THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine
National Academy of Sciences
National Academy of Engineering
Institute of Medicine
National Research Council

Space Studies Board
Commission on Physical Sciences, Mathematics and Applications

March 15, 2000

Dr. Edward J. Weiler
Associate Administrator for Space Science
Code S
NASA Headquarters
Washington, DC 20546

Dear Dr. Weiler:

In your letter of February 17, 1999,[1] you requested that the Space Studies Board (SSB) provide an external review of the Office of Space Science (OSS) technology development process. As requested, the review focused on assessing the OSS response to the recommendations in the SSB report *Assessment of Technology Development in NASA's Office of Space Science* (National Academy Press, Washington, D.C., 1998). The SSB established the Task Group on Technology Development in NASA's Office of Space Science (OSS) (task group),[2] drawing heavily on individuals who developed the 1998 report, to conduct this assessment.[3] The task group met on October 18 and 19, 1999, at the National Research Council's Georgetown offices in Washington, D.C. It received presentations by Edward Weiler (Associate Administrator, Office of Space Science), Granville Paules (Lead Technologist, Earth Science Enterprise), Arnauld Nicogossian (Associate Administrator, Office of Life and Microgravity Sciences and Applications), Peter Ulrich (Director, Advanced Technologies and Mission Studies Division, Office of Space Science), Michael Sander (Director, Technology and Applications Program, Jet Propulsion Laboratory), Mary Kicza (Associate Director, Goddard Space Flight Center), and William F. Dimmer (Program Analyst, Office of the Chief Financial Officer).

SUMMARY OF THE 1998 REPORT OF THE TASK GROUP ON TECHNOLOGY DEVELOPMENT IN NASA'S OFFICE OF SPACE SCIENCE

In the 1998 report, the task group recognized the transfer of NASA's cross-agency technology function to OSS as a positive step for two reasons: (1) Programs under OSS are the largest consumers of space technology, and (2) OSS has a well-developed strategic planning process. NASA has grouped technologies with application to more than one enterprise under the label "Cross-cutting Technologies," and these are also managed by OSS. In the 1998 report, the task group noted that the planning for the Cross-cutting Technology Program had not matured to a satisfactory level.

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[1]See Appendix 1.

[2]Task group membership: Daniel J. Fink, Chair (D.J. Fink Associates, Inc.), Robert S. Cooper (Atlantic Aerospace Electronic Corp.), Anthony W. England (University of Michigan), Donald C. Fraser (Boston University), Bruce D. Marcus (Consultant), Irwin I. Shapiro (Harvard-Smithsonian Center for Astrophysics), and Oswald Siegmund (University of California, Berkeley).

[3]The task group's assessment was reviewed by a individuals other than the authors in accordance with procedures approved by the National Research Council's Report Review Committee. See Appendix 2.

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The task group also was concerned with NASA's definition of core competencies. Some NASA Centers claim that their competencies cover an extensive and broad range of technologies. No organization that has realistic fiscal constraints can hope to be competitive or world-class across such a wide range. The task group recommended that NASA narrow the core competencies to those that meet stringent criteria. Thus, individual NASA Centers would not have active programs in all technologies relevant to the mission requirements of the Center. The task group recommended that NASA explore alternatives to maintaining in-house, hands-on research and development programs to achieve smart buying.

To be successful, an advanced technology development (ATD) program should be a careful mix of centralized and decentralized activities. For NASA this means appropriate roles for Headquarters and the Centers. The task group recommended in the 1998 report that the planning and selection processes be maintained as Headquarters activities. Other activities, such as selection of near-term technologies for a particular mission, could be delegated to the Centers when they are not competing for these technology development activities.

Many of the recommendations in the 1998 report called for external review and advice, including planning, program reviews, evaluation of competing proposals, core competency selection, and Center quality review. Providing adequate Headquarters staff to manage the reviews, utilizing clear investment and performance metrics, and making Centers more accountable to Headquarters are essential elements of the review process.

RESULTS AND ASSESSMENT BASED ON THE 1999 REVIEW

The original report (*Assessment of Technology Development in NASA's Office of Space Science*, 1998) was organized into four main parts—planning, implementation, infrastructure, and performance measurement—and made 11 recommendations. The task group has chosen to retain this organization here. Each of the previous 11 recommendations is reprinted below, followed by a summary of and comments on NASA's progress in each area and further recommendations where warranted. The summary sections are based on the presentations made to the task group at the October 1999 meeting.

A. Planning

Recommendation 1. NASA's advanced technology development (ATD) planning process should be formally evaluated in 12 months, after changes that are just now being completed have had time to mature. Factors to be considered in the evaluation should include (1) responsiveness to input from the outside research community and (2) the extent to which program balance is addressed regarding such dimensions as technology push versus program pull, near-term versus far-term applications, and science instruments versus spacecraft systems. The evaluation should be conducted by an independent, external body such as the NASA Advisory Council. [1998 *Assessment*, p. 14]

Summary of NASA's Presentation to the 1999 Task Group

In response to the task group's recommendation and at the request of NASA's Space Science Advisory Committee (SScAC), OSS assembled the Task Force on Technology Readiness[4] to provide

[4]OSS Task Force membership: Christine M. Anderson, Co-Chair (Phillips Laboratory), Daniel E. Hastings, Co-Chair (Massachusetts Institute of Technology), David Akin (University of Maryland), Thomas A. Brackey (Hughes Space and Communications Co.), Lynn Conway (University of Michigan), Dennis Fitzgerald (National

findings and recommendations on OSS's current technology planning process to ensure appropriate linkage between science missions and technology opportunities and to ensure cross-theme coordination of technology requirements. Specifically, the OSS Task Force addressed four questions in 1999:

> (1) Have missions for the near-term and visions for the far-term been articulated sufficiently to derive technology objectives and capabilities?
>
> (2) Have technology objectives for near-term and technology capabilities for far-term been described appropriately from missions and visions?
>
> (3) Have technology objectives and capabilities been well integrated across the four science themes into a single set of technology developments?
>
> (4) Is the technology development currently planned in various program elements (core, focused, flight validation, advanced concepts, and cross-enterprise) appropriately scoped, scheduled and funded to satisfy the strategic missions and visions of the Space Science Enterprise?

NASA has produced integrated technology development plans for enabling technologies. These plans will be incorporated into the OSS strategic plan for FY 2000. The OSS Task Force will be augmented to provide an external review of the technology program during February/March 2000.

Extensive work has been completed by the science and technology roadmap teams with respect to the Focused Technology Program. The new process involves considerable external input and was reviewed at the OSS Strategic Planning Workshop in November 1999. NASA has devised an approach to restructure the New Millennium Program (NMP). If recent program termination decisions are reversed, there will be open competition for technologies to be flown, and Headquarters will make the final selections of Centers to which missions are assigned.

NASA reported that most in-house FY 2000 cross-enterprise activities have been competitively peer reviewed for quality and the relevance of the proposed tasks to NASA's mission. In FY 2001, NASA expects to competitively peer review all thrust areas. The peer review panels consisted of extramural technology experts and user representatives. NASA panelists (58 out of 153 panelists) were involved chiefly to deal with the issue of relevance. Of the 567 proposals submitted, 264 were selected for funding. Depending on the thrust area, this represents 19 to 67% new work by task, averaging 44%. The first NASA Research Announcement (NRA) for the Cross-Enterprise Technology Development Program was released on October 29, 1999. This NRA provides for an open and broad competition in which NASA Centers can participate.

Task Group's Assessment

The task group found excellent responsiveness on the part of OSS to the task group's 1998 technology planning recommendations. Within OSS the process whereby technology plans are being linked with science objectives and program plans may well be a model of excellence in strategic planning. In addition, the task group lauds the progress (e.g., the number of new tasks funded) toward an objective and impartial technology program selection process administered at the NASA Centers. NASA's report that Center tasks were competitively peer reviewed during the FY 2000 selection process reflects a very positive change.

When applied to technology tasks, the concept of competitive peer review must be broadened to include not only peer experts in the specific technologies being addressed, but also expert engineering

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Reconnaissance Office), Gordon P. Garmire (Pennsylvania State University), Edward Howard (NOAA), Kenneth Johnston (U.S. Naval Observatory), Ralph L. McNutt, Jr. (Applied Physics Laboratory), and David Miller (Massachusetts Institute of Technology).

generalists who can provide a broad perspective on the overall relevance of technology development proposals to NASA's future needs. In addition, competitive peer review of NASA in-house Cross-Enterprise Technology Development Program activities should be conducted by experts both inside and outside the centers.

The task group supports the change in the NMP that refocuses it on flight demonstration of critical new technologies and applauds NASA's intention to use flights of opportunity rather than exclusively dedicated flights. The division between OSS and Earth Science Enterprise (ESE) New Millennium missions could be misinterpreted as giving a science (rather than technology) objective to NMP. The task group understands it to be a budget convenience but hopes that this artificial division does not inhibit flying critical ESE technologies on OSS New Millennium missions, or critical OSS technologies on ESE New Millennium missions where it makes technical sense to do so.

The task group also would expect that using any flight opportunity includes "purchasing" demonstration rights on the science missions of OSS and ESE, if inclusion would not add significantly to the risk of mission failure. Subsidizing the use of new technologies on science missions even though the enhanced capabilities of the new technologies are not needed could be appropriate where flight validations of the new technologies have significant value for future missions. For example, it might prove a wise investment to use a new technology communication system that will be needed for future deep-space science missions on a low-cost near-Earth spacecraft even though the capabilities of the enhanced communications system are not needed on the near-Earth mission. In this case, the added cost of the new communications technology should not be charged against the near-Earth spacecraft, but could be borne by a flight validation effort such as the New Millennium or Focused Programs. However, the validation of flight hardware on such science missions must be balanced against possibly increased mission risk.

Before the Space Science Program budgets were augmented to do technology development and before the Advanced Concepts Program was started, the Cross-Enterprise Technology Development Program spanned Technology Readiness Level (TRL) 1-5. The Research and Analysis Program had some technology components that were far term and the NMP was expected to do technology development, although there was no money in the program to do so. Today, the Advanced Concepts Program addresses TRL 0-2. The Cross-Enterprise Technology Development Program addresses TRL 1-3 and ramps down with co-funding from the Focused Programs that fund TRL 3-6. The Research and Analysis Program still has far-term technology components. One of the objectives of the New Millennium Program is to take technologies to flight qualification. However, the space sciences portion of the NMP was terminated, and unless it is restored there will be no program dedicated to flight qualifications of technology. The portfolio mix of near-term versus far-term technology development remains of some concern to the task group, but appears to be moving in the right direction with the "visionary" pull for far-term efforts and use of strategic plans for near-term needs.

The task group views the technology development budget increase in FY 2000 as a very positive step, although budget earmarks will place constraints on NASA's ability to deploy those funds optimally for technology development.

Recommendation 2. The planning process for cross-cutting technology should be modified so that it mirrors the process used by the Office of Space Science for space science technologies. Key attributes are the use of technology roadmaps that are linked to enterprise science roadmaps and that are developed with the broad participation of the research community. [1998 *Assessment*, p. 14]

Summary of NASA's Presentation to the 1999 Task Group

Each science theme in OSS has developed a far-term vision to guide far-term technology. NASA reported that the Cross-Enterprise Program is now 100% competitively peer reviewed for quality and relevance, as discussed under 1998 Recommendation 1. Newly designated NASA Center thrust area managers (TAMs) have been able to exert NASA-wide perspective and management approaches and have acted in a non-parochial manner in their recommended funding allocations among NASA Centers. One example of this is that in 7 out of 10 cases, the funding to the Center where the TAMs worked decreased from FY 1999 to FY 2000. NASA reported that there is wide management support at all levels for open and broad competition for funding. In FY 1999, $6 million in Cross-Enterprise funds was allocated through the Explorer Technology NRA. The first Advanced Cross-Enterprise Technology Development for NASA Missions NRA was released October 29, 1999.

Task Group's Assessment

The task group agrees with NASA that considerable progress has been made in responding to 1998 recommendation 2. The restructuring of the cross-cutting technology program is moving in the right direction. The ESE has made excellent progress in linking technology planning and strategic planning. However, the task group did not see evidence of similar progress in the Office of Life and Microgravity Sciences and Applications and encourages it to make renewed efforts. The Cross-Enterprise Technology Program NRA is seen as a positive step by the task group. The TAMs have the potential to be effective extensions of Headquarters in enabling NASA's responses to several of the task group's past concerns (see also 1998 Recommendations 4 and 6). The task group believes that the TAMs' assignments and responsibilities should be formalized as an indication of their importance.

B. Implementation

Recommendation 3. NASA should establish a comprehensive Center evaluation process that includes regular, objective, external evaluations of core competencies. Those internal core competencies essential to achieving a Center's mission should be identified and appropriate recommendations made to achieve and maintain excellence. As a result of these evaluations, NASA will have to make difficult choices about limiting internal research emphasis in some areas. External organizations with world-class capabilities should be selected competitively to complement the in-house work and ensure the maintenance of NASA's centers of excellence. ATD funds should not be set aside to provide support for in-house capability but should be earned by Centers through open competition with outside organizations. [1998 *Assessment*, p. 21]

Summary of NASA's Presentation to the 1999 Task Group

It is unfortunate that the task group, despite ample notification, could not receive any response from Headquarters regarding the agency response to recommendation 3 on the treatment of core competencies. The task group understands that the action had been assigned to the Office of the Chief Engineer, but a scheduling conflict apparently prevented a representative's attendance at the task group meeting. The task group did hear views from the Goddard Space Flight Center and the Jet Propulsion Laboratory and, while these presentations were interesting, there was no evidence of agency-wide guidance or direction to the process of selecting (and de-selecting) and maintaining core competencies. Goddard Space Flight Center's core competencies are defined as "those capabilities in which Goddard

must excel and that must reside within the civil service workforce and facilities to achieve the mission of the Center." Goddard's view is that it should have a core competency in a particular area if: (1) the capability is necessary to fulfill its mission and does not readily exist elsewhere, (2) having the capability is a necessary element within the larger NASA context and it does not readily exist elsewhere, or (3) having breadth and/or depth of a capability is essential to meeting Goddard's customers' requirements. Goddard is emphasizing its core competencies in the areas of experimental and theoretical research, sensors, instruments, and associated technologies, end-to-end mission systems engineering, advanced flight and ground systems development, large-scale scientific information systems, and program and project management. It is also competing for opportunities to establish competence in astrobiology.

JPL's core competencies are driven by its agency and enterprise assignments and strategic plans. It has program roles and responsibilities that contribute to three NASA strategic enterprises: OSS, ESE, and Human Exploration and Development of Space (HEDS). There are eight existing core competencies at JPL and three additional ones needed for the future. The existing core competencies include (1) complete-life-cycle deep-space missions design and architecture, (2) system engineering, (3) micro- and nano-technology for flight systems, (4) deep-space navigation, (5) deep-space communications, (6) mobility systems for planetary missions, (7) advanced science instruments, and (8) autonomous systems for deep-space systems. JPL would like to add large real and virtual space apertures, astrobiology, and planetary protection as future core competencies.

Task Group's Assessment

The task group views core competencies as central to implementing an effective ATD plan across the NASA Centers. The task group also recognizes that the issue of core competencies goes beyond the authority of OSS alone and must be addressed on a NASA-wide level.

Having now heard from several of the Centers on this subject, the task group finds little consistency in the selection processes or the criteria used to select the Center core competencies required to pursue NASA's mission. That mission includes the preservation of U.S. leadership (*not* just NASA leadership) in space science and technology. Thus the selection of NASA's core competencies must be made with a sense of responsibility to the nation's technological health and not just to the "care and feeding" of NASA Centers. It is natural that individual Centers might emphasize the latter, which is one reason that a Headquarters-led (with major Center participation) effort should be made in defining and locating NASA's internal core competencies.

An approach to the problem can be gleaned from a paper by Quinn and Hilmer,[5] who use a classical "nine-block" to develop a matrix for selecting core competencies versus those that could be outsourced. Their criteria include industrial measures such as competitive edge versus strategic vulnerability. Such an approach can be modified to make judgments about NASA's core competencies. For example, Figure 1 shows a matrix whose axes now represent the potential for state-of-the-art advancement versus the depth of external capability. Every technology can be placed somewhere on that matrix. Those that have a very high potential and for which the external (to NASA) capability is very low are clearly candidates for a NASA core competency. In contrast, those technologies that are mature and widely available externally can be purchased virtually as "commodities." Those with a high potential for advancement that are also widely available could be candidates for strategic purchasing requiring a "smart buyer." There are many shades of gray in the matrix, all of which can be used to sharpen core competency selection. The task group shows this example not as a final solution, but as an illustration of an approach that could be used across NASA to select Center core competencies.

[5]James Brian Quinn and Frederick G. Hilmer, 1994, "Strategic Outsourcing," *Sloan Management Review*, Figure 2, page 24.

The task group strongly recommends that Headquarters, working with the Centers, take the issue of core competency seriously. At a time of shrinking budgets yet great opportunity to raise the technology level of our nation's space program, selection of the proper NASA Center core technologies with full knowledge of what capability is important and what is available in industry and academia will be a requirement for success.

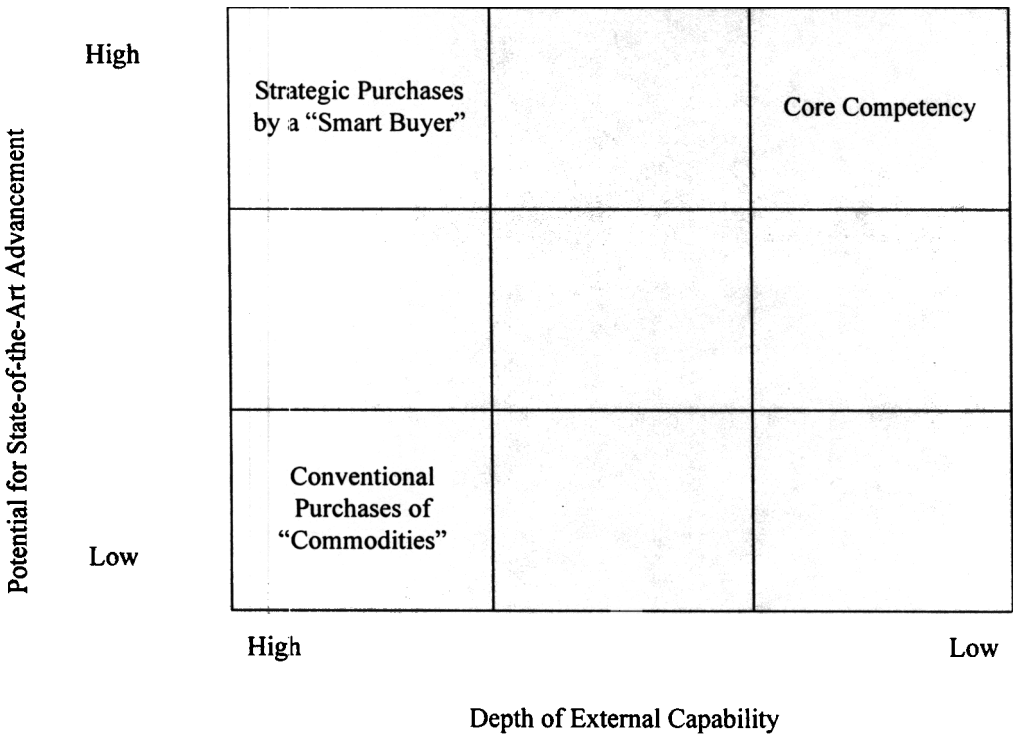

FIGURE 1 Sample matrix for selecting core competencies. Adapted from Quinn and Hilmer, 1994.

Recommendation 4. With the support of external reviewers, NASA Headquarters should conduct make-or-buy decisions and competitive procurements for all long-term ATD. [1998 *Assessment*, p. 22]

Summary of NASA's Presentation to the 1999 Task Group

NASA reported that 1998 recommendation 4 is impractical, given the reduction in Headquarters staffing and transfers of responsibility to Centers. However, Headquarters has retained the role of formal selection official. The roles of Headquarters and Centers have been clarified in key areas such as the New Millennium, Cross-Enterprise Technology Development, and Focused programs. For the New Millennium Program, Headquarters selects the technology, mission, and implementing Center. For the Cross-Enterprise Technology Development Program, Headquarters determines allocations to each thrust area, and the TAMs perform as an extension of Headquarters. For the Focused Programs, Headquarters periodically evaluates programs and projects, specifically make-or-buy decisions, as a part of program and project reviews.

Task Group's Assessment

Despite the "impracticality" of the task group's recommendation, it does appear that NASA is making considerable progress in satisfying the intent of the recommendation. It is clarifying the roles of Headquarters and the Centers, retaining certain important decisions at Headquarters, and expanding the "reach" of Headquarters through the effective use of the TAMs. In addition, the recent hiring of two additional senior staff at Headquarters should help considerably in leveling the workload. The effectiveness and clarity of the relative roles of Headquarters and the Centers in the make-buy process should become evident over the next year and should after that time be examined closely and evaluated by the task group.

Recommendation 5. For near-term technology development needed to support ongoing programs already under the direction of a particular Center, that Center should conduct make-or-buy decisions. However, if the Center decides to buy, then NASA should avoid real or perceived conflicts of interest by either administering the competition and external review from Headquarters or excluding from the competition all in-house organizations located at that Center. A Center decision to "make" should have Headquarters concurrence. [1998 *Assessment*, p. 22]

Summary of NASA's Presentation to the 1999 Task Group

Center-led processes are proposed, approved, and reviewed by NASA Headquarters.

Task Group's Assessment

NASA described a process that now captures the spirit of the 1998 recommendation, and the task group is satisfied with the implementation of this recommendation.

Recommendation 6. NASA should ensure that adequate resources, especially personnel, are available for Headquarters to organize, conduct, and respond to the needed number of external reviews to support competitive ATD procurements. [1998 *Assessment*, p. 22]

Summary of NASA's Presentation to the 1999 Task Group

The appointment process is under way for NASA to finish hiring at Headquarters two new staff members at the Senior Executive Service level. NASA also reported that the TAMs are functioning effectively as extensions of NASA Headquarters.

Task Group's Assessment

The task group endorses NASA's efforts to fill two new positions and agrees that the description of the TAMs' role is appropriate. The TAMs are located at Centers but have job descriptions similar to those of NASA Headquarters program managers. Their performance is monitored by Headquarters, especially the parochial or non-parochial nature of their decisions. Headquarters is also involved in their performance evaluations.

C. Infrastructure

Recommendation 7. NASA should foster increased workforce mobility among Centers and between NASA and industry, universities, and other government agencies to facilitate the transfer of information, obtain fresh points of view, and maintain the expertise of its workforce. Expanded use of Intergovernmental Personnel Act (IPA) exchanges and cooperative agreements should be considered to facilitate these efforts. [1998 *Assessment*, p. 25]

Summary of NASA's Presentation to the 1999 Task Group

NASA reported that it is continuing the effort to increase workforce mobility. However, it has found this recommendation difficult to implement given employees' personal constraints, cost of living inequities, and other government restrictions. IPAs generally involve relocation and disruption of families for a three-year period or more and, thus, it is difficult to attract people to these positions.

Task Group's Assessment

The task group recognizes the difficulty in implementing this recommendation but believes that NASA has the ability to do more. There remains a need to encourage identification of alternative approaches to ensuring that Centers can be "smart buyers." The smart-buyer argument should not be used to maintain unnecessary competency at the Centers. NASA routinely uses IPAs to operate its science programs. However, IPAs have not been effectively used to provide transfer of information into the technology programs. The task group continues to encourage NASA to expand its use of IPAs and other cooperative agreements at Headquarters and at the Centers, specifically to transfer technology information (or expertise) into NASA technology programs.

Recommendation 8. NASA should take prompt action to re-staff the Office of the Chief Scientist. [1998 *Assessment*, p. 25]

Summary of NASA's Presentation to the 1999 Task Group

Dr. Kathie Olsen was appointed as NASA Chief Scientist on May 24, 1999.

Task Group's Assessment

The task group commends NASA for filling the position of Chief Scientist. This position provides NASA Headquarters an important focus for evaluating the progress of technology investment in strengthening the nation's science investment. A first step toward this might be a standing committee organized by the Chief Scientist to assess the progress in important technologies for OSS and other science programs defined by the roadmaps. If the Centers are to have essentially non-overlapping responsibilities in the development of new technologies, then it is essential that Headquarters management understand the status of the various projects to balance funding allocations in a manner that achieves a maximum number of significant enhancements to the science missions.

Recommendation 9. Full-cost accounting is essential to effective management of ATD programs, and NASA should provide sufficient resources to complete and implement a full-cost accounting system. NASA should also determine how it will address workforce issues that may be raised when funding allocations are guided by full-cost accounting and organizational excellence, as determined through full and open competition. [1998 *Assessment*, p. 26]

Summary of NASA's Presentation to the 1999 Task Group

Acting on this recommendation goes beyond the authority of OSS alone. NASA reported that it is making progress on implementing a full cost management system and that the FY 2002 budget will be the first to include it.

Task Group's Assessment

The task group realizes that 1998 recommendation 9 goes beyond the authority of OSS. But it also believes that full cost accounting is necessary to permit proper program management and will revolutionize the way NASA does business. The lack of full cost accounting makes it difficult to accurately determine and compare the costs of different programs. As pointed out in the task group's 1998 report, without accurate fiscal data about funds allocations and program costs, it is impossible for NASA to make informed judgments about Center roles, make-or-buy decisions, or contract awards for competitive procurements that include NASA Centers. However, the task group was encouraged to see that NASA's efforts to implement full cost accounting appear to be nearing fruition and that they are projected to be completed by FY 2002.

D. Performance Measurement

Recommendation 10. NASA should identify performance measurement approaches (including independent external reviews) and metrics (including adequate investment data) needed to effectively manage its ATD programs. The findings and recommendations of external reviews of the Centers should be reported to Headquarters as well as to senior Center management. Investment data should cover the current program, and these metrics should be tracked for future use. [1998 *Assessment*, p. 26]

Summary of NASA's Presentation to the 1999 Task Group

NASA reported that the annual technology inventory has been greatly improved and is available online. It provides quantitative information on resource allocations to each technology area. External reviews were cited for all major program elements, including the New Millennium Program, the Cross-Enterprise Technology Development Program, and the Focused Programs.

Task Group's Assessment

The task group recognizes that NASA is increasing the level of technology and programmatic external reviews. However, based on material presented to the task group there appears to be little change in Center external reviews. The task group has seen no evidence of Headquarters leadership or interest in the Center review process. There is no coordinated and consistent process for Center review.

Each Center has developed its own method of review. In some cases, their customers are reviewing Centers. These customer reviews do not equate to impartial external reviews. NASA might find value in benchmarking against some of our leading industrial organizations.

Recommendation 11. To ensure accountability, NASA should formally respond to the recommendations contained in this task group report. Regular status reports should be made to external bodies, such as the NASA Advisory Council. [1998 *Assessment*, p. 28]

Summary of NASA's Presentation to the 1999 Task Group

NASA is adopting this recommendation by reporting regularly to the NRC task group, the OSS Task Force on Technology Readiness, and the Space Technology Management Operations Working Group.

Task Group's Assessment

The task group has a very positive reaction to NASA's and OSS's efforts.

Sincerely,

Daniel J. Fink, *Chair*
Task Group on Technology Development
in NASA's Office of Space Science

Claude R. Canizares, *Chair*
Space Studies Board

National Aeronautics and
Space Administration

Headquarters
Washington, DC 20546-0001

Request Letter from NASA

FEB 17 1999

Reply to Attn of: SM

Mr. Daniel J. Fink
Chair
D. J. Fink Associates, Inc.
18153 Chretien Court
San Diego, CA 92128

Dear Mr. Fink:

I want to thank you and your Task Group for your excellent report "Assessment of Technology Development in NASA's Office of Space Science" (OSS). You provided an outstanding analysis of our management of technology development in the context of current needs, concerns expressed by Congress, and previous recommendations of the Space Studies Board in the 1995 report "Managing the Space Sciences" and provided eleven insightful and incisive recommendations.

In concert with recommendations one and eleven, which focus on a method of using an external review team to ensure that the remainder of the recommendations are acted upon, I propose that your task group be that external review team. Dr. Peter Ulrich, Director of the Advanced Technology and Mission Studies Division in my office, is arranging a followup meeting with your committee at which these recommendations will be reviewed in some detail. He will bring appropriate NASA Headquarters and Center personnel with him, most of whom briefed your committee last summer. The purposes of this meeting will be to give you a status report on our progress in meeting the recommendations and to agree that we are aiming for the right targets on the remaining open issues. The second meeting should occur about 6 months afterwards. My goal for that meeting is that all of our action items be closed.

As you are well aware, some of your recommendations, such as those on hiring a NASA Chief Scientist and on implementing full cost accounting, are not the responsibility of OSS. Nevertheless, we can also bring you up to date at that time

on these Agency matters. Significant progress is being made on both of these items.

A number of steps have already been taken in the direction of your recommendations. For example:

We are in the process of updating the OSS Strategic Plan and have instituted a process to ensure that technology development is well integrated with science planning.

For the Cross-cutting Technology program, we have begun the NASA Research Announcement process which will ensure that by fiscal year 2001, 50 percent of the funding in that program will be broadly announced and peer reviewed.

The Cross-cutting Technology program has also instituted annual independent external reviews of program excellence

Without an aggressive successful technology program which is responsive to our needs, we will not be able to achieve our exciting and challenging visions for the future. Your analysis of our technology management and your recommendations will help us to achieve that. I look forward to Dr. Ulrich's report of the review discussed above, and I extend our thanks to you and your committee members for taking the time from your busy schedules to assist NASA in improving its Space Science Technology program.

Sincerely,

Edward J. Weiler
Associate Administrator
for Space Science

cc:
Space Studies Board/Mr. Alexander, Study Director
AF/Mr. Venneri
S/Dr. Huckins
S/Mr. Allen
SM/Dr. Ulrich

APPENDIX 2

Acknowledgment of Reviewers

This report has been reviewed by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the National Research Council's (NRC's) report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the authors and the NRC in making the published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The contents of the review comments and draft manuscript remain confidential to protect the integrity of the deliberative process. We wish to thank the following individuals for their participation in the review of this report:

Lew Allen, Jr., Jet Propulsion Laboratory (ret.),
John J. Donegan, John Donegan Associates, Inc.,
Steven H. Kahn, Columbia University,
John D. MacKenzie, University of California at Los Angeles, and
Robert J. Spinrad, Xerox PARC (ret.).

Although the individuals listed above have provided many constructive comments and suggestions, responsibility for the final content of this report rests solely with the authoring task group and the NRC.

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