NASA SCIENCE INSTITUTES PLAN

REPORT OF THE NASA SCIENCE INSTITUTES TEAM

Final Publication (Incorporating Public Comments and Revisions)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

WASHINGTON, D.C.

FEBRUARY 1996

PREFACE

"The most important role of NASA scientists is to bind NASA's immense engineering and technical capabilities to the still larger and more diverse industrial and research communities across the country and around the world."

— Space Studies Board
letter to the NASA Chief Scientist
March 29, 1995

We live in a time of change, when all agencies of government are introducing more effective and efficient ways of accomplishing their missions. NASA has led in finding better, faster, and cheaper ways of developing space hardware and accomplishing the exploration of space in partnership with the aerospace industry. We now have an opportunity to implement similar efficiencies in some areas of NASA science through innovative ventures with the scientific community. In creating a new class of science institutes, NASA will identify those elements of its in-house research programs that can be handled effectively through cooperative endeavors that bring together unique NASA facilities and capabilities with more effective, private-sector management and closer ties to the nation's academic and educational communities. These new institutes will enable the agency to accomplish its mission more effectively and enhance its support for the broad national capability in research.

For almost 40 years NASA has provided the scientific community with technical capabilities only dreamed of at the time of the establishment of the Agency. The unending stream of discovery flowing from the magnificent spacecraft and space experimental systems developed by the NASA and industry team stands as a tribute to American genius. But throughout the last four decades, these developments have required more than engineering competence and access to space. They have required a commitment on the part of NASA scientists and engineers to realizing the dreams of the scientific community. The role of NASA scientists in planning missions and enabling and facilitating the access of the broader community to the facilities developed by NASA has been crucial. This contribution by NASA scientists would not have been possible unless these individuals were competent scientists in their own right, viewed as peers of the scientists in the broader community that they serve.

The development and maintenance of this in-house competence has required a commitment by NASA to nurturing a scientific capability that is both broad and deep. As is the case in the external scientific community, this has required constant attention to the revitalization process which begins with the mentoring of students, the involvement of graduate students and post-doctoral scientists, the employment of entry level junior scientists, and the development of those scientists to the leaders who organize the efforts of the community at large and bind together the engineers and scientists who produce the results that the world has come to expect from NASA. But today there is a problem. NASA's ability to replenish and revitalize these capabilities has been adversely affected by declining budgets and workforce constraints, which threaten to stifle the in-house technical capability that NASA has depended upon in the past to assure scientific success. The threat is especially severe in the newer disciplines of microgravity and space life science, which must be nurtured and developed for most effective use of the international Space Station. NASA's in-house space scientists are still among the best in the world, but preservation of that capability requires innovative new ways of doing business.

The Agency now has an opportunity to use these current tensions constructively to forge a new and more effective alliance with the nation's scientific community. We can partner in ventures that preserve and develop the crucial information and skills needed for NASA space missions while at the same time enhancing the binding role between the external scientific community and unique NASA facilities and flight opportunities. We can accomplish more with less by tapping the space science capabilities that have grown in the nation's academic research organizations. The current scene is replete with examples of the ability of the scientific community to organize and manage very complex ventures in the national interest. NASA itself has some experience with these capabilities, most notably in the contributions of the Space Telescope Science Institute to the scientific success of the Hubble Space Telescope, while other Federal science agencies have even longer histories of accomplishing their missions through partnerships with academia and the broader research community. While the success of the Space Telescope Science Institute encourages the belief that NASA can successfully meet the current challenge through partnerships with the private sector, an even further evolution of the concept will be required. The innovation that is required must result in the emergence of organizations that, although they are not Federal entities and operate independently of any agency, will serve the nation by performing functions heretofore performed by NASA scientists. These organizations must also be closely tied to the scientific community to assure quality and provide more effective and cost efficient operations. If successful, the NASA science Institutes will preserve and improve the quality of NASA's contributions to national science in the face of reductions in the size of the Federal workforce, positioning the nation to continue it's pursuit of science and exploration in the development of space.

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EXECUTIVE SUMMARY

The Science Institute concept has merit and should be pursued.

Institutes provide a mechanism to preserve and/or improve the quality of NASA contributions to national science in the face of reductions in the size of the Federal workforce.

- Significant issues remain to be resolved.
- Several Institutes have interrelated missions. Initial efforts to establish Institutes should incorporate provisions for future integration.

The eleven science Institutes proposed by the Zero Base Review are in various stages of readiness and should be pursued in a phased manner. Only three are ready for near term initiation:

- ***Biomedical Research Institute (JSC):***
- ***Astrobiology Institute (ARC):***
- ***Microgravity Institute [Fluid and Combustion] (LERC):***

NASA should proceed immediately to:

- Complete detailed definition of all three institutes including review with appropriate external scientific groups;
- Release draft Cooperative Agreement Notice for Biomedical Institute;
- Pursue legislative authorities required and recommended prior to proceeding with Astrobiology and Microgravity Institutes.

After assurance of recommended legislation, NASA should continue sequentially with the Astrobiology and Microgravity Institutes allowing sufficient time between initiations to assure focused Enterprise and Headquarters senior management attention and an adequate interval for learning.

The remaining Institutes proposed by the Zero Base Review may require modifications to existing arrangements or further study.

Definition and Management Approach

A NASA Science Institute is defined as:

"A non-Federal entity established to accomplish an ongoing research program; An organization devoted to research, the development and transfer of technology, and the provision of services to the scientific community, and the public; and, An organization responsible for facilitating scientific and industrial community access to NASA's space and ground-based assets."

- ***Institutes will be chartered and directly funded at the direction of the NASA Enterprises.***
- ***NASA Centers will provide services and support to the Institutes. Any core function (including related science) remaining at a host Center which falls within the mission area of an Institute will be funded through the Institute.***
- ***The NASA Chief Scientist will be responsible for coordinating science community involvement in the formulation of Institute plans and continually assessing the quality of the science at each Institute, including any associated NASA component.***

General Issues and Proposed Strategies

Significant issues for the successful implementation of Institutes exist in several key areas. Findings and recommendations are outlined for issues relating to human resources, funding, accounting, and procurement.

- Any migration of civil servants to Institutes should be accomplished on a voluntary case-by-case basis, where there is a shared interest between the civil servant and the Institute.
- Institutes will require stable funding from NASA to support core service and research functions.
- Institutes and the Agency must both use full cost accounting.
- The process for establishing Institutes should be open in nature and encourage participation across a broad range of potential partners.

Request for Legislative Authorities

NASA should request legislative authority and pursue limited exceptions to: post-employment and procurement integrity restrictions; portability of benefits and restrictions on participation in the civil service retirement system; and, limitations on the transfer and use of appropriated funds for establishing Institutes.

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I. BACKGROUND AND INTRODUCTION

"Science is and should remain a driver for our Nation's space program, but in order to assure a future for science we must come to terms with some very real challenges."

— Zero Base Review
May 10, 1995

Background

In May 1995, NASA concluded a comprehensive internal review, known as the Zero Base Review, to respond to the Administration's challenges in the budget through FY 2000. The primary purpose of the review was to identify ways in which NASA could achieve the savings committed to in the President's FY 1996 budget through reductions in infrastructure instead of programs. This review concluded that the Agency could achieve these reductions, but that it would require cuts in Agency employment levels which would result in a total civil service workforce of no more than 17,500, as well as the elimination of 25,000 contractor personnel by the year 2000. In addition, the review recommended a more focused set of roles and responsibilities for each NASA center.

It was during the course of this Zero Base Review that the concept of Institutes was identified as a potentially beneficial approach to maintain or improve the quality of national science in the face of organizational streamlining.[1] The recommendation was made to reshape NASA's science program under a reinvention strategy to bind NASA's science program more closely to the larger science community that it serves. The strategy involved "privatization" of a portion of NASA's science program into a number of science "Institutes".

Eleven Institutes Proposed by the Zero Base Review

- Ames Research Center
  - Astrobiology Institute
- Goddard Space Flight Center
  - Goddard Institute for Space Studies
  - National Space Science Data Center
- Johnson Space Center
  - Biomedical Research Institute
  - Astromaterials Institute
- Langley Research Center
  - Atmospheric Science Institute
- Lewis Research Center
  - Microgravity Institute (Fluid and Combustion)
  - Space Power Institute
- Marshall Space Flight Center
  - Global Hydrology and Climate Center
  - Microgravity Institute (Materials and Biotechnology)
  - Space Science Institute (Astrophysics and Space Physics)

Table 1 *Eleven Institutes Proposed by the Zero Base Review.*

Motivation

The purpose for establishing science Institutes is to preserve and improve the quality of NASA's contributions to national science in the face of reductions in the size of the Federal workforce.

It is essential that NASA remain at the forefront of space science, while at the same time coupling its efforts more closely with other researchers and educators. NASA scientists should be enablers both for NASA and the broad community that is served by NASA facilities and access to space.

In the current environment, NASA's ability to conduct a viable research program is at risk. The motivation for considering Institutes was born out of the desire to preserve key science capabilities and to look beyond Agency downsizing or cost savings and to take positive steps towards establishing a new model for managing NASA's research program.

Introduction

This NASA Science Institute Plan has been produced in response to direction from the NASA Administrator for the benefit of NASA Senior Management, science enterprise leaders, and Center Directors. It is intended to provide a conceptual framework for organizing and planning the conduct of science in support of NASA's mission through the creation of a limited number of science Institutes.

This plan is the product of the NASA Science Institute Planning Integration Team (see Figure A). The team worked intensively over a three-month period to review proposed Institutes and produce findings for NASA senior management. The team's activities included visits to current NASA Institutes and associated Centers, as well as approximately a dozen non-NASA research Institutes. In addition to producing this plan, the team published a "Benchmarks" report. The Benchmarks report provides a basis for comparing NASA's proposed activities with those sponsored by other national science agencies, and identifies best practices to be considered in the establishment of NASA Science Institutes.

Throughout the team's activities, a Board of Advisors comprised of senior NASA officials (augmented as necessary with other government employees) provided overall advice and counsel.

Interaction with potential offerors to manage or operate Institutes was suspended throughout this activity in

1 *In this context, the term "Institute" refers to the independent entity with which NASA collaborates, rather than to a broader framework or mode of operation where NASA works collaboratively with other organizations.*

order to avoid providing potential offerors with premature and/or inconsistent information.

The plan is organized in three chapters. Chapter One provides an introduction, including guiding principles, a brief overview, history, and background. Chapter Two provides a definition and description of the Institute concept, both in terms of functional roles and responsibilities and in terms of relationships and interactions with other organization units. Chapter Two also outlines a management and implementation approach. Chapter Three presents functional management issues and strategies.

Guiding Principles

Institute planning was shaped by several important guiding principles:

- Institutes should preserve and/or improve the quality of NASA's contributions to national science.
- Institutes are expected to be cost efficient, thus optimizing the budget available for science.
- Initial funding must be identified from NASA's existing budget plan.
- Institutes are means for reducing infrastructure and optimizing the use of existing facilities.
- Institutes will adhere to the same principles and policies governing conduct of NASA science program—broad participation by full range of potential partners, cultural diversity in the workforce, open competition, rigorous review, etc.

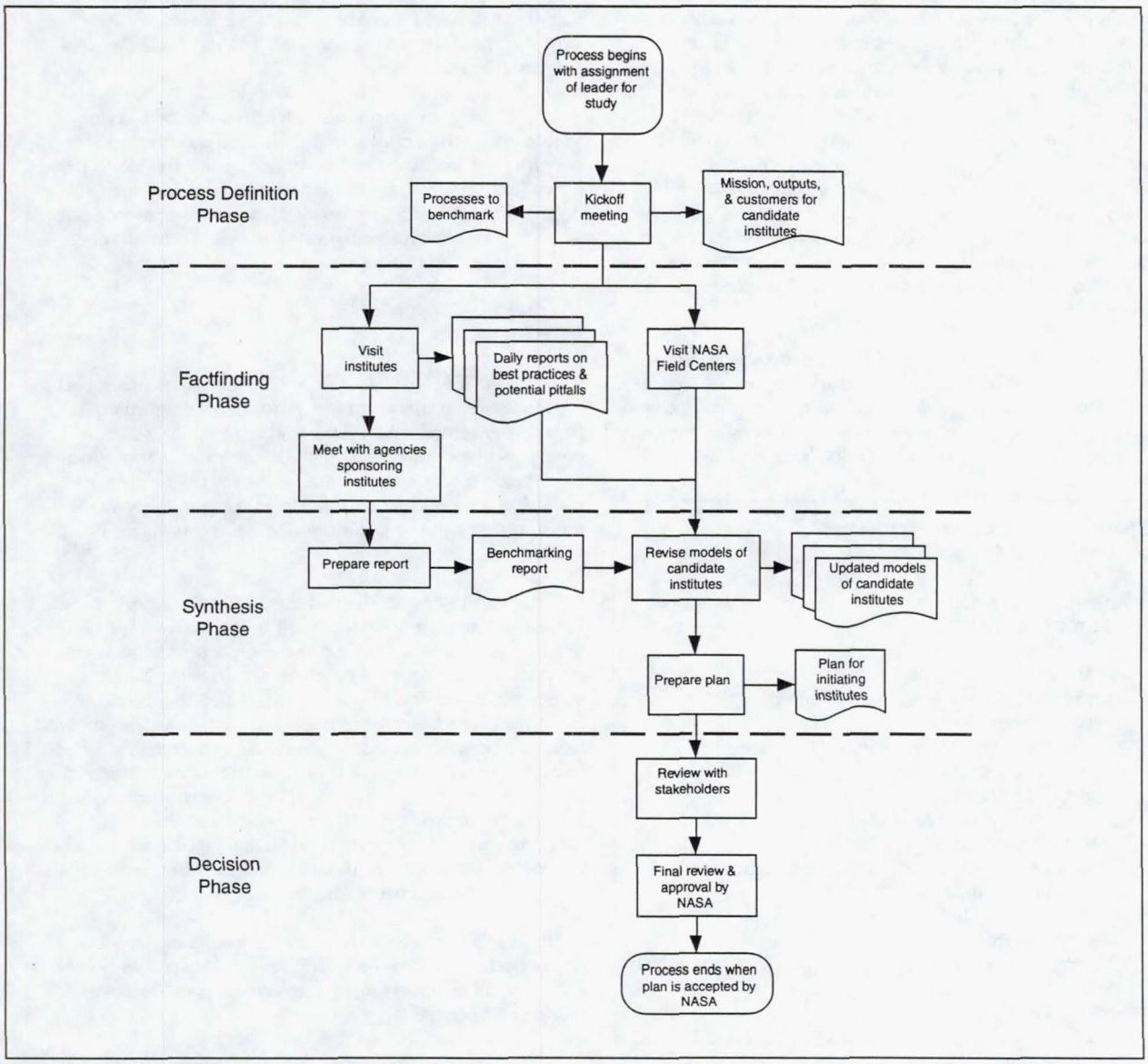

Figure A *Overview of Team Activities.*

II. Definition and Implementation

Definition

The definition for an Institute as proposed in the Zero Base Review has been modified as follows:

A NASA science Institute is:

- *A non-Federal entity established to accomplish an ongoing research program;*
- *An organization devoted to research, the development and/or transfer of technology, and the provision of services to the scientific community and the public; and,*
- *An organization responsible for facilitating scientific and industrial community access to NASA's space and ground-based assets.*

An Institute is an independent entity with the ability to enter into collaboration with NASA. The form of this collaboration and mode of operation may vary for each of the different Institutes proposed. While Institutes may engage in significant collaborations with NASA Centers, central to each of these arrangements is the existence of a legal entity separable from NASA.

Common Characteristics and Elements

It is expected that institutes will be operated by universities or other non-profit organizations in partnership with for-profit industry as appropriate. It is not expected that a single model for an Institute can deal with the wide range of missions and scopes identified for the Institutes under consideration. However, Institutes will have a number of common characteristics.

External Leadership. Each Institute will have identifiable intellectual leadership outside of NASA. Institute Directors will not be NASA employees. Similarly, Institute Boards of Directors will not include NASA employees. Institutes will be established to allow for shared ownership and the more substantive involvement of communities external to NASA. Institutes will foster cooperation, not competition, among the government, academic, and industry sectors.

Corporate Identity and Affiliation with NASA. A clear identity with NASA and a part of its mission is an essential common characteristic for each Institute proposed. This corporate identity is likely to be established through the Agency's long-term funding commitments to the Institute. It is reasonable to expect that Institutes may wish to acknowledge NASA's sponsorship and support in their institutional advertising, annual reports, press release credits, and other documents for public dissemination.

Competitive Selection and Peer Review. All work assigned to Institutes should be the result of a competitive selection process. This competitive process may be part of the initial selection process or subsequent selections for scientific research grants or individual projects. In the case of scientific research, all selections should result from a process that conforms to standard policies including peer review as appropriate.

Inclusion of Research, Technology, and Service Components. Each Institute will be responsible for: conducting and enabling peer reviewed research for the development of new scientific knowledge and understanding of nature; creating, developing, and/or transferring new technology; and providing value-added services to its external customers.

Degree of Independence. As mission organizations, Institutes will be expected to behave proactively, exercising the necessary degree of entrepreneurship, autonomy and judgment required to achieve their stated goals and objectives while contributing to NASA's mission. As independent entities, Institutes may also obtain support from other funding sources, open new lines of business, and perform work for others subject to a determination by their Board of Directors that such work is not inconsistent with the Institute's overall mission.

Off-Site Business Office. Science Institutes will have a physical presence and will not be merely "virtual" organizations. Consistent with an Institute's identity as an independent entity, separate and easy access should be provided for the external science community to make use of Institute services and facilities. In order to facilitate this non-government business, at a minimum, each Institute established should maintain a business office and "front-door" organization off-site from any affiliated NASA Center.

IPA Eligible. It will be desirable for an Institute to have as its operator or sponsor an organization which is able to exercise the flexible employment arrangements provided under the terms of Intergovernmental Personnel Agreements or IPAs. The IPA program provides a proven means for exchanging critical ideas, knowledge, skills, and human resources between the Federal government and other sectors. (Examples of IPA eligible organizations include state and local governments, institutions of higher education, and some non-profit organizations.)

Functional Roles and Responsibilities of Institutes

Institutes may also be described in terms of their functional roles and responsibilities. The broadest possible set of roles and responsibilities for Institutes are described in Table 2. Each Institute will need to be examined to determine appropriate roles and responsibilities for that Institute. In the end state, Institute functional responsibilities may include: managing science programs; conceiving, designing and developing Institute instruments; facilitating, fostering, and conducting scientific research; facilitating access to unique NASA and non-NASA facilities and expertise; providing the "project scientist" function; operating missions; acquiring, processing, archiving and distributing data products; developing and or transferring technology; supervising and training researchers and students; and, shaping and conducting outreach and education programs.

NASA Enterprise	Science Institute	NASA Center
• Strategic planning, policy development • Budget planning and resource allocation • Program direction, advocacy, and oversight	• Manage science programs • Conceive, design, and develop instruments and selected science missions • Facilitate, foster, and conduct scientific research • Facilitate access to unique facilities and expertise • Provide the project science functions • Operate missions • Acquire, process, archive and distribute data products • Develop and transfer new technology • Supervise and train researchers and students • Shape and conduct education and outreach programs	• Facility operations • NASA unique engineering services • Research Support

Table 2 *NASA Science Institutes: Broadest Possible Institute Roles and Responsibilities.*

The potential types of activities to be supported by the different Institute candidates is expected to vary. Fund sources will vary accordingly. In some cases, Institutes may focus almost exclusively on managing and facilitating peer reviewed research, and would draw the majority of their funding from Research and Analysis (R&A) accounts. In other instances, Institutes might be funded out of instrument and project development or flight program accounts. In addition, Institutes may perform archiving and data analysis support functions, and therefore, receive a significant fraction of their support from Mission Operations and Data Analysis (MO & DA) funding. In many instances, it is expected that "Mission Support" funds, e.g., research and program management, will need to be "converted" through the appropriations process to provide support for activities previously accomplished by the application of in-house resources.

Institute Relationship to Science Community, Other Entities, NASA Enterprises, and NASA Centers.

Another way of characterizing Institutes is through review of their interactions with other organizational units. The relationship between NASA, the Institute and the science community is graphically depicted in Figure B.

Given NASA' s policy to assure that participation in NASA research programs is as broad as possible, an Institute model is proposed which allows for direct interaction with and full participation by the science community, academia, industry, and the general public. In brief, Institutes will work for the community.

Science Community: In the strictest sense of the word, an Institute is an "extension" of the community into the day to day operations of NASA. The role of the science community in conjunction with the Institute is to bring new ideas, capabilities, and requirements, to bear in planning and implementing research programs and missions. In many cases, the science community will receive funding from NASA via the Institute based on a competitive peer review process. The Institute will provide access to NASA's unique facilities, capabilities, and expertise.

Institute: Institutes will enable the transfer of knowledge in the form of basic research or technology transfer to the larger academic, industrial, and scientific communities. Institutes will be independent entities with an identity separate from NASA's Centers. Institutes will also act as a representative of the community to NASA, identifying science requirements for the Agency as a result of its interactions with the science community. Institutes will facilitate peer reviewed extramural research, and may also engage in peer reviewed intramural research. Enterprises may also delegate authority to Institutes to manage scientific research programs. Institutes may facilitate and integrate research done under existing peer reviewed extramural research. Enterprises may also delegate management of scientific programs to Institutes in line with Enterprise program policy.

NASA Enterprise: The NASA Enterprise charters, funds, provides requirements, and conducts periodic reviews of the science Institute. In cases where responsibility for managing and implementing some part of the extramural research program is delegated to the Institute, the Enterprise will provide oversight and review.

NASA Center: The nature of the relationship between the Center and the Institute should be one in which the Center is viewed as responsive to the requirements of the

Institute. NASA Centers will provide Institutes with access to facilities, science, and engineering expertise on a full cost recovery basis. An individual center, when in close proximity to an Institute, may also be delegated the contractual and administrative management functions of the NASA/Institute arrangement.

Institutes will be independent entities with an identity separate from NASA's Centers.

Mission and Customers

All Institutes will be chartered to:
- Facilitate science program development;
- Conduct fundamental research;
- Provide Services to the external community;
- Facilitate technology transfer;
- Facilitate access to NASA facilities and expertise; and
- Provide for outreach and education.

In some instances, the Institutes are intended to become the primary vehicles for managing scientific research. In addition, NASA will retain limited science management and research capabilities in-house to provide for executing government fiduciary responsibilities, mission critical activities, and select research tasks.

Preliminary descriptions of the mission and scope of each Institute were developed to assure consistency with this plan, but are not included here. In every instance, these preliminary descriptions would benefit from formal discussion, review and confirmation by the broader science community. As a rule, mission statements include reference to either conducting or enabling peer reviewed research. Many of these statements describe a science leadership role to be performed by the Institutes, and several identify a unique niche to be filled by the Institute with regard to specific science disciplines. In general, these mission statements explicitly state as a focus serving the broader science community.

Each Enterprise Office, in concert with their respective scientific and technical advisory committee(s), will provide for a review of proposed Institute mission statements, intended scope, customers and products by the science community.

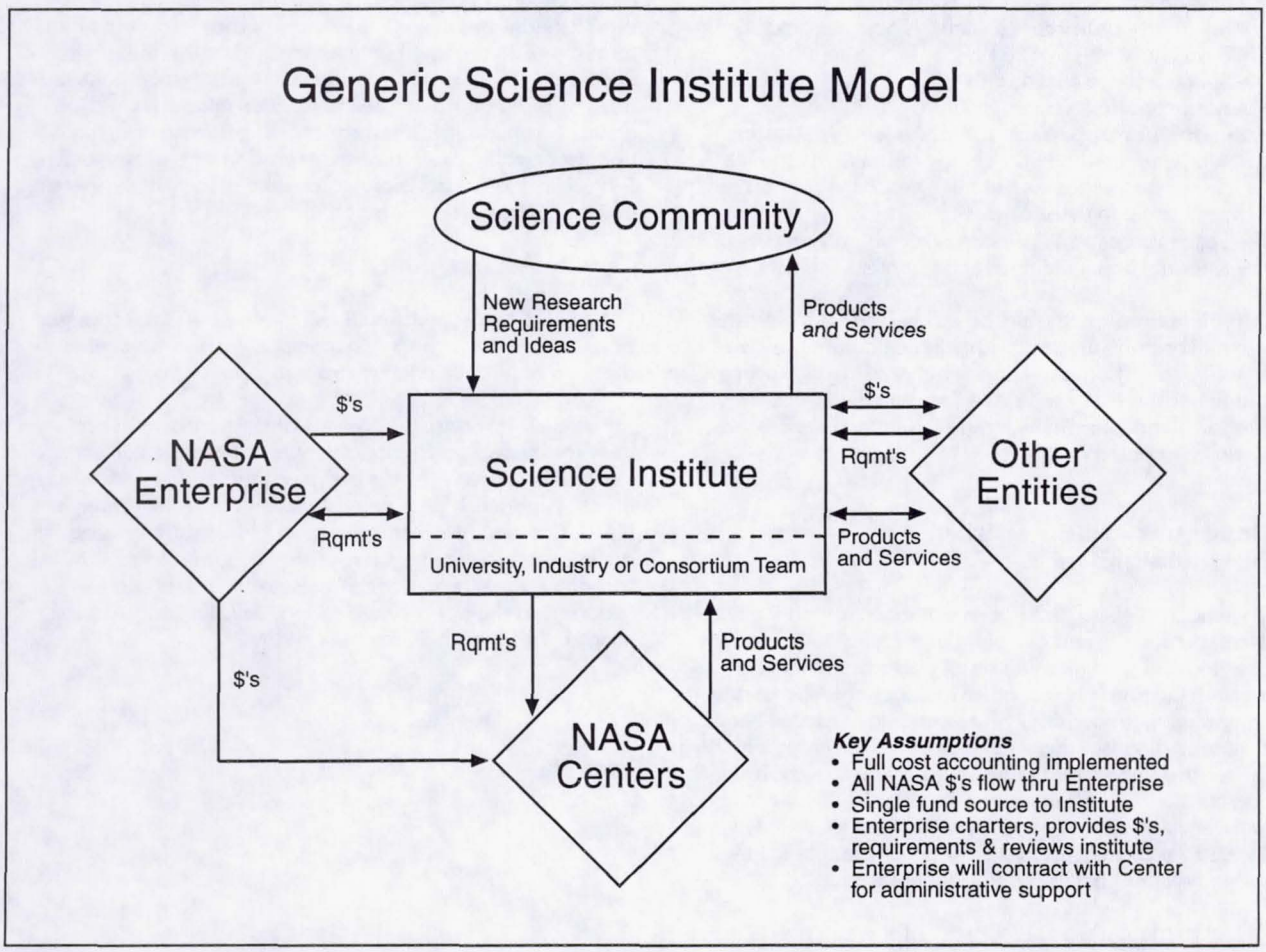

Figure B *Generic Science Institute Model.*

Implementation and Management Approach

Planning and Initiation of Institutes should be phased.

The eleven science Institutes proposed by the Zero Base Review are in various stages of readiness and should be pursued in a phased manner.

- **Modify, as necessary, existing Institutes and cooperative research centers** .
  - Global Hydrology and Climate Center (MSFC)
  - Astromaterials Institute (JSC)
  - Goddard Institute for Space Studies (GISS)
- **Complete planning and begin implementation of the Biomedical Research Institute (JSC):**
  The proposed Biomedical Research Institute should be reviewed with appropriate external scientific groups, and JSC should complete detailed definition, review, and approval of an announcement soliciting proposals in 1996.
- **Complete definition, pursue legislation, and proceed with planning for proposed science Institutes:**
  - Astrobiology Institute (ARC)
  - Microgravity Institute [Fluid and Combustion] (LERC)
- **Further define proposed Institutes:**
  - Microgravity Institute [Materials Sciences and Biotechnology] (MSFC)
  - Space Science Institute (MSFC)
  - Atmospheric Sciences Institute (LARC)
- **Reconsider approach for proposed Institutes:**
  While an Institute may be appropriate, the model developed for other Institutes proposed is not directly applicable in these cases.
  - Space Power and On-Board Propulsion Institute (LERC)
  - National Space Science Data Center (GSFC)

Implementation should be structured in a way that allows for consultation with science community and orderly definition by NASA. This phasing should result in a schedule that facilitates focused management attention and permits learning from each successive Institute experience.

Headquarters/Enterprise Responsibilities

In general, NASA's Enterprises will retain responsibility for the sponsorship and oversight of each Institute. Program direction and guidance will be a Headquarters function residing with the Enterprise or other Headquarters sponsoring organization. Responsibility for Cooperative Agreement or Contract Administration will be delegated to either a NASA Center, the NASA Management Office at JPL or equivalent organization. NASA's Enterprise Leader(s) will retain authority to review and approve any major changes in Institute sponsoring agreements, including any major changes in key personnel, most notably, the Institute Director.

The participation and support of the external science community will be sought as NASA proceeds to further define and validate proposed Institute missions. Specifically, NASA Science Offices will provide for the review of proposed Institutes by their respective advisory committees.

NASA Enterprise leaders should also include a discussion of Institutes within their Enterprise Strategic Plans and Strategic Management Implementation Plans, incorporating each Institute's mission and addressing the Institute's role in support of NASA's overall science plan.

Chief Scientist Responsibilities

Institute Coordination

While implementation of Institutes will be phased, and planning efforts will proceed along different time scales, NASA's overall efforts with regard to Institutes would benefit from some degree of coordination, review, and visibility provided at senior levels within the Agency.

The NASA Chief Scientist will coordinate all agencywide activities associated with the establishment of science Institutes.

The Agency's initial efforts to establish independent Institutes should incorporate provisions for potential future integration. While individual Institutes will first be established and allowed to mature before applying any formal or overarching management structure, there appear to be opportunities where the individual contributions of particular Institutes to NASA's mission could be enhanced and amplified through more formal coordination. (e.g., collaboration and integration of Astromaterials, Biomedical and Astrobioiogy Institute efforts in support of NASA's human exploration efforts).

Quality Assessment

NASA's Chief Scientist will assure continual assessments of Institute effectiveness in accomplishing key objectives outlined in NASA's science strategic plans.

For each Institute, the NASA Chief Scientist will provide for overall performance reviews on a regular basis, as well as providing for a comparative review and assessment of the work performed by both NASA Institutes and NASA Centers. As a general practice, Institutes will be encouraged to commission visiting committees to provide technical reviews. Copies of these reviews should be reported to the appropriate Associate Administrator and shared with the Chief Scientist.

III. Functional Management Issues and Strategies

Human Resources Issues and Civil Service Transition Strategies

It is expected that there will be some migration of the civil servant workforce to the Institutes. Where movement is expected, the most effective strategy for the migration of civil service employees into Institutes is to provide for the voluntary transition of employees to Institutes on case-by-case basis, where there is a shared interest between the civil servant and the Institute.

Equitable Treatment of NASA Employees

Given that Institutes have been proposed in part to perform functions which are currently performed by civil service employees, the potential opportunities for NASA employees must be considered. These employees have been instrumental in elevating NASA to an enviable position of scientific excellence and should be encouraged to remain an integral part of the larger scientific community through their continued contributions in a science "Institute" environment. As these Institutes may be private organizations, without a civil servant presence, it is important that NASA consider the potential impact on affected employees, and provide a mechanism for these employees to make an equitable transition to their next assignment.

Legislation to Accommodate Transition

Currently, civil service employees who leave the Federal government retain only temporary coverage under the Federal Health and Life Insurance programs, are ineligible to continue contributing to the Federal Retirement System, Civil Service Retirement System (CSRS), or Federal Employee Retirement System (FERS) and have post-employment limitations with respect to functions they performed as a civil servant. In order to facilitate the movement of civil servants who may be interested in positions within a science Institute, should the opportunity present itself, the following legislative relief is recommended:

Retirement System—The loss of vested interest in a secure retirement program may discourage some civil servants from pursuing a position with a science Institute. NASA should seek legislation to facilitate civil servant transition to a science Institute. One option would be legislation that would provide for continuing participation in their current retirement system (either CSRS or FERS) or converting to the retirement system provided by the science Institute offeror.

Another approach would be to permit those employees covered by CSRS to convert to FERS and continue to participate in FERS upon transition to an Institute. An open season to allow for the conversion would also require Congressional approval, as would the authority to transition with FERS into the private sector.

Health Benefits—In addition to concerns with the transfer of retirement benefits, the portability of health benefits and the potential costs to civil service employees associated with a change in status could significantly impact an employee's decision to voluntarily transition. NASA should seek legislation to provide civil service employees who are transitioning to an Institute with the option of continuing participation in the Health Benefits Program or converting to the health benefits program provided by the science Institute offeror.

Post Employment Restrictions/Procurement Integrity—Current post-employment and procurement integrity provisions restrict the degree to which prior civil servants can work in the private sector performing the same kind of functions as they were performing in the public sector. NASA should seek legislative authority to provide limited exceptions to these restrictions to maximize employment opportunities for NASA employees.

Employee Assistance Plan

Once an Institute has been established, its Director will be responsible for staffing the Institute. There will undoubtedly be some impacts on current NASA employees which will require NASA management involvement.

Every successful personnel plan needs a consistent foundation which creates employee trust and support. This foundation includes an environment of fair and consistent treatment; open and honest communication; and provision of reasonable assistance. NASA should seek to provide assistance through potential legislative relief as well as through training and counseling to enable employees to make a successful transition to another assignment, if necessary.

NASA Management at all levels of the organization should redouble its efforts to communicate with employees, clearly outlining current workforce reduction targets, and identifying potential impacts and future courses of action to be taken if targets are not met. Every NASA Center should provide for a briefing on Institutes to all eligible and potentially impacted employees in parallel with advance planning for the establishment of Institutes.

Funding Issues and Strategies

Each Institute should have stable funding from NASA to support core service and research functions.

Project support should be provided separately through amendments to the basic sponsoring agreement or through separate instruments as required.

Institutes will be encouraged to compete for additional NASA funding (e.g., through grants and funding proposals submitted in response to research announcements).

Institutes are expected to become partially self-sufficient. They should, therefore, be encouraged to seek funding from a variety of sources and to market their capability in ways that are appropriate to their primary NASA mission.

Although the science Institutes being considered come in many characters and sizes, all of them require stability of funding in order to attract both a responsible management organization and an excellent staff. A clearly-defined mission and a stable source of funding are prerequisites for success. While the Institutes being contemplated have been characterized as non-profit ventures, the experience and participation of for-profit industry may be necessary and/or desirable in some cases.

In many cases, NASA will continue to be the main source of funds, but individual Institutes should be encouraged to seek funding from a variety of sources and to market their capability in ways that are appropriate to their primary NASA mission. As with other successful Institutes, NASA may wish to establish some guidelines for the amount of funding which can be received from other sources.

Core Funding

Each NASA science Institute should have stable funding from NASA to support its core functions. Core functions are those that form the basis for the partnership. These funds are awarded from the appropriate Enterprise Office as part of the cooperative agreement or contract that establishes the Institute. They support the senior management, the basic infrastructure, and some of the salaries of the senior or most critical personnel required to carry out the Institute's mission.

For the support of scientists and their research, we expect that different Institutes will adopt mission-specific approaches. For example, it may be appropriate to create scientist ranks each with its own level of core support. These should be established to ensure equity with academic scientists. Where there are major service roles to be performed, it may be more appropriate to formulate the support for scientist salaries in terms of a basic level to support individual research with additional support to be derived from combinations of service or project funds in addition to research grants. Senior engineering and technical staff will require 100% salary support.

In most cases the core funding also includes basic facility support, programmatic travel, support for a visitor program, and a small director's discretionary research fund to encourage new ideas and assist young investigators. A major source of the funding will be current non-R&D support (salary and indirect funds), which will be transitioned into the new organization. Core funding levels should be reviewed and adjusted annually as part of the on-going NASA oversight of the Institute.

Project Funding

Tasks assigned to an Institute as a result of a competitive selection process beyond its core mission should be supported separately. If services or supplies (hardware) for NASA's use are anticipated, a separate contract may be necessary. Examples of projects an Institute might undertake include scientific investigations or flight instrumentation development associated with specific flight opportunities, or other projects of finite duration. The funding profile will be established and agreed upon by the sponsor and Institute via an equivalent to a currently employed "project plan," updated semi-annually in the Program Operating Plan (POP).

Grant Funding

Additional funding will be acquired by the Institute through individual peer reviewed research proposals submitted in response to NASA NRAs or other opportunities from other funding sources. NASA's grants are made directly to the PIs or their parent institutions and will be used as they are today, to support co-investigator salaries, postdocs, students, equipment and supplies, travel, and publication costs. It is assumed that the Institute scientific staff will be active participants in the peer-reviewed R&A program, although care must be taken to maintain a level playing field. The continuous evaluations derived from the review of these grant proposals will ensure quality and provide incentives for continuous improvement.

Accounting and Fund Source Issues and Strategies

Resources currently budgeted in Mission Support (e.g., salaries and administrative support) may be critical to the future successful operation of Institutes.

In order to provide all of the resources necessary for operation of the Institutes, NASA should obtain legislative authority to use all funds associated with the particular effort (R&D, salaries, fringes, travel, overhead) for science Institutes.

Science Institutes will operate under full cost accounting. NASA must also complete its transition to full cost accounting procedures.

Mission Support funds must be converted and provided to the Institute for indirect and infrastructure functions no longer provided by the Center. In keeping with the intent to retain current funding for science in the initial Institutes, funding necessary for administrative and support functions should be identified for the Institute budget. These functions would include activities like finance, procurement, facilities, etc. In cases where the programs transition to the new Institutes, and thereby provide relief from the demand for such functions in the Center, the funds to support these functions would be expected to move to the new organization.

Transition from a science program, based upon Civil Service staffing, to a privately-based Institute management structure requires application of full cost accounting principles. NASA must identify *all* costs related to current science programs performed by NASA Centers/Headquarters to fully account for all resource requirements and assure that the total budgeted dollars are provided to the Institute. As blocks of work are moved to the Institutes, NASA must

provide funding for the current research and development activities, as well as salaries and fringes, travel, and Research Operations Support. NASA will provide all funding to the Institutes from the appropriate R&D accounts.

After the Institutes are established, NASA will provide services to the Institutes on a full cost recovery basis or as a partner in a cooperative agreement where NASA and the Institute must identify total dollars expended under the agreement. In this environment, NASA must have a full cost accounting system to provide on-going NASA unique services to the Institutes. Institutes must also comply with applicable accounting standards and full cost accounting principles.

Procurement Issues and Strategies

Cooperative Agreements appear to be an attractive and viable means for establishing Institutes in most cases, having been successfully used by other government organizations to accomplish the same kind of work that NASA envisions to be performed by Science Institutes.

Sponsoring agreements and solicitation processes should be structured to encourage broad participation by the full range of potential partners wherever possible. Use of a fair and open process should be considered for the establishment of Institutes.

Cooperative agreements for Institutes should be structured to provide for periodic review and renewal.

Sponsoring agreements should be structured to permit and encourage Institutes to secure outside funding for work which complements NASA's scientific objectives.

Sponsoring Agreements

Institutes should be established under a single umbrella agreement, normally a cooperative agreement. However, in some cases, a contract may be required. The agreement should define the Institute's mission and bind the Institute to NASA for a period of decades. The sponsoring agreements should be structured to encourage the Institutes to seek outside funding for work which complements the Institute's stated scientific objectives. The Institute should be responsible for determining when to accept outside funding and for determining if the outside effort complements the Institute's core work. Rather than establishing a limit on the amount of external effort accepted by the Institute, the Institute's success in attracting and retaining outside fund sources consistent with the strategic plan should be regarded as a measure of Institute success and scientific excellence.

Use of Cooperative Agreements

The implementation vehicle employed should allow for an appropriate balance between the independent operation of the Institute and NASA's ability to maintain insight and direction to a degree sufficient to ensure the accomplishment of the Agency's science mission.

The Chiles Act, Public Law 97-258, defines the parameters for selection of the appropriate vehicle—contract, cooperative agreement, or grant. NASA's interest and expectations concerning Institute performance will meet the Chiles Act definition of "substantial involvement." Accordingly, the use of a grant is, by definition, inappropriate. The choices remaining for establishing the Institutes as currently planned are either a cooperative agreement or a contract.

The Chiles Act prescribes the use of a contract when the principal purpose of the agreement is to acquire property or services for the direct benefit or use of the government. A contract is the appropriate implementation vehicle for Institutes whose primary mission is providing property or a service where NASA will be the user of the Institute products. A cooperative agreement is prescribed when NASA wishes to transfer a thing of value to the Institute to carry out a public purpose of support or stimulation and substantial involvement is expected between the Institute and NASA.

The Chiles Act definitions provide sufficient latitude to select the cooperative agreement as the implementation vehicle in a wide variety of circumstances. Practical application of the cooperative agreement definition permits its use in lieu of a contract for establishing service oriented Institutes when the service to be provided by the Institute is not for NASA, but for the broader public and science community. The determination that NASA will not "benefit" from the service provided by the Institute should not be interpreted narrowly. Other non-NASA affiliated science Institutes operate under cooperative agreements which successfully employ the latitude described above. These Institutes are generally research and service oriented and in using a cooperative agreement, the parameters of what constitutes the transfer of service to the public or "user" communities is broadly defined.

The words "principal purpose" appear in the definition of both the cooperative agreement and the contract. This provision could conceivably be read to permit the use of a cooperative agreement even though some portion of the effort will involve providing property or a service as long as those efforts do not constitute the principal purpose of the Institute.

Encouraging Participation

The acquisition approach for establishing Institutes should be fair and open in nature. The process should provide the community with the opportunity to review and comment on the proposed scope or mission of an Institute during the presolicitation phase. This participation can occur in many ways. A suggested method for accomplishing this involvement is through the use of NASA Enterprise sponsored workshops. These workshops would provide a forum to bring interested members of the community together with appropriate NASA officials to: present the community with the range of potential NASA functions which could be assumed by a particular Institute; present an opportunity for interested parties to tour the NASA unique facilities available to the Institute; and provide an open forum for collegial discussions between all members of the community, both NASA and

non-NASA, regarding the scope of science functions available for privatization through an Institute. Proposed workshops would also be used to ascertain the general level of community interest in assuming responsibility for the performance of those functions.

When competition is considered appropriate, a two-step competitive Cooperative Agreement Notice (CAN) which includes a solicitation for community comment and review during the draft phase is the recommended acquisition approach. After the consideration of initial comments, a single CAN may be issued. Multiple offerors may be selected for award of fixed price study efforts under cooperative agreements. The result of these studies should be the submission of a proposal for implementing and operating the Institute. The managing entity for the Institute would be selected from the offerors on the basis of the proposals submitted. This approach would foster competition by providing bid and proposal (B&P) resources to a community of interested offerors where B&P funds are traditionally constrained, that is, to academic institutions and university consortia.

Institutes should be established using a competitive process whenever it appears appropriate to do so. There has been some discussion over whether Institute competition should be limited to universities or to not-for-profit organizations (e.g., university-based consortia). NASA believes that an Institute must have strong ties to the academic/research community to be successful. Therefore, it is expected that proposal teams will be led by universities, non-profit organizations or consortia in partnership with for-profit organizations as appropriate. Such a partnering of university and industry organizations could benefit NASA by providing the opportunity for non-Federal or private entities to bring other assets to the arena.

Cooperative agreements and contracts for Institutes should be structured to provide for periodic review and renewal. The term of the agreement or contract should authorize a long-term period of performance. The period of performance should be structured to contain a base period of five years plus the appropriate number of 5-year options to reach the full term of the vehicle. For example, a 20 year cooperative agreement would contain a base period of performance of five years plus three, 5-year options.

Acquisition Responsibility

The Institute implementation represents a significant departure from NASA's traditional approach to accomplishing its science mission and represents both a major shift in agency policy and a transfer of existing in-house agency missions to the Institutes. For those reasons, science Institute acquisitions should be subject to NASA's Master Buy Plan procedures, and acquisition strategy, solicitation review and selection should be retained by Headquarters in all cases. The Associate Administrator for the predominant enterprise sponsoring the Institute should serve as the selecting official.

Customizing Acquisition Vehicles

There are significant differences between contracts and cooperative agreements as acquisition vehicles. However, once the vehicle of choice is tailored to fit individual circumstances, the differences should become matters of degree. Contracts used to establish Institutes should be streamlined. If a cooperative agreement is used as the implementing vehicle, the agreement may need to be enhanced to expand the extent of government oversight and approval authority normally expected under a cooperative agreement arrangement.

The cooperative agreements used to sponsor science Institutes should incorporate selected federal acquisition provisions. This allows the government to exercise some of the more desirable insight afforded by federal contracts. For example, cost reporting, property accountability and technical reporting requirements should be incorporated into cooperative agreements. These hybrid, custom acquisition vehicles will enable the government to exercise required oversight, while dispensing with the most burdensome of federal acquisition requirements normally found in government contracts.

Other Considerations

Allocation of Risk, Liability

Each agreement with a science Institute operator should anticipate and allocate foreseeable risks. An agreement must specify, in advance of any activities, each party's degree of liability under various conditions.

It is not possible to prescribe uniform liability clauses. The activities in which the science Institutes will engage under agreements with NASA vary significantly. Some Institutes will have responsibility for Government research equipment and facilities, while others will have limited or no Government property responsibilities. The risk of injury to Institute or NASA employees or others engaging in different research activities vary significantly. Accordingly, the determination of the amount of risk NASA and the other party should assume will vary according to the specific circumstances surrounding the activity.

The Office of General Counsel should work with the NASA Procurement Office and the Office of the Comptroller to consider risk allocation and liability early on, in the development of any proposal solicitation, and throughout the negotiation of an agreement with a science Institute operator.

Intellectual Property Rights

With the exception of the Government's retention of a Government purpose license, an Institute operator should either retain or negotiate with its collaborators and affiliates for rights in intellectual property arising out of the Institute's research activities consistent with current laws and regulations.

Basic and/or applied scientific research will result in new discoveries and innovations that may be protected under various intellectual property regimes. NASA's enabling legislation, the Space Act, obligates the Agency to "provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof. . . ." On the other hand, any policy to widely disseminate information must be weighed against the desire to protect data in order to privatize and/or commercialize the activities and data generated by the Institute. With the exception of the Government's retention of a Government purpose license, an Institute operator, and/or collaborators and/or affiliates should retain all rights in intellectual property arising out of the Institute's research activities.

It is conceivable that the Agency may receive a proposal from a non-U.S. organization. In anticipation of this possibility, NASA should include provisions in any Institute proposal solicitation which address whether the right to title to inventions should be restricted to United States-owned companies and organizations.

It is reasonable to assume that Institutes will enter into more than one agreement with NASA, and may enter into agreements with other Government and private organizations. These agreements may well provide the Institute with differing intellectual property rights in data and/or inventions produced. Therefore, it is critical that the Institute carefully account for and document its work and under which agreement such work is produced, in order that the Institute and NASA may agree on their respective intellectual rights.

NASA's Office of General Counsel (Intellectual Property) should work with Agency procurement officials to include provisions in any proposal solicitation and resulting agreement which (with the exception of the government's retention of a government purpose license) permit the Institute to retain rights in intellectual property arising out of the Institute's research activities.

International Activities

While NASA must remain responsible for shaping the essential purpose and content of international agreements that establish development, flight or study projects to be carried out by the Institute, NASA may obtain support from science Institutes in meeting NASA's international obligations.

As is the case for NASA Centers, Institutes do not have independent authority to enter into international commitments or agreements on behalf of NASA. Either a sponsoring organization within the U.S. government must sign international agreements in order to legally commit the government, or NASA must negotiate specific government-to-government level agreements for international collaborations.

Institutes may support NASA in planning and implementing international initiatives and projects. An Institute may also provide technical and management interfaces with an international partner's project organization.

When directed by the Enterprise and described in the terms of the Institute sponsoring agreement, the role of the science Institute in performing international activities should be clearly defined. In cases where an international role is envisioned, the specific roles and authorities of Institute employees should also be clearly defined, since others may perceive them as representatives of NASA and its programs.