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Centre National d'Etudes Spatiales
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**NRA-03-OES-05
SALP-BC-MA-EA-14810-CN**

JOINT RESEARCH ANNOUNCEMENT

THE OCEAN SURFACE TOPOGRAPHY SCIENCE TEAM (OST/ST)

**Notice of Intent due August 29, 2003
Proposals Due October 30, 2003**

OMB Approval No. 2700-0087

The Ocean Surface Topography Science Team (OST/ST)

**Joint NASA/CNES Research Announcement
Soliciting Research Proposals
for
Period Ending
October 30, 2003**

**NRA 03-OES-05
CNES SALP-BC-MA-EA-14810-CN
Issued July 30, 2003**

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

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Joint NASA/CNES RESEARCH ANNOUNCEMENT

The Ocean Surface Topography Science Team (OST/ST)

1.0 Introduction

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

2.0 Purpose

The purpose of this NASA/French Space Agency (CNES) joint Research Announcement (NRA) is to solicit proposals for participation in the Ocean Surface Topography Science Team (OST/ST). The goals of the Ocean Surface Topography Science Team are to provide the scientific underpinning for production of the best possible satellite-derived ocean surface topography data sets and to demonstrate the Earth science and applications arising from analyses of the ocean surface topography data. Specifically, this NRA seeks proposals to utilize the new observational capability of the Jason-TOPEX/Poseidon Mission (TP) and the growing time series of multiple satellite altimeters. The team will also be involved in scientific preparations for future missions, such as the Ocean Surface Topography Mission (OSTM) a cooperative mission between NASA, CNES, NOAA and EUMETSAT planned for launch in 2007. The NRA will also cover inter-calibration/validation analyses of the Jason/TP missions during and after the verification phase. Special emphasis will be given to proposals that stress the use and application of satellite altimetry to basic research and operational projects in physical oceanography and related fields consistent with the goals of the strategic vision of NASA's Earth Science Enterprise (ESE) as part of its focus area on climate and climate variability, and CNES's "Terre-Océan-Surface Continentale-Atmosphère" (TOSCA) program.

3.0 Relationship to NASA's ESE and CNES's TOSCA program Strategic Goals

Climate Variability and Change is one of six focus areas of NASA's ESE and it requires measurements of ocean state variables such as ocean circulation and oceanic heat transport. Ocean surface height is one of the most important variables that NASA provides for studies of climate variability and change. It reflects an integrated measure of both the amount of liquid water and the heat content of the ocean, and thus is a good diagnostic quantity that responds to both long-term climate change and shorter-term natural variability. The measurement sensitivity of this variable to shorter term climate change was recently demonstrated by the significant sea surface height variations associated with recent strong El Nino events. Sea surface height has important space/time variations that emphasize the need to observe it globally and rapidly which is only possible from space since the in situ tide gauge network is limited by the distribution of islands and coastlines. This parameter of surface height has already been demonstrated to be a very valuable field for the initialization of numerical ocean models and also for continual assimilation into these models.

The measurement of sea surface height is presently provided by the number of satellite altimeters flying and planned for the future, along with other environmental satellites, *in situ* oceanographic data and numerical ocean simulations. This suite of satellite measurements constitutes a unique opportunity to make significant contributions to many of the science objectives of NASA's ESE focus area of climate variability, and CNES's TOSCA program. This combination of data can be employed to contribute vital new understanding to the nature of the ocean's circulation, both in terms of its mean state and variability and the inter-relationships between this circulation, its variability and global climate change. The absolute mean circulation can now be addressed by combining new satellite gravity measurements with satellite altimetry while ocean circulation variability will be addressed with the improving spatial resolutions of the Mission, and with overlapping multiple altimetric missions.

Specifically NASA's ESE and CNES' TOSCA "roadmaps" plan to improve our knowledge of the Earth's climate system by first observing the global ocean circulation from space and second by incorporating these observations into numerical model simulations to enable the prediction of global weather and climate on an expanding time scale. This is also a major objective of the Global Data Assimilation Experiment (GODAE). In the 2003-2007 period, this is developing a transition towards operational oceanography, integrating altimetry and other *in-situ* and satellite data into global ocean models to provide routine 3D visions and forecasts of the ocean. In addition, accurate measurement of global sea level will be used to constrain our knowledge of changes that take place in coastal regions that may have important societal impacts on global climate change. Proposed projects designed to address these objectives will take advantage of both the historical record of satellite altimetry and also exploit the future capabilities of the Mission, multiple altimeters and other aspects of high-resolution surface topography sampling. These improvements in spatial resolution will make it possible to explicitly treat the role of shorter time/space scale ocean circulations in the larger scale and mean circulation of the ocean and help to evaluate the role of the ocean in modifying and responding to global climate change.

Research projects in response to this NRA will fulfill many components of NASA's Earth Science Enterprise Climate Variability Roadmap and CNES's TOSCA by utilizing new measurement capabilities through technological improvements, greater understanding by combining a variety of satellite and *in situ* data and combining these measurements with numerical models to improve our ability to predict ocean behavior and evaluate its effects on the global climate. It is important to remember that the ocean represents the long-term memory of the Earth's climate system, and that changes in ocean circulation take place in response to climate change but can also feedback on the atmosphere and cause climate change as well. In order to properly evaluate these interactions it is necessary to have the highest quality altimetric measurements. For that reason continued calibration/validation projects will be supported under this NRA. Finally, projects responding to this NRA should also provide the path towards higher resolution surface topography measurements being considered for future altimetric missions.

Specifically proposals should address all, one or any combination of NASA ESE's and CNES TOSCA's research questions:

- a. How is the global ocean circulation varying on weekly, monthly, interannual, decadal and longer time scales?

- b. How can climate variations induce changes in the global ocean circulation?
- c. How is global sea level affected by natural variability and human-induced changes in the Earth system?
- d. How well can long-term climatic trends related to ocean circulation changes be assessed or predicted?

4.0 Background

Soon after its launch in early Dec. 2001 Jason was inserted into an orbit just one minute ahead of TP in order to provide an inter-calibration/validation of the two instruments necessary for Jason to continue the vital time series established by TP starting in 1992. The analyses of these data are underway but further efforts will be proposed in response to this NRA that will help to clearly establish the performance of the Jason system as compared to TP. This includes the altimeter performance as well as the environmental corrections and the precise orbit determination. Since many of the basic comparisons have already been carried out, significantly innovative comparison proposals are being sought in this competition in order to provide the updated definition of the errors in the Jason altimeter.

After completion of the calibration/validation phase of the Jason mission in September of 2002, TP was moved to a parallel orbit halfway between the repeat tracks of Jason thus yielding an "altimetry mission" with a cross track resolution half as large as with Jason alone. While the approximately 100 km spacing (at 45° latitude; 157 km at the equator) the Mission does not resolve all of the dynamic space scales in the ocean it is a substantial improvement over the previous 220 km track-to-track spacing (at 45° latitude; 315 km at the equator) of the TP mission itself. Unlike the previous repeat track sampling which entailed a finite time interval (approximately 3 days) between the widely separated adjacent tracks, these two spacecrafts are flying in and the two adjacent tracks with half the original separation are overflown simultaneously. Such simultaneous measurements along parallel tracks will be used to estimate the along-track component of the surface geostrophic velocity, allowing the full determination of the geostrophic velocity vector along the satellite tracks.

The conclusions of a recent report of the High-resolution Ocean Topography Science Working Group (JPL Publication 03-002; Fu, 2003) indicate that the Mission will provide an experimental optimal sampling of the ocean surface topography better than any other two-satellite combination that has been studied. Therefore the combined Jason-TP data will deliver fundamentally new science results that are not attainable from a single or uncoordinated pair of satellites. The value of the new results will grow with the length of the Mission, but the threshold is one year (Dec. 2003). In addition to the near-term science return addressed above, the Mission will also benefit a long-term sampling strategy. Through the Mission, TP will build a data record along the new tracks half way between the original Jason-TP tracks. Future overlaps between Jason and OSTM missions can potentially provide continued sampling along these mission TP ground tracks eliminating the need for a 1-year threshold for the use of Jason on these new tracks after OSTM is launched and calibrated.

This new observational capability of the Mission, along with other satellites carrying altimeters (e.g. Earth Remote sensing Satellite (ERS2), Geosat Follow On (GFO), ENVISAT), needs to be efficiently exploited to improve the understanding of the ocean's circulation and related surface processes. It should now be possible to resolve a

large part of the planetary wave system that was only partially seen in the TP and Jason data alone. The role of ocean eddies in the heat and momentum budgets of the ocean can be addressed diagnostically rather than just inferred from the variability of larger scale measurements. In addition related measurement fields such as significant wave height and wind speed will now be available with a much better spatial mapping capability and near-real time access. Finally other applications requiring improved spatial resolution such as applications to inland waters, ice sheets, terrestrial topography and the coastal environment will benefit greatly from this factor of two increase in spatial resolution.

This improved spatial resolution should prove useful for a variety of real-time and forecasting applications such as oil operations, oil-spill mitigation, marine routing, and recreation, fisheries and search/rescue operations. In many of these applications satellite altimetry data will be one element of a larger system and proposals are encouraged that merge Jason and TP satellite altimetry with other satellite altimetric data and other forms of satellite data such as surface thermal infrared and ocean color imagery. These applications are consistent with the present move into an "integrated ocean observing system (IOOS)" which will eventually couple both satellite and in situ observations. Also encouraged are studies that combine the altimeter data from TP and Jason with in situ data (e.g. ARGO data, surface drifters, etc.) as well as numerical model products via data assimilation.

The NRA also solicits investigations that utilize the decade-long combined data from TP and Jason to address the low-frequency variability of the ocean and its interaction with the Earth's climate *consistent with ESE's focus area of climate variability*. In particular, the data are useful for studies of seasonal-to-interannual variability and global mean sea level change a scientific area of focus for U.S. Climate Change Science program. Combination studies that merge altimeter data with other remote sensing, in situ data as well as numerical model products are encouraged. The successful launch and operation of the GRACE Mission provides a new opportunity for studies of the mean ocean circulation and its variability that utilize both altimeter and gravity data, making it possible to address the barotropic ocean currents.

To continue the observations made by TP and Jason and provide a transition into operational altimetry missions in the future, NASA, CNES with NOAA and EUMETSAT plan to launch a Jason follow-on mission, the OSTM. OSTM satellite will carry a similar instrument to Jason as its baseline payload, and fly in the same orbit as Jason. The primary mission objective is to continue the TP/Jason measurements with the same performance. The availability of a continued data stream from altimetric measurements with near real-time access has resulted in the participation in this mission by NOAA and EUMETSAT agencies interested in the operational applications of these data. The OSTM satellite is planned to be launched in 2007. This NRA solicits proposals that will address the planning and implementation of the calibration and validation of OSTM measurements.

In addition to its baseline altimeter the OSTM satellite may carry an experimental instrument called the Wide-Swath Ocean Altimeter (WSOA; Fu et al., 2002; Chelton et al., 2001) that uses an interferometric antenna for mapping the ocean surface topography with mesoscale spatial resolution. This is one possible approach to the realization of higher spatial resolution surface topography mapping from altimetric satellites. The TP/Jason Mission is a step towards the truly mesoscale altimetric coverage of the WSOA.

5.0 Program Objectives for the Ocean Surface Topography Science Team

The main objectives of this joint U.S./French OST/ST NRA are:

- to support studies in physical oceanography that utilize Jason/TP mission data as well as the combined decade-long TP and Jason data, preferably jointly with other satellite and in-situ data and/or models, in support of both basic research and operational applications. These projects will cover a wide range of studies of coastal and open ocean circulation, including intra-seasonal-to-inter-annual variability, global mean sea level variations, ocean waves propagation, low-frequency tides, gravity waves, wind/wave generation, etc. Many of these studies may be related to larger projects such as Climate Variability (CLIVAR), Global Ocean Observing System (GOOS), National Ocean Partners Program (NOPP) and the Ocean Argo international in situ program.
- to complete comparison studies between TP and Jason. This includes details on the Precise Orbit Determination assessment, role of the water vapor correction as provided by the passive microwave radiometers, as well as influence of others corrections (ionosphere, sea-state bias, barotropic effect) and a precise characterization of the errors involved in a Jason altimeter measurement. This includes also development and assessment of new geophysical algorithms and/or models likely to improve the quality of the data. The error budget for Jason must be completed relative to our updated knowledge of TP, based upon a comprehensive analysis of all of the inter-calibration/validation measurements during the coincident orbit phase and after. Many of these studies have been completed but some remain, which are solicited in order to issue revised error budgets and an updated estimate of the accuracy of Jason and TP flying now on interleaved tracks. This error evaluation will also serve in the analysis of the respective data streams of the Mission. Both follow-on studies and new proposals that identify needed error analyses are anticipated in this category.
- to explore operational applications of satellite altimetry with a requirement for near real-time delivery of data and data products. These include but are not limited to: seasonal-to-interannual climate prediction, local weather forecasting, oil exploration/operations, oil spill mitigation, coastal currents, shipping, fisheries, marine meteorology and marine recreation.
- to investigate the use of gravity mission data with altimeter data for improving the understanding of the mean ocean circulation and barotropic variability.
- to plan the calibration and validation of the baseline measurement of the OSTM, to develop and assess dedicated techniques, in particular taking advantage of the possible overlap of Jason and OSTM or by proposing palliative methods if unfortunately there is no overlap.
- to support complementary studies on ice sheet and sea ice monitoring, lake and in-land water studies, large river mouth survey, and marine geoid. Such studies can use altimetry but also additional data including the accurate geodesic point positioning provided by the highly performing POD systems (Doris, GPS, laser) on-board TP and Jason.

All OST/ST projects are encouraged to foster the development of an informed and environmentally aware public through both formal and informal educational activities. The OSTM program offers yet another opportunity for NASA/CNES to enhance and broaden scientific literacy and public understanding of our environment and the significant challenges it faces in today's world. NASA and CNES will pay a special attention to the proposed involvement of candidate teams in outreach and educational activities.

6.0 OST Science Team Functions

This NASA/CNES Research Announcement provides the selection of OST Science Team Members. They will conduct basic research and analyses to fulfill the Program Objectives as described above. This OST/ST will continue to function much as the previous Jason Science Working Team (SWT) with annual meetings alternately in Europe and the U.S. where the status of the mission is reviewed and poster and oral contributions are presented by investigators on many of the research and operational applications. The two Project Scientists from NASA/JPL and CNES will continue to function as the primary liaison between the project and the OST/ST members.

6.1 Proposal Requirements

All new OST/ST members must propose to carry out peer reviewed, publishable scientific research using Jason and TP data and other data and models that will contribute to a successful utilization and validation of the combined TP and Jason data as judged by the quality of the results and the scientific impact of the publications. An additional task is to make preparations for the successful calibration/validation and utilization of the OSTM data.

OST/ST proposals may be submitted by a Principal Investigator (PI) with one or more Co-Investigators (CoIs). Selection will depend on the experience and qualifications of the PI and the CoIs along with the quality and the pertinence of the proposal. Selection will not depend on the qualifications of support personnel who should not be identified by name but rather by category (i.e. graduate student, programmer, post-doctoral researcher, etc.).

7.0 Proposal Selection

Based on the result of a joint evaluation by ad-hoc committees, NASA and CNES anticipate selecting OST/ST members for a period of four years taking us through the planned launch of the OSTM satellite. In the event that the OSTM launch is significantly delayed, proposals will be reviewed on a case-by-case basis to determine if continued activity is justified. In any case, continuity of support for successful investigators is subject to satisfactory progress and availability of funds.

CNES and NASA will fund only French and U.S. investigators respectively. NASA and CNES seek to maximize the return on the funding through a strong partnership with outside investigators and agencies. To this end, proposals that are coordinated with other related and ongoing programs are encouraged. It is essential for proposers to document their funding sources that are relevant to their proposed OST/ST activities.

8.0 U.S. Investigator Funding

Initially the NASA funding available for U.S. investigators under this NRA will be approximately \$5.5 million per year. The funding instruments for this announcement will be either grants or contracts as appropriate.

8.1 French Investigator Funding

The funding available for French investigators will come from CNES program budget appropriations for scientific and CalVal investigations related to the Jason program and from the CNES Jason project for activities directly related to instruments or system performance. Yearly progress reviews of the selected studies will be conducted by CNES in relation with TOSCA and related National programs to determine if satisfactory progress has been towards achieving the goals of these programs.

8.2 Other Investigator Funding

For non-French and non-U.S. proposals, the proponents will have to seek and secure appropriate sources of funding from relevant national authorities. NASA and CNES, as well as NOAA and EUMETSAT, will provide letters of support when needed to help selected investigators in their funding requests.

9.0 Proposal Submission and Selection Schedule

All proposers are invited to submit their proposals in response to this announcement by 4:30p.m EDT, on October 30, 2003. Late proposals will not be considered for review and funding, unless it is judged to be in the interest of the U.S. or French Governments. The proposal must not exceed 20 pages (single space) including figures, tables, references in accordance with the guidance provided in Appendixes A-1 (NASA) or A-2 (CNES) and cover letters provided in Appendixes B-1 (NASA) or B-2 (CNES). Additional information such as curriculum vitae and other relevant information may be attached as an appendix.

All proposals from investigators from the U.S. should be sent to NASA. All proposals from investigators from France and Europe should be sent to CNES. All other proposals may be sent to either NASA or CNES. All the proposals will be jointly selected by NASA and CNES based on the review conducted by ad-hoc committees.

A complete proposal schedule is given below:

- * Release of NRA, July 30, 2003
- * Proposals due at NASA or CNES October 30, 2003.
- * Joint NASA/CNES announcement of final selections will be made in December 2003.

Appendix A1 contains the basic guidance needed for investigators to prepare and send proposals to NASA in response to this announcement. Appendix A-2 contains the basic guidance needed to prepare and send proposals to CNES in response to this announcement. Appendix A-3 provides additional guidance for investigators outside the U.S. or France.

Identifiers:NASA; NRA-03-OES-05, CNES; **SALP-BC-MA-EA-14810-CN**

Submit Proposals (20 copies) to NASA (for proposals from USA) or 10 copies to CNES (for proposals from Europe) and either to NASA or CNES (for proposals from other countries)

NASA

OST Science Working Team
NASA Peer Review Services, Code Y
500 E St. SW, Suite 200
Washington, DC 20024-2760

CNES

CNES, Mrs Pascale Snini
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18 Ave Edouard Belin,
31401, Toulouse cedex 4, France

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

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

Selecting CNES Official: Direction des Programmes, Observation de la Terre

Obtain additional general information:

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

Ghassem R. Asrar
Associate Administrator for
Earth Science

Daniel Vidal Madjar
Direction des Programmes CNES

APPENDIX A-1
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 proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

(1) Transmittal Letter or Prefatory Material.

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

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

Notice

Restriction on Use and Disclosure of Proposal Information

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

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

(4) Project Description.

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present

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

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

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

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

(7) **Facilities and Equipment.**

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

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

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

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

subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

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

(iii) Allowable costs are governed by [FAR Part 31](#) and the [NASA FAR Supplement Part 1831](#) (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations). All proposals involving NASA employees as either PI or as a CO-I must be shown in full cost in accordance with Agency full cost accounting standards.

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

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

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

(11) **Special Matters.**

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

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

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

(d) **Renewal Proposals.**

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

significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

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

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

(f) **Joint Proposals.**

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

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

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

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

(i) **Evaluation Factors.**

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

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

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

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

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

- (iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.
 - (iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.
- (4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

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

(k) Selection for Award.

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

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

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

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

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

closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

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

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

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

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

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.

(o) Data Policy

NASA's policy is to work cooperatively with other U.S. government agencies and our international partners in the development of a comprehensive capability to observe and understand the Earth. In addition, both National and NASA policy require NASA to support private-sector investment in commercial space activities by committing the U.S. government to purchase commercially available goods and services. NASA will not develop a mission that in any significant way competes with or duplicates commercially available goods or services from U.S. industry.

APPENDIX A-2

INSTRUCTIONS FOR RESPONDING TO CNES RESEARCH

ANNOUNCEMENT

A. GUIDELINES FOR PROPOSAL PREPARATION:

The proposals may be written in French or English, but **a full copy in English shall be made available at the time of submission.**

The proposal format outlined below is merely a guide for the prospective proponent. Strict adherence to most of these guidelines is not absolutely necessary. However, page limits will be strictly enforced and proposals should provide information related to all items described below and as otherwise specified in this Announcement.

I. COVER LETTER

A letter or cover page should be forwarded with the proposal (see Appendix B-2). It should be signed by the proponent and an official of the proponent's organization who is authorized to commit the organization to the contents and implementation of the proposal.

II. TABLE OF CONTENTS

The proposal should contain a table of contents.

III. IDENTIFYING INFORMATION

The proposal should contain a short descriptive title for the investigation, the names of all investigators, the name of the organization or institution, the full name of the proposed principal investigator, his address with postal code, his telephone and fax numbers and E-mail and/or telex number.

IV. INVESTIGATION AND TECHNICAL PLAN

The investigation and experimental plan should not exceed 15 to 20 single-spaced pages or printed text, including illustrations, tables, references, bibliographies and biographical information. Information concerning the education, training and relevant experience of the investigators involved in the proposed study should be provided on separate sheets attached to the technical plan. Biographical information of this nature should be limited to two pages or less for each investigator who will play a substantial role in the investigation. Proponents who wish to provide evidence of their experience and competence in particular disciplinary fields are encouraged to quote relevant publications in general scientific literature of which they are the author. References to earlier publications should be limited to major publications that are directly relevant to the

proposed investigation. These citations should be included within the two pages allotted to each investigator for biographical information. Proponents should not include lengthy publication bibliographies or copies of specific publications in their proposal.

Information concerning specialized equipment or facilities that will be used during the course of the investigation should not be presented in the technical plan. Information of this nature should be included in the management and cost plans described in next sections.

It is anticipated that a large number of proposals will be received by CNES in response to this Announcement. To expedite the proposal evaluation process and assure fairness to all proponents, the length restrictions described above will be strictly enforced. If a prospective investigator fails to observe the restrictions on proposal length cited above, CNES reserves the right to return the proposal to the proponent upon receipt without further review or evaluation.

The investigation and technical plan will generally contain the following:

IV.1. Summary

A simple, concise statement about the investigation, its conduct and the anticipated results. This summary should not exceed one single-spaced, typewritten pages.

IV.2. Experimental Objectives

Proposals are primarily solicited in the fields indicated in section 4 of the core document of this Announcement. The Proposal should identify and detail its contribution to each of its fields of relevance. For each contribution, a brief description of the technical objectives and their relationship to past research efforts and the current state-of-the-art should be given. The scientific rationale for the proposed investigation should be clearly established through reference to existing scientific literature and other publications. The proposed investigation should be defined in relation to the current state-of-the-art and to the specific objectives of this NRA. Proponents are encouraged to define explicit hypotheses that will be tested and/or evaluated by the proposed project.

IV.3. Approach:

The concept of the investigation should be clearly stated and the methods to be employed in data analysis and interpretation should be presented.

IV.4. Experimental and Work Plan:

The overall methodology and the sequence of key milestones of the investigation should be presented in some detail.

The proposal should specifically identify the data required by the investigation, the desirable form in which it should be delivered to the proposed principal investigator (OSDR, IGDR, GDR or expertise products) . Ancillary types of data or models to be employed in the analysis and interpretation of data should be clearly identified. Sources of ancillary data should be described along with the procedures that will be used to obtain and reduce ancillary data sets. There should be a clear and logical connection between the data that will be employed by the investigation, the information that will be extracted or inferred from these data and the manner in which such information will be used in addressing the objectives of the investigation. The chronological sequence foreseen for the data collection, analysis and interpretation activities envisaged by the investigation should be explicitly described. This sequence of events will be carefully evaluated to ensure that the study can be successfully completed during the proposed lifetime of the investigation. In cases where detailed studies of particular regional areas will be conducted, the proposal should explicitly define the factors that were considered in regional selection.

IV.5. Anticipated Results:

As far as feasible, the expected outcome of the proposed project should be presented. The significance of these results should be discussed, if possible, in terms of their scientific or real-time application interest and implications for future research and development.

IV.6. Significance of the Investigation:

The significance of the proposed study should be defined in terms of its relationship to earlier studies of a similar nature (as those using TOPEX/POSEIDON data funded under previous grants) and/or to implications of the anticipated results. The proposal should attempt to characterize the relative degree of innovation associated with the objectives or approach of the proposed study. In addition, the proposal should attempt to characterize the importance of the anticipated results in relation to the current state of knowledge within particular disciplinary fields. The extent to which the anticipated results will influence the definition and conduct of future research and/or operational projects on similar or related topics should be discussed in the proposal.

V. MANAGEMENT PLAN AND COST PLAN

Management plans are required from all proponents submitting proposals to CNES.

Cost plans are required by CNES from French proponents and French participants in non-French proposals.

The investigation and technical plans and the management and cost plans will be reviewed independently during the various stages of the proposal evaluation process described in the last section of this appendix.

V.1. Management Plan

The management plan should summarize the management approach and the facilities and equipment required.

Management

The management plan sets forth the investigator's approach for efficiently managing the work, the recognition of essential management functions and the effective overall integration of these functions. If ancillary data are needed, the method for obtaining these data should be detailed.

The management plan gives insight into the organization proposed for the work, including the internal operations and lines of authority with delegations, together with internal interfaces and relationships with CNES, major subcontractors and associated investigators. It also mention the link (if any) with other national or international programs. Likewise, the management plan usually reflects various schedules necessary for the logical and timely pursuit of the work, accompanied by a description of the Principal Investigator's work plan, the amount and responsibilities of the scientific collaborators (if any) and the amount and responsibilities of the technical collaborators (if any).

Facilities and Equipment

All major facilities and equipment essential to the proposed investigation should be indicated, including those of the investigator's proposed subcontractors and those of CNES and other French Government agencies (or foreign agencies in the case of non-French proposals or joint proposals). Existing equipment should be explicitly differentiated from facilities that will be developed to implement the investigation. Procurement schedules and lead times for the acquisition and installation of new equipment and facilities should also be indicated. Since these investigations will focus on Jason data analysis, the development of new equipment and facilities will be limited only to the support required for these analyses.

V.2. Cost Plan (French Investigators Only)

The cost plan should summarize the total investigation cost by major categories of cost as well as by function.

Cost categories

- Materials: This should give the total cost of the bill of materials including estimated cost of each major item. Includede lead time of critical items.

- Travel: This should give the estimated number of trips, destinations, duration, purpose, number of travelers and anticipated dates.

As a rule, direct labor and overhead costs will not be considered.

The cost borne by the PI organization or the organization endorsing the proposal (and signing the cover letter) should be clearly identified as well as those for which support will be requested to other organizations.

Detailed cost schedule

Separate schedules for each year should be attached to show total cost allocable to the following

- Principal Investigator and scientific collaborators costs.
- Data reduction and analysis including the amount and cost of computer time.
- Cost of auxiliary data (if any) to be acquired by the investigator.
- Cost of field studies.

B. PROPOSAL EVALUATION, SELECTION and IMPLEMENTATION

I. TENTATIVE SELECTION, PHASED DEVELOPMENT, PARTIAL SELECTION.

By submitting a proposal, the investigator and his institution agree that CNES has the option to make a tentative selection pending a successful feasibility or definition study of the proposed investigation and, in addition, upon confirmation of the availability of adequate financial support by the proponent's funding agency. Furthermore, CNES has the option to contract in phases for implementation of a proposed investigation and to discontinue the development of an investigative effort at the completion of any phase.

The investigator should also understand that CNES may desire to select only a portion of the proposed 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 topical problems and/or adopt similar approaches to data analysis, CNES may desire joint participation on the part of two or more proponents in a single data analysis project. Where joint participation with other investigators is agreed to, a single individual will be designated as the PI for the investigator group.

II. SELECTION WITHOUT DISCUSSION OR AFTER LIMITED DISCUSSION

CNES reserves the right to reject any or all proposals received in response to this Announcement when such action shall be considered in the best interest of the French Government. Notice is also given of the possibility that any selection may be made without discussion or after limited discussion.

III. NON-FRENCH PROPOSALS

All non-French proposals will compete on an equal basis with proposals originating within France and will go through the same review evaluation, selection and confirmation process.

Should a non-French proposal be selected, CNES will make arrangements with the sponsoring foreign agency for the proposed participation on a cooperative (no-exchange-of-funds) basis, in which CNES and the sponsoring agency will each bear the cost of

discharging its respective responsibilities, including travel and subsistence for its own personnel.

Non-French proponents must submit a Management Plan, such as described in section A of this appendix. In cases where the participation of a French individual is included in a proposal submitted by a non-French Principal Investigator and where it is anticipated that such participation will be supported by CNES and other French Research institutions, a Cost Plan covering such participation must be submitted to CNES as part of the proposal. This Cost Plan must be signed by the French proponent and certified by his institution. Such costs will be considered in the review and evaluation of proposals submitted by non-French individuals.

Sponsoring agencies may, in exceptional circumstances, forward in anticipation copies of unendorsed proposals to CNES if review and endorsement are not possible, before the specified deadline. In such cases, CNES should be advised when endorsement can be expected.

Non-French individuals who plan to participate as CoIs in a proposal submitted by a French PI must have such participation reviewed and endorsed by their appropriate governmental agency before proposals involving such participation can be selected in the selection process. Evidence of such review and endorsement should be provided at the time that the proposal is submitted or as soon as possible thereafter. Formal arrangements for such participation will be made by CNES International Affairs after selection of the proposed investigation.

All other correspondence from non-French proponents and their sponsoring organizations should be sent to CNES International Affairs (see address in Appendix A3).

IV. EVALUATION AND SELECTION PROCEDURES

All proposals received by CNES in response to this Announcement will be initially screened to determine their general relevance to the objectives stated in section 4 of this Announcement. Proposals considered to be unresponsive to the stated objectives of this Announcement will be returned to their authors immediately with a written explanation of this determination. Such proposals will not be considered further by CNES.

Those proposals considered to be responsive to the Announcement objectives will subsequently be peer-reviewed by a technical and scientific panel composed of individuals with widely recognized expertise in the scientific fields covered by the T/P-Jason/OSTM missions. Experts pertaining to the International Scientific Community are expected to participate in this panel. The purpose of this review will be to evaluate the scientific and technical merit of each proposed investigation in terms of its strengths and weaknesses. Those proposals considered to be responsive to the Announcement and having scientific merit will be further jointly reviewed by CNES and NASA to determine their technical feasibility and compatibility with the overall Project Plan.

Proposals which do not request funds will be subjected to the same review and evaluation procedures as those proposals requiring financial support.

Final decisions concerning the acceptance of individual proposals will be made by the NASA-CNES Joint Steering Group for the T/P-Jason programme on the basis of the recommendation by the review panel(s). These decisions will also take into consideration the overall balance between different scientific disciplines, the availability of funds and other mission related resources.

After this selection, the investigations will enter the Ocean Surface Topography Science Investigation Plan and Principal investigators and Co-investigators will be active members of the Ocean Surface Topography Science Team

V. EVALUATION CRITERIA

The fundamental goal of the investigation process is to identify unique ideas and capabilities which best suit the overall scientific, technological and pre-operational objectives of this NRA , as described in section 4 of the core text. All the following criteria, listed in descending order of importance, will be used by CNES in evaluating individual proposals:

1. the relevance of the proposed investigation to the NRA specific opportunity and to the established experiment objectives quoted in section 4 of the core text of this Announcement.
2. the scientific and technological merit of the investigation, including the topical importance of the proposed study within a specific disciplinary field and the probability of achieving positive results,
3. the need for and planned contribution of the Principal Investigator and any collaborators to prelaunch and post-launch mission planning activities,
4. the competence and relevant experience of the Principal Investigator and any collaborators as an indication of their ability to carry the investigation to a successful conclusion,
5. the reputation and interest of the investigator's institution, as measured by the willingness of the institution to provide the necessary support to ensure that the investigation can be completed satisfactorily.

In the event that ancillary data is crucial to the success of the proposed investigation, the proposal must clearly indicate the adequacy and practicality of any plan to acquire these data. In addition to the criteria listed above, cost (when relevant) and management factors will be considered separately in all selections. Management aspects include the time and attention that the Principal Investigator plans to devote personally to the investigation.

VI. IMPLEMENTATION

It is currently expected that official notifications of acceptance or rejection will be jointly issued by CNES and NASA on December 2003 .

Selected investigators will subsequently be contacted by a representative of CNES to discuss the specific terms under which the investigation will be implemented.

VII. TREATMENT OF PROPOSAL DATA

a. Commercial and Financial Data

It is CNES policy to use commercial and financial data included in proposals for evaluation purposes only. Where it is the practice of a proponent or his proposed subcontractor to treat certain commercial and financial data as a trade secret and such data is protectable as a trade secret under law, he may apply the "Notice" of paragraph b, below, to those portions to be maintained as a trade secret.

In any event, commercial and financial data submitted to CNES in a proposal will be protected to the extent permitted under the law, either as a properly noticed trade secret, or as commercial or financial information received from a person and considered confidential or privileged.

b. Technical Data

It is CNES policy to use the technical data contained in any proposal submitted in response to this Announcement for evaluation purposes only. Where any such technical data constitutes a trade secret under the law and the proponent or his potential subcontractor desires to maintain trade secret rights in such technical data, the following "Notice" must be affixed to the cover sheet of the proposal specifying the pages of the proposal which contain trade secrets to be restricted in accordance with the conditions of the "Notice". It is CNES policy to protect technical data labelled in this fashion as a trade secret. CNES assumes no liability for use or disclosure of any proposal technical data to which the "Notice" has not been applied.

"NOTICE"

"Data on page(s)... of this proposal constitute a trade secret. They are furnished to CNES in confidence with the understanding that they will not, without permission of the proponent, be used or disclosed other than for evaluation purposes. In the event a contract is awarded on this proposal CNES may obtain, in the contract, additional rights to use and disclose these data".

VIII. INVENTION AND DATA RIGHTS

Within the implementation of an investigation selected under this Announcement of Opportunity, the Principal Investigator will be required to inform CNES within eight days of any patent or model request deposited for the protection of inventions which may result from the work performed.

Whenever the Investigator may decide not to deposit such a patent or model request, CNES reserves the right to do so and if so, in compliance with the terms of the MoU for T/P, "Jason" and the future OSTM. missions

The Investigator is required to grant CNES a royalty-free license to use patent and models deposited as a result from the work performed under this Announcement.

The Investigator may use the T/P-Jason/OSTM data only for purposes related to his selected investigation. The Investigator is required to ask for CNES or NASA approval before distribution of any T/P, Jason, OSTM expertise, IGDR or OSDR data to a third party non-member of the Ocean Surface Topography Science Team. He should inform CNES or NASA about the distribution of GDR data to a third party non-registered in CNES or NASA data center.

As a general rule, it is understood that the investigator on the one hand and NASA and CNES on the other hand and under the terms of the aforementioned MoU, can use and disclose, without restriction, the data first produced in the performance of the selected investigation. Data is recorded information, regardless of form, the media on which it may be recorded, or the method of recording. The term includes, but is not limited to, data of a scientific or technical nature, software and documentation thereof, and data comprising commercial and financial information. The definition of data for these purposes includes documented source code for scientific software, that is, software used for processing raw instrument data into scientific data.

Appendix A-3

GUIDELINES FOR FOREIGN PARTICIPATION

NASA and CNES accept proposals from entities located outside the U.S. and France, respectively (hereafter termed foreign entities) in response to this NRA. All proposals from Europe should be sent to CNES when all other proposals should be sent either NASA or CNES.

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

Proposals, along with the requested number of copies and Letter of Endorsement must be forwarded to NASA or CNES in time to arrive before the deadline established for this NRA (see addresses at the end of the core text).

Any materials sent by courier or express mail to NASA should be sent to:
OST Science Working Team
NASA Peer Review Services, Code Y
500 E Street, SW Suite 200
Washington, DC 20024-2760

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

Successful and unsuccessful proposers will be contacted directly by NASA and/or CNES program offices. Copies of these letters will be sent to the sponsoring government agency. Formal arrangements for the participation of the selected investigators in the programme will be made by CNES and NASA External Relation Offices.

APPENDIX B-1

Required NASA Proposal Cover Page

Two steps are required to submit a cover page. The first step is to complete the proposal cover page (see SAMPLE Appendix D) **electronically** to the SYS-EYFUS Website located at <http://proposals.hq.nasa.gov/>. If the proposer has submitted an electronic Notice of Intent (Appendix F) 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** (see Appendix D) of the electronic cover page that must be signed by the Principal Investigator and an official 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:

- a) Click the hyperlink for **new user** that will take you to the Personal Information Search Page.
- b) Enter your first and last name. SYS-EYFUS will **search** for your record information in the SYS-EYFUS database.
- c) Confirm your personal information by **choosing** the record displayed.
- d) 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.



Proposal Cover Page

Proposal Number: _____

Date: ___/___/___

Name of Submitting Institution: _____

Congressional District: _____

Proposal Title: _____

Name of Submitting Institution: _____

Congressional District: _____

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.

Principal Investigator Name:	Authorized Institutional Official Name:
Organization:	Organization:
Department:	Department:
Mailing Address:	Mailing Address:
City, State Zip:	City, State Zip:
Telephone Number:	Telephone Number:
Fax Number:	Fax Number:
Email Address:	Email Address:
Principal Investigator Signature: _____	Authorized Institutional Official Signature: _____
Date: _____	Date: _____

Sample

Co-Investigator:

Name	Telephone	Email	Institution	Address

Budget:

Year	Budget
1	
2	
3	
Total	

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

The (*Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant "*) hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1972 (20 U.S.C. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 794), and the Age Discrimination Act of 1975 (42 U.S.C. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

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

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

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

1. LOBBYING

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

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

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

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

2. GOVERNMENTWIDE DEBARMENT AND SUSPENSION

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

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

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

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

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

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

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

APPENDIX B-2

CNES Proposal Cover Sheet
NASA/CNES Research Announcement SALP-BC-MA-EA-14810-CN

Proposal No. _____ (Leave Blank for NASA/CNES Use)

Title: _____

Principal Investigator:

Name: _____

Department: _____

Institution: _____

Street/PO Box: _____

City: _____ State: _____ Zip: _____

Country: _____ E-mail: _____

Telephone: _____ Fax: _____

Co-Investigators:

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

Budget (for U.S. and French Investigators only):

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

Total: _____

Authorizing Official: _____
(Name) (Institution)

APPENDIX C

OST/ST SCIENTIFIC MANAGEMENT, ORGANIZATION AND RESPONSIBILITIES

The purpose of this Appendix is to describe the management approach for the science activities associated with the T/P-Jason/OSTM missions and the authority, responsibilities and interfaces of key participants in the mission.

I. ROLE OF THE OST/ST SCIENCE TEAM

The timing of this Announcement is aimed at establishing an International Ocean Surface Topography Science Team (OST/ST) to advise CNES and NASA on implementation trade-offs from the point of view of the ultimate users of T/P-Jason/OSTM data.. The OST/ST will work to assist and guide the CNES and NASA Project teams in the optimisation of the T/P-Jason/OSTM missions within the constraints and resources of the systems. The PIs will have the responsibility of demonstrating through their investigations the scientific utility of T/P-Jason/OSTM data to the international research community.

The OST/ST will:

- assist the Project in the upgrading/improvement of on-going T/P and Jason missions and in the detailed definition and planning of the OSTM mission,
- assist the Project in the definition of Project/science interfaces,
- participate in reviews to coordinate science requirements and to advise the Project in mission decisions and on the way they might affect science objectives and investigations,
- assist and advise the Projects in identifying, planning, coordinating and conducting data verification activities,
- jointly discuss and coordinate among all members data analysis techniques and methods as well as the publication of the scientific results of investigations related to T/P-Jason/OSTM,
- communicate plans and progress to, and coordinate with, related research programmes and pre-operational and operational programmes

II. RESPONSIBILITIES AND ROLE OF THE OST/ST PROJECT SCIENTISTS

Two Project Scientists are designated by CNES and NASA. They are responsible for creating the optimum conditions and mechanisms for maximizing the scientific return from T/P-Jason/OSTM missions within the applicable constraints. They will therefore coordinate the overall investigation plan, the planning and conduct of validation activities, encourage cooperations between investigation teams and with other investigator teams as appropriate and act as the principal science advisors to the CNES and NASA Project Manager and Programme Manager. They will also harmonize science requirements, plans and field experiments with other organizations, whether private, academic, national or international.

As co-chairs of the OST/ST, they will be the primary interfaces between the Principal Investigators and the Project on matters of scientific interest, they will represent the OST/ST in activities not requiring participation of all team members, they will report and pass recommendations to the NASA/CNES Joint Steering Group for T/P-Jason/OSTM on behalf of the OST/ST.

III. RESPONSIBILITIES OF THE PRINCIPAL INVESTIGATORS (PIs)

Each PI has full responsibility for:

- the conduct of the selected investigation including the cost, development and implementation of pre- and post-launch activities,
- the direction and coordination of the acquisition of any ancillary data necessary for the investigation, the analysis of all relevant data and the publication of scientific results.

Other specific activities of the PI include :

- allocating work assignments among and managing the activities of his Co-Investigators,
- ensuring that the investigation design is appropriate to the objectives and consistent with the capabilities of the T/P-Jason/OSTM missions,
- developing and maintaining adequate documentation regarding the investigation and preparing periodic progress summaries for the Project Scientists,
- planning, conducting and coordinating with the Project verification activities, over and above those conducted by the Project,
- identifying, planning and conducting activities to assist the Projects in improvement of on-going T/P-Jason missions and in detailed definition and planning of the OSTM mission within the constraints and resources available, reporting the results or representing the interests of his Cols at all meetings of the OST/ST.

Appendix D

Notice of Intent to Propose

In order to plan for a timely and efficient peer review process, *Notices of Intent* (NOI's) to propose are strongly encouraged by the date given in this NRA. The submission of a NOI is not a commitment to submit a proposal, nor is information contained therein considered binding on the submitter. NOI's are to be submitted electronically by entering the requested information through SYS-EYFUS Web site located at <http://proposals.hq.nasa.gov/>.

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 Notice of Intent to Propose in response to this research opportunity announcement.

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

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

Once you receive your User ID and Password, **login** to the SYS-EYFUS Web site and follow the instructions for **New Notice of Intent**.

At a minimum, the following information will be requested:

- NRA number, alpha-numeric identifier, (Note: this may be included on the Web site template);
- the Principal Investigator's name, mailing address, phone number, and E-mail address;
- the name(s) of any Co-Investigator(s) and institution(s) known by the NOI due date;
- a descriptive title of the intended investigation; and,
- a brief description of the investigation to be proposed.

A separate NOI must be submitted for each intended proposal.

Appendix E
BUDGET SUMMARY

For period from _____ to _____

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

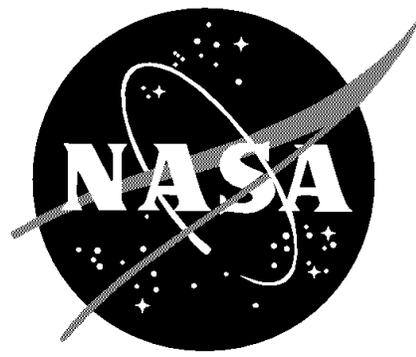
	A	NASA USE ONLY	
		B	C
1. <u>Direct Labor</u> (salaries, wages, and fringe benefits)	_____	_____	_____
2. <u>Other Direct Costs:</u>			
a. Subcontracts	_____	_____	_____
b. Consultants	_____	_____	_____
c. Equipment	_____	_____	_____
d. Supplies	_____	_____	_____
e. Travel	_____	_____	_____
f. Other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

INSTRUCTIONS FOR BUDGET SUMMARY

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

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

* Facilities and Administrative (F&A) Costs



Centre National d'Etudes Spatiales National Aeronautics and Space Administration

30 Juillet 2003

**NRA-03-OES-05
SALP-BC-MA-EA-14810-CN**

JOINT RESEARCH ANNOUNCEMENT

**THE OCEAN SURFACE TOPOGRAPHY SCIENCE TEAM (OST/ST)
GROUPE SCIENTIFIQUE SUR LA TOPOGRAPHIE DE SURFACE DES OCEANS**

APPEL A PROPOSITIONS DE RECHERCHE

Propositions attendues pour le 30 Octobre 2003

Groupe Scientifique sur la Topographie de Surface des Océans

**Appel à propositions de Recherche NASA/CNES
pour soumission avant le 30 Octobre, 2003**

**Référence CNES : SALP-BC-MA-EA-14810-CN
Référence NASA : NRA 03-OES-05**

Publié le 30 juillet 2003

**Centre National d'Etudes Spatiales
DSO/ED/AL, bpi 2002
18 Ave Ed. Belin,
31401, Toulouse, France**

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

1.0 Introduction

Le CNES a pour objectif de développer les utilisations de l'espace, que ce soit pour satisfaire les besoins des collectivités publiques en matière civile et militaire et de la communauté scientifique, ou pour favoriser l'émergence et la diffusion de nouvelles applications, sources de création de richesses et d'emplois. En outre, le CNES, en liaison avec ses nombreux partenaires, a pour mission d'animer la politique de la science spatiale, notamment dans le domaine des sciences de la Terre et de l'océanographie pour lequel d'excellents résultats ont été obtenus, permettant ainsi de mieux connaître notre planète.

2.0 Objectif

La NASA et le CNES ont décidé de lancer ce nouvel appel à propositions pour solliciter des propositions de Recherche en vue de la participation des investigateurs sélectionnés aux activités du Groupe Scientifique sur la Topographie de Surface des Océans (« Ocean Surface Topography/Science Team », OST/ST). Le but de ce Groupe OST/ST est d'assurer l'accompagnement scientifique indispensable à la génération des meilleurs jeux possibles de données satellitales de la topographie de surface des océans et à leur exploitation. Ce groupe s'attachera également à démontrer l'apport essentiel de ces données pour les sciences de la Terre et à favoriser le développement des applications dérivées. Sont sollicitées en particulier des études utilisant les nouvelles capacités d'observation de la mission couplée Jason-TOPEX/POSEIDON et s'appuyant sur des séries altimétriques multi-satellites de plus en plus longues. Le groupe OST/ST sera également impliqué dans la préparation des futures missions, telles que la mission OSTM dont le lancement est prévu en 2007, mission développée dans le cadre d'un partenariat entre la NASA, le CNES, la NOAA et EUMETSAT pour succéder à la mission Jason. Cet appel à propositions couvre également les activités d'étalonnage et de validation croisés des missions Jason et TOPEX/POSEIDON (T/P) pendant et après la phase de vérification. Un intérêt tout particulier sera porté aux propositions mettant en avant l'utilisation de l'altimétrie satellitale pour des travaux de recherche essentiels en océanographie physique et ceux destinés à préparer l'océanographie opérationnelle. D'autres domaines connexes, répondant à la vision stratégique du programme NASA Earth Science Enterprise (ESE) de la NASA et du programme "Terre-Océan-Surface Continentale-Atmosphère" (TOSCA) du CNES, sont également concernés.

3.0 Relations avec les programmes « Earth Science Enterprise » (ESE) de la NASA et "Terre-Océan-Surface Continentale-Atmosphère" (TOSCA) du CNES

La variabilité et le changement climatique sont des domaines d'étude qui demandent des mesures continues des variables caractéristiques de l'océan, tels que la circulation océanique et le transport de chaleur associé. La hauteur de la surface des océans est un des paramètres les plus importants pour étudier la variabilité et le changement climatique. En effet, cette mesure intégrée qui reflète la quantité d'eau liquide et le contenu en chaleur de l'océan est un très bon indicateur diagnostique de la réponse de l'océan aux changements climatiques long terme et à la variabilité à plus court terme. La sensibilité de ce paramètre aux changements climatiques à court terme a été montrée au travers de l'observation des variations significatives du niveau de la mer induites par

les récents évènements majeurs El Nino. La surface du niveau de la mer a des variations spatio-temporelles importantes qui nécessitent un système d'observation global et synoptique seulement possible depuis l'espace, puisque le réseau de marégraphes est limité aux côtes et aux îles. Le niveau de la mer s'est avéré être un paramètre essentiel pour initialiser les modèles numériques océaniques et pour les alimenter et les ajuster en continu.

Les mesures de la topographie des Océans réalisées par les altimètres actuellement en orbite et ceux à venir, sont aujourd'hui indispensables pour compléter les autres observations faites par satellite, les mesures océanographiques *in-situ* et les simulations numériques de l'océan. Cet ensemble de mesures contribue de manière essentielle aux nombreux objectifs scientifiques des programmes ESE de la NASA et TOSCA du CNES, en particulier ceux dédiés à l'étude du climat. La mise en commun de toutes ces observations est un moyen d'acquérir des connaissances nouvelles fondamentales sur les caractéristiques de la circulation océanique, aussi bien en termes de flux moyen et de variabilité, que d'interaction entre cette circulation, sa variabilité, et les changements climatiques. La circulation moyenne absolue peut dès à présent être accessible en utilisant conjointement les nouvelles mesures gravimétriques faites par satellite avec l'altimétrie par satellite, alors que l'étude de la variabilité va bénéficier largement de la résolution spatiale et temporelle améliorée de la mission combinée à d'autres missions altimétriques.

Plus spécifiquement, les programmes ESE de la NASA et TOSCA du CNES soutiennent les études visant à améliorer notre connaissance du système climatique de la Terre en observant les variables océaniques depuis l'espace, et en les intégrant dans des modèles numériques afin de permettre la prévision du temps et du climat sur des échelles spatio-temporelles plus étendues. Ceci fait également partie des objectifs majeurs de l'expérience GODAE (expérience globale d'assimilation de données océanographiques). Ce Programme International prépare, sur la période 2003-2005, la transition vers l'océanographie opérationnelle. Il s'appuie sur l'incorporation de l'altimétrie et des autres données satellitales et *in-situ* dans des modèles océanographiques globaux afin de fournir en routine des analyses et des prévisions 3D de l'état des océans. En outre, la mesure précise du niveau moyen des océans est un indicateur essentiel à prendre en compte pour évaluer l'impact sociétal des changements climatiques de la Planète, en particulier dans les régions côtières. Les propositions en prise directe avec ces objectifs bénéficieront d'une part des données historiques issues de l'altimétrie satellitale, et pourront exploiter d'autre part les capacités de résolution améliorée de la mission, s'appuyant sur des altimètres multiples et autres systèmes possibles d'échantillonnage haute résolution de la topographie des océans. Ces améliorations de la résolution spatiale et temporelle permettront de traiter explicitement le rôle des courtes échelles spatio-temporelles de la circulation océanique, leurs interactions avec les signaux à grande échelle et la circulation océanique moyenne. Ceci permettra de mieux évaluer l'impact de l'océan sur les changements climatiques et inversement la réponse de l'océan à ces changements.

Les projets de recherche soumis en réponse à cet appel à propositions aborderont les nombreux objectifs des programmes ESE de la NASA et TOSCA du CNES portant sur la variabilité du climat. Ils s'appuieront sur de nouvelles techniques de mesure et sur le mélange des multiples données satellitales et *in-situ*, et leur assimilation dans des

modèles numériques, pour améliorer la connaissance et les prévisions sur le comportement des océans et leurs effets sur le climat. L'Océan constitue en effet la mémoire "à long terme" du système climatique de la Terre qui est fortement gouverné par un couplage intense entre l'Océan et l'Atmosphère. Les changements climatiques modifient la circulation océanique qui affecte en retour l'atmosphère ce qui, à son tour, modifie le climat. Afin de pouvoir évaluer correctement ces interactions, il est nécessaire de disposer de mesures altimétriques de très haute qualité. C'est pourquoi, des programmes continus d'étalonnage/validation seront soutenus dans le cadre du présent appel à propositions. Enfin, certains des projets soumis pourront également traiter de l'évaluation de nouveaux systèmes d'échantillonnage à haute résolution de la topographie de surface des océans envisagés pour de futures missions altimétriques.

Les propositions soumises pourront donc aborder tout ou partie des questions génériques qui sont au cœur des programmes ESE de la NASA et TOSCA du CNES, à savoir:

- e. Comment varie la circulation océanique globale à l'échelle hebdomadaire, mensuelle, inter annuelle, décennale et à plus long terme?
- f. Comment les variations climatiques peuvent-elles interagir sur la circulation océanique globale ?
- g. Comment le niveau moyen des océans est-il affecté par la variabilité naturelle du système terrestre et par les modifications engendrées par l'homme?
- h. Dans quelle mesure les tendances climatiques à long terme induites par les changements de la circulation océanique peuvent-elles être bien estimées ou prédites ?

4.0 Contexte

Peu de temps après son lancement, le 7 décembre 2001, Jason fut placé sur la même orbite que T/P, le précédant d'à peine une minute. Une telle configuration était propice à un inter-étalonnage précis des deux systèmes, condition nécessaire et indispensable à la poursuite par Jason de la série temporelle exceptionnelle démarrée par T/P en 1992. Les analyses de ces données croisées T/P-Jason sont en cours mais de nouveaux travaux, visant à déterminer les performances respectives des systèmes Jason et T/P, pourront être proposés en réponse à cet appel à propositions. Ceci concerne aussi bien l'évaluation des performances altimétriques et des corrections environnementales associées, que la détermination précise de l'orbite. De nombreuses comparaisons ayant déjà été réalisées, il est recommandé de soumettre, dans le cadre de cette consultation, des propositions innovantes aptes à fournir une estimation réactualisée des erreurs du système Jason.

A l'issue de la phase d'étalonnage/validation de la mission Jason, en septembre 2002, T/P a été positionné sur une orbite parallèle, à mi-distance des traces au sol Jason; Cette nouvelle configuration offre une résolution spatiale au sol, améliorée d'un facteur deux par rapport à celle obtenue avec le seul satellite Jason. Même si la nouvelle distance inter-traces des deux satellites (environ 100 km à une latitude de 45°; 157 km à l'équateur) ne permet pas de résoudre l'ensemble des échelles spatiales dynamiques des

océans, cette configuration constitue une amélioration notable par rapport à l'espacement initial des traces au sol T/P (220 km à une latitude de 45°; 315 km à l'équateur). De plus, contrairement à l'échantillonnage initial qui offrait un intervalle de temps d'environ 3 jours entre des traces adjacentes espacées de plusieurs centaines de kilomètres, la nouvelle configuration permet un survol simultané des deux satellites le long de traces adjacentes distantes de quelques 100 km. Ces mesures simultanées le long de traces parallèles devraient permettre d'estimer la composante tangentielle de la vitesse des courants géostrophiques pour reconstruire ainsi dans sa totalité le vecteur vitesse des courants.

Les conclusions du rapport d'un groupe de travail scientifique sur la topographie des océans à haute-résolution (Publication JPL 03-002; Fu, 2003) indiquent que la mission T/P-Jason dans sa nouvelle configuration offre un échantillonnage de la topographie de la surface des océans mieux adapté que celui issu de toute autre combinaison envisageable de deux satellites. Ainsi, les données combinées de Jason et T/P devraient être à l'origine de nouveaux résultats scientifiques impossibles à obtenir à partir d'un satellite isolé ou d'un autre couple de satellites non coordonné. L'intérêt de cette nouvelle mission augmentera avec sa durée, une année de vie commune T/P-Jason étant le minimum requis. Outre les retombées scientifiques à court terme mentionnées ci-dessus, la mission combinée actuelle pourra être mise à profit pour mettre en place rapidement les futures stratégies d'échantillonnage. Le recouvrement potentiel entre les missions Jason et OSTM permettra de déplacer Jason sur les nouvelles traces décalées T/P, et pouvoir en exploiter les données, sans avoir à attendre une année complète de fonctionnement, après le début de la phase routine, de la mission OSTM.

Cette nouvelle capacité d'observation de la mission T/P-Jason, conjointement avec les autres missions altimétriques (Earth Remote sensing Satellite (ERS2), Geosat Follow On (GFO), ENVISAT), doit être exploitée efficacement afin d'améliorer la compréhension de la circulation océanique et les processus de surface associés. Il devrait à présent être possible de résoudre une grande partie du système d'ondes planétaires, qui n'était visible que partiellement à l'examen des seules données T/P et Jason. Le rôle des tourbillons océaniques dans les bilans thermique et dynamique des océans peut être étudié de manière diagnostique et non plus déduit simplement de la variabilité des mesures à plus grande échelle. En outre, les champs de mesure associés, tels que la hauteur des vagues et la vitesse du vent, seront dorénavant disponibles avec une bien meilleure résolution et un accès en temps quasi-réel. Enfin, d'autres applications exigeant une résolution spatiale améliorée, telles que l'observation des eaux continentales, des glaces, de la topographie terrestre et des zones côtières, pourront largement bénéficier de cette résolution spatiale doublée.

L'amélioration de la résolution spatiale devrait également s'avérer utile pour de multiples applications en temps réel, par exemple pour les opérations off-shores pétrolières, le suivi des nappes polluantes, le routage de la navigation commerciale et de plaisance, les activités de pêche et les opérations de recherche et de sauvetage. Pour un grand nombre de ces applications, les données altimétriques satellitaires représentent une composante essentielle d'un système intégré plus vaste. C'est pourquoi, sont particulièrement sollicitées les propositions s'appuyant sur l'utilisation conjointe de

l'altimétrie Jason et T/P avec d'autres données d'altimétrie et d'autres observations satellitales, comme l'imagerie infrarouge thermique de la surface et la couleur des océans. Ces applications s'inscrivent dans le mouvement actuel visant à développer un "système intégré d'observation des océans" (IOOS), qui met l'accent sur l'association des mesures *in-situ* avec les observations par satellites. Sont donc également encouragées les études combinant les données altimétriques T/P et Jason avec les données *in-situ* (par exemple, données ARGO, flotteurs, etc.) et avec les sorties des modèles numériques dans lesquels sont assimilées ces mêmes données.

Cet appel à propositions vise également à promouvoir les recherches utilisant les données combinées de T/P et Jason, accumulées depuis plus d'une décennie, afin d'étudier la variabilité basse fréquence des océans et ses effets sur le climat. De telles séries de données sont en effet particulièrement utiles pour suivre les variations saisonnières et inter annuelles et le niveau moyen des mers. Les études combinées s'appuyant à la fois sur les données altimétriques, les autres types de mesures satellitales, les données *in-situ* et les produits des modèles numériques, sont ici aussi encouragées. Enfin, le lancement réussi et l'exploitation de la mission géodésique GRACE offre une nouvelle opportunité d'étude de la circulation océanique moyenne et de sa variabilité. Puisque, l'utilisation conjointe des données altimétriques et des mesures GRACE de gravité devrait rendre possible l'observation des courants barotropes des océans.

Afin d'assurer la pérennité des observations réalisées par T/P et Jason et la transition vers les missions opérationnelles altimétriques du futur, la NASA et le CNES, en partenariat avec la NOAA et EUMETSAT, prévoient de lancer la Mission de Topographie de la Surface des Océans (OSTM) pour succéder à la mission Jason. C'est un satellite identique à Jason, ayant une charge utile nominale similaire à celle de Jason, et placé sur la même orbite, qui assurera cette mission OSTM. La continuité des mesures T/P-Jason, objectif majeur, sera ainsi maintenue en offrant le même niveau de performance. La disponibilité ininterrompue du flot de données altimétriques, avec la possibilité d'un accès en temps très peu différé, via le réseau sol NOAA et EUMETSAT, permettra de favoriser et de développer les applications opérationnelles dérivées. Le lancement de la mission OSTM est prévu pour 2007. Le présent appel à propositions vise également à solliciter des propositions portant sur la préparation et la mise en oeuvre des expériences d'étalonnage et de validation des futures mesures OSTM.

En plus de sa charge utile nominale, le satellite de la mission OSTM pourrait transporter un instrument expérimental désigné sous le nom de WSOA («Wide Swath Ocean Altimeter»). Il s'agit d'un altimètre large fauchée (Fu et al., 2002 ; Chelton et al., 2001) qui utilise une antenne interférométrique pour cartographier en quelques jours la topographie de la surface des océans avec une résolution spatiale très fine. C'est une des approches possibles pour réaliser la cartographie haute résolution de la topographie de surface des océans à partir de radars altimétriques embarqués sur satellite. La mission conjointe TP/Jason ne constitue en effet qu'un premier pas vers une véritable couverture altimétrique méso-échelle, telle que celle offerte par le WSOA.

5.0 Objectifs ciblés du Programme d'Etude du Groupe Scientifique OST

Les objectifs majeurs visés par cet appel à contributions conjoint NASA/CNES sont les suivants :

- Mener des études en océanographie physique utilisant les données de la mission conjointe T/P-Jason ainsi que la série temporelle continue de plus de 10 ans T/P et Jason, en les associant de préférence à d'autres jeux de données satellites, *in-situ* et/ou modèles, que ce soit à des fins de recherche fondamentale ou pour développer des applications opérationnelles. Ces projets pourront aborder un grand nombre de thèmes en zone côtière et en plein océan, notamment les variations intra-saisonnières à inter-annuelles, les variations du niveau moyen des mers, la caractérisation des ondes planétaires, les marées basse fréquence, les ondes de gravité, la génération du vent et des vagues, etc. De nombreuses études pourront être liées à des projets plus vastes, tels que CLIVAR («Climate Variability»), GOOS («Global Ocean Observing System»), NOPP («National Ocean Partners Program») et le programme international de réseau de surveillance *in-situ* Argo.
- Poursuivre les études comparatives entre T/P et Jason pour améliorer la détermination précise de l'orbite, pour contrôler la qualité de la correction de la vapeur d'eau mesurée par les radiomètres micro ondes passifs et celle des autres corrections (ionosphère, biais d'état de mer, effet barotropique), et pour caractériser précisément les différents postes d'erreur des mesures altimétriques Jason. Il s'agit également de développer et d'évaluer de nouveaux algorithmes géophysiques et/ou modèles susceptibles d'améliorer la qualité des données. Le bilan des performances Jason pourra être ainsi comparé aux performances réactualisées de T/P, après prise en compte de l'ensemble des résultats croisés d'étalonnage/validation obtenus durant la phase initiale de vérification et après. Un grand nombre de résultats ont déjà été exploités, mais un effort d'investigation complémentaire est nécessaire pour affiner les bilans d'erreur et les niveaux de précision des données Jason et T/P. Un tel travail d'évaluation est indispensable à une exploitation adéquate des flots de données de la mission conjointe T/P-Jason. Les propositions attendues concerneront, soit des études complémentaires à des travaux en cours, soit de nouveaux types d'investigation s'appuyant sur des techniques d'analyse originales.
- Participer au développement des applications opérationnelles de l'altimétrie satellitale qui exigent une mise à disposition en temps peu différé des données et des produits. Ceci inclut, de manière non exhaustive: les prévisions climatiques saisonnières à inter-annuelles, les prévisions océaniques à plus court terme, l'exploration et l'exploitation des ressources pétrolifères, le suivi des nappes polluantes, les courants côtiers, l'aide à la navigation commerciale et de plaisance, les activités de pêche, et la météorologie marine.
- Utiliser les données des missions de gravité conjointement avec les données altimétriques, afin d'améliorer l'observation et la compréhension de la circulation océanique moyenne et de la variabilité barotropique.
- Préparer l'étalonnage et la validation des mesures de la mission OSTM en développant et en évaluant des techniques dédiées, tirant parti notamment du chevauchement espéré

des missions Jason et OSTM ou en proposant des méthodes palliatives si une telle période commune de fonctionnement n'avait pas lieu.

- Exploiter les mesures altimétriques dans des domaines connexes comme: l'observation de la calotte glaciaire et des glaces de mer, les études sur les lacs et les eaux continentales, la surveillance des embouchures des grands fleuves, la connaissance du géoïde marin. Ces études peuvent utiliser l'altimétrie, mais également des données complémentaires, notamment la localisation précise de points géodésiques par les systèmes POD hautement performants embarqués sur T/P et Jason (Doris, GPS, laser).

Toutes les équipes proposantes sont invitées à participer à la valorisation et à la promotion des résultats obtenus auprès d'un vaste public, aujourd'hui conscient de l'importance des études sur la connaissance et la préservation de notre environnement. Un tel effort peut être entrepris au travers d'activités éducatives et de communication, tant formelles qu'informelles. Le programme OSTM offre au CNES, à la NASA et aux investigateurs sélectionnés, une nouvelle opportunité pour mettre en avant et transmettre auprès du public les nouvelles connaissances acquises sur notre environnement et le sensibiliser sur les défis majeurs à relever dans les années à venir. La NASA et le CNES apporteront donc un intérêt tout particulier aux propositions de travail qui prévoient d'apporter une contribution significative à de telles activités de valorisation, d'éducation et de promotion vers l'extérieur.

6.0 Mandat du groupe scientifique OST

Cet appel à propositions de Recherche du CNES et de la NASA est destiné à sélectionner les équipes membres du groupe scientifique OST. Ce groupe sera chargé de conduire les travaux de recherche et d'analyse répondant aux objectifs du programme tels que décrits ci-dessus. Il continuera de fonctionner de manière très similaire au Groupe de Travail Scientifique Jason précédent (SWT). Des réunions annuelles regroupant les membres du groupe scientifique et des équipes projet auront lieu en alternance en Europe et aux USA. Ce sera l'occasion de présenter, sous forme orale ou affichée, de discuter et d'examiner l'état d'avancement de la mission et des travaux menés par les chercheurs sur de nombreux sujets de recherche et sur leurs applications opérationnelles. Les deux responsables Scientifiques du Projet, nommés et mandatés par la NASA/JPL et le CNES, continueront à assurer la liaison entre le projet et les membres du groupe scientifique.

6.1 Conditions requises pour soumettre une proposition

Pour être recevables, les propositions devront porter sur des recherches scientifiques pouvant être librement évaluées et publiées, s'appuyant sur l'utilisation des données Jason et T/P et autres données et modèles. Elles devront contribuer à la valorisation et à la validation des données combinées TP et Jason au travers de la production et de la publication de résultats de qualité ayant un impact scientifique significatif. Les travaux proposés pourront porter également sur la préparation aux activités d'étalonnage/validation et à l'exploitation des futures données OSTM.

Les propositions seront soumises par un Investigateur Principal (PI) associé à un ou plusieurs Co-Investigateurs (CoI). Les critères de sélection porteront entre autres sur

l'expérience et les qualifications du PI et des CoI, ainsi que sur la qualité et la pertinence des propositions. La procédure de sélection ne prendra pas en compte les qualifications du personnel de soutien qui ne sera pas nommément désigné mais identifié par catégorie (par exemple, étudiant 3^{ème} cycle, informaticien, chercheur post-doctorat, etc.).

7.0 Sélection des propositions

A la suite des résultats de l'évaluation conjointe menée par des comités ad-hoc désignés, la NASA et le CNES envisagent de sélectionner les membres du groupe scientifique pour une durée de quatre ans, soit jusqu'au lancement prévu du satellite de la mission OSTM. Si le début de la mission OSTM est retardé de manière significative, les propositions seront réexaminées au cas par cas afin de déterminer si le maintien de l'activité est justifié. En tout état de cause, le soutien aux chercheurs sélectionnés ne sera maintenu que sous réserve d'un état d'avancement satisfaisant des travaux et de la disponibilité du financement requis s'il y a lieu.

Le CNES et la NASA ne financeront que les investigateurs français et américains respectivement. En retour, la NASA et le CNES chercheront à utiliser au mieux les résultats obtenus au travers d'un partenariat solide avec les investigateurs et les agences concernées. A cet effet, les propositions établies en coordination avec d'autres programmes en cours sont encouragées. Il est d'ailleurs demandé aux soumissionnaires de préciser toutes les autres sources de financement ayant un lien avec les activités proposées dans le cadre de cet appel à propositions.

8.0 Financement

8.1 Financement des Investigateurs américains

Dans un premier temps, le financement global disponible pour les Investigateurs américains sélectionnés dans le cadre de cet appel à propositions s'élèvera à environ 5,5 millions de dollars par an. Le financement prendra la forme de bourses ou de contrats selon le cas.

8.2 Financement des Investigateurs français

Le financement disponible pour les investigateurs français proviendra des crédits alloués par la Direction des programmes du CNES pour mener les travaux d'investigations scientifiques et d'étalonnage/validation de la mission Jason/OSTM, et de ceux alloués par le projet Jason/OSTM du CNES pour conduire les activités d'évaluation des performances des instruments et du système. Afin de juger des progrès réalisés par rapport aux objectifs affichés, une évaluation annuelle de l'état d'avancement des projets sélectionnés sera conduite par le CNES en collaboration avec le programme TOSCA et les programmes nationaux associés.

8.3 Financements des autres Investigateurs

Les investigateurs qui ne sont ni français ni américains devront rechercher des sources de financement appropriées auprès des autorités nationales dont ils dépendent. La

NASA et le CNES, ainsi que la NOAA et EUMETSAT, fourniront, si besoin, des lettres d'accompagnement et de soutien, afin d'aider les investigateurs à obtenir le financement demandé.

9.0 Modalités de soumission des propositions et calendrier

Tous les candidats sont invités à remettre leurs propositions en réponse à cet appel à soumission au plus tard à 16h30 TUC le 30 octobre 2003. Les propositions soumises après ce délai ne seront pas examinées, sauf s'il est avéré qu'elles présentent un intérêt particulier pour les gouvernements français ou américains. Les propositions ne devront pas excéder 20 pages (interligne simple) et incluront les figures, tableaux et références (et budget demandé pour les soumissionnaires américains et français), conformément aux instructions indiquées dans les Annexes A-1 (NASA) ou A-2 (CNES), ainsi que la page de garde dont un modèle est fournie dans les Annexes B-1 (NASA) et B-2 (CNES). Des informations complémentaires, telles que CV et autres renseignements pertinents, pourront être jointes en annexe.

Toutes les propositions soumises par les investigateurs américains seront adressées à la NASA. Toutes les propositions soumises par les investigateurs français et européens seront adressées au CNES. Les autres propositions pourront être adressées soit à la NASA, soit au CNES. Elles seront sélectionnées conjointement par la NASA et le CNES sur la base des résultats des évaluations menées par les comités ad-hoc.

Le calendrier complet de la procédure de sélection est le suivant:

- * Publication de l'appel à propositions: 30 juillet 2003
- * Remise des propositions à la NASA ou au CNES: 30 octobre 2003
- * Annonce conjointe par la NASA et le CNES des propositions retenues: décembre 2003.

L'Annexe A-1 donne les instructions de base nécessaires aux candidats pour rédiger et soumettre leur proposition à la NASA. L'Annexe A-2 donne les instructions de base nécessaires aux candidats pour rédiger et soumettre leur proposition au CNES. L'Annexe A-3 fournit des instructions supplémentaires pour les candidats qui ne sont ni américains ni français.

10. Envoi des propositions

Référence CNES: SALP-BC-MA-EA-14810-CN

Référence NASA: NRA-03-OES-05

Les proposant américains doivent envoyer 20 copies de leur proposition à la NASA (adresse indiquée ci-dessous) et les proposant européens doivent envoyer 10 copies de leur proposition au CNES (adresse indiquée ci-dessous). Tous les autres proposant doivent envoyer leur proposition, soit au CNES soit à la NASA.

NASA

OST Science Working Team
NASA Peer Review Services, Code Y
500 E St. SW, Suite 200
Washington, DC 20024-2760

CNES

DSO/ED/AL, Mrs Pascale Snini
AO OST/ST, bpi 2002
18 Ave Edouard Belin,
31401, Toulouse cedex 4, France

Pour les envois express de nuit aux USA, prière de mentionner le numéro de téléphone suivant: (202) 479-9030.

Cette procédure de sélection est placée sous la responsabilité de la Direction de la Division Recherche du Bureau des Sciences de la Terre de la NASA et de la Direction des Programmes d'Observation de la Terre du CNES.

Des informations complémentaires peuvent être obtenues auprès de :

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Le CNES et la NASA apprécient l'intérêt porté par les proposant à cet appel à propositions.

Ghassem R. Asrar

Associate Administrator for
Office of Earth Science

Daniel Vidal Madjar

Direction des Programmes du CNES
Observation de la Terre