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**Earth Science Enterprise
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RESEARCH ANNOUNCEMENT

NASA ENERGY- AND WATER-CYCLE SPONSORED RESEARCH

Including contributions from:
**Global Water and Energy Cycle Focus Area
Terrestrial Hydrology Program (THP)
Land Cover and Land Use Change (LCLUC) Program
Water Management Program (WMP)**

This is the Initial release of this Research Announcement

**Step-1 proposals due – Aug. 24, 2004
Step-2 proposals due – Dec. 1, 2004**

OMB Approval No. 2700-0087

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**NASA Research & Applications
Initial Announcement Soliciting Proposals
for the Period Ending
Step-1 Proposals – Aug. 24, 2004
Step-2 Proposals – Dec. 1, 2004**

NN-H-04-Z-YS-005-N

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

Table of Contents

Cover Page

Table of Contents

I. Funding Opportunity

A. Overview

B. Introduction

C. Project Goals and Proposal Classification

II. Award Information

A. Terms and Level of Funding Available

B. Commercially Available Data Sets

III. Eligibility Information

A. Eligible Applicants

B. Cost Sharing or Matching

IV. Proposal and Submission Information

A. Source of Application Materials

B. Content and Form of the Application Submission

C. Proposal Submission Dates, Time, and Location

D. Proposal Funding Restrictions

E. Additional Information

V. Proposal Review Information

A. Evaluation Criteria

B. Review and Selection Processes

C. Selection Announcement and Award Dates

VI. Award Administration Information

A. Award Notice

B. Administrative and National Policy Requirements

C. Reporting

VII. NASA Contacts

VIII. Concluding Statement

Appendices

NASA RESEARCH ANNOUNCEMENT

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Water Management Program (WMP)

I. FUNDING OPPORTUNITY DESCRIPTION

A. Overview

The NASA vision is: *To improve life here*
 To extend life to there
 To find life beyond

The NASA mission is: *To understand and protect our home planet*
 To explore the Universe and search for life
 To inspire the next generation of explorers

...as only NASA can.

The Earth Science Enterprise is one of six NASA enterprises seeking to fulfill the Agency's vision and carry out its mission, which is articulated in the NASA 2003 Strategy (http://www.nasa.gov/pdf/1968main_strategi.pdf). The ESE mission is to understand and protect our home planet by using our view from space to study the Earth system and improve predictions of Earth system change. This mission is articulated in a series of documents, including the Earth Science Enterprise Strategy, the Research Plan, and the Applications Plan (all available at <http://www.earth.nasa.gov/visions/index.html>). The ESE, working with its domestic and international partners, provides accurate, objective scientific data and analyses to advance our understanding of Earth system processes and to help policy makers and citizens achieve economic growth and effective, responsible stewardship of Earth's resources. The ESE research program aims to acquire deeper scientific understanding of the components of the Earth system, their interactions, and the consequences of changes in the Earth system for life. These interactions occur on a continuum of temporal and spatial scales

ranging from short-term weather to long-term climate and motions of the solid Earth, and from local and regional to global.

The frontier of Earth system science is to: (1) explore interactions among the major components of the Earth system – continents, oceans, atmosphere, ice, and life, (2) distinguish natural from human-induced causes of change, and (3) understand and predict the consequences of change. NASA has established six scientific focus areas for these complex processes. These scientific focus areas are: Atmospheric Composition, Carbon Cycle and Ecosystems, Climate Variability and Change, Earth Surface and Interior, Water and Energy Cycle, and Weather. Roadmaps have been developed to summarize the technology, observations, modeling, field campaigns, basic research, and partnerships needed over time to achieve the long-term goals for each of these focus areas (<http://earth.nasa.gov/roadmaps>). The roadmap for the Water and Energy Cycle focus area provides the strategic framework for research under this NRA. ESE focus areas are interrelated and must eventually be integrated to arrive at a fully interactive and realistic Earth system representation. The opportunities for research offered in this NRA fall within the Water and Energy Cycle focus area, but there are strong interrelationships with other focus areas that must not be overlooked in research plans. Separate research announcements are planned for other ESE-focus areas (see http://research.hq.nasa.gov/code_y/open.cfm); in particular, please note the Oceans and Ice, and Carbon Cycle Science NRAs. The Tropical Cloud Systems and Processes study will integrate aircraft, satellites, ground observations and models, and subsequent analysis of the collected data, to provide a comprehensive view of aerosols, clouds, precipitation, and atmospheric radiation in the tropical region. An NRA released this year, solicits investigators to support this major study, scheduled to initiate in Costa Rica during the summer of 2005.

Five fundamental questions drive ESE research:

- How is the global Earth system changing?
- What are the primary causes of change in the Earth system?
- How does the Earth system respond to natural and human-induced changes?
- What are the consequences of change in the Earth system for human civilization?
- How will the Earth system change in the future?

These core questions represent a paradigm of forcing, response, and the processes that link these and maintain feedbacks within the Earth system. The topics called out by this NRA will help ESE to answer, either in full or in part, the following subset of the Enterprise's 24

second-tier research questions related to the Water and Energy Cycle focus area:

- How are global precipitation, evaporation and the cycling of water changing?
- What are the effects of clouds and surface hydrologic processes on Earth's climate?
- How are variations in local weather, precipitation and water resources related to global climate variation?
- What are the consequences of land cover and land use change for human societies and the sustainability of ecosystems?
- What are the consequences of climate change and increased human activities for coastal regions?
- How can weather forecast duration and reliability be improved?
- How can predictions of climate variability and change be improved?
- How will water cycle dynamics change in the future?

This solicitation seeks to support the NASA-ESE Global Water and Energy Cycle focus area by soliciting participants for NASA Energy- and Water-Cycle Sponsored Research (NEWS). NEWS responds to several of the national, scientific priorities identified by the US Climate Change Science Program (CCSP), which is composed of the Climate Change Research Initiative (CCRI) and the US Global Change Research Program (USGCRP). The goal of CCRI is to accelerate the USGCRP research activities, through multi-agency cooperation, in the next two to five years to assist in the development of public policy and natural resource management tools related to climate change issues.

Internationally, NASA's water and energy research connection is through the World Climate Research Programme (WCRP) - in particular the Global Energy and Water Experiment (GEWEX) - but also including the Climate Variability and Predictability (CLIVAR) and Climate and the Cryosphere (CLiC) research programs. GEWEX has overall international WCRP responsibility for providing an interface with all the national space agencies with respect to global climate research requirements, instruments, data, and science support.

In addition, research activities supported within this announcement will serve the scientific observation and prediction goals of the Global Climate Observing System (GCOS), which is sponsored by the World Meteorological Organization, United Nations Educational, Scientific and Cultural Organization, United Nations Environmental Programme, and the International Council of Scientific Unions. The goals of GCOS emphasize timely detection and effective prediction of changes and trends in the global climate system as high priorities for Earth

science. Moreover, through international, cooperative endeavors within the WCRP such as the Coordinated Enhanced Observation Period (CEOP) as well as partnerships of the Integrated Global Observing Strategy (IGOS) that include the Committee on Earth Observation Satellites (CEOS), research supported under this announcement will constitute notable stride toward the coordinated, global observation and assimilation of key water and energy cycle variables for improved detection and prediction of global change. Through all of these national and international relationships, this solicitation will ultimately facilitate NASA's providing added value to the Earth observations resulting from NASA science and technology research and development, assist in bringing in added satellite calibration/evaluation data sources, and deliver independent observationally-based data sets for evaluating 4-dimensional data assimilation (4DDA) and prediction capabilities on a regional and global basis.

B. Introduction

Earth is a unique, living planet due to the abundance of water and the vigorous cycling and replenishing of water throughout our global environment. The global water cycle represents the transport and transformation of water within the Earth system, and as such, distributes fresh water over the Earth's surface. The water cycle operates on a continuum of time and space scales and exchanges large amounts of energy as water undergoes phase changes and is moved from one part of the Earth system to another. Through latent heat release from condensation and sublimation, the water cycle is a major driving agent of global atmospheric circulation. Energy exchanges are modulated by the interaction of water (in all three of its phases) with radiation. A continuous supply of energy from the Sun keeps the water cycle in motion. So while the water cycle delivers the hydrologic consequences of climate changes, the global water cycle is both a consequence of, and influence on, the global energy cycle. The global water and energy cycles are intimately entwined.

Water is the fundamental and most abundant solvent of the Earth's natural environment. The functioning of the biosphere in our living planet is dependent on variations in accessibility of energy and water, through its role both as a solvent and as a reactant, e.g. photosynthesis. The global water and energy cycles maintain a considerable influence upon the global pathways of biogeochemical cycles. The cycling of water and energy and nutrient exchanges among the atmosphere, ocean, and land help determine the Earth's climate and cause much of climate's natural variability. Natural and human-induced changes to the water and energy cycle have major impacts on industry, agriculture, and other human activities. Increased

exposure and density of human settlements in flood plains and coastal regions amplify the potential loss of life, property, and commodities that are at risk from intense precipitation events. Improved monitoring and prediction of the global water and energy cycle enable improved knowledge of the Earth system that must be nurtured to proactively mitigate future adversities. Current and forthcoming projections of such impacts will remain speculative unless fundamental understanding is assimilated into effective global prediction systems and effective decision support tools applicable to local conditions. Predicting the consequences of global change – whether natural or human-induced – and developing useful science-based applications of climate, weather, and hydrologic prediction systems are paramount challenges of NASA’s ESE Research Strategy and Earth science in general.

This NASA Research Announcement (NRA) solicits participants for NEWS “product-driven” investigations that are performed in direct cooperation with NASA, as well as “discovery driven” investigations that may include independent NEWS, THP, LCLUC, and WMP. Proposers will be prompted to indicate to which category they are responding in their cover page. Principal Investigators (PIs) currently funded under the Global Water and Energy Cycle (GWEC, NRA-00-OES-07) seeking continuation of their investigations are encouraged to respond to this NRA (assuming the research is congruent with the NEWS challenge). For the purposes of this NRA, the following sections detail the requirements, guidelines and scope of each of these proposal categories. Note that while NEWS is intended to be an end-to-end research program, providing integrated solutions for NASA by encompassing contributions to, and use of, NASA technology, observation, research, application, and education, this announcement is intended to primarily support research and application contributions to NEWS.

Participation in this program announcement is open to all categories of domestic and foreign organizations, including educational institutions, industry, non-profit institutions, NASA centers, and other U.S. agencies. In accordance with NASA policy, all investigations by foreign participants will be conducted without any exchange of funds, i.e., investigators whose home institution is outside the United States cannot be funded by NASA.

To lessen the proposal writing burden to the research community, NASA is employing a two step proposal process for this announcement. All prospective proposers are required to submit a brief Step-1 proposal describing the investigation to be proposed to NASA in response to this announcement by no later than Aug. 24, 2004. Appendix A contains a description of the required elements of the Step-1 proposals. By Oct. 24, 2004, prospective

Step-1 proposals will be evaluated, and proposers will be “encouraged” or “discouraged” to submit a Step-2 proposal on or before Dec. 1, 2004. Proposers are required both to submit their Step-1 proposal electronically by following the instructions in Appendix A as well as submit four hard copies that must be received by the Step-1 proposal due date. A Step-1 proposal must be submitted and reviewed in order for a Step-2 proposal to be accepted for consideration. Step-1 and Step-2 proposals submitted to NASA will be evaluated through scientific peer reviews, such as mail reviews and/or panel reviews. Selection of Step-2 proposals and project initiation is expected by TBD.

Standards for Proposing

All policies and procedures for the preparation and submission of proposals, as well as those for NASA’s review and selection of proposals for funding, are now presented in a separate document entitled “Guidebook for Proposers Responding to NASA Research Announcements” that is located at:

<http://www.hq.nasa.gov/office/procurement/nraguidebook/>.

By reference, the newest edition of this “Guidebook for Proposers Responding to a NASA Research Announcement, Edition” 2004 (January 2004)” is hereby incorporated into this NRA, and proposers to this NRA are responsible for understanding and complying with its procedures before preparing and submitting their proposals. Proposal that do not conform to its standard may be declared noncompliant and returned without review.

The other chapters and appendices of this “Guidebook for Proposers Responding to a NASA Research Announcement” provide supplemental information about the entire NRA process, including NASA policies for the solicitation of proposal, guidelines for writing complete and effective proposals, the NASA policies and procedures for the review and selection of proposals as well as for issuing and managing the awards to the institutions that submitted selected proposals, and Frequently Asked Questions (FAQ’s) about a variety of the NASA proposal and award processes and procedures. Note that the NASA policy for proposals involving non-U.S. participants is given in Section (1) of Appendix B of this Guidebook.

Safety is a top priority for all of NASA's programs. As such, all proposers should regard the following statement:

Safety is the freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. NASA’s safety priority is to protect: (1) the public, (2)

astronauts and pilots, (3) the NASA workforce (including employees working under NASA award instruments), and (4) high-value equipment and property.”

Proposers should be aware that funds are not currently available for awards under this announcement. The Government’s obligation to make award(s) is contingent upon the availability of appropriated funds from which payment can be made and the receipt of proposals that NASA determines are acceptable for award under this announcement.

C. Project Goals and Proposal Classification

The US Climate Change Science Program (CCSP) has established the water cycle goals of the Nation’s climate change program (<http://www.climatechange.gov/Library/stratplan2003/default.htm>). Accomplishing these goals will require, in part, an accurate accounting of the key reservoirs and fluxes associated with the global water and energy cycle, including their spatial and temporal variability, through integration of all necessary observations and research tools. To this end, in conjunction with the ESE research strategy, the overarching long-term NEWS grand challenge can be summarized as: ***documenting and enabling improved, observationally-based, predictions of water and energy cycle consequences of Earth system variability and change***. This challenge requires documenting and predicting trends in the rate of the Earth’s water and energy cycling that corresponds to climate change, and changes in the frequency and intensity of naturally-occurring related meteorological and hydrologic events, which may vary as climate may vary in the future. The cycling of water and energy has obvious and significant implications for the health and prosperity of our society. The importance of documenting and predicting water and energy cycle variations and extremes is necessary to accomplish this benefit to society.

The NEWS challenge implies certain constraints on the type and scope of research to be performed under this announcement, as follows:

- 1) The research supported by this announcement is focused on water and energy processes, and dynamics, in the climate system.
- 2) The NEWS challenge is a global scale objective; prediction of water and energy cycle consequences of climate variability and change requires a complete understanding of global-scale teleconnections and feedback processes.
- 3) NASA currently has significant water and energy cycle system components (observations and predictions) that need to be integrated as part of this announcement

to accelerate near-term progress.

- 4) Research proposals submitted to this announcement are to contribute unique efforts to advance our nation's goals for water and energy cycling studies. The focus is on developing, testing, and implementing approaches using innovative global environmental information from NASA's research programs that contribute to enhanced predictive capability for the water and energy cycles. Under the programmatic auspices of the NASA ESE Strategy, the progression of the key research elements is constructed as: Variability, Forcing, Response, Consequences, and Prediction. The progression of these descriptive research headings is aimed at the overarching NASA ESE goal to understand the changes in the Earth's systems and predict their consequences for life on Earth. The more specific NEWS strategic elements of Observation, Understanding, Models, Prediction and Consequences (Figure 1) are focused on making decisive progress toward documenting and enabling improved, observationally-based, predictions of water and energy cycle consequences of Earth system variability and change. The NEWS strategic elements are consistent with the NASA-ESE elements in that they represent an end-to-end and integrated research program, while identifying specific research integration activities designed to make decisive and measurable progress towards the NEWS challenge. Figure 1 outlines a progressive path from NASA's unique water and energy cycle observation capabilities towards the development of useful prediction skill. It is also recognized that the research element path described in Figure 1 will require iteration amongst its components.
- 5) Project proposals must explicitly describe their approach to make decisive progress toward the NEWS challenge in support of the NASA water and energy cycle roadmap (see <http://earth.nasa.gov/roadmaps>) plan. This is particularly important, as the roadmap is fundamental in communicating NASA's program to its sponsors and stakeholders.
- 6) NASA administers the water and energy cycle focus area as an end-to-end program that includes transitioning its research to academic/public education and real-world applications,

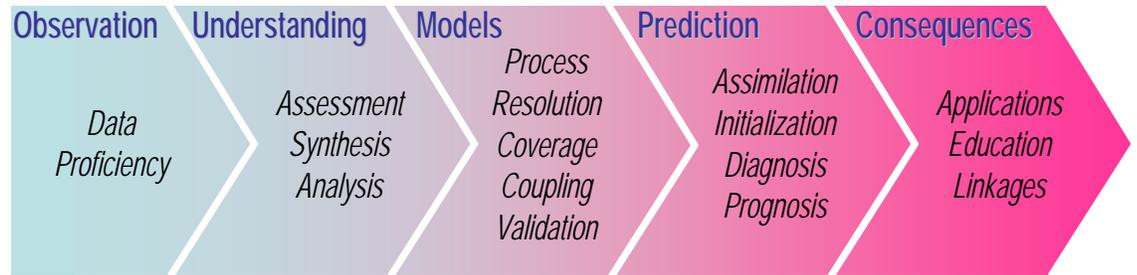


Figure 1: Conceptual NEWS research path from observations to useful predictions and their consequences, highlighting required research elements.

through partnerships with other entities, including other Federal agencies.

Because the Earth’s water and energy cycle is central to the mechanics and impacts of climate change, NASA’s Earth Science Enterprise (ESE) seeks to advance and integrate water and energy-cycle observation, scientific understanding, and ultimately its prediction to enable society to cope with future climate adversities. Discovery-driven water and energy research projects carried out by individuals or small groups of scientists have yielded significant advances in our understanding of key Earth-science processes. However, to facilitate product-driven coordination and integration of cross-discipline applied research that meet the NEWS challenge, the compendium of these water and energy cycle discoveries must be unified and integrated into a comprehensive and coordinated science solution. A coordinated team effort is required that will integrate NASA’s global water and energy-cycle resources to directly address the NEWS challenge.

NASA Earth science research investments have resulted in water and energy cycle observation capacity, data resources, and scientific expertise (see Appendix I) that can be integrated to contribute progress toward addressing the NEWS challenge. As part of this NRA, we solicit product-driven NEWS investigators who collaborate for the purpose of integrating these NASA Earth Science Enterprise system components to make decisive progress toward documenting and enabling improved, observationally-based, predictions of water and energy cycle consequences of Earth system variability and change in accordance with the NASA water and energy cycle roadmap (see <http://earth.nasa.gov/roadmaps>).

Recognizing the central importance of discovery-driven research projects that support the scientific expertise available to NASA, and exploring new scientific frontiers, a selection of discovery driven NEWS investigations will also be funded that will independently develop

and improve NASA’s base capabilities and system components.

Research proposals under this NRA can be submitted in one of two categories, which are:

- (1) product-driven NEWS investigations directly cooperating with NASA, or
- (2) discovery-driven NEWS investigations that address NEWS challenge and other relevant NASA ESE science goals, but are too preliminary to be integrated in the NEWS team.

Proposers will be prompted to clearly indicate to which category they are responding in their cover page. The following sections detail the requirements, guidelines and scope of each of these proposal categories.

Table 1: *Examples of discovery versus product driven NASA Energy and Water Study (NEWS) investigations. Please note these are not representative of the breath of research needed to reach the NEWS challenge, but rather are presented to help distinguish product versus discovery driven research.*

	Discovery-driven NEWS investigations	Product-driven NEWS investigations
Observation and Understanding	Improve observation capability, characterization and understanding of a single variable	Integrate multiple NASA observations to characterize and understand processes that link key parameters
Modeling	Develop a new or improved model component	Integrate well-proven model component(s) into NASA assimilation or prediction system
Prediction	Develop a new data assimilation method	Integrate observations into NASA prediction system to enable better prediction
Consequences	Develop a new capability with an application component (e.g. downscaled monitoring/prediction product).	Integrate existing prediction and decision-support systems to facilitate management and public-policy decisions.

a. Participation in product-driven NEWS research projects and the NEWS team

Product-driven NEWS investigations will be constituted to integrate and focus NASA’s expertise for addressing water and energy cycle questions.

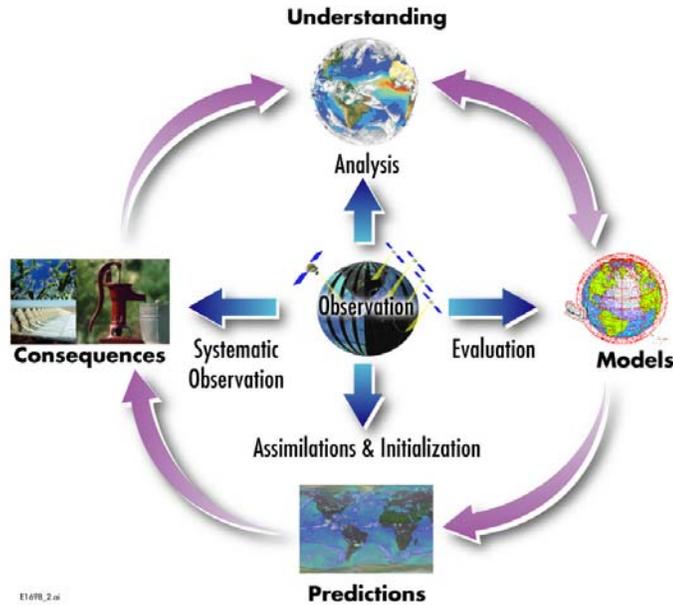


Figure 2 NEWS end to end research strategy

The overarching goal of the product-driven NEWS investigations will be to integrate NASA Earth Science Enterprise System Components (Appendix I) to make *decisive progress toward the NEWS challenge*. To achieve this objective, the product-driven NEWS investigations will integrate and interpret past, current, and future space-based and in-situ observations into assimilation and prediction products and models that are global in scope. These activities will serve efforts to improve understanding, modeling, and information for global prediction systems (Figure 2). To achieve these goals, the NEWS product-driven investigations must recognize that accurate prediction of not only trends, but also extremes and abrupt changes, is a key step toward useful applications. The critical feedbacks within the overall NEWS strategy (Figure 2) are the lessons that scientific analysis, model, prediction and consequences can guide and identify the technological and observational requirements of future NASA missions.

The NEWS product-driven investigations will be focused and served by a NEWS integration group (see Appendix G) comprised of scientists associated with NASA centers whose primary responsibility is to support NEWS investigations and integrate their research results to address NASA-ESE science questions. The NEWS integration group will serve as an interface to NASA system components (Appendix I), and to coordinate and integrate the results of the NEWS product- and discovery-driven investigations. The NEWS integration group will actually work with NEWS investigations to implement their results into a larger

coordinated product, such as a NASA model, data system, etc. The exact nature of the NEWS integration group cannot be fully specified until the NEWS product-driven and discovery-driven investigations are selected. Shortly after the selections are made for this NRA, the entire NEWS team will identify the gaps and specify the activities required of the NEWS integration group. The NEWS team will be comprised principally of the NEWS discovery-driven, product-driven, and integration investigations, but will also be open to any relevant water and energy cycle investigator. The NEWS integration group will provide a pathway for the results of NEWS investigations to be implemented and retained as NASA system components.

In the NEWS context, “integration” means that resources must be specifically combined and applied to diagnose the key exchange processes within the energy and water cycles. Also, rigorous analyses of uncertainties are important to establish benchmarks of knowledge for observations and prediction parameters. These processes and parameters must necessarily include radiative/heat exchanges, the transport of water vapor (in the atmosphere) and liquid water (i.e. runoff and river discharge into the oceans), but emphasis is also to be placed on the main water transformations, such as: evaporation from the surface (both land and ocean), snowmelt, and the formation of clouds and precipitation. Surface-atmosphere interactions (including the atmospheric boundary layer) and cloud processes are crucial areas of research.

The NEWS strategic elements of Observation, Understanding, Models, Prediction and Consequences are focused on making decisive and measurable progress towards the NEWS challenge (Figure 1). The NEWS strategic elements are described in more detail below.

1) **Observation:** Substantiate and facilitate observations of the global water and energy cycles that will: address long-term research and prediction needs and; monitor the water- and energy-cycle consequences and feedbacks to climate variation and change.

- Collection, assembly and processing of currently available data to produce global, long-term data products that can be used to characterize the variations of the water and energy cycles, including reservoir budgets and exchanges among reservoirs. Error assessment and mitigation must be addressed; community-aggregated information must also be made easily accessible to stakeholders in a form they can use.
- Assess the current water and energy cycle observation technology/capabilities. In doing so, define the data requirements as well as technological advancements for future integrated climate observation systems that will gain knowledge and value-added

information about the global water and energy cycles.

2) **Understanding:** Integrate current observational resources to decipher the Earth's water and energy cycle systems; determine how their process-level components work, what their drivers are and the predictable nature of their variations and extremes.

- Quantification of the water and energy cycles that include balances of fluxes and storage terms, comparison of data products from multiple sources, budget variation and closure accuracy assessments, and measurement and analysis error assessments.
- Unification, calibration, and time/space continuity of data from disparate instruments and platforms. These efforts should illustrate the scientific value added and/or synergy obtained.
- Diagnosis of exchanges and factors controlling water and energy cycle variations, diagnostic analysis of the global, long-term data products, augmented by more detailed experimental data analysis, to improve understanding of the processes controlling the water and energy cycles and to assess the predictability of their variations.

3) **Models:** Integrate current knowledge of global water and energy processes and human systems into predictive models for optimal management of water resources.

- Develop and improve models, based on data from NASA satellites and/or field campaigns, that *explicitly* represent the critical processes (e.g. clouds, boundary layer and terrestrial) of the water and energy cycles.
- Develop data-driven models capable of resolving climate anomalies at the spatial and temporal scales that are useful for regional management of water and energy resources.
- Move towards data-driven climate models that statistically represent the relevant process- and application-scale conditions and extremes (not just mean states or area-averaged quantities) and the capability to run climate models at spatial resolution that allows explicit simulation of weather systems.
- Implement numerical techniques (e.g. “super-parameterization” or similar mosaic/statistical sub-grid sampling methods) that couple the process-level representations and physical models (e.g. land, ocean, cryosphere, and ecosystem) into global prediction systems.
- Focused evaluation and verification of the developed model components using data

obtained from NASA satellite missions and field campaigns.

4) **Prediction:** Contribute to the national goals for the development of global model systems to predict water- and energy-cycle consequences of climate variations and changes through the innovative usage of NASA produced data.

- Capability to constrain climate models with global measurements of thermodynamic and hydrologic data, and directly compare time-dependent model products to global observations at the same location and time (as is done in numerical weather prediction).
- Develop and enable prediction systems that can systematically and consistently use global retrievals of atmospheric, ocean and terrestrial variables for initial-value conditions. These systems must also be flexible and adaptive to pending and future satellite information.
- Comprehensive and quantitative evaluation of the global “prediction system” (this includes the models, assimilation and initialization systems) for simulating observed and predictable variations and extremes.
- Provide for the development and operation of a data-driven water and energy cycle global prediction system. In doing so, design a flexible numerical framework for the testing and integration of new methodologies and (satellite-based) information with the aim of providing a unique contribution to the nation’s water and energy cycle global prediction goals.

5) **Consequences:** Link water- and energy-cycle science and prediction to Earth system science, technology, and application, as follows:

- Determine specific decision support tools to serve end-user needs and define observing systems, research, and prediction systems that can be assimilated into the tools. Evaluate the potential for and integrate NASA products into national decision support systems.
- Disseminate advances in technology, understanding, monitoring and prediction to the public as well as educate the research community on the needs of end users, and facilitate research defined by these needs.
- Link water and energy research with other components of Earth system science, technology, and outreach activities that include (but are not limited to): *carbon cycle, biogeochemistry and ecosystems, atmospheric composition and Earth structure and*

interior.

The expected long-term outcomes of NEWS are enhanced data sets documenting the global distribution and variability of key water and energy cycle parameters and improvements to the nation's *global water- and energy-cycle prediction systems* that can be used to quantify the hydrologic consequences of given climate change scenarios and produce seasonal and longer-range hydrologic predictions based on relevant initial value data from global observation systems. The NEWS product-driven investigations will focus on integrating data from NASA satellites and/or integrated satellite and suborbital field campaigns into unified data sets and model developments from process-level to global models, and pursue the necessary coupling and nesting strategies to establish the algorithms that represent the global, physical and dynamical system. This next-generation prediction system will be founded upon existing "state-of-the-art" climate models, and advances will be realized through the use of integrated water and energy cycle observations (space-based, airborne, and in-situ) that will: facilitate improved empirical understanding of physical processes; exploit the predictability of the global water and energy cycles as well as improve model physics, initialization, assimilation, and prediction. This effort will take advantage of NASA's existing modeling, data assimilation, and observation expertise. It will also, however, rely heavily on contributing and collaborating research from other government agencies and the community-at-large through NEWS coordinated research and funding.

Proposers who wish to cooperate directly with NASA as part of a product-driven NEWS investigation should provide a clear description of which of the five aforementioned key research elements (Observation, Understanding, Models, Prediction and Consequences), and their relevant sub-element foci (i.e. Figure 1), that will be served. The integration of NASA products in pursuit of the NEWS challenge is an important aspect of product-driven NEWS investigations. Respondents should clearly identify and justify the NASA-ESE system components that will be utilized and integrated during the course of their proposed research, such as: satellite data, models, technologies, and application and/or education tools (see Appendix I). Based on the research elements addressed and extent of the integrating activities, the specific terms of NASA collaboration within the NEWS product-driven investigations will be established after projects are awarded or during project negotiation (see Section III A).

Selected NEWS investigations will be expected to interact proactively with the entire NEWS team to optimize progress toward integrating NASA Earth Science Enterprise System

components to make decisive progress toward the NEWS challenge. This will require some modification of investigators' tasks to optimize integration (i.e. identify and eliminate areas of potential overlap) and fill NEWS team gaps as they become apparent. This will require frequent communication via telephone conferences and by attending at least two NEWS team meetings per year. The first task of the NEWS team will be to develop the end-to-end NEWS implementation strategy. A required NEWS team kick-off meeting will be held shortly after announcement of NRA selections (see <http://wec.gsfc.nasa.gov> for more details). The NEWS team will encourage the participation of non-NEWS investigators through open team meetings, telecons, and workshops. Finally, frequently asked questions concerning this NRA will be publicly available at <http://wec.gsfc.nasa.gov/news.html>.

b. Discovery-Driven NEWS, THP, LCLUC, and WMP Investigations

Recognizing the central importance of discovery-driven research projects to develop, improve, and mature NASA's base capabilities and expertise and to explore new scientific frontiers, a crosscut of discovery-driven water and energy cycle research projects will also be established in support of the NEWS challenge. These discovery-driven investigations may act independently from the overall NEWS team, pursuing research that promises to contribute to the NEWS challenge, but may not result in science advances that are sufficiently conclusive to be integrated by the NEWS team. NASA is seeking research activities that cut across traditional program boundaries, or lie outside traditional disciplinary programs, and focus on improvements of observation capability of specific variables and processes of water and energy cycle and developments of new or improved models and data assimilation methods for predictions.

Additional contributions from disciplinary NASA-ESE programs, specifically the NASA *Terrestrial Hydrology Program (THP)*, the *Land-Cover and Land-Use Change Program (LCLUC)*, and the *Water Management Program (WMP)* are also being made through this announcement. Proposals to conduct research under these programs are also solicited. Disciplinary projects submitted to this announcement that do not address discovery-driven NEWS research, the Terrestrial Hydrology Program, the Land-Cover and Land-Use Change Program, or the Water Management Program may be considered non-responsive. These proposals may instead be submitted to the relevant disciplinary programs that are already working towards ESE goals (<http://earth.nasa.gov/researchopportunities>). A more detailed description of the discovery-driven NEWS investigations, THP, LCLUC, and WMP research

solicited by this announcement is given below.

The terms and guidelines of potential awards are outlined in Appendix B. Selected discovery-driven NEWS investigations will be invited to participate in a NEWS kick-off meeting to be held shortly after announcement of selections (see <http://wec.gsfc.nasa.gov> for more details), and to participate in at least one NEWS coordination meeting per year.

1. NASA Energy and Water Study (NEWS) Discovery Investigations

The thrust of NASA's ESE research strategy is based upon a hierarchy of science questions (Table 2) and embraces many Earth-science disciplines (e.g. atmosphere, hydrology, oceanography, ecology, and geology), thereby substantiating the need for integrated, cross-cutting research focus areas (e.g. Carbon Cycle and Ecosystems, Global Water and Energy Cycle, Atmospheric Composition, Weather, Climate Variability and Change, and Earth Surface and Interior). Within the context of NEWS, many of the NASA ESE questions to be answered either engage in studies of processes, storages, fluxes and feedbacks or require in tandem, improved understanding and prediction of the global water and energy cycles (therefore denoting a critical, synergistic link to other cross-cutting themes such as biogeochemical cycles). While NEWS cannot address all of the science described in the overall NASA ESE strategy, a number of key questions can and will be pursued. For the purpose of this announcement, the more specific research questions relevant to this NRA were presented in the opening section of this announcement (p. 4) and are articulated in the ESE research strategy. It is recognized that pursuit of the NEWS challenge will require interdisciplinary research. Therefore, discovery-driven research that bridges NASA-ESE research focus areas (Carbon Cycle and Ecosystems, Global Water and Energy Cycle, Atmospheric Composition, Weather, Climate Variability and Change, and Earth Surface and Interior) will also be supported. Projects addressing these identified questions will be selected based jointly on scientific merit and the building of a balanced program. Proposals for discovery-driven NEWS investigations should clearly indicate which of the foci questions will be addressed.

The water and energy cycle questions highlighted in this NRA represent a considerable cross-cut of traditional scientific disciplines, and also encompass many of the NASA ESE programs that support Earth-science research. Investigations that (1) develop or improve a NASA satellite product to analyze aspects of water and energy exchanges, (2) emphasize global and long-term analysis of NASA products, (3) use NASA observations to develop or

improve a process-level model component or data assimilation method, and (4) use NASA observations to develop or improve a capability to augment a decision support system will be responsive to this announcement.

The NASA-ESE administers significant resources to study the processes that constitute the Earth system. NASA is specifically seeking discovery-driven NEWS research investigations that cut across traditional program boundaries, or lie outside traditional disciplinary programs. To diagnose and model the forced and unforced responses of the Earth system successfully, there are some processes that need specific additional attention because they provide key coupling of Earth system components and are currently poorly understood: (i) clouds-precipitation-dynamics, including cloud-aerosol interactions, that couple the water and energy cycles, (ii) surface-atmosphere energy and water exchange processes that couple the land and ocean to the atmosphere, (iii) land water storage, including snow and hydrological processes, that provide the long-term memory to the water cycle part of climate, (iv) ocean heat storage (mixing) processes that provide long-term memory to the energy part of climate, (v) sea ice processes that couple the polar ocean and atmosphere, and (vi) observation and modeling of precipitation processes. Topics (iv), (v), and (vi) are covered by existing NASA-ESE disciplinary programs and should therefore be submitted to appropriate announcements made by those programs. Proposals addressing items (ii) and (iii) are encouraged to respond to THP and LCLUC programs outlined in the next two sections of this announcement but not to the NEWS component of this announcement. Discipline-based research proposals submitted as discovery-driven NEWS investigations whose discipline is already included within existing NASA programs (see Appendix K) will be deemed unresponsive to this announcement. If a NEWS related prospective disciplinary investigation is not sufficiently addressed by any existing NASA-ESE program (such as item (i)), it would be responsive to the discovery-driven NEWS section of this announcement. Finally, a prospective investigation that includes multiple disciplines (and therefore would likely not be normally related to a disciplinary program call) would be especially welcomed.

As noted above, proposals concerning item (i): model and data analysis studies of cloud-precipitation-aerosol processes, are especially encouraged under the discovery-driven NEWS component of this announcement. Such studies must be attacked by a coordinated process-model and data analysis program based on NASA produced data following the methods of the GEWEX Cloud System Study (GCSS) (see <http://www.gewex.org/gcss.html>), where teams of modelers and data analysts work on common problems. The datasets needed for these focused studies can come from specific NASA integrated satellite and suborbital field

experiments in combination with experimental NASA satellite observations and also from the integrated analysis of long-term observations, like those being produced at the U.S. Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) Program sites, with longer-term NASA satellite observations. The models used to study these processes can encompass a range from the most detailed process-models to the study of new parameterization ideas in global models. These specific activities must be coordinated to enhance the interpretation of the global, long-term datasets.

2. NASA Terrestrial Hydrology Program (THP) Discovery Investigations

The NASA Terrestrial Hydrology Program (THP) has the scientific objective “to use remote sensing to develop a predictive understanding of the role of water in land-atmosphere interactions, and to further the scientific basis of water resources management.”

The NASA Terrestrial Hydrology Program (THP) uses NASA’s unique view from space to study hydrologic processes associated with runoff production, hydrologic fluxes at the land-air interface and terrestrial water stores. THP fosters the development of hydrologic remote sensing theory, new hydrologic satellite missions, hydrologic remote sensing field experiments, and the interface of hydrology with other disciplines, such as ecology. Particular emphasis is placed on the application of satellite-based remotely sensed data for characterizing, understanding, and predicting the terrestrially linked components of the hydrologic cycle and the dynamics of large-scale river basins. THP is currently focused on research involving the Soil Moisture Experiments (SMEX), Cold Land Processes Experiment (CLPX), NASA GEWEX Americas Prediction Project (GAPP), Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA), and community working groups for soil moisture, cold land processes, and surface water processes. Future support will include projects under the emerging international program NEESPI (Northern Eurasia Earth Science Partnership Initiative, <http://neespi.gsfc.nasa.gov>). A complete description of the Terrestrial Hydrology program (formerly called Land Surface Hydrology Program) is located at the following URL: <http://thp.gsfc.nasa.gov>. Description of the soil moisture, cold land processes and surface water processes working groups can be found through this URL.

Research is solicited for observational and modeling studies designed to understand large-scale dynamics of the terrestrial hydrosphere. This should include improving observation, understanding and prediction of the magnitude, trend, timing, and partitioning of terrestrial water stores and fluxes. Examples of terrestrial stores include water contained in the soil, subsurface, snowpack, rivers, lakes, and wetlands. Fluxes involve movement of water

between these reservoirs, as well as the atmosphere, cyrosphere, and ocean reservoirs.

Specific research foci include the following:

- Development of the scientific basis for observing and modeling large-scale terrestrial water-storage dynamics with emphases on how these processes are affected by the heterogeneity of soil, vegetation, precipitation, and topography and their interaction with various biogeochemical cycles.
- Enhancement of hydrologic model capability and performance through modern data assimilation techniques to incorporate remotely sensed observations.
- Understanding and characterizing regional to global scale variability and prediction of fluxes and storages of the terrestrial hydrosphere. As an example: characterization of terrestrial hydrologic variability including understanding the causes of variability, and the delineation of natural and human-induced effects.
- Remote sensing of hydrologic fluxes, states and parameters. As an example: development of new and innovative remote sensing techniques, including combined active and passive microwave observations, to improve understanding of the variability of the terrestrial hydrosphere.
- Theoretical scaling between: point hydrologic processes, satellite pixel scales, and global climate model grid scales.
- Terrestrial hydrologic controls on the Earth's weather and climate. Research may include the role of feedback effects of terrestrial water and energy stores and hydrologic processes on the regional to continental scale hydrologic cycle, including soil moisture, snow, and freeze-thaw, on the local weather and climate, and how those feedbacks effects are modified under global change scenarios.
- Scientific justification of new measurements, both those involving satellites and possible long duration suborbital platforms. Research may include development of Observing Simulation System Experiments (OSSEs) or other investigations to support:
 - i) application of new technologies for remote sensing hydrologic quantities and for terrestrial hydrologic interpretation
 - ii) studies on appropriate spatial and temporal sampling scales of new sensors for satisfying specific scientific objectives

iii) understanding the enhancement on prediction systems by potential missions

Research efforts are encouraged to leverage off of various NASA system components (Appendix I), including Earth observations from Terra, Aqua, and the Gravity Recovery and Climate Experiment (GRACE), and available field experiment data. Assistance obtaining data from field experiments supported by THP can be found at the program's website (<http://thp.gsfc.nasa.gov>).

There are multiple geographic regions of emphasis for which research is particularly solicited. These areas include northern Eurasia (<http://neespi.gsfc.nasa.gov>) and the La Plata basin of South America. The THP supports those works involving the various GEWEX Continental Scale Experiments, for example GAPP and LBA.

To maximize efficiency using research resources it is important to maintain focus on NASA's role in emerging critical research areas. Therefore, the NASA Terrestrial Hydrology Program supports three working groups focused on soil moisture, cold land processes, and surface water processes (see <http://thp.gsfc.nasa.gov>). These working groups enable the research community to self-organize to better use the resources currently available, and to develop methods to optimize future satellite missions. Participation in these working groups is encouraged, and will be supported under this NRA.

3) NASA Land Cover and Land-Use Change Program (LCLUC) Discovery Investigations

NASA's LCLUC program aims to develop and use NASA remote sensing technologies to improve understanding of human interaction with the environment, and thus provide a scientific foundation for understanding the sustainability, vulnerability and resilience of land cover and land use systems. In so doing, a major goal of the ESE LCLUC Program is to further the understanding of the consequences of land-cover and land-use change on environmental goods and services, the carbon and water cycles and the management of natural resources.

Biophysical phenomena and human activities that drive changes in land cover and land-use and modify ground surface hydrology include changes in agricultural or grazing practices, fires, droughts and flooding, forest exploitation and clearing, wetlands loss and urbanization. Each of these examples can cause considerable disturbance, stress or permanent change to natural and managed ecosystems, with regional and global implications. Individually and in combination, changes in land-cover and land-use can impact hydrological regimes.

Incorporation of a land-use component in climate models is important for developing scenarios of various climate-change impacts on land-use change. Proposals are solicited to develop an improved understanding of the impacts of climate change on land cover and land use at a regional scale. This understanding can be developed through a combination of satellite data, ancillary information and modeling. Satellite data provide information on the current land cover and recent changes.

This NRA welcomes proposals to study the following LCLUC science questions:

- What are the current patterns and attributes of land use and land cover at national to global scales that affect atmospheric and surface hydrological processes?
- Where are the current areas of rapid land use and land cover change at the national and global levels leading to land degradation and affecting water resources?
- What are the most significant drivers and opportunities for managing land use change to minimize negative impacts and maximize positive outcomes on the water cycle?
- How, and to what extent, do extreme events (e.g., droughts, floods, and fires) affect land-use and land-cover change?

This particular NRA focuses on the following three topics.

Topic 1. Water resources in semi-arid regions: feedbacks of LCLUC and surface hydrology as related to human vulnerability. Droughts and associated land degradation are large-scale phenomena affecting hundreds of millions of people who live in semi-arid ecosystems. Mitigation of drought and desertification has been on scientific and political agendas for at least 30 years. Changes in land cover and land use are closely related to water processes at the land surface. Water availability, to a large part, determines the distribution of agriculture. Changes in precipitation regimes can result in changes in land use, and, in turn, land use affects hydrological processes at local to regional scales. Changes in land use can impact hydrological processes by altering run-off, ground water, soil erosion and water quality. Increasing demand for and inadequate supplies of water are now drawing attention to land use and water management. Thus, there is an urgent need for improved scientific understanding of the impacts of land use change on hydrological processes.

Funded projects will carry out studies utilizing remotely sensed data to advance our understanding of land-cover and land-use change as related to land surface hydrology over a range of space and time scales. Such studies will, for example, address the hydrological impacts of land-cover and land-use change in relation to human vulnerability, drought

susceptibility, or changes in water quality. The focus of this NRA is on semi-arid regions, where human livelihood and land use are closely tied to water supply. Some semi-arid regions are undergoing rapid social, economic or demographic changes and there is a need for a stronger scientific underpinning to resource management. Priority will be given to studies of a regional to global scale and significance.

Topic 2. LCLUC and Flooding. Flooding represents an extreme event affecting people's lives and economies. Changing land use within catchments can impact run-off positively or adversely, increasing or decreasing the potential for flooding. Land located along rivers has always been very attractive for human societies. These lands are often fertile and thus are convenient for human settlement with access to transportation networks but are often subject to inundation by floods. Management of floods and planning of floodplain land use is a fundamental issue where structural and non-structural actions have to be combined in order to achieve social and ecological goals in a satisfactory way. Floods are considered one of the leading natural threats in many countries. The adverse human impact of flooding can be ameliorated by appropriate land use practices. Human vulnerability and ecosystem sustainability, vulnerability and resilience to the aforementioned natural hazards are of particular importance in view of potential changes in their frequency due to global climate change. Proposals are solicited to study the effects of land use change on flooding and the effects of flooding on land cover and land use, based on NASA remote sensing satellite system (i.e. Landsat, EO-1, Terra, etc.).

Topic 3. Urban growth impacts on surface hydrology. High resolution satellite data (e.g. Landsat data) collected over the past two decades provide the basis for quantifying and understanding changes in land cover. Satellite data, when combined with information from other sources and an understanding of the processes of change, can be used to drive models projecting future land use change. Rapid land-cover change has occurred associated with urban areas, for example resulting in the loss of agricultural land. Research is required to develop satellite driven land use and land cover projections of urban and suburban growth and its impact on the hydrologic cycle. The models developed should address the necessary spatial and temporal scales, and include the necessary physical, biological, and social factors and processes of interest, to ensure that projections of land use and land cover can be incorporated in the study of impacts. The focus of this topic is on the observed and projected changes in urban land use and land cover and how these changes in turn impact social, economic and physical systems, as related to water cycle. Proposals are solicited to develop satellite driven models projecting land cover change with "smart growth" applications.

Emphasis should be on regions of significant urban expansion and impact.

A primary region of interest for the LCLUC part of this NRA is northern Eurasia (all land areas in the Eastern Hemisphere north of 40 N latitude and east of 15 E longitude.) These funded project studies for this region are expected to contribute to a new international program - the Northern Eurasia Earth Science Partnership Initiative (NEESPI). The goals of this program and other details can be found at <http://neespi.gsfc.nasa.gov>. The focus of the water resources component of this section of the NRA is on arid regions of Central Asia where semi-arid arable lands have been subject to rapid socioeconomic changes. Regional-scale proposals that demonstrate strong linkages to in-country scientists involved in research on the topic will receive priority.

Scale becomes an extremely important issue when quantifying the impacts of land cover and land use change. Impacts that can be identified and characterized at regional or global scales have had a great effect in framing important research questions and dramatically pointing to the magnitude of certain problems (e.g. deforestation, environmental degradation, drought). Detailed characterization and quantification of impacts have generally relied on in-situ or high-resolution observations at the more local scale, typically at the scale of the Landsat Thematic Mapper (c. 30m). This dichotomy of scale presents a challenge to our fundamental understanding of LCLUC processes and impacts. High-resolution data are clearly critical for identifying LCLUC pathways and impacts, but there remains the need to consider how these local observations feed into a regional view. The availability of higher spatial resolution sensors, geographically comprehensive data acquisition strategies, and frequent observations coupled with expanding capacities for investigators to analyze large data volumes will likely lead to a better merging of these approaches in the future. Regional scale high resolution analyses are now feasible and have been demonstrated by the previous LCLUC funded projects.

The LCLUC investigators selected by this NRA will join the LCLUC Science Team which includes selected investigators from other peer-reviewed projects and programs within ESE. The Science Team meets once a year as a whole to review progress, report results, advise ESE on new research directions. Funding for travel to Science Team meetings, usually held in the US for about 3 days, should be incorporated in the proposed budget.

The projects selected by this NRA with research on processes in northern Eurasia will also become part of the NEESPI program and the selected investigators will become members of

the NEESPI Science Team. The NEESPI Science Team will meet once a year, with meetings held alternately in the US and in northern Eurasia. Funding for travel to these meetings should be incorporated in the proposed budget.

4) NASA Water Management Program (WMP) Discovery Investigations

The NASA-ESE Water Management Program (WMP) specifically targets the use of existing water and energy cycle knowledge, science, and technologies resulting from the ESE mission to improve decision support systems. A depiction of the WMP's plans can be found in its roadmap, visible at <http://wec.gsfc.nasa.gov/wmp/roadmap.html>

The Earth Science Applications program of the NASA Earth Science Enterprise (ESE) benchmarks practical uses of NASA-sponsored observations (from remote sensing systems) and predictions from scientific research and modeling. NASA implements projects through partnerships with public, private, and academic organizations. These partnerships focus on innovative approaches for using Earth science information to provide decision support that can be adapted in applications worldwide.

The program focuses on applications of national priority to expand and accelerate the use of knowledge, science, and technologies resulting from the ESE mission of improving predictions in weather, climate, and natural hazards. The approach is to enable the assimilation of Earth science model and remote sensing mission outputs to serve as inputs to decision support systems (DSS) that serve society. These DSSs would be benchmarked, before and after the addition of NASA-based inputs to gauge improvement.

This solicitation specifically targets the use of existing water and energy cycle knowledge, science, and technologies resulting from the ESE mission, to improve decision support systems. NASA seeks proposals that link NASA water and energy cycle data products and model outputs with national or international decision support systems and benchmark their utility.

Projects descriptions must have the following pieces of information clearly detailed in their proposals.

1. Clear identification of the existing NASA water and energy data product (either satellite or model output) to be incorporated into the DSS.
2. Identification of the decision support system to be augmented and the organization

that employs this DSS.

3. A description of how the NASA satellite or model data product will enhance the performance of the DSS.
4. An outline of the steps necessary to infuse the NASA data into the DSS.
5. A plan for benchmarking the results of the data infusion, i.e. clear demonstration that the NASA data improves the performance of the DSS.

Investigators are strongly encouraged to seek collaborators from the agencies that employ the chosen DSS. Cost sharing with these agencies and organizations of the total project cost is encouraged and will be considered as part of the selection process.

NASA's typically global-scale water and energy cycle data products cover portions of the Earth that are not well monitored by in situ observation data systems. As such, NASA data may be capable of producing large improvements in decision support systems that cover these regions of limited in situ data availability. For that reason this solicitation encourages the exploration of DSSs that are employed either nationally, internationally, or both. For DSSs covering international areas, the appropriate federal partners may be, but are not limited to, The Department of State or US Agency for International Development (USAID).

II. AWARD INFORMATION

A. Terms and Level of Funding Available

As selected proposals will be funded during fiscal years 2005-2009, funds are not currently appropriated by the U.S. Congress for award under this NRA. The Government's obligation to make award(s) is contingent upon the availability of appropriated funds from which payment can be made and the receipt of proposals that NASA determines are acceptable for award under this NRA. The anticipated levels of available funding and the guidance for project sizes for the various components of this NRA are summarized below. It is estimated that roughly 32 million dollars will be award over the first three year time period, increasing to a total of 38 million dollars over the entire five year period. Proposed projects with budgets exceeding the suggested maximum project funding (see below) will be accepted but must clearly demonstrate exceptional technical merit that warrants the elevated funding level. Once the product-driven NEWS investigations are selected, the specific nature and terms of NASA collaboration (i.e. NASA tools utilized and developed, deliverables, and milestones) will be negotiated. NASA recognizes the need for a longer-term commitment to realize its water and energy cycle research goals. This commitment is reflected in the potential for longer-term, up to 5 year, product-driven NEWS investigation awards. However, it is recognized that the NEWS challenge will not be realized in the timeframe of this NRA, but rather this NRA will decisively *move towards* these NEWS challenge.

Available funding and project guidance

	Available Funding (millions per year)	Maximum Project Funding (thousands per year)	Duration (years)
<i>Product-Driven NEWS Investigations</i>			
NEWS Product	3	300	3-5
<i>Discovery-Driven NEWS, THP, LCLUC, and Water Management Investigations</i>			
NEWS Discovery	2	200	1-3
THP	3-4	200	1-3
LCLUC	1-1.5	200	1-3
Water Management	1	200	1-3

NASA computational resources may be requested in support of projects funded under this NRA.

B. Commercially 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 they meet scientific requirements and are cost-effective. When responding to this

NRA, the proposer should identify the commercial data sources intended for use and the associated cost. Costs for any other types of required data should also be identified in the budget request.

III. ELIGIBILITY INFORMATION

A. Eligible Applicants

Participation in this program is open to all categories of U.S. and non-U.S. organizations, including educational institutions, industry, nonprofit institutions, as well as NASA centers, and other U.S. agencies. Historically Black Colleges and Universities, other minority educational institutions, and small businesses and organizations owned and controlled by socially and economically disadvantaged individuals or women are particularly encouraged to apply. Participation by non-U.S. organizations in this program is encouraged subject to NASA's policy of no-exchange-of-funds. Participation by non-U.S. institutions must be proposed within the specific guidelines described in Appendix C, sections (l) and (m), which include a no-exchange-of-funds provision. Further information on foreign participation is provided in Section §1260.12(e), "Choice of award instrument" of the NASA Grant and Cooperative Agreement Handbook. This Handbook is located at: <http://ec.msfc.nasa.gov/hq/grcover.htm>."

B. Cost Sharing or Matching

If an institution of higher education or other non-profit organization wants to receive a grant or cooperative agreement, cost sharing is not required; however, NASA can accept cost sharing if it is voluntarily offered. Section B, Provision §1260.123, "Cost sharing or matching" describes the acceptable forms of cost sharing. If a commercial organization wants to receive a grant or cooperative agreement, cost sharing is required, unless the commercial organization can demonstrate that they will not receive substantial compensating benefits for performance of the work. If no substantial compensating benefits will be received, then cost sharing is not required, but can be accepted. Section D, Provision §1274.204, "Costs and Payments" of the NASA Grant and Cooperative Agreement Handbook describes the acceptable forms of cost sharing."

IV. PROPOSAL AND SUBMISSION INFORMATION

A. Source of Application Materials

All applicants must provide the Dun and Bradstreet (D&B) data Universal Numbering System

(DUNS) number for their organization in the Cover Page of their proposal. Responses to this NRA are all considered prospective new awards but note that for other NASA announcements requests for renewals of awards will also require a DUNS number. The DUNS number is a unique nine-character identification number provided by the commercial company Dun & Bradstreet (D&B). Applicants may call D&B at 1-866-705-5711 to register and obtain a DUNS number, or access the D&B website at: <http://www.dnb.com/us/>. The process to request a DUNS number by telephone take about 10 minutes and is free of charge. The process to obtain a DUNS number through the website takes about fourteen days, and is also free of charge. Organizations will use the same DUNS number with every proposal submitted for a Federal grant and cooperative agreement. Note that the DUNS number is site-specific.

NASA also requires the applicant's organization to be registered in the Central Contractor Registration (CCR) database and obtain a Commercial and Government Entity (CAGE) code prior to submitting a proposal. The purpose of this requirement is to help centralize information about grant recipients and provide a central location for grant recipients to change organizational information. Information for registering in the CCR and online documents can be found at <http://www.ccr.gov>. Before registering applicants and recipients should review the Central Contractor Registration Handbook, which is also located at <http://www.ccr.gov>. The process for obtaining a CAGE code is incorporated into the CCR registration.

B. Content and Form of the Application Submission

Step-1 Proposals

All prospective proposers are required to submit a Step-1 proposal describing the investigation to be proposed to NASA in response to this announcement by no later than Aug. 24, 2004. Appendix A contains information regarding the required content for a Step-1 proposal. Prospective proposers will be encouraged or discouraged to submit a full proposal (i.e. a Step-2 proposal) based on a review of the Step-1 proposal by no later than Sept, 24, 2004. Proposers are required to submit their Step-1 proposal both electronically by following the instructions in Appendix A, and in hard copy format. If electronic submission is not possible, NASA will accept a FAX copy containing the information described in Appendix A and sent to (202) 479-0511.

Step-2 Proposal Content and Format

The proposal should be self-contained, and should not refer reviewers to external sources or

web-sites for critical information. Proposals may be a maximum of fifteen pages of text, single-spaced, 12-pt type. 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.

C. Proposal Submission Dates, Time, and Location

Step-2 proposals may be submitted at any time during the period ending at 4:00 p.m., EDT, on Dec. 1, 2004, contingent upon the investigators timely submission and successful review of a Step-1 proposal (due by Aug. 24, 2004).

A complete schedule for this opportunity is given below:

Release Date	June 22, 2004
Step-1 Proposals due:	4:00 p.m., EST, Aug. 24, 2004
Step-2 Proposals due:	4:00 p.m., EST, Dec. 1, 2004
Review:	Feb. 1, 2005
Grant Award Date:	March 1, 2005

All due dates and times refer to the deadline by which the agency must have received the proposals, regardless of submission method (e.g. mail, electronic, or personal/courier delivery).

The following items apply only to this announcement.

Identifier: NN-H-04-Z-YS-005-N

Submit Proposals to: NEWS 2004 NRA
NASA Peer Review Services, Code Y
500 E Street, SW
Suite 200
Washington, DC 20024-2760

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

Step-1 Proposals:
Number of Copies Required: 4 (*printed directly from SYS-EFYUS as outlined in Appendix A*)

Step-2 Proposals:
Number of Copies Required: 12

D. Proposal Funding Restrictions

The information in section II.A. Terms and Level of Funding Available provides an estimate of the funds expected to be available for competition through this NRA, as well as the approximate number of awards these funds are expected to support.

- Construction of facilities is not an allowed activity.
- Travel, including foreign travel, is allowed as may be necessary for the meaningful completion of the proposed investigation, as well as for the publicizing its results at an appropriate professional meeting.
- U.S. research award recipients may directly purchase supplies and/or services that do not constitute research from non-U.S. sources, but award funds may not be used to fund research carried out by non-U.S. organizations. However, subject to possible export control restrictions, foreign nationals may conduct research while employed by a U.S. organization.
- Regardless of whether function as a team lead or as a team member, personnel from NASA Centers must propose budgets based on Full Cost Accounting (FCA). Non-NASA U.S. Government organizations should propose based on FCA unless no such standards are in effect; in that case such proposers should follow the Managerial Cost Accounting Standards for the Federal Government as recommended by the Federal Accounting Standards Advisory Board (for further information, see <http://www.hq.nasa.gov/fullcost/>).

E. Additional Information

Appendix B provides amendatory guidance to the general guidelines for responding to NASA Research Announcements, contained in Appendix C, specific to this interdisciplinary research program, information on required proposal format and content, and the proposal evaluation criteria. Appendix C contains instructions for foreign participation in this opportunity. Appendices D and E contain information about and a sample proposal cover sheet with required institutional declarations in Appendix D. Appendix F contains the budget summary form. If electronic access is not available to 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 A provides instructions for submitting Step-1 proposals electronically. *Prospective investigators are urged to read the information in all of the appendices carefully and to follow completely the specific guidelines therein.*

For proposals responding to the NEWS, LCLUC, and THP sections:
NASA Selecting Official: Director, Research Division
Office of Earth Science

For proposals responding to the WMP section:
NASA Selecting Official: Director, Applications Division
Office of Earth Science

Period of Performance

Product-driven NEWS investigations will be considered for periods of performance of up to five years. Discovery-driven NEWS, LCLUC, THP, and WMP investigation proposals will be considered for periods of performance of up to three years. Projects may be partially funded within fiscal years (i.e., incremental funding) to minimize uncosted carry over.

V. PROPOSAL REVIEW INFORMATION

A. Evaluation Criteria

The Evaluation Criteria for Step-1 proposals will be intrinsic scientific and technical merit and its relevance to NASA's stated objectives. The Evaluation Criteria for Step-2 proposals will be intrinsic scientific and technical merit, its relevance to NASA's stated objectives, and its cost realism and reasonableness. See Appendix B for further discussion of these criteria.

B. Review and Selection Processes

All proposals will be subjected to 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 of proposals and evaluate any logistical, implementation, cost, and/or management concerns.

C. Selection Announcement and Award Dates

NASA's stated goal is to announce selections within 150 days of the proposal due date. For this solicitation this period will correspond to the time between the due date of the Step-2 proposals and selections. It is our intention to announce our recommendations based on the Step-1 proposals within 30 days of their due dates. Proposers may contact the responsible Program Officer listed in section VII. Contacts if communication has not occurred within these two respective time periods.

Those proposers not selected for award will be notified by mail and offered a debriefing

consistent with the policy in Section C.6 of the *NASA Guidebook for Proposers*.

VI. AWARD ADMINISTRATION INFORMATION

A. Award Notices

All proposers submitting a Step-1 proposal will receive a response from NASA either encouraging or discouraging them to submit a Step-2 proposal. All proposers submitting a Step-2 proposal will receive a response from NASA either informing them their proposal has been rejected or selected to receive an award. Letters indicating acceptance should NOT be used as authorization to begin performance. Accepted proposers will then be contacted by NASA, either by phone, mail, or electronically to discuss the type of award to be issued, as well as the suggested budget for the project. It is anticipated that most selected awards to this announcement will be research grants, with exception of those responding to the NEWS product-driven section, for which most awards will be cooperative agreements. As an exception, agreements with investigators from some institutions may take the form of a more common agreement mechanism used between NASA and these institutions, such as an Interagency agreements between NASA and other federal agencies.

B. Administrative and National Policy Requirements

This solicitation does not invoke any special administrative or National policy requirements, nor do the awards that will be made involve any special terms and conditions that differ from NASA's general terms and conditions as given in the Handbook.

C. Reporting

At the time proposers are contacted regarding their successful Step-2 proposals, NASA will discuss the required reporting for the award. It is anticipated that most research grants issued will require annual reports, most likely submitted electronically, similar to former ESE research grants. Those awardees receiving cooperative agreements will have their reporting requirements defined as part of the agreement. These requirements may include, but are not limited too, more frequent reporting and attendance at NEWS product-driven team meetings. The Handbook, located at <http://ec.msfc.nasa.gov/hq/grcover.htm>, references the standard required reports for grants and cooperative agreements in Exhibit G.

VII. NASA CONTACTS

Obtain additional information from:

Dr. Jared K. Entin (Responsible official for NEWS, THP, and Water Management)

Mail Code YS
NASA Headquarters
300 E. Street SW
Washington, DC 20546-0001
Telephone: (202) 358-0275
FAX: (202) 358-2770
Jared.K.Entin@nasa.gov

Dr. Garik Gutman (Responsible official for LCLUC)

Mail Code YS
NASA Headquarters
300 E Street SW
Washington, DC 20546-0001
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Garik.Gutman@nasa.gov

Dr. Paul R. Houser (NEWS integration group lead)

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Greenbelt, MD 20771
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VIII. Concluding Statement

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

Ghassem R. Asrar
Associate Administrator for Earth Science

Enclosures:

- Appendix A – Instructions for Step-1 Proposal Submission
- 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 – Required Step-2 Proposal Cover Page
- Appendix E – Sample Step-2 Proposal Cover Page, Assurance of Compliance, and Certifications
- Appendix F – Step-2 Proposal Budget Summary Sheet and Instructions
- Appendix G – NASA Energy and Water Sponsored Research (NEWS) Integration Group
- Appendix H – Water Management Integrated System Solutions Chart
- Appendix I – Earth Science Enterprise System Components
- Appendix J – Acronyms
- Appendix K - NASA-ESE Research Program Websites

APPENDIX A
Instructions for Step-1 Proposal Submission

Prospective proposers are required to submit a Step-1 proposal that concisely describes the investigation to be proposed by the date given in this NRA. The submission of a Step-1 proposal is not a commitment to submit a Step-2 proposal, nor is information contained therein considered binding on the submitter. Step-1 proposals are to be submitted electronically by entering the requested information through SYS-EYFUS Web site located at <http://proposals.hq.nasa.gov>. Additionally, 4 hard copies of the final Step-1 SYS-EYFUS proposal submission must be received by the due date. Please note that the Step-1 SYS-EYFUS proposal submission will be used as a starting point for the Step-2 SYS-EYFUS cover page submission, and will retain the same proposal reference number.

User identifications (IDs) and passwords are required by NASA security policies in order to access the SYS-EYFUS Web site.

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 Step-1 proposal.

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:

1. Click the hyperlink for **new user**, that will open the Personal Information Search Page.
2. Enter your first and last name. SYS-EYFUS will **search** for your record information in the SYS-EYFUS database.
3. Confirm your personal information by **choosing** the record displayed.
4. 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 **Step-1 Proposal**.

At a minimum, the following information will be requested:

- NRA number or identification
- Type of NEWS proposal (check product-driven or discovery driven):
 - Product-driven NEWS investigation (check all that apply)
 - Observation; Understanding; Models; Prediction; Consequences

- Discovery-driven NEWS investigation (check only one)
 - NEWS; THP; LCLUC; Water Management
- The principal investigator's name, mailing address, phone number, and e-mail address
- The name(s) of any co-investigator(s) and institution(s)
- A descriptive title of the intended investigation
- A brief ~4 page text-only description of the investigation to be proposed (not to exceed 2000 words) that includes the following information:
 - statement of the problem or opportunity;
 - project hypothesis (single sentence project summary);
 - how the project will advance towards the NEWS challenge;
 - identify NASA ESE system components (i.e. Appendix I) to be engaged;
 - a brief description of the current work on the topic of the proposal.
 - expected outcomes;
 - potential deliverables with timeline;
 - a rough total project budget and very brief explanation;
 - anticipated cooperators investigators, organizations, agencies and companies

A separate Step-1 proposal must be submitted for each intended (and thus corresponding) Step-2 proposal. Please note that because the Step-1 proposal review will not evaluate the proposed budget, and no funds will be distributed as part of the Step-1 review process, formal budget estimates, signatures, and certification/disclosure forms will not be required for Step-1 proposals. A complete Step-1 proposal is considered to be the final Step-1 SYS-EYFUS web submission, of which 4 copies must be received at the address specified in this announcement by the Step-1 proposal due date.

APPENDIX B

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

PURPOSE

These guidelines contain general and specific information regarding the submission of Step-2 proposals in response to this NRA. Formats for submission of Step-2 proposals for research related to this program are provided. The evaluation criteria are specified. Appendix C contains general instructions for responding to NRAs. Where conflicts exist between this Appendix and Appendix C, this appendix shall be the controlling document.

PROPOSAL CONTENT AND FORMAT

The Step-2 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 is to be limited to the equivalent of 15 pages of text, single-spaced, with type no smaller than 12 pt. A reasonable number of figures and tables (not to exceed 4 pages) may be appended. Short resumes (no more than 1-2 pages per investigator) 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, cost plan, resumes, and statements of current and pending funding need not count in the 15-page limit. The proposal should be self-contained, and should not refer reviewers to external sources or web-sites for critical information. If color is used, proposers should ensure that all copies have color. To facilitate recycling, proposals should not be bound or in covers.

A. Page Limits.

Offerors must adhere to the following page limits for Step-2 proposals:

Cover Letter	1
Cover Page	1 - 2
Table of Contents	1
Abstract	1
Technical Plan	15
List of References	1 - 2
Management Plan	1/2 – 2
Cost Plan	3 - 8
Current and Pending Research	1 – 2 per investigator
Resumes	1 - 2 per investigator
Other	As few as possible

B. Content. Each Step-2 proposal should contain the following materials assembled in the order given.

1. **Cover Letter.** Each Step-2 proposal should be prefaced by a cover letter signed by an official of the 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). The cover letter should refer to the NEWS 2004 NRA.

2. **Proposal Cover Page.** Please see Appendix D.

3. **Table of Contents.** A table of contents listing the page numbers for key sections of the proposal, including the cost and management plans, should be provided.

4. **Abstract (length must not exceed 1 page).** The abstract 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 interdisciplinary research program. It is very important that this abstract be specific and accurately represents the research to be conducted.

5. **Technical Plan (length must not exceed 15 pages).** The main body of the Step-2 proposal should contain a full statement of the research to be undertaken and should describe key background, 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 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. Where 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. The plan should also describe how any data products to be created or additional, ancillary data sets to be obtained will be shared with NASA, other investigators, and the broader scientific and user communities.

6. References (1-2 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.

7. Management Plan (recommended length: 1/2 - 2 pages, depending on complexity). The Management Plan should outline the roles and responsibilities of all investigators and collaborators and indicate the relationships among these roles and responsibilities within the group. The management plan should also 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.

8. Cost Plan for U.S. Proposals Only. Please see Appendix F for specific guidance and forms. Contributions from any cost-sharing plan or other support for the proposed research should be detailed.

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. Full costs for the purchase of data from commercial sources should be included in the budget and the requirement documented in the

proposal.

To ensure adequate communications between investigators, proposers should plan for funds for two NASA-related meetings of three days duration and located in the U.S. during the course of their research.

9. Summary of 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.

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

11. Other Enclosures. Reviewers are under no obligation to read any enclosures and proposals should thus be self-contained. Proposers may include other materials such as preprints or reprints of relevant publications, background on new measurement or analysis approaches, or letters of support and/or participation by scientists and/or institutions. Such materials are considered ancillary. Information in the Technical Plan of the proposal should stand alone. Other materials will not be evaluated

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.

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 and any Co-Investigators or 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 institution to provide the necessary support to ensure that the investigation can be completed satisfactorily.

2. The relevance and responsiveness of the proposed research to the goals and objectives of ESE and to the goals and objectives described in this NRA, including:
 - (a) the probability of achieving one or more significant objectives directly relevant to one or more of the topics identified in this NRA.
 - (b) the interdisciplinary nature of the proposed research, in particular, its probability of succeeding in addressing scientific questions pertaining to more than one traditional Earth science discipline.

3. 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 evaluation approach(es) (i.e., cost/benefit) to the user community.

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.

Final decisions will be made promptly and investigators will be notified by either electronic mail or surface mail, or both.

APPENDIX C
INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS
(1852.235-72, OCTOBER 2002)

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 that 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 award 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 Step-2 proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

1. Step-2 Proposal Transmittal Letter or Prefatory Material.

- (a) The legal name and address of the organization and specific division or campus identification if part of a larger organization;
- (b) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;
- (c) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;
- (d) Name and telephone number of the principal investigator and business person nel who may be contacted during evaluation or negotiation;
- (e) Identification of other organizations that are currently evaluating a proposal for the same efforts;
- (f) Identification of the NRA, by number and title, to which the proposal is responding;
- (g) Dollar amount requested, desired starting date, and duration of project;
- (h) Date of submission; and
- (i) 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.

(a) The main body of the Step-2 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.

(b) 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

(a) 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.

(b) 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)

(a) 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.

(b) 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.

(c) 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).

(d) 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.

(a) 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.

(b) Identify and discuss risk factors and issues throughout the proposal where they are relevant, and your approach to managing these risks.

(c) 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 Step-2 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. Step-2 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:

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

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

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

(d) 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.

(a) **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:

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

M. Export Control Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.

U.S. 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.

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

APPENDIX D

Required Step-2 Proposal Cover Page

Two steps are required to submit a cover page. The first step is to complete the proposal cover page (see the SAMPLE below) **electronically** through the SYS-EYFUS Website located at <http://proposals.hq.nasa.gov>. If the proposer has submitted an electronic Step-1 Proposal (Appendix A) to SYS-EYFUS, the same user UserID and password can be used to complete the electronic proposal cover page. 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. Be sure to click on "Edit Personal Information" if any of your correspondence information in SYS-EYFUS is not current.

The second step is to print a **hard copy** of the electronic cover page that 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.

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:

1. Click the hyperlink for **new user** that will take you to the Personal Information Search Page.
2. Enter your first and last name. SYS-EYFUS will **search** for your record information in the SYS-EYFUS database.
3. Confirm your personal information by **choosing** the record displayed.
4. 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 website and follow the instructions for **New Proposal Cover Page**.

Proposers without access to the web or who experience difficulty in using this site may contact the Help Desk at proposals@hq.nasa.gov (or call 202-479-9376) for assistance. After you have submitted your notice of intent or 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.

APPENDIX E

PROPOSAL COVER PAGE

(Date : Oct 24, 2003)

SAMPLE

NEWS/03-1-0000-0013

Name of Submitting Institution: IDI

Congressional District: 8

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).

NASA PROCEDURE FOR HANDLING PROPOSALS

This proposal shall be used and disclosed for evaluation purposes only, and a copy of this Government notice shall be applied to any reproduction or abstract thereof. Any authorized restrictive notices that the submitter places on this proposal shall also be strictly complied with. Disclosure of this proposal for any reason outside the Government evaluation purposes shall be made only to the extent authorized by the Government.

[1] ... PI Information

Name:		Email:	
Organization:		Department:	
Mail Stop:		Telephone:	
Address:		Fax:	
Address:			
City, State, Zip:		Country:	

PI Signature and Date:

Authorizing Official:		Email:	
Title:		Phone:	
Institution:			
Address:			

AO Signature and Date:

[2] ... Team Member

[3] ... Proposal Title (Short and/or Full)

Short Title:	
Full Title:	

[4] ... Summary

--

[5] ... NEWS Proposal

Type of NEWS Proposal:	
------------------------	--

[6] ... Budget

Continue

Edit Proposal

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 Step-2 Proposal Cover Sheet above are authorized to sign on behalf of the Applicant.

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

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 Step-2 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 Step-2 proposal.

APPENDIX F
STEP-2 PROPOSAL BUDGET SUMMARY

For period from October 1, 2004 to _____(Sept. 30, 2007 or Sept. 30, 2009)

- Assume a October 1, 2004 project start date.
- Product-driven projects may have up to a 5 year-duration; all others have a 3-year duration.
- Enter the proposed estimated costs in each column.
- 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.

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
1. Direct Labor (salaries, wages, and fringe benefits)	_____	_____	_____	_____	_____	_____
2. Other Direct Costs:						
a. Subcontracts	_____	_____	_____	_____	_____	_____
b. Consultants	_____	_____	_____	_____	_____	_____
c. Equipment	_____	_____	_____	_____	_____	_____
d. Supplies	_____	_____	_____	_____	_____	_____
e. Travel	_____	_____	_____	_____	_____	_____
f. Data Costs	_____	_____	_____	_____	_____	_____
g. Other	_____	_____	_____	_____	_____	_____
3. Facilities and Administrative Costs	_____	_____	_____	_____	_____	_____
4. Other Applicable Costs:	_____	_____	_____	_____	_____	_____
5. SUBTOTAL--Estimated Costs	_____	_____	_____	_____	_____	_____
6. Less Proposed Cost Sharing (if any)	_____	_____	_____	_____	_____	_____
7. Total NASA-ESE Cost	_____	_____	_____	_____	_____	_____

INSTRUCTIONS FOR STEP-2 PROPOSAL BUDGET SUMMARY

During the next several years, NASA must effectively and efficiently implement a variety of new Federal and Agency standards and initiatives to support long-term financial and resources management excellence. These standards include recent Federal standards related to managerial cost accounting (full costing). The NASA full cost concept and approach integrates full-cost accounting, budgeting, and management practices to enhance cost-effective mission performance by providing complete cost information for improved (more fully informed) decision making and management. The initiative introduces a concept that ties all Agency costs (including all Civil Service and other personnel costs) to major activities (programs and projects) and budgets, accounts, reports, and manage programs and projects from a full cost perspective.

Therefore, Step-2 proposals submitted to this NRA should report their full cost including all contributions on lines 1-5 of the required budget page. Every effort should be made to account for the full cost including contributed expenses (such as facilities, salaries, benefits etc.) by partner universities, agencies and NASA centers (i.e. civil service salaries, benefits, travel, and training) as these will be seen to strengthen the proposal's merits. The portion of the full project cost contributed by the proposing institution or its partners should be explicitly specified on line 6, and detailed in the attached budget explanation. Then, the actual funding requested from NASA-ESE in support of the proposal should be summarized on line 7. Since partner contributions generally strengthen proposed projects and benefit NASA-ESE, the guidance on suggested proposal cost caps for this announcement applies to the NASA-ESE cost on line 7.

General Instruction

- Provide specific and complete data as requested below.
- When "Basis of Estimate" is requested, this means provide the details and methodology used to determine the estimate.
- Costs on the Budget Summary Sheet with no supporting rationale or basis of estimate will be considered incomplete, and proposal scores will reflect this lack of supporting information.
- If more than one institution is involved, provide a separate budget sheet for each institution, plus a summary budget sheet for the complete project.
- Cost data are **not** included in page count limitations.
- All costs, including those for high-end scientific computing required to meet

proposed project goals should be included in the budget request.

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 fully-burdened rates of pay. This item should include all labor costs, including those contributed by the proposing institution.

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: <http://www.opm.gov/oca/01tables/execsesc/html/01execsc.htm>, exclusive of expenses and indirect costs).

(c) **Equipment:** List separately. Explain the need for items costing more than \$500. 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. General purpose personal computers may not be included unless specifically approved by the NASA Grant Officer.

(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 award and provide the basis of estimate, including information on destination, number of days, and number of travelers.

(f) Enter estimated cost of commercial data and public data sets. Include itemized list indicating type of data, from whom it will be purchased, quantity and cost.

(g) **Other:** Enter the total of direct costs not covered by 2a through 2e. Attach an itemized list explaining the need for each item and the basis for the estimate.

3. Facilities and Administrative (F&A) Costs. Identify F&A cost rate(s) and base(s) as approved by the cognizant Federal agency, including the effective period of the rate. Provide the name, address, and telephone number of the Federal agency official having cognizance. If

unapproved rates are used, explain why, and include the computational basis for the indirect expense pool and corresponding allocation base for each rate.

4. **Other Applicable Costs.** Enter total explaining the need for each item.
5. **Subtotal-Estimated Costs.** Enter the sum of items 1 through 4.
6. **Less Proposed Cost Sharing (if any).** Enter any amount proposed. If cost sharing is based on specific cost items, identify each item and amount in an attachment. This item should include any contributions reported in items 1-5 that will be supported from sources other than this budget request.
7. **Total NASA Cost.** Enter the total after subtracting item 6 from item 5.

APPENDIX G

NASA Energy and Water Study (NEWS) Integration Group

Projects funded through this NRA will be coordinated jointly by the NASA Earth Science Enterprise and by the NEWS integration group (listed below). Among other considerations that must be addressed after project selection, these NASA representatives will negotiate with each selected project, a plan for making progress towards the NEWS challenge, and a NASA teaming plan as appropriate. The parties will settle on project metrics, including a baseline against which project progress and outcome can be measured. Subsequently, there will be a requirement for short reports based on a common format. There will be no less than one annual meeting of the entire team funded under this NRA, possibly in conjunction with appropriate national or regional organizations, e.g., the American Geophysical Union (AGU) or American Meteorological Society (AMS).

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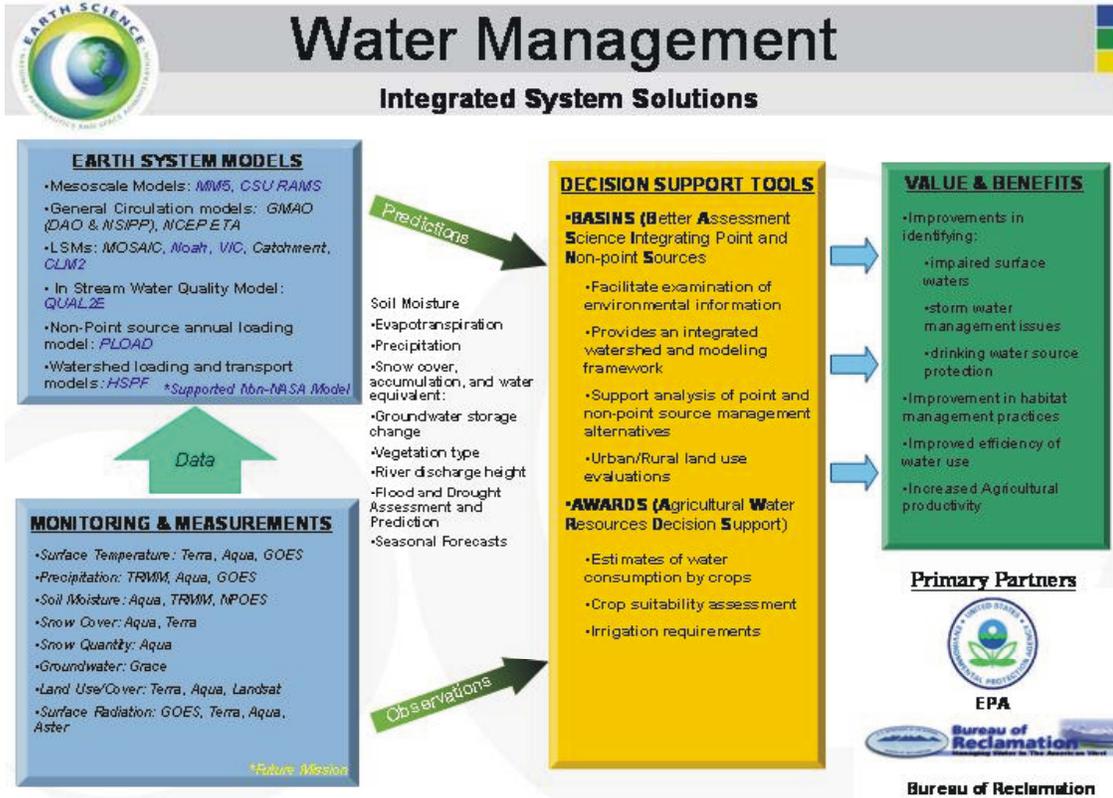
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APPENDIX H

Water Management



APPENDIX I

Earth Science Enterprise System Components

The use of NASA ESE system components in pursuit of the NEWS challenge is an important aspect of projects awarded under this announcement. Proposals should document all collaboration with NASA teams and utilization of NASA ESE system components envisioned during the course of their proposed research, such as: satellite data, models, technologies, application, and/or education tools. However, it should be recognized that NASA is ultimately interested in advancing the best science and applications available, so in the absence of NASA system component, non-NASA system components should be actively entrained. The currently identified Earth Science Enterprise System Components are to numerous to be shown here. A visual representation can be found at <http://wec.gsfc.nasa.gov/coin.html>). This is a living document and its contents may change periodically, though an updated version will always be available via this website.

APPENDIX J

Acronyms

4DDA	4-dimensional data assimilation
AGU	American Geophysical Union http://www.agu.org
AMS	American Meteorological Society http://www.ametsoc.org
ARM	Atmospheric Radiation Measurement Program http://www.arm.gov
CCRI	Climate Change Research Initiative http://www.usgcrp.gov/usgcrp/Library/CCRIreport-aug2001
CCSP	Climate Change Science Program http://www.climate-science.gov
CEOP	Coordinated Enhanced Observation Period http://www.gewex.org/ceop.htm
CEOS	Committee on Earth Observation Satellites http://disaster.ceos.org
CLiC	Climate and the Cryosphere http://clic.npolar.no
CLIVAR	Climate Variability and Predictability http://www.clivar.org
CLPX	Cold Land Processes Experiment http://www.nohrsc.nws.gov/cline/clp.html
DDS	Decision Support Systems
ESE	Earth Science Enterprise http://earth.nasa.gov
F&A	Facilities and Administrative Costs
GAPP	GEWEX Americas Prediction Project http://www.ogp.noaa.gov/mpe/gapp
GCOS	Global Climate Observing System http://www.wmo.ch/web/gcos/gcoshome.html
GCSS	GEWEX Cloud System Study http://www.gewex.org/gcss.html
GEWEX	Global Energy and Water Experiment http://www.gewex.org
GRACE	Gravity Recovery and Climate Experiment http://www.csr.utexas.edu/grace
GWEC	Global Water and Energy Cycle Program
IGOS	Integrated Global Observing Strategy http://www.igospartners.org
LBA	Large Scale Biosphere-Atmosphere Experiment in Amazonia http://daac.ornl.gov/lba_cptec/lba/indexi.html
LCLUC	Land Cover and Land Use Change http://lcluc.gsfc.nasa.gov

NASA	National Aeronautics and Space Administration http://www.nasa.gov
NEESPI	Northern Eurasia Earth Science Partnership Initiative http://neespi.gsfc.nasa.gov
NEWS	NASA Energy- and Water-Cycle Study http://wec.gsfc.nasa.gov
NRA	NASA Research Announcement http://research.hq.nasa.gov
OMB.	Office of Management and Budget http://www.whitehouse.gov/omb
OSSEs	Observing Simulation System Experiments http://gmao.gsfc.nasa.gov/sci_highlights/osse/index.php
OSTP	Office of Science and Technology Policy http://www.ostp.gov
PI	Principal Investigator
SMEX	Soil Moisture Experiments http://hydrolab.arsusda.gov/smex02
THP	Terrestrial Hydrology Program http://thp.gsfc.nasa.gov
USAID	US Agency for International Development http://www.usaid.gov
USGCRP	US Global Change Research Program http://www.usgcrp.gov
WCRP	World Climate Research Programme http://www.wmo.ch/web/wcrp/wcrp-home.html
WMO	World Meteorological Organization http://www.wmo.ch
WMP	Water Management Program http://wmp.gsfc.nasa.gov

APPENDIX K
NASA-ESE Research Programs

Terrestrial Hydrology Program:	http://thp.gsfc.nasa.gov
NEWS Energy and Water Sponsored Research:	http://wec.gsfc.nasa.gov
Land Cover Land Use Change Program:	http://lcluc.gsfc.nasa.gov