates) of the various data sets. Data set documentation capabilities are integrated with the LME. Beija-flor provides the needed metadata search and sharing functionality by harvesting and organizing metadata that are then accessed and reviewed by the users. Data providers and scientists use the LME to provide metadata to Beija-flor by saving the files of information in specified locations on their own or other web-accessible computer systems and marking the file as "searchable." During its regular harvesting cycle (currently nightly), Beija-flor collects metadata from only the files that are marked as searchable. Each Beija-flor system node (currently ORNL and the INPE/CPTEC) harvests metadata and builds a database of the harvested information. Harvested information is shared across the nodes so that users are able to search and review available metadata by accessing the web-based Beija-flor and LME interfaces at any of the nodes with their web-browser software. For more information, see the Beija-flor search page: <http://beija-flor.ornl.gov/servlet/lbaeco> and the LBA Metadata Editor: <http://daacl.esd.ornl.gov/cgi-bin/MDEDIT/access.pl>

Proposers unable to provide Web hosting for their data or requiring special help with large data sets should indicate this in the Data Plan section of their proposal. Web hosting of moderate sized and large data sets may be arranged through the LBA-ECO Project Office.

F. UNITED STATES - BRAZIL / SOUTH AMERICA FORMAL AGREEMENTS

NASA and the Ministry of Science and Technology (MCT) of Brazil have executed an Implementing Arrangement under a framework agreement on science and technology between the U.S. and Brazil to formalize the scientific cooperation and secure the necessary approvals for conducting research under LBA-ECO in Brazil. This implementing arrangement covers all investigations that are sponsored by NASA under LBA-ECO except those requiring airborne science on U.S. aircraft. A new implementing arrangement is being developed and discussed with Brazil to cover airborne science on U.S. aircraft in support of investigations recently selected to add such observations to LBA-ECO. It is unlikely that this new implementing arrangement will be completed before proposals are due under this NRA. Proposers are encouraged to offer use of the airborne data to be collected by U.S. aircraft, but should be aware that this airborne data collection is subject to the successful execution of this new implementing arrangement and obtaining all other necessary approvals for flights over Brazil.

V. REFERENCES FOR ENTIRE NRA

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VI. ACRONYM LIST FOR ENTIRE NRA

AMC - Atmospheric Mesoscale Campaign (LBA)
ASTER - Advanced Spaceborne Thermal Emission and Reflection Radiometer (Japanese instrument on EOS Terra)
AVHRR - Advanced Very High Resolution Radiometer (U.S.; on NOAA meteorological satellite)
AVIRIS - Airborne Visible-Infrared Imaging Spectrometer (aircraft instrument)
CERES - Clouds and the Earth's Radiant Energy System (on EOS)
CLAIRE - Cooperative LBA Airborne Regional Experiment (LBA)
CPTEC - Centro de Previsão de Tempo e Estudos Climáticos (Center for Weather Forecasting and Climate Study) (part of INPE)
DAAC - Distributed Active Archive Center (part of EOSDIS)
ENSO - El Niño - Southern Oscillation
EO-1 - Earth Observing-1 (U.S.)
EOS - Earth Observing System (U.S.)
EOSDIS - Earth Observing System Data and Information System (NASA)
ESE - Earth Science Enterprise (NASA)
EUSTACH - European Studies on Trace Gases and Atmospheric Chemistry (LBA)
GCM - General Circulation Model
GIS - Geographic Information System
GOES - Geostationary Operational Environment Satellite (U.S.)
GSFC - Goddard Space Flight Center (NASA)
IGBP - International Geosphere-Biosphere Programme
IHDP - International Human Dimensions Programme
IKONOS - a hyperspatial satellite sensor (not an acronym)
INPA - Instituto Nacional de Pesquisas da Amazônia (Brazilian Amazonian Research Institute)
INPE - Instituto Nacional de Pesquisas Espaciais (Brazilian Space Research Institute)
JERS-1 - Japanese Earth Remote Sensing Satellite (Japan)

LBA - Large-Scale Biosphere-Atmosphere Experiment in Amazônia
LBA-DIS - Large-Scale Biosphere-Atmosphere Experiment in Amazônia - Data and Information System
LCLUC – Land Cover and Land Use Change (NASA program)
LUCC - Land-Use and Land-Cover Change (joint IGBP/IHDP Core Project)
LVIS – Laser Vegetation Imaging Sensor (aircraft instrument)
MISR - Multi-angle Imaging Spectroradiometer (on EOS Terra)
MODIS - Moderate Resolution Imaging Spectroradiometer (on EOS Terra)
MODLAND – MODIS Land Science Team
MOPITT – Measurements of Pollution in the Troposphere (Canadian instrument on EOS Terra)
MQUALS – MODLAND Quick Airborne Looks System (aircraft instrument)
NASA - U.S. National Aeronautics and Space Administration
NRA - NASA Research Announcement
OIC - Organizing and Implementation Committee (for LBA)
ORNL - Oak Ridge National Laboratory (U.S. Department of Energy)
NPP - NPOESS Preparatory Project (U.S.)
NPOESS - National Polar-orbiting Operational Environmental Satellite System (U.S.)
SRTM - Shuttle Radar Topography Mission (U.S.)
SSC - Science Steering Committee (for LBA)
SSM/I - Special Sensor Microwave/Imager (U.S.)
TE - Terrestrial Ecology (NASA program)
TRMM-LBA - Tropical Rainfall Measuring Mission (LBA module)
URL - Uniform Resource Locator
USGCRP – U. S. Global Change Research Program
VOC – Volatile Organic Carbon compound

APPENDIX B

AMENDATORY GUIDANCE TO THE GENERAL GUIDELINES CONTAINED IN APPENDIX C AND APPLICABLE ONLY TO THIS NRA AND INSTRUCTIONS FOR PROPOSERS

I. PURPOSE

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

II. PROPOSAL CONTENT AND FORMAT

The proposal should provide sufficient detail to enable a reviewer to assess the value of the proposed research, its relation to the objectives of the NRA, and the probability that the investigators will be able to accomplish the stated objectives within the requested resources and schedule. Capabilities of the proposing organizations should be described including the experience of the Principal Investigator and any Co-Investigators. The technical part of the proposal should be limited to the equivalent of 23 pages of text, single-spaced, with type no smaller than 12 pt. Approximately 3-5 of these pages should describe relevant past work and accomplishments (required for **LBA-ECO** proposals and optional for **terrestrial ecology**). For **LBA-ECO** proposals, approximately 3-5 of these pages should be devoted to describing synthesis and integration work that includes collaboration and cooperation across LBA; these pages are not required for **terrestrial ecology** proposals. A reasonable number of figures and tables (not to exceed 5 pages) may be appended. Short resumes and statements of current and pending research funding (including proposal name, funding agency, duration, and total funding) for all investigators should be included. The cover sheet, table of contents, abstract, list of references, management plan, data plan, training and education plan, cost plan, resumes, statements of current and pending funding, and letters indicating the commitment of co-investigators, collaborators, and institutional partners need not count in the technical plan page limit. The proposal should be self-contained, and should not refer reviewers to external sources or web sites for critical information. Additional pertinent information (e.g., pre-prints, and reprints) may be added as appendices. If color is used, proposers should ensure that all copies have color. Proposals should not be bound or in covers.

A. PAGE LIMITS

Offerors should adhere to the following page limit recommendations:

Cover Letter	1	
Cover Page	1-2	
Table of Contents	1	
Abstract / Summary	1	
Technical Plan	23 (total)	
Summary of Past Work and Accomplishments		3-5
Technical Description of Proposed Work		15
Plan for Integrative Science		3-5
References	1-5	
Training and Education Plan	2-4	
Data Plan	2-5	
Management Plan	1-3	
Cost Plan	4-8	
Current and Pending Funding	1-2 per investigator	
Resumes	1-2 per investigator	
Letters of Commitment	1-2 per collaborating institution	
Other Enclosures	As few as possible	

B. CONTENT

Each proposal should contain the following materials assembled in the order given.

Cover Letter. Each proposal should be prefaced by a cover letter signed by an official of the Principal Investigator's institution who is authorized to legally bind the organization to the proposal and its content (unless the signature appears on the proposal itself). For **LBA-ECO** proposals, the cover letter should specify the lead host country collaborator(s) as well as the Principal Investigator. The cover letter should refer to the LBA / TE NRA.

Cover Page. See Appendix D for example. *Please note that the budget request to be summarized on the cover page should be for the entire investigation, totaling the budget requests for all institutions that are participating in the proposal and requesting funding from NASA.* An electronic submission of the cover letter is also requested; see Appendix F for details.

Table of Contents (recommended length: 1 page). A table of contents listing the page numbers for key sections of the proposal should be provided.

Abstract / Summary (length must not exceed 1 page). The abstract (also referred to as "summary") should summarize the research proposed in one page or less. It should contain a simple, concise overview of the investigation, its objectives, its scientific approach, expected results, and the value of its results to NASA's **LBA-ECO** or **terrestrial ecology** and to Earth Science Enterprise efforts. It is very important that this abstract be specific and accurately represent the research to be conducted.

Technical Plan (length must not exceed 23 pages). The Technical Plan section of **LBA-ECO** proposals should begin with a 3-5 page summary of relevant past research and

accomplishments. See Appendix A, section III.B.4 for details on what information should be included. For proposals to the **terrestrial ecology** component of this NRA this section is optional.

The main body of the Technical Plan section should not exceed 15 pages. It should contain a full statement of the research to be undertaken and should describe key background (background should take less than 3 pages), objectives, scientific relevance, technical approach, and expected significance of the work. The key elements of the project should be clearly identified and related to each other. The methods or approaches to be used should be described, and, as appropriate, the advantages of the selected methods or approaches over alternatives should be discussed. The data analysis strategy and methods to be used should be described. The anticipated results should be identified and their relation to the proposal's stated objectives and NASA's objectives, as outlined in the NRA, should be discussed. The research should be described in sufficient detail that peer reviewers can adequately assess the scientific methods and quality of the work proposed.

For **LBA-ECO** proposals, the Technical Plan section should end with a 3-5 page description of how the investigator plans to participate in LBA-wide synthesis and integration activities. See Appendix A, section III.B.5 for details on what information is desired in this section of the proposal. For **terrestrial ecology** proposals, this section is not relevant and not required.

References (recommended length: 1-5 pages). A complete list of references cited in the technical plan must be provided. Each reference should include the title, names of all authors, book or journal, volume number, page numbers, and year of publication. While it is important to be concise, proposers should follow accepted scholarly practices in providing citations for source materials relied upon when preparing any section of the proposal.

Training and Education Plan (recommended length 2-4 pages). Each proposal submitted for participation in **LBA-ECO** is required to conduct training and education. The Training and Education Plan should describe these activities. See Appendix A, section III.B.1 for details on what type of activities would be relevant in this section.

A Training and Education Plan is optional, but would be welcome, for **terrestrial ecology** proposals.

Data Plan (recommended length: 2-5 pages). All **LBA-ECO** proposals should provide a Data Plan section describing the investigator's commitment to the LBA Data Policy and plans for sharing data and for interacting with the LBA Data and Information System (LBA-DIS). See Appendix A, section III.B.2 for details on the desired content of the Data Plan. All **terrestrial ecology** proposals should provide a Data Plan section that describes how they will acquire, manage, and share data to be obtained or produced within the proposed research project.

For both **LBA-ECO** and **terrestrial ecology** proposals, when resources from satellites or other data sources (e.g., aircraft sensors) are required, proposals should indicate whether a commitment has been made for access to the other systems or whether the required/desired data are available (the costs for such data should be included in the cost plan). Resources (i.e., personnel and equipment) for supporting the Data Plan should be identified in the Cost Plan.

Management Plan (recommended length: 1-3 pages, depending on complexity). The Management Plan section of the proposal should outline the roles and responsibilities of all investigators and collaborators and indicate the relationships among these roles and responsibilities within the group. If the proposal is for participation in **LBA-ECO**, see Appendix A, section III.B.3 for details on special information required in the Management Plan. The management plan also should identify what contractor and/or non-institutional support is anticipated and who will be providing it. A schedule for reporting results and publishing papers should be described.

Cost Plan (for U.S. Proposals Only). Please see Appendix C for additional guidance and Appendix D for forms. Contributions from any cost-sharing plan or other support for the proposed research should be detailed.

Proposers are encouraged to seek off-campus overhead rates, where appropriate, for the elements of their LBA-ECO research that qualify for such rates.

Costs for the acquisition, purchase, storage, or processing of all required data should be included. Also, costs for modeling, if proposed, should include all aspects of the process from writing software through computer operations and time. If use of NASA or other supercomputer resources is anticipated, an estimate of computational requirements should be included as part of the budget submission. Requirements for any data from NASA's commercial data buy should be clearly specified. Full costs for the purchase of data from commercial sources should be included in the budget and the requirement documented in the proposal.

In coordination with the LBA Central Office, the LBA-ECO Project Office will provide logistical support to the **LBA-ECO** Science Team and will work to efficiently provide field infrastructure and to seek economies of scale that will minimize costs. Needed logistical support and infrastructure for the field activities and airborne campaign(s) will be provided; special support for individual investigations must be described and budgeted for in individual proposals, but some or all of it may be pulled out post-selection for implementation by the LBA-ECO Project Office. Proposers are urged to delineate such needs separately in their budget if at all possible. If difficulties arise in estimating costs for requested Project logistical and infrastructural support, proposers should at least describe their needs in sufficient detail that Project staff can evaluate the requirement. Selected scientists should expect to negotiate with the LBA-ECO Project Office to ensure that their infrastructural and logistical needs are met adequately and in a cost-effective manner.

Participation in LBA and LBA-ECO Science Team activities must be accounted for in each **LBA-ECO** investigator's Cost Plan; see Appendix A, section IV.B.2 for details.

Current and Pending Funding. A list of current and pending research funding, to include the proposal name, funding agency, duration of research project, and total funding level, for all investigators should be included.

Resumes. Brief resumes (1-2 pages) for all named investigators should be appended to the proposal.

Letters of Commitment. Letters documenting the commitments of all co-investigators and collaborators, should be appended to the proposal. Letters of commitment must be signed by an official of the collaborating institution authorized to commit that institution to the activity. For **LBA-ECO**, the letter of commitment from the lead host country counterpart(s) and their institution(s) is extremely important. It is also important that responsibilities for scientific analysis and integration be described as well as responsibilities for measurements and field operations.

Other Enclosures. Any other material pertinent to the consideration of the proposal may be attached as an appendix. This might include preprints or reprints of relevant publications or background on new measurement or analysis approaches. Inclusion of general materials that will not aid in the evaluation of the proposal is specifically discouraged. Proposers are advised that reviewers will not be required to read these "other enclosures," but rather will be instructed to use their own judgment as to whether or not they merit consideration.

III. SELECTION PROCESS AND EVALUATION CRITERIA

The review of proposals submitted under this NRA will consist of a full peer review including external reviewers, which may involve a mail review, a panel review, or both. This will be followed by a programmatic review in which NASA managers will assess program balance across the competitive-range proposals and evaluate any logistical, implementation, cost, and/or management concerns. Prior to making its selection for LBA-ECO, NASA will consult with MCT and the LBA Central Office at INPE to ensure that the proposals adequately address the LBA issues that MCT and the LBA Central Office are responsible for coordinating (see section IV of Appendix A). For any **terrestrial ecology** proposals received to conduct NACP preparatory research, NASA will coordinate with the USGCRP's Carbon Cycle Interagency Working Group in the review and selection process.

A. EVALUATION CRITERIA

The criteria listed below will be used in evaluating individual proposals. These criteria supersede those listed in section (i) of Appendix C, and are of approximately equal importance.

1. The intrinsic merits of the investigation, including:

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

(b) the qualifications, capabilities, and relevant experience of the Principal Investigator, Principal Counterpart(s) (for **LBA-ECO** only), and any co-investigators or other collaborators as an indication of their ability to carry the investigation to a successful conclusion within the requested resources, including timely publication of peer-reviewed journal articles.

(c) the adequacy of facilities and ability and commitment of the investigator's, counterpart investigator's (for **LBA-ECO** only), and co-investigator's institutions to provide the necessary support to ensure that the investigation can be completed satisfactorily.

(d) performance of the investigator(s) and their institution(s) in past LBA or terrestrial ecology research or similar relevant research projects.

2. The relevance and responsiveness of the proposed research to the goals and objectives of NASA's Earth Science Enterprise and to the goals and objectives described in this NRA for **LBA-ECO** or for **terrestrial ecology**, including:

(a) the probability of achieving one or more significant objectives directly relevant to the research areas identified in this NRA.

(b) the soundness, logic, and practicality of the proposed technical methods and concepts for achieving successful results.

(c) the potential benefits to future U.S. Earth Science missions or data purchases.

(d) the quality, effectiveness, and appropriateness of the Management Plan, Data Plan, and Training and Education Plan component (if offered) that is focused on NASA ESE goals.

FOR LBA-ECO ONLY: 3. The strength, quality, effectiveness, and appropriateness of the:

(a) host country collaboration.

(b) Training and Education Plan component that is focused on LBA-ECO goals.

3. (for **terrestrial ecology**) or 4. (for **LBA-ECO**) The cost of the investigation, including consideration of the realism and reasonableness of the proposed cost, the relationship of the proposed cost to available funds, and the potential value of the research results (i.e., cost/benefit) to the user community. Cost sharing on the part of proposing and collaborating institutions is encouraged, but not required. Proposals that offer to make available existing equipment, infrastructure, data sets, and analytical tools will be viewed favorably

B. OTHER CONSIDERATIONS

NASA reserves the right to select and make an award covering only a portion of a proposer's investigation, in which case the investigator will be given the opportunity to accept or decline such partial acceptance. In cases in which two or more proposals address similar problems and/or adopt similar approaches to data analysis, NASA may desire joint participation on the part of two or more proposers in a single project. If such overlap involves more than one funding organization, NASA and those organizations will confer and mutually agree to the disposition of those proposals.

Any negotiations prior to final decisions will occur only after the peer review of proposals has been completed. The final decisions will be made by the NASA selecting official based on the results of the peer review; programmatic considerations, including the program's focus, goals, and balance; and consultations with MCT and the LBA Central Office at INPE in Brazil (for **LBA-ECO**). Final decisions will be made promptly and investigators will be notified by either electronic mail or surface mail, or both. Proposers will receive anonymous copies of the reviews for their proposal(s).

APPENDIX C

INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS

NASA Federal Acquisition Regulation (FAR), Supplement (NFS) Part 1852.235-72, Effective JANUARY 2000

(a) **General.**

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

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

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

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

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

(b) NRA-Specific Items.

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

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

(1) Transmittal Letter or Prefatory Material.

- (i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;
- (ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
- (iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
- (iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;
- (v) Identification of other organizations that are currently evaluating a proposal for the same efforts;
- (vi) Identification of the NRA, by number and title, to which the proposal is responding;
- (vii) Dollar amount requested, desired starting date, and duration of project;
- (viii) Date of submission; and
- (ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

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

**Notice
Restriction on Use and Disclosure of Proposal Information**

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

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

(4) **Project Description.**

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

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

(6) **Personnel.** The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants,

together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

(7) Facilities and Equipment.

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

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

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

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

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

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

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

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

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

(11) **Special Matters.**

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

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

(d) **Renewal Proposals.**

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

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

(e) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

(f) **Joint Proposals.**

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

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

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

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

(i) **Evaluation Factors.**

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

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

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

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

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

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

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

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

(j) **Evaluation Techniques.** Selection decisions will be made following peer and/or scientific review of the proposals. Several evaluation techniques are regularly used within

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

(k) Selection for Award.

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

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

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

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

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

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a

foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

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

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

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

(1) Foreign proposals and proposals including foreign participation must include a section discussing compliance with U.S. export laws and regulations, e.g., 22 CFR Parts 120-130 and 15 CFR Parts 730-774, as applicable to the circumstances surrounding the particular foreign participation. The discussion must describe in detail the proposed foreign participation and is to include, but not limited to, whether or not the foreign participation may require the prospective proposer to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or if not, the projected timing of the application and any implications for the schedule. Information regarding 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 regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered "Defense Articles" on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

(n) Cancellation of NRA.

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

(End of provision)

APPENDIX D

PROPOSAL COVER SHEET, REQUIRED DECLARATIONS, AND BUDGET SUMMARY FORM

Proposal Cover Page

NASA Research Announcement 01-OES-06

Proposal No. _____ (Leave Blank for NASA Use)

Title: _____

Principal Investigator: _____

Department: _____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ Congressional District: _____
(used for database sorting purposes only)

E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

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

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Budget Request (total, summing all institutions's requirements of NASA):

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

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

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

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

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

Title of Authorizing Institutional Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: _____

Telephone: _____ E-mail: _____ Facsimile: _____

Assurance 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 1972 (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 it retains ownership or possession of the property. In all other cases, 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 recognizes 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 on the Proposal Cover Sheet above are authorized to sign on behalf of the Applicant.

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

1. LOBBYING

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

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

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

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

2. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

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

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

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

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

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

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

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

BUDGET SUMMARY

For period from _____ to _____

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

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

***Facilities and Administrative Costs.**

INSTRUCTIONS FOR BUDGET SUMMARY

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

8. Total Estimated Costs: Enter the total after subtracting items 6 and 7b from item 5.

* Facilities and Administrative (F&A) Costs

APPENDIX E

ELECTRONIC ADDRESSES

The URL references listed below are available for on-line access via the following World Wide Web Home Pages:

- (1) NASA Earth Science Enterprise Home Page:

<http://www.earth.nasa.gov/>

ESE Strategic Plan at: <http://www.earth.nasa.gov/visions/stratplan/index.html>

ESE Research Strategy at:

http://www.earth.nasa.gov/visions/researchstrat/Research_Strategy.htm

- (2) LCLUC Home Page:

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

- (3) LBA Home Page:

http://www-eosdis.ornl.gov/lba_cptec/

- (4) LBA-ECO Home Page:

<http://lba-ecology.gsfc.nasa.gov/lbaeco/>

LBA-ECO Experiment Plan at: <http://lba-ecology.gsfc.nasa.gov/lbaeco/> (select "Experiment Plan" under "About the Project" on the sidebar).

LBA-ECO Mid-Term Review and LBA-ECO Phase I Activities and Analysis at: <http://lba-ecology.gsfc.nasa.gov/lbaeco/> (select "Reports" under "Investigator Information" on the sidebar)

- (5) NASA CRSP Home Page:

<http://www.crsp.ssc.nasa.gov/intro.htm>

- (6) USGCRP Carbon Cycle Science Home Page:

<http://www.carboncyclescience.gov/>

APPENDIX F

REQUIRED PROPOSAL COVER PAGES

Two proposal cover pages are required as part of the proposal. The first is a **hard copy** (see Appendix D) which must be signed by the Principal Investigator and an official by title of the investigator's organization who is authorized to commit the organization. This authorizing signature also certifies that the proposing institution has read and is in compliance with the required certifications printed in full, therefore, these certifications do not need to be submitted separately. This page will not be counted against the page limit of the proposal.

The second proposal cover page (Appendix F) must be submitted **electronically** to the SYS-EYFUS Web site located at <http://proposals.hq.nasa.gov/>. If the proposer obtained a User ID and password in the process of submitting a proposal for a previous research opportunity announcement, the same user UserID and password can be used to complete the electronic proposal cover page in response to this research opportunity announcement.

If you do not have a SYS-EYFUS UserID or password, you may obtain one electronically by going to <http://proposals.hq.nasa.gov> and performing the following steps:

- Click the hyperlink for **new user** which will take you to the Personal Information Search Page.
- Enter your first and last name. SYS-EYFUS will **search** for your record information in the SYS-EYFUS database.
- Confirm your personal information by **choosing** the record displayed.
- Select **continue**, and a User ID and password will be e-mailed to you.

Once you receive your User ID and Password, **login** to the SYS-EYFUS Web site and follow the instructions for **New Proposal Cover Page**.

Proposers without access to the Web may submit only the hard copy with the full proposal. Proposers who experience difficulty in using the Web site should contact the Help Desk at proposals@hq.nasa.gov (or call 202.479.9376) for assistance. After you have submitted your proposal cover page electronically, if you are unsure if it has been successfully submitted, do not re-submit. Please call the Help Desk. They will be able to promptly tell you if your submission has been received. Please note that submission of the electronic cover page does not satisfy the deadline for proposal submission.