AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

BUILDING AND MAINTAINING A HEALTHY AND STRONG NASA WORKFORCE

HEARING

BEFORE THE

SUBCOMMITTEE ON SPACE AND AERONAUTICS

COMMITTEE ON SCIENCE AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

MAY 17, 2007

Serial No. 110–31

Printed for the use of the Committee on Science and Technology

Available via the World Wide Web: http://www.house.gov/science

U.S. GOVERNMENT PRINTING OFFICE

35–235PS WASHINGTON : 2007

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2104 Mail: Stop IDCC, Washington, DC 20402–0001

COMMITTEE ON SCIENCE AND TECHNOLOGY

HON. BART GORDON, Tennessee, *Chairman*

JERRY F. COSTELLO, Illinois
EDDIE BERNICE JOHNSON, Texas
LYNN C. WOOLSEY, California
MARK UDALL, Colorado
DAVID WU, Oregon
BRIAN BAIRD, Washington
BRAD MILLER, North Carolina
DANIEL LIPINSKI, Illinois
NICK LAMPSON, Texas
GABRIELLE GIFFORDS, Arizona
JERRY MCNERNEY, California
PAUL KANJORSKI, Pennsylvania
DARLENE HOOLEY, Oregon
STEVEN R. ROTHMAN, New Jersey
MICHAEL M. HONDA, California
JIM MATHESON, Utah
MIKE ROSS, Arkansas
BEN CHANDLER, Kentucky
RUSS CARNAHAN, Missouri
CHARLIE MELANCON, Louisiana
BARON P. HILL, Indiana
HARRY E. MITCHELL, Arizona
CHARLES A. WILSON, Ohio

RALPH M. HALL, Texas
F. JAMES SENSENBRENNER JR., Wisconsin
LAMAR S. SMITH, Texas
DANA ROHRABACHER, California
ROSCOE G. BARTLETT, Maryland
VERNON J. EHLERS, Michigan
FRANK D. LUCAS, Oklahoma
JUDY BIGGERT, Illinois
W. TODD AKIN, Missouri
JO BONNER, Alabama
TOM FEENEY, Florida
RANDY NEUGEBAUER, Texas
BOB INGLIS, South Carolina
DAVID G. REICHERT, Washington
MICHAEL T. MCCAUL, Texas
MARIO DIAZ-BALART, Florida
PHIL GINGREY, Georgia
BRIAN P. BILBRAY, California
ADRIAN SMITH, Nebraska
VACANCY

SUBCOMMITTEE ON SPACE AND AERONAUTICS

HON. MARK UDALL, Colorado, *Chairman*

DAVID WU, Oregon
NICK LAMPSON, Texas
STEVEN R. ROTHMAN, New Jersey
MIKE ROSS, Arizona
BEN CHANDLER, Kentucky
CHARLIE MELANCON, Louisiana
BART GORDON, Tennessee

TOM FEENEY, Florida
DANA ROHRABACHER, California
FRANK D. LUCAS, Oklahoma
JO BONNER, Alabama
VACANCY

RALPH M. HALL, Texas

RICHARD OBERMANN *Subcommittee Staff Director*
PAM WHITNEY *Democratic Professional Staff Member*
KEN MONROE *Republican Professional Staff Member*
ED FEDDEMAN *Republican Professional Staff Member*
DEVIN BRYANT *Research Assistant*

CONTENTS

May 17, 2007

	Page
Witness List	2
Hearing Charter	3

Opening Statements

Statement by Representative Mark Udall, Chairman, Subcommittee on Space and Aeronautics, Committee on Science and Technology, U.S. House of Representatives	13
Written Statement	14
Statement by Representative Ralph M. Hall, Minority Ranking Member, Committee on Science and Technology, U.S. House of Representatives	15
Written Statement	16

Witnesses:

Ms. Toni Dawsey, Assistant Administrator, Human Capital Management; Chief Human Capital Officer, National Aeronautics and Space Administration (NASA)	
Oral Statement	17
Written Statement	19
Mr. John G. Stewart, National Academy of Public Administration Fellow; Member, Panel on NASA Multi-sector Workforce	
Oral Statement	24
Written Statement	26
Dr. David C. Black, President Emeritus, Universities Space Research Association; Adjunct Professor, Physics and Astronomy Department, Rice University; Co-Chair, Committee on Issues Affecting the Future of the U.S. Space Science and Engineering Workforce, National Research Council, The National Academies	
Oral Statement	28
Written Statement	30
Biography	38
Dr. Lee Stone, Legislative Representative, NASA Council of IFPTE Locals, International Federation of Professional and Technical Engineers	
Oral Statement	38
Written Statement	40
Discussion	
Opinions on NASA's Response to National Academies' and NAPA's Reports	53
How NASA Is Achieving Workforce Goals	55
Suggested Resources for Funding NASA	56
Introduction of Mr. Feeney as Ranking Member	58
Suggestions for Utilizing the Current Pool of Workers and Developing a Workforce for the Future	60
Future Vision for NASA	61
Age Demographics of the NASA Workforce	63
Workforce Implementation Plan	65
Importance of In-house Scientists at NASA	65
Ratio of Permanent and Nonpermanent Civil Servants	67

Page

Appendix 1: Answers to Post-Hearing Questions

Ms. Toni Dawsey, Assistant Administrator, Human Capital Management; Chief Human Capital Officer, National Aeronautics and Space Administration (NASA) 70

Mr. John G. Stewart, National Academy of Public Administration Fellow; Member, Panel on NASA Multi-sector Workforce 79

Dr. David C. Black, President Emeritus, Universities Space Research Association; Adjunct Professor, Physics and Astronomy Department, Rice University; Co-Chair, Committee on Issues Affecting the Future of the U.S. Space Science and Engineering Workforce, National Research Council, The National Academies 82

Dr. Lee Stone, Legislative Representative, NASA Council of IFPTE Locals, International Federation of Professional and Technical Engineers 85

Appendix 2: Additional Material for the Record

Supplemental Information for the Record by Dr. John Stewart, Academy Fellow and Member of the NASA Multi-sector Workforce Panel 92

NASA: Balancing a Multi-sector Workforce to Achieve a Healthy Organization, A Report by a Panel of the National Academy of Public Administration, February 2007 95

BUILDING AND MAINTAINING A HEALTHY AND STRONG NASA WORKFORCE

THURSDAY, MAY 17, 2007

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON SPACE AND AERONAUTICS,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 10:03 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Mark Udall [Chair of the Subcommittee] presiding.

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON SPACE AND AERONAUTICS

Hearing on

Building and Maintaining a Healthy and Strong NASA Workforce

May 17, 2007
10:00 a.m. – 12:00 p.m.
2318 Rayburn House Office Building

WITNESS LIST

Ms. Toni Dawsey
Assistant Administrator
Human Capital Management
NASA

Mr. John G. Stewart
National Academy of Public Administration Fellow
Member
NASA Multisector Workforce Panel

Dr. David Black
Co-Chair
Committee on Meeting the Workforce Needs for the National Vision for Space Exploration
National Research Council

Dr. Lee Stone
Legislative Representative
NASA Council of IFPTE Locals
International Federation of Professional and Technical Engineers

Section 210 of the Congressional Accountability Act of 1995, applies the rights and protections covered under the Americans with Disabilities Act of 1990 to the United States Congress. Accordingly, the Committee on Science strives to accommodate/meet the needs of those requiring special assistance. If you need special accommodation, please contact the Committee on Science in advance of the scheduled event (3 days requested) at (202) 225-6371 or FAX (202) 225-0891.
Should you need Committee materials in alternative formats, please contact the Committee as noted above.

HEARING CHARTER

SUBCOMMITTEE ON SPACE AND AERONAUTICS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

Building and Maintaining a Healthy and Strong NASA Workforce

THURSDAY, MAY 17, 2007
10:00 A.M.—12:00 P.M.
2318 RAYBURN HOUSE OFFICE BUILDING

Purpose

On Thursday, May 17, 2007 at 10:00 am, the House Committee on Science and Technology, Subcommittee on Space and Aeronautics will hold a hearing to examine National Aeronautics and Space Administration (NASA) workforce issues and the recommendations of independent review panels for ensuring the health and vitality of the NASA workforce in the 21st century. This is the first in a series of NASA workforce hearings. Later hearings will address Shuttle transition workforce issues and specific legislative proposals.

Witnesses:

Witnesses scheduled to testify at the hearing include the following:

Ms. Toni Dawsey
Assistant Administrator for Human Capital Management, NASA

Mr. John G. Stewart
Fellow, National Academy of Public Administration, Member, NASA Multi-sector Workforce Panel

Dr. David Black
Co-Chair, Committee on Meeting the Workforce Needs for the National Vision for Space Exploration, National Research Council

Dr. Lee Stone
Legislative Representative, NASA Council of IFPTE Locals, International Federation of Professional and Technical Engineers

Background

Potential Issues

The following are some of the potential issues that might be raised at the hearing:

- **Is NASA's Workforce Strategy the Right Approach for Building the NASA Workforce?—**NASA is undertaking a sizable shift of programmatic activities as the Agency endeavors to carry out the President's *Vision for Space Exploration.* Specifically, NASA is in the midst of the following changes:
  - Implementing the *Vision for Space Exploration;*
  - Retiring the Space Shuttle by 2010;
  - Completing the International Space Station;
  - Developing the Orion Crew Exploration Vehicle (CEV) and the Ares Crew Launch Vehicle (CLV);
  - Refocusing the aeronautics program;
  - Dealing with a flatter funding profile than previously assumed; and
  - Encountering a growing, retirement-eligible workforce.

  These changes will have a significant impact on the NASA workforce in large part because the Agency has not developed a human space transportation system in over 25 years. Pursuant to the *NASA Authorization Act of 2005,* the Agency has developed a Workforce Strategy to ensure that NASA possesses a workforce of the appropriate size and skills to carry out its programs.

However, the strategy only covers the period through FY 2011. Is NASA's Workforce Strategy the right approach for building NASA's future workforce? How well does the strategy address the two recent independent reports on NASA's workforce—the National Academy of Public Administration's (NAPA) *NASA: Balancing a Multi-sector Workforce to Achieve a Healthy Organization* and the National Academies' *Building a Better NASA Workforce: Meeting the Workforce Needs for the National Vision for Space Exploration?* What, if any, gaps or shortcomings do the reports identify in the Workforce Strategy, and what actions does NASA plan to take in response?

- **NASA's Workforce Strategy and Long-Term Planning—**NASA's Strategy states that "The workforce strategy allows NASA to deal effectively with the critical issues now facing the Agency, particularly a significant amount of uncovered capacity [workers whose time is not allocated to projects at 100 percent]. . .. NASA does recognize that some future events, such as the termination of the Space Shuttle Program, require long-term planning. . .." On the other hand, the Strategy notes that "Planning is a task requiring sensitivity to ongoing changes in programs, budgets, political priorities, and the labor market." What are the underlying assumptions on which the strategy was developed? Was the strategy aimed at responding to near-term workforce challenges, and if so, is the existing strategy sufficient for long-term planning? NASA has developed a strategic plan that outlines the Agency's goals and programs for the next decade. Does NASA have a workforce strategy and implementation plan that supports the Agency's strategic plan? How robust is the Workforce Strategy against potential changes in resources and priorities that Congress or a new Administration might have for NASA?

- **Workforce Strategy and NASA's Contract Workforce—**NASA's Workforce Strategy reflects an analysis of competencies and approaches for building and strengthening the Agency's 18,000 civil servant workforce. However, the Agency also relies on some 44,000 contractors to execute its projects. The National Academies report states that "in the short-term, NASA does not possess the requisite in-house personnel with the experience in human space flight systems needed to implement the VSE *[Vision for Space Exploration]*. . .. Much of the workforce on which NASA has historically relied, and will continue to rely, exists outside the Agency. . ." in industry and at universities. Does NASA plan to include contractors and academic researchers in its strategic workforce decisions? How is NASA making long-term decisions about the number of contractors it may need, at which centers, and for which competencies, skill areas, and positions it will need those contractors? Does NASA have the right infrastructure and in-house skills for managing contracts and procurements?

- **The Pipeline of NASA Workers—**NASA, like other government agencies, has used hiring freezes to control the size of its workforce and avoid Reductions in Force (RIFs). Opportunities to bring entry level civil servants into the workforce depend, in part, on attrition, buy-outs, or acceptances of early-retirement offers. This practice has led to a NASA workforce that is comprised of an increasing number of retirement-eligible workers and an insufficient number of younger workers who can rise to leadership positions in the future. The National Academies report notes that NASA will suffer a long-term shortage of in-house technical expertise in human space flight systems if the Agency does not take steps to improve the pipeline of future leaders and managers. What steps is NASA taking to ensure a pipeline in its workforce? The independent reports also recommend improvements to NASA's mentoring, internship, cooperative education, and graduate fellow programs in the interest of attracting new talent to NASA. In addition, the National Academies recommends that small science space flight programs be used as opportunities to train younger workers and build the skills in program/project management and systems engineering the Agency has says it needs. Does NASA plan to make any changes to its training and recruitment programs? How effective are buy-outs and early-retirement offers in opening positions for younger workers, and how is NASA ensuring that those offers do not eliminate individuals with skills that are difficult to replace?

- **The Workforce Strategy and NASA's Aeronautics and Science Programs—**NASA's workforce strategy identifies a moderate diminished need for Full-Time Equivalents [FTEs] in space sciences, biological sciences, physical sciences, among other competencies. The National Academies report recommends that "NASA should assess whether the skill levels of in-house sci-

entists at each field center are appropriate to fulfilling that center's scientific leadership and service responsibilities and should ensure that appropriate efforts are made to maintain the scientific competency and currency of each center's scientific workforce." How well does the strategy address the need to develop and maintain healthy science and aeronautics programs? Were NASA's assessments of needs in the space, biological, and physical sciences based on the Agency's understanding of the core capabilities needs and the number of individuals that can meet those core capabilities? Or rather, were NASA's assessments based on the projected resources available for those disciplines in view of the Agency's other priorities? Does NASA have mechanisms for assessing the research and engineering capabilities needed from universities to support current and potential NASA programs?

- **Other Challenges Facing NASA's Workforce—**During the June 2006 Science Committee workforce hearing, a NASA official testified that the Agency had reduced the problem of "uncovered capacity" (workers whose time is not allocated to projects at the 100 percent level) by two-thirds, but still carried significant uncovered capacity. Furthermore, NASA had instituted retraining programs to enable uncovered workers to take on new tasks. What are the causes of uncovered capacity? What is the status of the Agency's uncovered capacity and how effective have the retraining programs been? Are NASA's approaches to handling uncovered capacity adequate over the long-term? NASA has reported difficulty in tracking uncovered capacity and the NAPA report notes that NASA does not have a transparent process for monitoring its uncovered capacity; there is no accounting code or tracking of when an employee is uncovered or working on tasks outside his/her competencies. Does NASA plan to make any changes in response to improve its monitoring of uncovered capacity?
- **Is "Ten Healthy Centers" a Good Idea?—**NASA's Workforce Strategy embraces the goal of maintaining a fully productive workforce at all of its field centers in what it calls "Ten Healthy Centers." Centers have been given new exploration roles but face challenges as they shift from a focus on research or aeronautics, for example, to exploration projects. The National Academies report notes that, "According to NASA, the immediate problem with employees whose primary skills are not currently needed is most significant at the three aeronautics centers (Ames, Glenn, and Langley)." In addition, these centers have been identified as carrying the highest percentages of uncovered capacity. The NAPA report questions "whether the pursuit of ten healthy centers will yield a healthy NASA." What is NASA's definition of a healthy center? What are the long-term implications of the "Ten Healthy Centers" approach?"
- **Supporting Strategic Decisions about the NASA Workforce—**NASA has assessed its requirements for the categories of workers the Agency needs to support its programs. The Agency has used an information system—the Competency Management System (CMS)—devoted to workforce planning to conduct this assessment. The independent reports assert that NASA needs more information for its workforce planning, question the adequacy of the CMS, and recommend that NASA develop models for projecting future competency and skill requirements. In particular, the National Academies recommends that more information is needed about the current skills, experience levels and expected attrition of the center workforce. Competencies and experience levels need to be translated into specific positions. What is the status of the CMS and does NASA plan to make any changes to CMS? Will NASA workforce decisions and future planning be based on robust, transparent data and analyses? What information does NASA plan to acquire to support both short-term and long-term workforce decisions and plans?
- **Looking Beyond NASA to Build the Future NASA Workforce—**The NAPA and National Academy reports seem to suggest that NASA's workforce planning would benefit from the same innovation and external partnerships that make the Agency's space missions so successful. The National Academies state that "the solution to NASA's workforce issues is not to be found by considering NASA in isolation from the rest of the aerospace ecosystem [NASA, Department of Defense, industry, and universities]." NASA should conduct workforce planning in cooperation with other government agencies, industry, and universities. Both independent reports recommend that NASA use interagency partnerships and improve internships and cooperative programs to attract new talent. The National Academies recommends that NASA invest in

nontraditional approaches such as the Centennial Challenges program to build public support and train the next generation. NAPA recommends that NASA consider detailing highly skilled technical experts to other agencies during periods when NASA projects do not require those employees' skills. How would such interagency transfers work? How open is NASA to looking beyond itself to address its workforce challenges? What plans does NASA have, if any, for undertaking innovative approaches to strengthen and build its workforce?

BACKGROUND

This section provides summary information on 1) NASA's current workforce, 2) the NASA Workforce Strategy, 3) the National Academies and National Academy of Public Administration's reports on NASA's workforce, 4) the 109th Congress, Committee on Science's hearing on NASA's workforce held on June 13, 2006, and 5) on the *NASA Flexibility Act of 2004.*

Current NASA Workforce Demographics

As detailed in Attachment 1, NASA's workforce includes a total of 18,343 civil servants (as of April 2007) and approximately 44,023 contractors (as of April 2006). The largest numbers of civil servants and contractor employees are retained at Johnson Space Center, Kennedy Space Center, Marshall Space Flight Center, and Goddard Space Flight Center, respectively.

Summary of NASA's Workforce Strategy

Pursuant to the *NASA Authorization Act of 2005,* NASA prepared a Workforce Strategy. The Strategy serves to assess and build a NASA workforce that can achieve the Agency's objectives for the *Vision for Space Exploration,* scientific activities, and aeronautics research. Specifically, the Strategy identifies the factors affecting NASA's workforce:

- Implementation of the *Vision for Space Exploration*
- Retiring of the Space Shuttle by 2010 and development of the Crew Launch Vehicle and Crew Exploration Vehicle
- A refocusing of aeronautics research program away from technology demonstration and toward long-term basic research
- Increasing numbers of retirement-eligible workers
- Change to full cost management and a resulting need to balance human resources with center workload and project life cycles

Elements of the Workforce Strategy include:

- The objective of 10 Healthy Centers that maintain a workload to sustain a productive workforce.
- A workforce planning process that involves all levels of management, including center management, and serves as a central component of NASA's strategic, business, and resource planning.
- A set of workforce planning tools including a Competency Management System (CMS) to identify and monitor NASA's knowledge base. According to the NASA workforce strategy, "Competencies are used to categorize the capabilities of an employee, identify the knowledge requirements of a position or those associated with projects and programs, and forecast the Agency's workforce requirements." In addition, a Workforce Integrated Management System (WIMS) collects and manages NASA's data on the workforce and competency planning.
- An assessment of supply and demand for specific competencies in the workforce between 2006 and 2011, including a projection of the number of FTEs needed at each NASA center from FY 2005–FY 2011, based on expected requirements and anticipated funding.
    - NASA identified, based on the assessment, competencies in increasing demand: 1) program/ project management; 2) systems engineering and integration, and 3) mission operations. Primary competencies in decreasing demand are: 1) engineering and science support; 2) management competencies; and 3) paraprofessional business operations, among other functions.
    - The Strategy discusses a problem with "uncovered capacity," that is, employees whose work time is not allocated at 100 percent to project tasks.

- Identified steps for addressing the gap in required competency areas, including approaches for recruiting new talent and for retaining employees who possesses competencies required to fulfill the Agency's objectives.

The Workforce Strategy emphasizes the need for flexibility to reflect new information and changes in policies, plans, resources, and political situations.

Building a Better NASA Workforce: Meeting the Workforce Needs for the National Vision for Space Exploration (National Academies, 2007)

In September 2005, NASA's Associate Administrator for Program Analysis and Evaluation requested that the National Academies "study the long-range science and technology workforce needs of NASA and the larger aerospace science and engineering community to achieve the Vision for Space Exploration. . .." The report's key conclusions and recommendations are summarized below:

No National Shortage of Skilled Employees to Support the Vision

- There is "no looming national shortage of skilled scientists and engineers to implement the VSE over the long-term."
- Low numbers of entry-level NASA workers (25–29 year age range) who can build the experience necessary to implement the Vision over the coming decades raise concern.
- The workforce that NASA has relied on in the past and will continue to rely on resides outside of the Agency in universities and industry. NASA will need to approach its outside scientific workforce differently than its outside engineering workforce, because while industry personnel can move among defense, commercial aerospace, and NASA projects, university research talent will be lost if NASA stops supporting scientific research.

NASA Needs to Collect More Data In Order to Assess its Workforce

- NASA has conducted a top-down, headquarters-led assessment of the Agency's needs and skills to meet its workforce demands but needs to conduct a bottom-up, center-led "assessment of the current skills, experience levels, and projected attrition of the workforce for each individual center."
- This information should be used to develop a model that will allow the Agency to project the skills it needs to develop as well as the competencies and experience levels NASA requires. NASA should translate such competencies and experience levels into specific positions and projected timeframes of when each center will require those positions.
- NASA should also apply the model to project the mix of skills that could be conducted internally or externally in industry.

Increased Need for Program/Project Managers and Systems Engineers

NASA's requirements for both internal and external scientific and engineering workforce share the common need for "highly skilled program and project managers and systems engineers." Approaches for increasing these capabilities include:

- Leveraging workers with systems engineering and technical experience acquired from robotic science programs for human spacecraft development;
- Providing opportunities for junior-level workers to obtain hands-on flight development experience through low-cost sounding rocket, balloon, and aircraft research projects to develop the program/ project management and systems engineering skills that NASA needs now and in the future.
- Retaining existing employees with much needed program/project and systems engineering skills while also recruiting employees from outside the Agency that possess those capabilities.
- Using the NASA Flexibility Act of 2004 and working with Congress and the executive branch to reduce the barriers that enable the flow of skilled employees between industry and NASA.

NASA Should Help Train Its Future Workforce

- NASA should become involved in training its potential workforce, because the Agency cannot rely on other government agencies or external institutions to provide "the skills that are unique to the work the Agency conducts."
- NASA training programs have languished and need additional support and restructuring. The Graduate Student Research Program (GSRP) establishes a

strong link between NASA and university scientists, but similar connections do not exist for engineering and human exploration.

- NASA's Education Program could be used to fund workforce programs including hands-on training opportunities in suborbital programs and small mission programs such as Explorers.
- Nontraditional means of inspiring and training the future workforce such as the Centennial Challenge prizes should also be considered. Many of the programs it mentions—sub-orbital, GSRP, and Centennial Challenges—do not require large investments and will yield training benefits many times more than the necessary investments.

NASA Workforce Within the Broader Context

- The stability of support for and funding for the Vision will be important to industry's ability to attract and maintain skilled and younger workers to support exploration projects.
- NASA's workforce is not an internal matter but must be considered as part of a national strategy with input from national security government agencies, industry, and universities.

NASA: Balancing A Multi-sector Workforce to Achieve a Healthy Organization (National Academy of Public Administration, 2007)

In March 2006, the Senate Appropriations Subcommittee and NASA asked the National Academy of Public Administration to conduct a study on NASA's workforce that would focus on 1) the challenges of transitioning from the Shuttle Program to the Vision, and 2) acquiring the right balance within its multi-sector workforce of approximately 18,000 civil servants and 44,000 contractors.

Some of the NAPA study panel's specific concerns are summarized below:

NASA's Dedication to "Ten Healthy Centers"

- The panel noted that *"NASA has not established a comprehensive evaluation process to assess and monitor the long-term health of each center."* The report introduces a guide for assessing the health of each center and recommends that NASA's Program Analysis and Evaluation Office use the guidelines to evaluate each center annually.
- The panel warns that *". . .the potential danger of the ten healthy centers approach is that actions intended to help the struggling centers could harm the other centers. Therefore, supporting all ten field installations could come at the expense of NASA as an agency."* The panel added that *"The current and long-term health of the three NASA research centers (Ames, Glenn, and Langley) is questionable and should be a core concern of NASA headquarters."*

Multi-sector Balance

- The panel noted that interpretations of responsibilities that are *'inherently governmental,'* and therefore should be conducted by civil servants, differ across the government. The report presents guidelines for deciding whether a position should be filled with a civil servant or a contractor. For decisions on civil servant hires, the report introduces guidelines for determining what kind of appointment should be used: tenured permanent or multi-year term.
- NASA's *Workforce Strategy* is limited to the civil service workforce. It does not address the contractor personnel that comprise two-thirds of the Agency's total workforce. *"Although the Strategy is consistent with historical approaches to civil service workforce planning, it was a narrow interpretation of the Congressional mandate for a human capital strategy to ensure a workforce of the appropriate size and with the appropriate skills."*
- NASA's Competency Management System (CMS) covers only civil service employees, however, NAPA notes that *"other federal organizations have developed systems to capture aggregate contractor competencies. In June 2006, for example, the Department of National Intelligence (DNI) began to develop a comprehensive competency-based inventory for its civil servants and its "embedded" (on-site) contractors who are doing core work."*

Contracting Officer Technical Representatives

- The NAPA panel observes that there is *"An inconsistent definition of the federal acquisition workforce, which often excludes and, by implication may undervalue, Contracting Officer Technical Representatives (COTRs). COTRs are an agency's technical link to ensure that contractors deliver quality prod-*

ucts meeting agency specifications, schedules, and costs." "The Panel believes that NASA must have more comprehensive information regarding who its COTRs are, what training they have had, what training they need, what parts of their contracting work they are doing effectively and timely, and what responsibilities are perhaps not getting adequate attention."

- The report also calls attention to a December 2005, NASA Inspector General (IG) report that identified a list of *"trouble areas"* relating to the contracting process, including problems with the financial management system in tracking contract spending; insufficient transparency in work performed by subcontractors; sizable cost overruns in some NASA programs, among other concerns. The IG recommended an improved internal control framework, as well as establishing institutional procurement officials accountable for acquisition integrity."

Centralization of Human Resources

- The report notes that *"Until recently, each NASA center had its own tools and processes for workforce strategy and planning, which made it difficult to track uncovered capacity, skill mismatches, and other human capital issues and take appropriate corrective actions."* Recently NASA has moved to centralize and make uniform its human resources activities through its NASA Shared Service Center. *"By consolidating these services, NASA intends to improve operational efficiency and overall customer service and focus more on its core competencies. NASA has projected annual savings of up to $6.6 million from NSSC, with more than 200 civil service FTE across the four redirected functional areas."*

Human Resource Tools

- To efficiently manage the anticipated workforce transitions, the NAPA report calls for workforce flexibilities, including *"modified RIF rules, blanket buy-out authority with a higher dollar value incentive, and limited statutory authority for emergency retirement reform."*

Workplace Planning Scope

- The NAPA panel believes that, in light of the considerable uncertainty in mission direction that NASA will receive, NASA's workplace planning should expand from a one to two-year to a five year horizon.
- The panel endorsed a recommendation from a 2005 GAO report (GAO–05–230) to use scenario planning. The planning should be focused and *"Identify the driving forces underlying each likely scenario; Incorporate the scenarios into strategic actions; Identify key events that would indicate a particular scenario is unfolding; Create mechanisms to monitor the environment; Make adjustments to agency strategies based on environmental monitoring; and Identify and coordinate overall agency competencies, schedules, and facilities across programs by scenario."*
- NAPA learned in October 2006 that NASA's Office of Human Capital Management (OHCM) is working to incorporate scenario planning into the workforce planning process across the five-year budget cycle.

Maintaining Core Skills

- Drawing upon workforce studies conducted by RAND, the Panel emphasized the importance of identifying, sizing, and maintaining core competencies. This process requires long-term planning, and according to RAND, analysis of the demand for labor at the skill level over time; understanding and definition of core capabilities; and planning over the long-term to maintain such capabilities.

Human Capital Flexibilities

- The *NASA Flexibility Act of 2004* enlarged NASA's workforce flexibilities, yet the Panel notes *"While these flexibilities are important, they are much more modest than those given to the DOD and the Department of Homeland Security (DHS). NASA is subject to such Title 5 requirements as staffing, position classification, compensation, and performance management. For example, it is not authorized to implement pay-banding or performance-based compensation strategies."*
- The panel recommends that NASA *"Pursue additional statutory and regulatory authorizations to obtain other flexibilities needed to strategically manage the workforce. . .."* For example, the Panel's 2005 *Human Capital Flexi-*

bilities report recommended that NASA be able to alter its agency's career life cycle by modifying retirement rules *"to allow the Agency to separate an employee eligible for optional retirement if doing so would help it achieve workforce reshaping or downsizing goals."*

The Competency Management System (CMS)

- Since 2003, NASA has used a Competency Management System (CMS) to document the workforce competencies required by NASA positions and possessed by NASA employees. As NASA has defined it, a competency is not a role or function, but a base level of knowledge relevant to the Agency's mission that defines for a position what knowledge is needed and how it is applied.
- The report notes that *"As presently constituted, CMS is not always as helpful to centers at the personnel hiring level because it does not track directly to positions."* The panel recommends that NASA *"Strengthen the CMS by integrating it with existing budget tools. . .with a methodology for translating competency surpluses and deficits into FTE needs."*

Hearing before the Subcommittee on Space and Aeronautics, Committee on Science, June 13, 2006. "The NASA Workforce: Does NASA Have the Right Strategy and Policies to Retain and Build the Workforce It Will Need?"

During the 109th Congress, the House Science Committee's Subcommittee on Space and Aeronautics examined issues related to NASA's workforce during a hearing held in June 13, 2006.

- Ms. Toni Dawsey, NASA Assistant Administrator for Human Capital Management testified on NASA's workforce challenges including the Agency's uncovered capacity and efforts to ensure that employees with critical skills are not lost during buy-outs or early retirement offers. She also discussed the Agency's workforce strategy and the importance of human capital tools and flexibility such as the *NASA Flexibility Act,* cooperative education programs, and intern programs in attracting new talent into the Agency.
- Dr. Lee Stone, Legislative Representative from IFPTE and an employee of NASA Ames Research Center testified that NASA does not have the right strategies or policies to build the workforce it needs and that the Agency's efforts in workforce planning can only provide short-term solutions. The only long-term solution to building a healthy workforce is to reverse the trend in budget cuts to aeronautics, science and exploration programs.
- Dr. David Black, Co-Chair of the National Academies' report on NASA's Workforce testified that, in the view of the Academy committee, NASA's work is incomplete and represents a top-down approach that does not properly reflect the workforce needs of individual centers. He also noted that the lack of support and budget for the *Vision for Space Exploration* affects the Agency's ability to find the best and brightest employees. Dr. Black noted that if NASA elects to build its workforce internally rather than use outside contractors, the Agency will over the next five years face a gap in expertise that cannot be addressed through new hires or in-house employees.
- Mr. John Douglass, President, Aerospace Industries Association testified that aerospace workforce is aging and that industry is in the process of rebuilding its workforce for the future. He spoke about the use of contractors for short-term projects and civil servants for basic research and development efforts. Mr. Douglass testified that competition for systems engineering skills among industry and other government agencies is of concern. He said that the aerospace industry can absorb more NASA work.

Uncovered Capacity

Subcommittee Members probed the issue of uncovered capacity. Ms. Dawsey reported a total of 1000 FTEs were uncovered, which equates to 828 employees. NASA's approach to addressing the problem is to reassign work to those centers with the most significant uncovered capacity and to retrain workers for exploration-related tasks. The union asserted that NASA's uncovered capacity problem had little to do with workforce and much to do with full cost accounting. Dr. Lee Stone testified that NASA managers were diverting labor funds to support hardware procurements, thus creating the problem in uncovered capacity.

Competency Management System (CMS)

The IFPTE union called attention to the deficiencies in NASA's CMS system. The system was originally intended to include several databases but so far only includes one. The database in use only captures primary competencies and cannot reflect an employee's secondary skills. In addition, competencies have not been assessed and translated into specific positions.

Balance of In-House Civil Servants and Contractors

The Subcommittee also examined the process for making decisions on NASA's use of in-house civil servants versus contractors and the balance between these elements of its workforce. Ms. Dawsey noted that the Agency was seeking guidance on this issue from the National Academy of Public Administration. Dr. Black suggested that NASA look beyond itself and consider the question with the broader aerospace and research community. Dr. Lee Stone referred to the *Columbia* Accident Investigation Board (CAIB) report and its cautioning on NASA's reliance on contractors for technical support, use of experienced managers for contract oversight rather than technical leadership, and use of inexperienced engineers for management roles.

A Funding Crisis, Not a Workforce Crisis

Members and witnesses alike referred to the fact that NASA's expanding responsibilities are not being met with appropriate resources. As a result, the Agency will lose capabilities in science programs, especially life and micro-gravity sciences and astrobiology, which cannot be easily replaced. Insufficient funding to execute NASA's multiple missions does not present a strong signal to graduate students and young workers who might be considering NASA or NASA-related work as a means to build and grow their careers.

The NASA Flexibility Act of 2004 (P.L. 108–201)

The *NASA Flexibility Act of 2004* granted a range of increased flexibilities for strengthening NASA's workforce. Under the Act, term appointments could last longer, and conversion from term to permanent appointments was made easier. Recruitment, relocation and retention bonuses were increased, and redesignation bonuses were added. Authority was granted for hiring distinguished scholars and for critical position hiring. The time period for an Intergovernmental Personnel Act (IPA) assignment limit was increased. Travel and transportation reimbursement capabilities, and change of position incentives, were enlarged. Annual leave, and Senior Executive Service (SES), eligibilities also were enlarged. The maximum allowable rate of pay for NASA-excepted (NEX) employees was increased. A scholarship program was established.

The NASA Transition Act of 2007

The *NASA Transition Act of 2007* proposes to amend the *Space Act of 1958* and the *NASA Flexibility Act of 2004.* The *Transition Act* includes two new workforce management tools:

- Authority to offer a permanent employee an incentive for voluntarily converting to a time-limited appointment; and
- Authority to pay the government's share of the Federal Employees Health Benefits Program (FEHBP) premium for employees who separate because their positions are being eliminated or transferred out of the commuting area. This is expected to result in a greater number of employees being willing to separate voluntarily.
- Specific provisions of the legislation would terminate in 2010.

Attachment 1

Total NASA Civil Service Workforce
as of April 28, 2007

CS Head Count	JSC	KSC	MSFC	GSFC	LARC	GRC	ARC	DFRC	SSC	HQ	NSSC	Total
Full-Time Permanent	2,842	1,769	2,333	2,966	1,787	1,535	1,136	430	255	1,181	106	16,340
Part-Time Permanent	23	14	14	42	11	20	3	9	1	6	0	143
Term Appointment	389	280	170	118	85	56	77	70	9	24	0	1,278
Student	166	69	40	97	34	37	6	26	7	1	0	483
Other Non-Permanent	6	5	1	4	7	0	0	10	1	65	0	99
All Employees	3,426	2,137	2,558	3,227	1,924	1,648	1,222	545	273	1,277	106	18,343

This is total Civil Service workforce, including individuals on extended leave without pay.

NASA On-site and Near-site Contractor and Other Workyears - FY 2006 FAIR Act Inventory
as of June 30, 2006

	JSC	KSC	MSFC	GSFC	LARC	GRC	ARC	DFRC	SSC	HQ	NSSC	JPL	Total
Contractor WYE	12,645.0	10,381.0	3,583.0	4,838.0	1,459.0	1,353.0	1,130.0	468.0	1,386.0	725.0	145.0	237.4	38,350.4
JPL CalTech FTE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5,230.0	5,230.0
IPA FTE	6.0	2.0	12.0	8.0	3.0	1.0	8.0	0.0	3.0	42.0	0.0	0.0	85.0
Grantee FTE	0.0	0.0	85.0	103.0	41.0	90.0	34.0	0.0	0.0	5.0	0.0	0.0	358.0
Total	12,651.0	10,383.0	3,680.0	4,949.0	1,503.0	1,444.0	1,172.0	468.0	1,389.0	772.0	145.0	5,467.4	44,023.4

Notes
Data source is the annual Federal Activities Inventory Reform (FAIR) Act inventory
Data is in the form of FTE (Full-Time Equivalent employees) and WYE (Work Year Equivalent employees)
Data includes contractor WYE that are on-site at NASA Centers or near-site
Data will be updated for FY 2007 on June 30, 2007
Grantees are NASA grantees working on-site
IPA are Intergovernmental Personnel Act assignees working at NASA Centers
Per OMB instructions, Civil Service FTE matches President's Budget

Chairman UDALL. The hearing will come to order.

I want to welcome all our witnesses here today, and before I make my opening remarks, I did want to tell everybody who is gathered that we have got a tight schedule this morning. I apologize in advance. We may be disrupted 45 or 50 minutes into the hearing, because we have a series of votes, but we will move with some dispatch, because we really do want to hear from this distinguished panel.

I look forward to getting your views on this important issue of how best to ensure that NASA will have the workforce that it needs to accomplish its various challenging missions. It is obvious that NASA's workforce is critical to the success of its missions, and yet, it should be equally obvious that the continued health and strength of NASA's workforce cannot be taken for granted. It needs to be nurtured, supported, and given the tools and resources it will need to carry out the complex and challenging mission that it has been asked to undertake in science, aeronautics, and human space flight.

That is why I am keenly interested in hearing the findings and recommendations of the two recent independent assessments of NASA's workforce needs, as well as NASA's response to them. However, I envision today's hearing as only the first step in a continuing examination of the health of NASA's workforce by our subcommittee.

In particular, I hope to have a follow-on hearing later this year to examine some of the particular civil service and contractor workforce challenges that are associated with the upcoming retirement of the Space Shuttle, and in addition, I would like the Subcommittee to review the proposed legislative provisions that have been provided to Congress by NASA to address some of these workforce challenges.

Thus, I hope that this hearing will be one in a series of hearings on this topic. We owe it to both the highly talented NASA employees, as well as to the broader aerospace community, to make sure NASA and Congress get it right in attempting to shape NASA's future workforce.

As I have said, and many others have acknowledged it, NASA's civil service workforce consists of some of this nation's "best and brightest." In most cases, they have made a long-term commitment to public service. I respect them for that commitment, and I think that whatever workforce strategy NASA develops should build on the strengths that these individuals bring to the Agency, because if those skills are discarded, whether for short-term budgetary reasons, or for some other reason, we would find out at a later date that it is difficult, if not impossible to recapture skills that the Nation discovers it needs. And at the same time, NASA must work to attract and properly utilize the young men and women who will provide the scientific, engineering, and project management expertise required for NASA's future missions decades into the future.

Doing all of that would be a tall order under the best of circumstances, and it will be doubly difficult if NASA is not provided resources that are equal to the missions that it has been asked to undertake.

Now, I am sure Judge Hall would agree with me that money alone will not ensure that NASA will have the strong and vital workforce that it needs, but insufficient funding will undercut whatever workforce initiatives are put in place.

We have got a lot to talk about today, and I want to again welcome our witnesses, and I am at this time honored to yield whatever time he deems necessary to my good friend, Congressman Hall, the Ranking Member of the entire Committee.

Judge Hall.

[The prepared statement of Chairman Udall follows:]

PREPARED STATEMENT OF CHAIRMAN MARK UDALL

Good morning.

I'd like to welcome all of our witnesses to today's hearing.

We have a distinguished panel, and I look forward to getting your views on the important issue of how best to ensure that NASA will have the workforce it needs to accomplish its various challenging missions.

Before I say more, however, I'd like to take a moment to congratulate Mr. Feeney on his selection as the new Ranking Member of the Subcommittee, replacing my good friend and colleague Ken Calvert, who has moved over the Appropriations Committee.

Welcome Mr. Feeney, I look forward to working with you in your new capacity in the days and weeks ahead.

Now it's obvious that NASA's workforce is critical to the success of NASA's missions.

Yet it should be equally obvious that the continued health and strength of NASA's workforce cannot be taken for granted.

It needs to be nurtured, supported, and given the tools and resources it will need to carry out the complex and challenging missions it has been asked to undertake in science, aeronautics, and human space flight and exploration.

That is why I am keenly interested in hearing the findings and recommendations of the two recent independent assessments of NASA's workforce needs, as well as NASA's response to them.

However, I envision today's hearing as only the first step in a continuing examination of the health of NASA's workforce by this subcommittee.

In particular, I hope to have a follow-on hearing later this year to examine some of the particular civil service and contractor workforce challenges that are associated with the upcoming retirement of the Space Shuttle.

In addition, I would like the Subcommittee to review the proposed legislative provisions that have been provided to Congress by NASA to address some of those workforce challenges.

Thus, I hope that this hearing will just be one in a series of hearings on this topic—we owe it both to the highly talented NASA employees as well as to the broader aerospace community to make sure NASA and Congress "get it right" in attempting to shape NASA's future workforce.

As I have said in the past, NASA's civil service workforce consists of some of this nation's "best and brightest."

In most cases, they have made a long-term commitment to public service.

I respect them for that commitment, and I think that whatever workforce strategy NASA develops should build on the strengths that those individuals bring to the Agency. . .

. . .Because if those skills are discarded, whether for short-term budgetary reasons or for some other reason, we could find out at a later date that it is difficult if not impossible to recapture skills that the Nation discovers it needs.

At the same time, NASA must work to attract and properly utilize the young men and women who will provide the scientific, engineering, and project management expertise required for NASA's future missions.

Doing all that would be a tall order under the best of circumstances.

It will be doubly difficult if NASA is not provided resources that are equal to the missions that it has been asked to undertake.

Money alone will not ensure that NASA will have the strong and vital workforce that it needs, but insufficient funding will undercut whatever workforce initiatives are put in place.

Well, we have a lot to talk about today.

I again want to welcome our witnesses, and I look forward to your testimony.

Mr. HALL. I thank you, Mr. Chairman, and I think I would be remiss if I didn't say I was honored to be sitting by a member of really a great American family, and one that has lived a life of public service, and the guy is so dang handsome, I ask unanimous consent if I could sit down there, I didn't have to sit by him.

Chairman UDALL. Judge Hall, you are out of order, and——

Mr. HALL. All right, here I go. And I do thank you, Mr. Chairman, for holding this meeting, because I always like to welcome the witnesses, and thank them for coming today, because they are giving up their time. It takes time to get here. I think that I saw Mr. Stewart coming in this morning, and I thought he was Norm Augustine. I almost said hello, Norm, how are you doing. And Ms. Dawsey, good to see you again, and welcome, and thank you.

NASA has a unique and interesting set of missions, and all of us on this committee want you to successfully accomplish the missions that we have laid out, and I don't think we ought to give any on the program that is laid out, we ought to hold what is laid out. We shouldn't have to take any suggestion that we are not in a good economy, because that wouldn't be true, and we don't need to start surrendering any of the gains that we have laid out, and that the President's vision has set out, and that we have accepted. We need just to carry it out and to follow it.

And the workforce is so important in that. Everything that NASA does depends on its ability to maintain a really highly qualified and competent workforce, and developing the right mix of skills, and keeping people engaged in the challenging work, as budgets and program priorities change, I think, requires just a very continuing commitment, a commitment that I have noticed in NASA from the time I have been here.

You face a number of workforce challenges over the next few years, including retiring the Space Shuttle in 2010, while simultaneously completing the International Space Station, and developing the new Orion Crew Exploration Vehicle and Ares Launch System. NASA's aeronautics program has been refocused, shifting away from technology demonstrations and toward long-term basic research.

NASA's vital science programs have faced difficult changes as well. Furthermore, in addition to technical, scientific, and engineering challenges, the Agency also faces daunting financial management challenges that it has been largely unable to address, in part because of a lack of qualified financial auditors and administrators, I am told.

These pressures are unlikely to go away. In fact, they will almost certainly continue in the future. Things are always changing, that's the nature of science and technology, but the workforce has to adapt to these changes, and the Agency bears responsibility to employees and to its stakeholders including Congress to develop a strategy to effectively address these changes.

In April of 2006, NASA released its Workforce Strategy document, as required by the *NASA Authorization Act of 2005*. The National Research Council and the National Academy of Public Administration have each reviewed NASA's strategy, and offered very thoughtful perspectives on it. I look forward to hearing from them

today, and I also look forward to hearing from the International Federation of Professional and Technical Engineers.

Workforce is so vital to NASA's mission, NASA has to constantly evaluate its future needs, and be ready to take preemptive action when necessary to ensure the right people are there to do exciting and challenging missions, and continue to accomplish extraordinary scientific discoveries.

I look forward to hearing from you today, from the witnesses, and with that, I thank the Chairman, and yield back my time.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF REPRESENTATIVE RALPH M. HALL

I want to thank Chairman Udall for holding today's important hearing. I'd also like to welcome the witnesses, and thank them for coming before us today to help us better understand NASA's workforce challenges and the strategy to address them.

NASA has a unique and interesting set of missions, and all of us on this committee want NASA to successfully accomplish the missions that have been laid out. Everything that NASA does depends on its ability to maintain a highly-qualified and competent workforce. Developing the right mix of skills, and keeping people engaged in challenging work as budgets and program priorities change, requires a continuing commitment.

NASA faces a number of workforce challenges over the next few years including retiring the Space Shuttle in 2010 while simultaneously completing the International Space Station, and developing the new Orion Crew Exploration Vehicle and Ares launch system. NASA's Aeronautics programs have been refocused, shifting away from technology demonstrations and toward long-term basic research. NASA's vital Science programs have faced difficult changes as well. Furthermore, in addition to technical, scientific, and engineering challenges, the Agency also faces daunting financial management challenges that it has been largely unable to address in part because of a lack of qualified financial auditors and administrators.

These pressures are unlikely to go away. In fact they will almost certainly continue in the future. Things are always changing—that's the nature of science and technology—but the workforce must adapt to the changes, and the Agency bears a responsibility to employees and its stakeholders, including Congress, to develop a strategy to effectively address the changes.

In April 2006, NASA released its Workforce Strategy document as required by the *NASA Authorization Act of 2005*. The National Research Council and the National Academy of Public Administration have each reviewed NASA's strategy and offered thoughtful perspectives. I look forward to hearing from them today. I also look forward to hearing from the International Federation of Professional and Technical Engineers.

The workforce is so vital to NASA's mission. NASA must constantly evaluate its future needs, and be ready and able to take preemptive actions when necessary to ensure the right people are there to do the exciting and challenging missions, and continue to accomplish extraordinary scientific discoveries.

I look forward to hearing from today's witnesses. And with that, I yield back the balance of my time.

Chairman UDALL. Thank you, Judge Hall.

At this point, if there are Members who wish to submit additional opening statements, your statements will be added to the record, and without objection, so ordered.

And at this time, I wanted to introduce the panel of witnesses, and I will introduce all of you, and then we will start on my left with Ms. Dawsey and her testimony, but let me welcome all of you again, and say a little bit about each one of you.

Ms. Toni Dawsey is the NASA Assistant Administrator for Human Capital Management. Mr. John Stewart, next in line, is a Fellow at the National Academy of Public Administration, and was a member of its NASA Multi-sector Workforce Panel.

Dr. David Black recently co-chaired the National Research Council's Committee on Meeting the Workforce Needs for the National Vision for Space Exploration, and we have to his left Dr. Lee Stone, the Legislative Representative from the International Federation of Professional and Technical Engineers, who serves on the NASA Council of IFPTE Locals.

Welcome. I think most of you, if not all of you, are professionals at this. You have been in front of the Committee and the Subcommittee before, and you know you have five minutes, and then, we will turn to questions, so that we can further drill down into the expertise you have in your perspective.

So, Ms. Dawsey, the floor is yours for five minutes.

STATEMENT OF MS. TONI DAWSEY, ASSISTANT ADMINISTRATOR, HUMAN CAPITAL MANAGEMENT; CHIEF HUMAN CAPITAL OFFICER, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA)

Ms. DAWSEY. Thank you Chairman and Members of the Subcommittee. I am pleased to appear before you today to discuss NASA's workforce.

Implementing the *Vision for Space Exploration* clearly represents a great management challenge, now and for many years to come. In particular, the retirement of the Shuttle, the completion of the International Space Station, and the development of the multiple elements of the Constellation Program involve a daunting series of transitions both programmatic and institutional.

The NASA Workforce Strategy submitted to Congress in April 2006 laid the foundation for the actions the Agency must take to maintain the knowledgebase of the current workforce, and to acquire the skills necessary to accomplish NASA's mission.

The document articulates three principles underlying our workforce strategy: building and sustaining ten healthy centers, maximizing the use of NASA's people, and evolving to a more flexible, scalable workforce.

We have developed a comprehensive plan based on these principles, with three primary goals to implement them. The first goal is to understand mission requirements, both near and long-term. The second goal is to align the skills of the workforce with mission needs, and the third goal is to enable more effective and efficient human resources operations, through the delivery of comprehensive and authoritative workforce information.

The first goal, understanding mission requirements, requires an especially strong workforce planning capability. Recognizing that it is critical that all levels of management be involved in workforce planning. In January, the Agency established a workforce planning governance structure, comprised of key agency managers, to identify workforce risks, and to develop joint solutions to issues as they emerge. We have also integrated workforce planning with the development of program and project budgets. With an enhanced workforce planning capability, NASA will be better able to determine the demand for and supply of individual workforce skills.

The second goal, to align the workforce with the mission, requires strengthening the technical and leadership excellence of our employees, and reshaping the workforce to better serve future mis-

sion requirements. In addition, as more of our experienced employees reach retirement eligibility, it is imperative that we attract and develop new talent.

To strengthen technical excellence, the Agency is providing workforce retraining and skill development through a number of programs designed to develop program and project managers and engineers to transfer knowledge across NASA, academia, industry, and international partners, and to ensure that lessons learned are captured for the next generation. In order to build leadership "bench strength," NASA has created a corporate leadership framework that provides succession planning and executive development.

Another challenge is to reshape the existing workforce to better serve current and future requirements. The use of buy-out/early out authority to encourage voluntary attrition has been critical to NASA workforce reshaping. Since the start of Fiscal Year '04, over 1,300 employees in targeted areas of surplus took buy-outs or early outs. This is over one third of the total attrition of 3,500 during this period.

We continue to monitor this program to ensure that experienced employees with needed and critical skills are not leaving the Agency, and that safety of the Space Shuttle or the International Space Station is not compromised. To replace normal attrition, since 2004, we have hired nearly 2,500 employees. Of this number, 700 are recent college graduates.

The tools provided by the NASA Flexibility Act of 2004 continue to be vitally important to us as we reshape our workforce. They provide over a dozen tools that include enhanced recruitment, relocation, and retention bonuses, expanded use of term appointments, and benefits for new hires.

In March, NASA submitted legislative proposals to provide the Agency with additional flexibilities that it needs to better implement the transition from Shuttle to Constellation. To effectively manage change, NASA must leverage information technology also to provide more responsive, reliable information to support decision-making. This is our third goal.

NASA is working toward full integration of human resources information across the Agency. NASA also is converging business systems, expanding access throughout the Agency, and increasing tools and applications. These efforts will form a human capital information environment that will provide a foundation for total business systems integration and provide near real-time comprehensive information to enable an informed decision-making at all levels.

The initial operating capability for this environment is planned for the summer of 2007, with final implementation during the fall of 2008. In summary, in implementing the NASA Workforce Strategy, NASA is positioning itself to deal effectively with the critical issues now facing the Agency on an integrated, agency-wide basis. NASA is putting in place approaches that not only will alleviate the Agency's current imbalances, but also will provide a structure that allows such issues to be resolved in the future, as part of a deliberate, systematic process.

The foundation that NASA is building is a big picture view that will facilitate and institutionalize long-term planning and agency-level coordination.

Thank you.

[The prepared statement of Ms. Dawsey follows:]

PREPARED STATEMENT OF TONI DAWSEY

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss NASA's workforce.

Implementing the President's *Vision for Space Exploration* clearly represents a great management challenge, now and for many years to come. In particular, the retirement of the Space Shuttle, the completion of the International Space Station, and the development of the multiple elements of the Constellation Program involve a daunting series of transitions both programmatic and institutional in nature. The issues associated with these transitions are complex and our planning, already well underway, will be an iterative, evolutionary process featuring tight integration between these efforts and NASA's ongoing Science and Aeronautics Programs.

The NASA Workforce Strategy, submitted to the Congress in April 2006, laid the foundation for the actions the Agency must take to maintain the knowledge base of the current workforce, as well as broaden, reinvigorate, and acquire new skills necessary to accomplish NASA's Exploration, Science and Aeronautics missions. The document articulates three principles underlying our workforce strategy: building and sustaining ten healthy Centers; maximizing the use of NASA's current human capital capabilities; and evolving to a more flexible, scalable workforce. We remain committed to these principles and view them as essential to mission success. Our comprehensive plan for managing NASA's current and future workforce is based on these principles, and we have developed three primary goals to implement them.

- The first goal is to understand mission requirements, both near- and long-term, to enable the identification and matching of needed skills to program tasks through a robust, comprehensive workforce planning process.
- The second goal is to align the skills in the workforce with mission needs by strengthening technical and leadership excellence and by reshaping the existing workforce.
- The third goal is to enable more effective and efficient human resources operations through the delivery of comprehensive and authoritative workforce information for decision-making through integrated human resources, financial and other business support systems.

Recently, both the National Academy of Public Administration (NAPA) and the National Research Council (NRC) released reports of recommendations for addressing our overall workforce challenges, as well as for addressing more specific issues relating to the aforementioned transitions. To a large degree, these reports confirm our assessments of the challenges facing us in the workforce arena and validate the actions that we have initiated to address the most critical and encompassing issues. All of the information, findings and recommendations contained in the reports will continue to inform implementation of our basic workforce strategy, and will help ensure that we remain focused on the key issues.

Below, I have highlighted some of the key initiatives we've undertaken over the past year in support of implementing the Workforce Strategy through the stated goals.

Understand the Mission Requirements

Workforce Planning

Implementation of the *Vision for Space Exploration* requires an especially strong workforce planning capability—a capability that will allow Centers and the Agency to identify and assess areas of workforce risk so that viable solutions to mitigate those risks can be developed and implemented.

Recognizing that it is critical that all levels of management be involved in workforce planning, the Agency's first Workforce Planning Governance Structure was established in January 2007. The Governance Structure comprises key management officials from across the Agency who, in collaboration with the human resources community, work together to identify Agency workforce risks and develop solutions to workforce issues as soon as they emerge.

We have also integrated and synchronized workforce planning with the development of program and project budgets. This new approach—planning and integration among all levels of management—helps NASA determine the best application of workforce to projects as they proceed from formulation through development and mission operations. With an enhanced workforce planning capability, NASA will be better able to determine the demand for, and supply of, workforce skills based on

current and projected work requirements and to identify areas of potential risk in matching workforce to work. This will allow more time to develop strategies to mitigate these risks. In addition, we've enhanced our ability to analyze workforce data necessary to support effective workforce planning. We have begun to develop measures to monitor multiple dimensions of workforce capability at the Centers and to identify areas of strengths and weaknesses.

Shuttle Workforce Transition

With the retirement of the Shuttle in 2010, NASA will shift from the current primary focus on operations to one in which we develop new systems, with the capability for human space exploration missions to the Moon, on to Mars and beyond.

These changes have significant workforce implications—for both civil servants and contractors. The nature of the work will change as we transition from Shuttle operations to research and development-focused activities like planning, design, development, testing and verification for Constellation systems. This presents unique challenges to the Agency. NASA must retain the skills necessary to safely execute the remaining Shuttle missions, manage the transition of skilled Shuttle employees into Constellation development, and retain skills between FY 2010 and FY 2015 necessary to safely execute Constellation flight operations.

The National Research Council noted that "NASA has undertaken a commendable top-down analysis of current agency needs and the skill levels of its current workforce that the committee believes is an excellent first step" (Finding 1). We acknowledge that more work is needed, though. As the Constellation Systems Requirements Reviews are completed this year, NASA will gain a much clearer understanding of the demand for future workforce skills, which will form the foundation for making any future decisions.

We are engaged in many initiatives to manage this transition. We are striving to give our employees opportunities to build on their existing skills by moving appropriate work packages across the Centers to match resident workforce skills, by building "virtual" project teams within and across Centers, and by offering temporary details. Through such initiatives, many employees will be prepared to easily transition into new positions when the exploration systems development work comes on-line. We are developing a mapping of current available skills among the Shuttle workforce with the skills we will need for future work so that we can better plan and implement workforce reassignments. We are supporting retraining to ensure that employees have the skills to be successful in the new work. We are making good use of temporary and term appointments to get the flexibility to better align to the time-phased workload.

As we work through this transition, NASA remains committed to working with our industry, supplier, and research partners to minimize disruption, upheaval, and economic impact, while maximizing support vital for Shuttle missions and program requirements. A Shuttle Human Capital Council convened recently to bring together the civil service and contractor Human Resources Directors to surface and address common workforce issues, share best practices in resolving issues, and strengthen the human capital network.

Workforce Flexibilities

In March 2007, NASA submitted legislative proposals to the Subcommittee to provide the Agency with additional workforce flexibilities to better implement the transition from the Space Shuttle era to the new era of exploration.

Several years ago, NASA gained important new workforce flexibilities through the enactment of the *NASA Flexibility Act of 2004.* Those flexibilities have made a difference already, and will be vitally important to the Agency over the coming years in competing for top talent and maintaining the knowledge base of the workforce. However, the authorities in the *NASA Flexibility Act* represent, for the most part, tools for attracting and retaining high-quality employees. They do not address a different—but equally critical—human capital challenge: managing attrition in a strategic, effective, and compassionate manner. The need for attrition management tools is particularly important to NASA as we face the challenges associated with retaining Shuttle skills through completion of the Program, and then effectively transitioning that workforce.

In many cases, skill misalignments can be addressed by retraining or reassigning the employees whose skills cannot be utilized effectively in their current assignments. NASA has been aggressive in this regard over the past several years with hundreds of people now productively and enthusiastically engaged in the Constellation Program. But not all skill misalignments can be resolved by retraining and redeployment. Furthermore, NASA historically has had an exceptionally low attrition rate, rendering reshaping of the workforce difficult and slow.

As such, NASA needs to manage attrition in a targeted manner to achieve better alignment of the workforce with the mission without creating unwanted losses, skill imbalances, and disruption in the general workforce. But that is not the only objective. The *method* by which attrition is achieved is just as important. NASA must manage attrition in a way that does not demoralize the workforce, create an environment of uncertainty, generate a lack of trust in management, or stimulate the departure of the workforce the Agency needs to retain. If attrition is not managed in the right way, NASA's outstanding image as a leading employer of choice will be eroded, resulting in a long-term negative impact on the Agency's ability to attract and retain the workforce it needs.

NASA has submitted proposals for two new workforce authorities in its legislative package—a conversion incentive and temporary continuation of coverage of health benefits—in order to manage attrition more effectively and strategically. The conversion incentive would allow the Administrator to pay a permanent employee a monetary incentive for voluntarily converting to a time-limited appointment. The purpose of this financial incentive is to offset the risk the employee assumes by giving up the right to continued permanent employment. The incentive may not exceed $25,000 or 25 percent of the employee's annual salary, whichever is less, for each 12-month period of service for which the incentive is paid. Unlike a buy-out, an employee who converts to a term appointment and receives the conversion incentive is not precluded from securing full time federal employment and retaining the incentive.

This authority is particularly tailored to managing the Shuttle workforce. A conversion incentive serves as both an incentive for the employee to remain with the program to the date needed by management (similar to the concept of a retention incentive) while allowing management to plan for an orderly release of employees on a defined date without the need to resort to involuntary actions such as a reduction-in-force.

The other workforce provision in the legislative proposals, the temporary continuation of coverage of health benefits, would permit NASA to pay the government's share of the Federal Employees Health Benefits premiums for certain NASA employees who elect temporary continuation of health benefits coverage upon separation from NASA. Eligible employees would be those who are separating because their positions are being eliminated. This provides a "soft landing" benefit to employees who desire continued health coverage while they seek other employment and are not otherwise eligible for the Federal health benefits without paying the full cost of the premiums. We believe that this benefit will expand the pool of employees who would be willing to resign voluntarily from the Agency.

Align the Workforce with the Mission

NASA is filled with highly educated, dedicated employees at all levels who love what they do and are inspired by the challenging and exciting environment. Our current diverse workforce represents a wealth of skills and valuable experience. In order for the Agency to accomplish its aggressive mission, it is critical that this workforce be aligned with the mission by strengthening the technical and leadership excellence of our employees and by reshaping the workforce to better serve future mission requirements. In addition, as more of our experienced employees reach retirement eligibility, it is imperative that we attract and develop the new talent that is needed to implement the Agency's Exploration, Science and Aeronautics missions. To do so, we must create, sharpen, and use all the tools that are needed to enable current and future employees to support the work of this agency.

Technical and Leadership Excellence

One of our challenges is to strengthen the technical and leadership excellence of the NASA workforce. In so doing, we have a number of tools at our disposal to ensure that our workforce continues to excel technically and that we are building "bench strength" in both our technical disciplines as well as in our leadership roles.

To strengthen technical excellence, the Office of the Chief Engineer supports NASA's field centers in workforce retraining and in current and future workforce skill development through its Academy of Program/Project and Engineering Leadership (APPEL), the NASA Engineering Network (NEN), and the NASA Engineering Safety Center (NESC) Academy. These programs are designed to both develop and enhance the professional knowledge of NASA program/project managers and engineers at all career levels; to capture and transfer knowledge from seasoned program/project managers and engineers across NASA as well as from industry, academia, and international partners; and to ensure that lessons learned are captured for the next generation.

In order to build leadership "bench strength," we have developed a corporate, integrated approach to leadership development. NASA has created a leadership strategy which is used both agency-wide and at the Centers as a framework for designing and implementing leadership programs. This framework provides continuity through succession planning and executive development—creating a skilled pipeline for leadership within NASA. It includes a variety of components: workforce planning and analysis, career paths, formal agency-wide leadership development programs, formal and informal coaching and mentoring programs, and leadership training. Many of these Programs are supplemented by Center-level development activities. Our formal Agency-wide programs reflect a life cycle approach to leadership development with programs targeting entry, mid and senior level employees as they prepare for leadership responsibilities.

Reshaping of the Workforce

Another challenge is to reshape the existing workforce to better serve current and future requirements. This involves not only some reductions in aggregate workforce size, but also a build up in areas of greater need and reduction in areas that are surplus to evolving mission requirements.

The use of buy-out/early out authority to encourage voluntary attrition has been critical to NASA workforce reshaping. Since the start of FY 2004, over 1,300 employees in targeted areas of surplus took buy-outs or early outs. This is over one-third of the total attrition of 3,500 during this period. We continue to monitor this program to ensure that experienced employees with needed and critical skills are not leaving the Agency and that the safety of the Space Shuttle or the International Space Station is not compromised.

To replace normal attrition and strengthen areas with increased requirements, we have hired nearly 2,500 employees with a range of experiences and skills. Of this number, 700 are workers hired either directly out of colleges and universities, or shortly thereafter. NASA Centers make good use of programs such as the student employment program and the Federal Career Intern Program to recruit new talent into the Agency. NASA Centers have cooperative education program (co-op) agreements in place with multiple universities. Across the Centers, we have maintained a constant average of 450 students participating in the co-op Program. These students have an opportunity to get "hands-on" experience in their technical field, and to demonstrate their abilities on the job. The best of them are converted to entry level engineers, scientists and business professionals upon graduation. The Federal Career Intern Program also has allowed us to hire recent college graduates. The fact that these interns are brought in as term appointments, with the ability to convert them to permanent positions, provides additional flexibility in managing our workforce. Of the 700 entry level hires, 400 have been outside hires and the other 300 are conversions from either our co-op pool or from temporary or term appointments.

We are also refining our recruitment strategy by conducting more targeted recruitment on mission critical occupations and with under-represented groups; working with NASA's Office of Education to enhance and expand student programs that can serve as a pipeline into our workforce; and developing partnerships and relationships that can be beneficial in future recruitment efforts.

The tools provided by the *NASA Flexibility Act of 2004* continue to be vitally important as we reshape our workforce. They provide targeted solutions to multiple challenges—the need to recruit new talent and the need to leverage the talent of the current workforce. Along with the government wide flexibilities, they provide over a dozen tools that include enhanced recruitment, relocation and retention bonuses, expanded use of term appointments, pay authority for critical positions, and enhanced travel and annual leave benefits for new hires. We make use of the full range of these flexibilities and find that combining them to create incentive packages tailored to the needs of specific candidates has been a particularly successful strategy.

Enable Effective and Efficient Human Resources Operations

To effectively manage change while attending to our critical resource, our people, NASA must leverage information technology to provide more responsive, reliable information to support decision-making.

Workforce Information Systems

Our current human resources information systems (HRIS) environment is quite robust, providing automated solutions for the majority of our human capital programs, and providing a wealth of information to managers and workforce planners. NASA is working toward full integration of the HRIS environment and improvement of capabilities that will provide the full range of information required to most effectively manage our changing environment.

Over the years, NASA has invested in a number of Agency-wide systems such as our Staffing and Recruitment System and our Competency Management System (CMS). CMS enables NASA to assess the demand for, and supply of, workforce skills based on current and projected work requirements. CMS captures the competencies for every civil service position and multiple personal competencies for each individual NASA employee. Management of personal competencies enables the identification of expertise across the Agency and provides the capability to integrate this information for use in planning the workforce.

Competencies are the common thread that tie the elements of workforce management together. CMS is a relatively new system that we are continually working to improve. By integrating CMS with other workforce planning tools, we are able to not only identify the critical current and future competency gaps and surpluses, but we can weave that competency information throughout the workforce management process.

Recognizing the almost limitless possibilities of information technology (IT), NASA is converging business systems, expanding access to managers, supervisors, and employees, and increasing the capabilities of tools and applications. These efforts will form a Human Capital Information Environment (HCIE) that will provide a foundation for total business systems integration, foster Agency-wide collaboration, provide tools and information to assist our management team in their strategic planning efforts, and provide near real-time comprehensive information to enable and inform decision-making at all levels.

Developing an HCIE is the first step in instituting a fully integrated, strategically focused, business environment for online, near real-time access to reliable, comprehensive information that managers need for rapid and accurate decision-making. The HCIE will inter-operate seamlessly with NASA's financial management authoritative data repository (ADR), and provide dependable integrated workforce and financial information to all organizational elements. A common, robust data repository will remove the need for redundant systems because the ADR will furnish the wealth of information needed to meet the demands of this mission-driven, project-oriented Agency.

Information will be presented through a secure, web-based workforce services portal accessible from the user's desktop computer, enabling managers to formulate workforce plans and manage employees; manage and plan based on workforce indicators, including competency, demographic and trending information; and conduct analyses and run reports using common and timely information. The initial operating capability for HCIE is planned for the summer of 2007 with final implementation during the Fall of 2008. The capabilities of HCIE are enormous, limited only by our ingenuity in identifying the boundless ways in which information can be woven together to drive decisions and enable success.

Summary

In implementing the NASA Workforce Strategy and associated workforce management goals, NASA is positioning itself to deal effectively with the critical issues now facing the Agency on an integrated, Agency-wide basis. NASA is putting in place approaches that not only will alleviate the Agency's current imbalances, but also provide a structure that allows such issues to be resolved in the future as part of a deliberate, systematic process. To quote the NASA Administrator, ". . .it is clear that an understanding of the broad issues, the big picture, is so much more influential in determining the ultimate success or failure of an enterprise than is the mastery of any given technical detail. The understanding of the organizational and technical interactions in our systems, emphatically including the human beings who are a part of them, is the present-day frontier of both engineering education and practice." The foundation that NASA is building is a big picture view that will facilitate and institutionalize long-term planning and Agency-level coordination. As stated in the NRC report, though, some of the issues NASA faces are "not unique to NASA" and require "a national approach" to solve them. NASA plans to be in the forefront in developing such approaches.

Last year NASA presented its Workforce Strategy which outlined the steps to manage the transitions associated with implementing the Agency's Exploration, Science and Aeronautics missions. Since then, we have made significant progress, with specific human capital initiatives aimed at three key goals: understanding mission requirements, aligning workforce to mission, and enabling effective and efficient human resources operations. The NRC and NAPA reports confirm the actions we've initiated, and will continue to inform further implementation of the Strategy.

I would be please to respond to any questions the Subcommittee may have.

Chairman UDALL. Thank you, Ms. Dawsey. Mr. Stewart, five minutes.

Mr. STEWART. I would be personally remiss, Mr. Chairman, if I didn't say how much I admired your father, and had a chance to work with him on occasion back in the old days, but a truly great, great public servant, and I am not just——

Chairman UDALL. On that note, I would put Judge Hall in that same category, as a great public servant, and somebody who has roots in that area, and Judge Hall has helped to, in his own way, keep that spirit alive, so——

Mr. HALL. Mr. Chairman, would you yield?

Chairman UDALL. I would be happy to yield to my good friend from Texas.

Mr. HALL. I knew Mo Udall, and I'm no Mo Udall. I would say this, that I learned more from Mo, my first office was directly across from him back 27 years ago, and I learned more from him the first 30 days than I had learned in the last ten years in the Texas Senate.

Chairman UDALL. You are out of order again twice in one day.

STATEMENT OF MR. JOHN G. STEWART, NATIONAL ACADEMY OF PUBLIC ADMINISTRATION FELLOW; MEMBER, PANEL ON NASA MULTI–SECTOR WORKFORCE

Mr. STEWART. Well, anyway, I had better get going here.

Mr. Chairman and Members of the Subcommittee, Sally Anne Harper, our panel chair, very much wanted to present this testimony. She is the Chief Administrative Officer at the Government Accountability Office, and her duties there this morning made her appearance not possible, and so they have to go to the bench, and I am here to stand in for Sally Anne Harper.

Our panel had six major conclusions and recommendations. First, we said that NASA should make greater use of strategic planning mechanisms to position itself for programmatic and scheduled changes. The agency needs to adopt a longer range, risk-based planning strategy to anticipate and respond effectively to future program needs, budget shortfalls, and schedule revisions for its total multi-sector workforce.

Despite declining overall budgets for aeronautics, as well as reductions in some scientific programs, NASA has retained most of its aeronautic and scientific workforce. Although many of these individuals can continue working on existing aeronautics and scientific programs, or transition to new programs, it is unrealistic to expect that all will be able to do so. Essentially, NASA needs to determine the number and type of employees that would constitute a critical mass for its aeronautics and scientific responsibilities, as well as a critical mass to develop the various systems needed to achieve the *Vision for Space Exploration*.

Second, NASA must broaden its workforce planning to encompass its multi-sector workforce. The process should inventory the key components and skills available for both civil servants and contractor organizations, including the Jet Propulsion Laboratory. In the initial version of the NASA Workforce Plan, it dealt solely with civil servants, and we felt that this was an omission that needs to be acted on.

Third, NASA must integrate its acquisition and human capital planning processes. This is really important. Contracts provide surge and long-term support capacity, as well as the ability to shift people and competencies as the mission dictates. So, NASA has made a good start at establishing a new acquisition process that begins with a strategic discussion of whether and how to contract for major programs and projects, but this should be further developed. Such integration will help NASA better understand the workforce implications of contracting decisions. To help facilitate this process, the Panel designed two rules to help managers focus on the critical common factors to consider in making civil service versus contractor decisions.

Fourth, NASA should strengthen its human capital function, and use a formal process to decide when to hire a permanent civil servant or a term employee. As one of NASA's most critical internal support capabilities, human capital needs to be a full participant in all agency decisions, with important workforce implications, including high level planning for the total workforce. And NASA is moving in that direction, let me just interject, which is good. And to be effective, human capital professionals must have the ability to identify skill mismatches, promote the effective use of existing flexibilities, and collaborate with others to craft other needed flexibilities. In addition, NASA needs to be more strategic in how to make civil service hiring and conversion decisions, and we have developed a tool to assist NASA decision-making in these areas.

Fifth, the Panel has concerns about the long-term health of NASA's research centers, and believes that the Agency should use a more comprehensive framework to evaluate them. The panel found NASA's approach to healthy centers to be people-focused, which to some degree is fine, but with an emphasis on fully funding civil servants to assist NASA in this area, the Panel developed a detailed 12 factor framework covering such areas as center's mission, program performance, civil service, contractor workforce, and organizational structure. This framework should help NASA balance changing mission requirements and budget constraints.

Sixth, NASA must make maximum use of existing human capital flexibilities, while seeking new authorizations for necessary reform, and of course, the NASA Flexibility Act of 2004 gave NASA some flexibilities. They are being used, but not as fully as they could be, and we think there are some more that are needed.

And more controversially, and we know this is controversial, the Panel believes that Congress should provide NASA with limited emergency authority to invoke a fully eligible individual's retirement to meet work restructuring needs, if some or all of the following criteria are met, and we list those criteria, and we can talk about them in the question period. And I want to emphasize that these statutory recommendations that we are making cannot be implemented by NASA alone. They require action by Congress and OPM in the face of likely political resistance. They are controversial. And let me just say for the record, we understand that NASA understands the nature of this problem. It has taken some initial steps, and we have made some suggestions to help them move further down the right road.

Mr. Chairman, that concludes my prepared statement, and I will answer questions when that time comes.

[The prepared statement of Mr. Stewart follows:]

PREPARED STATEMENT OF JOHN G. STEWART

Mr. Chairman and Members of the Subcommittee, I appreciate the opportunity to testify today. I represent a Panel of the National Academy of Public Administration that recently completed, a comprehensive study of the workforce challenges facing the National Aeronautics and Space Administration (NASA). That study was done at the request of the Senate Appropriations Committee. As the former Staff Director of the Senate Science, Technology, and Space Subcommittee, I recognize the importance this committee attaches to addressing critical aeronautics and space issues.

Also, as a former member of the NASA Aerospace Safety Advisory Panel, I strongly believe NASA's mission to advance space exploration, scientific discoveries, and aeronautics research is critical to our nation. Thirty-eight years after the Apollo 11 mission, NASA remains the only organization in the world to have landed a person on the Moon. Now, with the Congressionally-authorized *Vision for Space Exploration,* NASA is tasked with expanding our presence in the solar system and establishing a permanent human outpost on the Moon.

Our Panel was asked to examine several critical questions:

- How should NASA decide whether to obtain the services and products from a contractor or hire a civil servant?
- If NASA decides to hire a civil servant, what kind of appointment should it use (tenured permanent or multi-year term)?
- What is a healthy center? How should NASA measure it?

In responding, we primarily focused on issues facing NASA as it transitions from the Shuttle program to the Vision. The Panel had six major conclusions and recommendations.

First, NASA should make greater use of strategic planning mechanisms to position itself for programmatic and schedule changes.

The Agency needs to adopt a longer-range, risk-based planning strategy to anticipate and respond effectively to future program needs, budget shortfalls, and schedule revisions for its total multi-sector workforce. Despite declining overall budgets for aeronautics, as well as reductions in some scientific programs, NASA has retained most of its aeronautics and scientific workforce. Although many of these individuals can continue working on existing aeronautics and scientific programs or the transition to new programs, it is unrealistic to expect that all will be able to do so. Essentially, NASA needs to determine the number and type of employees that would constitute a critical mass for its aeronautics and scientific responsibilities.

Second, NASA must broaden its workforce planning to encompass its multi-sector workforce.

This process should inventory the key competencies and skills available for both civil servants and contractor organizations. Although contractors constitute approximately two-thirds of NASA's total workforce of 58,000 employees, the Agency's April 2006 Workforce Strategy focused solely on its 18,000 civil servants. Many of the contractors—and particularly the up to 26,000 on-site contractors—have competencies that mirror those of NASA civil servants. A broader workforce planning process would allow NASA to maximize organizational flexibility and fully leverage its workforce to meet changing demands.

Third, NASA must integrate its acquisition and human capital planning processes.

Contracts provide surge and long-term support capacity as well as the ability to shift people and competencies as the mission dictates. NASA has made a good start at establishing a new acquisition process that begins with a strategic discussion of whether and how to contract for major programs and projects. But, this should be further developed. NASA needs to factor in how cost, safety, facility availability, existing expertise, and scheduling will impact agency work. Such integration will help NASA better understand the workforce implications of contracting decisions. To help facilitate this process, the Panel designed tools to help managers focus on critical common factors to consider in making civil service vs. contractor decisions.

Fourth, NASA should strengthen its human capital function and use a formal process to decide when to hire a permanent civil servant or a term employee.

As one of NASA's most critical internal support capabilities, human capital needs to be a full participant in all agency decisions with important workforce implications, including high-level planning for the total workforce. And, to be effective, human capital professionals must have the ability to identify skill mismatches, promote the effective use of existing flexibilities, and collaborate with others to craft other needed flexibilities.

In addition, NASA needs to be more strategic in how it makes civil service hiring and conversion decisions. While the Agency uses many short-tenure employees, each center currently has discretion to make its own decisions about which type of civil servant to hire, and conversion to permanent employment is the predominant practice for most NASA term hires. The Panel developed a tool to assist NASA's decision-making in these areas.

Fifth, the Panel has concerns about the long-term health of NASA's research centers and believes that the Agency should use a more comprehensive framework to evaluate them.

The Panel found NASA's approach to healthy centers to be people focused with an emphasis on fully funding civil servants. To assist NASA in this area, the Panel developed a detailed twelve-factor framework covering such areas as the center's mission, program performance, civil service and contractor workforce, and organizational structure. This framework should help NASA balance changing mission requirements and budget constraints. The Panel believes the ultimate test of the ten healthy centers approach is whether it leads to a *healthy NASA*.

Sixth, NASA must make maximum use of existing human capital flexibilities while seeking new authorizations for other necessary reforms.

NASA has acknowledged that the significant programmatic changes over the past few years have created a major imbalance between the work the Agency plans to do and the existing workforce. In the Panel's view, this imbalance is NASA's most serious workforce challenge. While the Agency's mission and allocation of resources have been changing substantially, the civil service workforce has not. The Panel found that NASA could be more proactive in using currently available flexibilities by establishing a more innovative recruitment program and encouraging the outplacement of blocks of employees with competencies no longer needed.

Also, the Panel believes that NASA should be provided a package of additional flexibilities. Clearly, Administrator Griffin's recent request for legislative authority to pay an allowance to civil servants who voluntarily convert to a time-limited appointment recognizes the significant challenges facing NASA. Among other things, the Panel believes that Congress should increase the monetary cap on buy-outs and establish a new Reduction-in-Force (RIF) framework for NASA modeled on the National Institute of Science and Technology's Alternative Personnel Management System. This new framework would allow the Agency to retain its highest-performing employees in critical occupations by enhancing the weight given to performance, narrowing the definition of "competitive area," and preventing employees from "bumping" or "retreating" into positions for which they are poorly suited. The Panel also believes that OPM should grant blanket authority to NASA to conduct buy-outs over the next five years and to waive salary offsets when recruiting reemployed federal annuitants for critical areas.

More controversially, the Panel believes that Congress should provide NASA with limited emergency authority to invoke a fully eligible individual's retirement to meet work restructuring needs if some or all of the following criteria are met:

- The employee's skills are no longer required for mission accomplishment.
- The employee's skills are outdated or unnecessary, and management determines that retraining would not be practical, or the employee is unwilling to update skills.
- Funding for the employee's existing work is not available.
- The employee's skills are not easily transferred to other work.

Retiring employees should be compensated fairly by being given severance pay in addition to earned annuities. While NASA would not likely use this emergency statutory authority on a broad basis, its availability would provide the means to secure the expertise required for its highly complex mission, protecting the safety and integrity of the space program.

I want to emphasize that these statutory and regulatory recommendations cannot be implemented by NASA alone. They require action by Congress and OPM in the face of likely political resistance. However, by providing NASA with the tools to reshape its workforce, Congress could more easily hold NASA accountable for meeting program milestones in a cost-effective, timely way.

Mr. Chairman, underlying the Panel's recommendations is the belief that NASA's institutional health depends on a knowledge-based, data-driven approach to workforce utilization and management. For NASA to develop an optimally-sized, appropriately skilled workforce that is flexible and scalable, it will need to make human capital decisions based on the rigorous collection and analysis of data widely shared with stakeholders. From our work, we believe that NASA understands the nature of this problem. It has taken some initial steps, but more significant changes are needed. We believe NASA could adopt most of our recommendations without significant additional resources. And, the Panel's recommended approach would not only provide a stronger basis for internal agency decisions, but would also ensure that you, as Members of Congress, have better information decisions about annual appropriations and the human capital flexibilities needed to accomplish NASA's mission.

Mr. Chairman, that concludes my prepared statement, and I would be pleased to answer any questions you or the Subcommittee Members may have.

Chairman UDALL. Thank you, Mr. Stewart, and Dr. Black, the floor is yours.

STATEMENT OF DR. DAVID C. BLACK, PRESIDENT EMERITUS, UNIVERSITIES SPACE RESEARCH ASSOCIATION; ADJUNCT PROFESSOR, PHYSICS AND ASTRONOMY DEPARTMENT, RICE UNIVERSITY; CO-CHAIR, COMMITTEE ON ISSUES AFFECTING THE FUTURE OF THE U.S. SPACE SCIENCE AND ENGINEERING WORKFORCE, NATIONAL RESEARCH COUNCIL, THE NATIONAL ACADEMIES

Dr. BLACK. Chairman Udall, Ranking Member Hall, and Committee Members, I appreciate the opportunity to testify before you today. I appear in my capacity as Co-Chair of the National Research Council's Committee on Issues Affecting the Future of the U.S. Space Science and Engineering Workforce. My Co-Chair of the NRC study, Professor Daniel Hastings, joins me today, and you can tell which one of us drew the short straw.

Our committee found it useful to consider two distinct timeframes when evaluating the NASA workforce as it relates to NASA's implementation of the *Vision for Space Exploration*. Specifically, we looked at the next five years, and then, the timeframe beyond 2012. I want to highlight three aspects of our committee's conclusions.

First, in the view of our committee, NASA does not currently have the expertise needed in-house, particularly in the areas of systems engineering and project management, to implement the Vision, nor do we feel that any amount of training or retraining during this timeframe will address fully the shortage of expertise.

Second, we are confident that a well thought out and implemented training and hiring program will allow NASA to be well positioned in the post-2012 timeframe to implement the Vision. Third, the Committee feels strongly that the issues NASA faces are not unique to NASA. They are at the heart of any assessment of the Nation's aerospace technical workforce generally, and as such, deserve consideration on a national scale.

Mr. Chairman, I would like to share a story with the Committee. At the end of April, after our committee presented its report to NASA, the Agency announced the winner of its Astronautic Glove

Challenge. The winner was Mr. Peter Homer. NASA used this new and nontraditional approach to acquire a hardware design that will eventually improve the ability of our astronauts to work in space, but this is not simply a story about new equipment or an innovative approach to finding new ideas, one that our committee, in fact, endorses. It turns out that Mr. Homer is unemployed, and actually left the field of aerospace engineering many years ago to work as a sales manager in the computer industry.

Indeed, this is a frequent aspect of the aerospace workforce, if I could have the first figure, please. This is some data that we got from NSF, and pertains to the year 2003. As you can see, of the roughly 200,000 people, that blue circle, currently working in the aerospace and space science arenas, only 40 percent of them have degrees in those areas. Oh, you can't see it. I can see it. I am sorry you can't see it.

Chairman UDALL. Dr. Black, why don't you continue, and we will——

Dr. BLACK. I will just continue.

Chairman UDALL. And this will be included in the record, and we will do our best—here we go.

Dr. BLACK. Very good. Thank you. The blue area, as I say, has roughly 200,000 people, and those are the ones currently working. Only 40 percent of them actually have degrees in that area. Another point to make here is that the NASA civil service workforce comprises only 10 percent of that area.

Moreover, fully 75 percent of the people with degrees in aerospace and space science are not currently working in this area, people like Mr. Homer. The point here is that one needs to take care in interpreting the many numbers floating around, in terms of how many skilled workers truly are available for these kinds of activities.

One of the main themes of our report is the need for hands-on training for NASA's workforce, particularly in the areas that are key to achieving its programs on schedule and on budget. The Committee recognized that two skill areas are important not only to NASA, but to the national security space programs. These are systems engineering and program project management. Those skills cannot simply be produced in a classroom. They must be acquired over time. Just as a baseball player cannot become proficient by seeing the game explained on a blackboard, a systems engineer cannot become proficient at his job without building and integrating a spacecraft.

But also, just as baseball players do not immediately head to the major leagues without first graduating from Little Leagues, through the farm systems, up to the majors, a systems engineer or program manager must also start small and gain experience. Unfortunately, the opportunities for gaining this kind of experience are missing. If you look at the following figure, that shows the kind of opportunities for hands-on experience by graduate students in earth and space sciences over the years, and as you can see, they have been diminishing. That shows both sounding rockets, airborne opportunities, balloons, and spacecraft, and in the aggregate, as well as each of the individual elements of that graph, have all been decreasing drastically over the years.

In closing, I would like to return to the third aspect of our conclusions. My experience as a former NASA employee and as the president of a not-for-profit association of a hundred universities working with NASA is that the Agency has a tendency, has tended to deal with problems in relative isolation of other entities, a reflection of the can-do attitude of the Apollo era, as well as a bit of the not invented here syndrome. The Committee feels that NASA workforce issues are a microcosm of a broader set of national concerns, and that solutions are best sought in the context of what the Committee refers to as the aerospace ecosystem, shown here.

NASA is a relatively small player in this ecosystem. As I said earlier, the civil service makes up only 10 percent of the total workforce, and it therefore seems that it would do better to work with other elements in defining and understanding the key issues, and then arriving at a solution that is in everyone's best interest. In this way, NASA would be able to leverage its concerns off of those of the larger inhabitants of the ecosystem.

That concludes my remarks, Mr. Chairman, and I thank you for your interest in this important topic, and would be happy to answer any questions you have.

[The prepared statement of Dr. Black follows:]

PREPARED STATEMENT OF DAVID C. BLACK

Mr. Chairman, Ranking Minority Member, and Committee Members: I appreciate the opportunity to testify before you today. My name is David Black. I am President Emeritus of the Universities Space Research Association. I am also an Adjunct Professor in the Physics and Astronomy Department at Rice University. I appear today largely in my capacity as Co-Chair of the National Research Council (NRC)'s Committee on Issues Affecting the Future of the U.S. Space Science and Engineering Workforce. The NRC is the operating arm of the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine of the National Academies, chartered by Congress in 1863 to advise the government on matters of science and technology. The views expressed in my testimony today are primarily those expressed by the NRC Committee in its Final Report, as well as my own.[1] I shall do my best to make clear which views are mine and which are those of the Committee. The latter views are fully supported by my co-chair of the NRC study, Dr. Daniel Hastings, Dean for Undergraduate Education and Professor of Aeronautics and Astronautics and Engineering Systems at MIT.

Allow me to address the specific questions that you posed prior to this hearing. Your questions are indicated in bold type followed by my responses.

What was the scope of your recently released report on NASA's Workforce, and what are its major findings and recommendations?

The NRC Committee's charge from NASA is to explore long-range science and technology workforce needs to achieve the Nation's long-term space exploration vision, identify obstacles to filling those needs, and explore solutions for consideration by government, academia, and industry. The specific tasks that we have been requested to undertake are the following:

1. Assess current and projected demographics of the U.S. aerospace engineering and space science workforce needed to accomplish the exploration vision;
2. Identify factors that impact the demographics of the affected workforces;
3. Assess NASA's list of the workforce skills that will be needed to implement the Vision for Space Exploration, both within the government and in industry;
4. Identify the skills needed to implement NASA's Vision for Space Exploration within the academic community;
5. Assess the current workforce against projected needs;

[1] *Issues Affecting the Future of the U.S. Space Science and Engineering Workforce—Interim Report,* The National Academies Press, Washington, D.C., 2006.

6. Identify workforce gaps and analyze obstacles to responding to the workforce needs, and in particular, analyze the proper role of academia and the obstacles to achieving this proper role; and
7. Develop recommendations for specific actions by the Federal Government, industry, and academia to address those needs, including considerations such as organizational changes, recruiting and hiring practices, student programs, and existing workforce training and improvement.

The NRC Committee has drawn upon input from a workshop and meetings, documents provided by NASA, and our own experiences to arrive at the following findings and associated recommendations:

Finding 1: NASA has undertaken a commendable top-down (i.e., headquarters-directed) analysis of current agency needs and the skill levels of its current workforce that the committee believes is an excellent first step. But although NASA has considered workforce needs for the Agency as a whole, it has not yet projected its requirements for future hiring in terms of (1) the numbers and specific skill sets of workers expected to be needed by each NASA center over time and (2) the timeframes for hiring based on anticipated retirements of the present workforce. The committee believes that understanding future hiring requirements will depend on an accurate, detailed assessment of the skills, *Vision for Space Exploration*-related development capabilities, and expected attrition of the workforce for each center.

Recommendation 1: Collect detailed data on NASA workforce requirements.

The committee recommends that NASA collect detailed data on and develop accurate assessments of the capabilities possessed by the current workforce and required for the future S&T workforce. The issue here is not simply "more data," but data that are more to the point in terms of understanding the workforce issue. Examples of the type of data are cited below.

- Because each NASA center has unique mission requirements and the mobility of personnel between centers is limited, NASA should complete a center-developed, bottom-up assessment of the current skills, experience levels, and projected attrition of the workforce for each individual NASA center.
- NASA should use the data obtained from such assessments to develop a model for projecting future NASA priorities for *Vision for Space Exploration* skill development and hiring by competencies, experience levels, and centers, as well as a model for the best mix of skill development conducted within NASA versus within industry.
- NASA should translate identified workforce needs from competencies and experience levels into specific positions to be implemented at individual centers at specific points in time.
- NASA should assess whether the skill levels of in-house scientists at each field center are appropriate to fulfilling that center's scientific leadership and service responsibilities and should ensure that appropriate efforts are made to maintain the scientific competency and currency of each center's scientific workforce.
- NASA should ensure that hiring constraints such as pay levels, personnel ceilings, and ability to recruit suitable candidates guide make-or-buy decisions about how staffing needs will be met.
- NASA should ensure that appropriate workforce strategies?including providing training for staff (e.g., through the NASA Academy of Program/Project and Engineering Leadership program), contracting out work to industry and academia, facilitating exchange programs, and hiring temporary contract and term employees are applied at each center.

The committee believes that it is premature to recommend a particular mix of strategies for obtaining the desired worker skill mix until NASA fully defines its staffing needs. NASA is moving to collect the data necessary to help them make these capability assessments. Since NASA is in the *Vision for Space Exploration* for the long-term, NASA will need to establish a systematic process for monitoring and updating its workforce needs.

Finding 2: In the short-term, NASA has too few program and project managers and systems engineers with the requisite experience in human space flight systems development to successfully oversee *Vision for Space Exploration* projects. Given the lack of detailed data on NASA's near-term workforce skills and needs as well as uncertainties over NASA's budget, the committee did not attempt to assess the likely success of NASA's planned steps to address near-term workforce problems.

Recommendation 2: Hire and retain younger workers within NASA.

The committee recommends that NASA implement a long-term strategy for hiring a steady supply of younger workers and subsequently retaining those workers as they rise to senior management positions so that a balanced distribution of age and skill is maintained throughout the Agency's entire workforce.

- NASA should take full advantage of the *NASA Flexibility Act of 2004,* which was passed to facilitate the Agency's recruitment of employees from industry. NASA has already utilized the act to a considerable extent, and the committee encourages the Agency to continue to do so, as well as to inform Congress of any additional hiring flexibility that is required.
- NASA, working with Congress and the executive branch, should develop solutions to legal problems that limit the flow of senior and highly skilled employees from industry to NASA even when such employees are willing to accept lower salaries. Issues regarding share holding, pensions, and perceived or actual conflicts of interest severely hamper personnel exchanges between industry and NASA. These problems stem from policy issues that cannot be resolved by NASA alone but instead require action by Congress and the executive branch working in concert with NASA.

Finding 3: NASA's workforce requirements and challenges cannot be considered in isolation from those of other government and industry organizations. NASA is part of an aerospace workforce ecosystem in which the health and needs of one organization or sector can affect another. Thus, NASA's workforce issues require the intervention and assistance of higher-level government organizations such as the Office of Science and Technology Policy in the Executive Office of the President.

Recommendation 3: Ensure a coordinated national strategy for aerospace workforce development among relevant institutions.

The committee recommends that representatives from relevant government agencies, the aerospace industry, including the emerging private sector, and the academic community work together to develop a coordinated national strategy to ensure an effective aerospace workforce ecosystem. When NASA is using only approximately 10 percent of the workers in the aerospace workforce, it must think about its needs in the context of agencies and actors who have much larger needs.

Finding 4: There is a longstanding, widely recognized requirement for more highly skilled program and project managers and systems engineers who have acquired substantial experience in space systems development. Although the need exists across all of NASA and the aerospace industry, it seems particularly acute for human space flight systems because of the long periods between initiation of new programs (i.e., the Space Shuttle program in the 1970s and the Constellation program 30 years later). NASA training programs are addressing some of the Agency's requirements in this experience base, but the current requirement for a strong base of highly skilled program and project management and systems engineering personnel, and limited opportunities for junior specialists to gain hands-on space project experience, remain impediments to NASA's ability to successfully carry out *Vision for Space Exploration* programs and projects.

Recommendation 4: Provide hands-on training opportunities for NASA workers.

The committee recommends that NASA place a high priority on recruiting, training, and retaining skilled program and project managers and systems engineers and that it provide the hands-on training and development opportunities for younger and junior personnel required to establish and maintain the necessary capabilities in these disciplines. Specific and immediate actions to be taken by NASA and other parts of the Federal Government include the following:

- In establishing its strategy for meeting *Vision for Space Exploration* systems engineering needs, NASA should determine the right balance between in-house and out-of-house work and contractor roles and responsibilities, including the use of support service contractors.
- NASA should continue and also expand its current employee training programs such as those being conducted by the Academy of Program/Project and Engineering Leadership (APPEL). To facilitate the development of key systems engineering and project management skills, NASA should increase the number of opportunities for entry-level employees to be involved in hands-on flight and end-to-end development programs. A variety of programs—including those involving balloons, sounding rockets, aircraft-based research, small satellites, and so on—can be used to give these employees critical experience

relatively early in their careers and allow them to contribute as systems engineers and program managers more quickly.

System Engineering is a discipline and skill that can be partially taught and also has an important component of learning from experiences. It is much easier to learn on small projects where mistakes can be made and recovery is possible than from large projects where recovery might not be possible.

Finding 5: NASA relies on a highly trained technical workforce to achieve its goals and has long accepted a responsibility for supporting the training of those who are potential employees. In recent years, however, training for students has been less well supported by NASA. A robust and stable commitment to creating opportunities at the university level for experience in hands-on flight mission development, graduate research fellowships for science and engineering students, and research is essential for recruiting and developing the long-term supply of competent workers necessary to implement NASA's future programs.

- Faculty research not only is fundamental to student training but also leads to the development of new technology and tools for future applications in space. Programs supporting critical scientific and technological expertise are highly desirable.
- Hands-on experience for students is provided by sub-orbital programs, Explorer and other small spacecraft missions, and design competitions, all of which rely on continuing NASA support.
- The Graduate Student Researchers Program supports the education and training of prospective NASA employees and deserves augmented support.
- Undergraduate and graduate co-op student programs are particularly effective in giving students early hands-on experience and in exposing students and NASA to each other to help enable sound career choices and hiring decisions.

Recommendation 5: Support university programs and provide hands-on opportunities at the college level.

The committee recommends that NASA make workforce-related programs such as the Graduate Student Researchers Program and co-op programs a high priority within its education budget. NASA should also invest in the future workforce by partnering with universities to provide hands-on experiences for students and opportunities for fundamental scientific and engineering research specific to NASA's needs. These experiences should include significant numbers of opportunities to participate in all aspects of sub-orbital and Explorer-class flight programs and in research fellowships and co-op student assignments.

Finding 6: Although NASA's primary role is not education or outreach, improved support of the higher education community and of young professionals is critical to maintaining a sufficiently talented workforce. Involvement in providing development and educational opportunities, especially hands-on flight and vehicle development opportunities, will pay future dividends not only by encouraging larger numbers of talented students to enter the field, but also by improving the abilities of incoming employees. Indeed, a failure to invest in today's students and young professionals will ultimately lead to a crisis when that generation is expected to assume the mantle of leadership within the U.S. aerospace community.

Recommendation 6: Support involvement in suborbital programs and nontraditional approaches to developing skills.

The committee recommends that NASA increase its investment in proven programs such as sounding rocket launches, aircraft-based research, and high-altitude balloon campaigns, which provide ample opportunities for hands-on flight development experience at a relatively low cost of failure. Rather than viewing sounding rockets, aircraft-based research, and balloon programs simply as low-cost, competed, scientific missions, NASA should also recognize as an equal factor in the criteria for their selection their ability to provide valuable hands-on experience for its younger workers and should investigate the possibility of funding such programs through its education budget. In addition, NASA should take advantage of nontraditional institutions and approaches both to inspire and to train potential future employees. Investment in programs such as Centennial Challenge prizes and other innovative methods has the potential to pay benefits many times greater than their cost, by simultaneously increasing NASA's public visibility, training a new generation of workers, and pushing the technology envelope.

Strategic planning for workforce issues is difficult because budget and program decisions often have major impacts on the workforce that make strategic planning irrelevant. The committee heard from industry representatives who stated that NASA's ability to attract junior-level personnel and retain senior personnel would be heavily influenced by perceptions about how compelling and stably funded the Vision for Space Exploration is. The committee thus believes that NASA must adopt policies that, while relatively inexpensive, can have a longer-term impact on its ability to obtain the highest-quality personnel. The development of the right people is as important as the development of the right hardware. NASA policies must recognize and reflect this attention.

Which issues, according to the report, present the most serious challenges to building and maintaining a healthy and strong NASA workforce?

The major challenges identified by the Committee are a) conducting programs on time scales that are better matched to those of the emerging labor market and for the near future, up to roughly five years from the present, and b) finding ways to tap the broad and deep experience base in key job areas that currently exist outside of the Agency. Allow me to expand on both of these points.

The Committee received input from university professors who observed that people in today's young to middle-age labor market are more focused on short-term success and are more mobile than were their counterparts of the Apollo era. They are attracted to careers where measurable progress of both a personal and professional nature takes place over five to ten years, as contrasted with decades. The vast majority of current and recent large scale and therefore highly visible NASA programs, be they robotic or human space flight, are of the latter variety. For example, it took nearly three decades of planning, replanning and redesigning before the remarkably successful Spitzer telescope was launched. It has been over 23 years since President Reagan charged NASA with building and operating a space station, and the end of that journey remains far in the future. These examples are typical of current NASA programs. Perhaps just as telling is that this trend appears to be true also for the Vision. The projected availability of the two key hardware components of the Vision is slipping for a number of reasons.

The Committee's discussions with members of the academic community revealed that most are unwilling to urge their best students to pursue a career with NASA or NASA-related programs. Moreover, given the propensity of younger members of the aerospace workforce to seek shorter-term gratification, they are looking to other professions such as bio-related fields, or economics, as their first choice rather than the Nation's space program. This represents rational choices given the potential returns and the perceptions of involvement in programs that might take a long time to come to fruition.

The Committee found that pay scales for entry to mid-range professionals at NASA are generally comparable, or even better, than in competing job sectors. This is generally not the case for the more senior members of the aerospace workforce. The drawn out nature of NASA's current programs, coupled with the pay discrepancy, is a major cause for the drain of experienced workers from the Agency. Additional barriers in bringing experienced people back to NASA are found in conflict of interest issues and the need for these individuals to divest themselves of the financial returns that took them to industry in the first place. This tends to make these opportunities most attractive to people who are retiring from industry.

How well does NASA's Workforce Strategy address the findings and recommendations contained in your report?

The Committee applauds NASA's early efforts at developing a strategy for workforce development, but feels that it needs substantial work on several fronts. This strategy is based fundamentally on the notion of maintaining ten healthy centers. While such an approach is understandable from a purely political perspective, I am concerned that it runs great risk that it becomes essentially a jobs program with work being sent to centers that are not necessarily staffed to do the jobs. If there were complete mobility in the civil service workforce, NASA might be able to make this approach viable, but that mobility does not exist.

The NASA Workforce Strategy does recognize many of the key challenges that NASA faces, but the Committee is concerned that the NASA strategy views its workforce issues in isolation of what the Committee has dubbed the "aerospace workforce ecosystem." The workforce problems that NASA faces are a microcosm of a broader national problem, one that faces academia, industry and other government entities, and it is the view of the Committee that all parties would be best served by seeking a *national* solution to these problems. This approach would yield a more stable long-term solution for NASA and the Nation's aerospace workforce as

a whole. This may take a cultural shift on the part of NASA and its centers. Data provided to the Committee by NSF from 2003 reveals that fully 75 percent of the workforce with a degree in aeronautics and space science-related fields does not currently work in those fields (Figure 1). The workforce is potentially available, but needs revectoring.

Given that NASA is a multi-mission agency, how de we ensure that core competencies are maintained in each of NASA's core missions?

The fundamental issue facing NASA in its efforts to maintain core competency in the short-term is its shortage of qualified experienced personnel in key areas such as systems engineers and project managers. The Committee feels that training or retraining of existing staff cannot meet this shortage in the near-term. There are too few opportunities to gain the needed experience, particularly in the human space flight regime to provide the number of needed experienced staff. Viewed from a longer-term perspective, say the time frame from 2012 and beyond, a well conceived and implemented set of training programs and opportunities could provide the necessary core of skilled workforce. This may mean looking to the full aerospace workforce ecosystem as a means to provide adequate hands-on training opportunities, not just NASA missions.

NASA is a relatively small player in the aerospace workforce ecosystem from a pure numbers perspective. For this reason, and others, the Committee encourages NASA to look for opportunities to leverage its efforts with those of the DOD, industry, and the academic community to identify existing programs that could provide opportunities, as well as work in a coordinated manner to develop new programs to accomplish this vital training.

Which of the recommendations do you believe NASA could readily adopt (i.e., that do not require significant resources or disruption in business processes), and which do you think will be the most difficult to implement?

A strong finding from the Committee's work is that meaningful opportunities for hands-on training, an end-to-end involvement in doing space projects, has been a declining element of NASA's portfolio for several years (see Figure 2). The programs that are most effective in providing the experience that is needed are the low cost suborbital programs, such as sounding rockets and balloon programs. Relatively low cost space missions such as the small end of the Explorer line are also of value here, but they do not provide the opportunity to reach as many students as do the suborbital programs. Reaching students and workers when they are younger, and potentially more open to career paths is important.

Increasing efforts in the suborbital programs, particularly if paired with other entities with a vested interest in seeing skilled workers developed, would cost relatively little and could begin to show dividends on a time scale that is short compared to other similar training opportunities. The Committee feels that use of NASA educational funding, along with joint funding from other entities, could be brought to bear in this area. Emphasizing workforce development as a major factor in proposal competition for such programs, as distinct from a focus purely on the scientific return is also encouraged by the Committee. This would bring an explicitly strategic view to the funding of these opportunities.

Which issues related to NASA's workforce are least well understood and what recommendations does your report offer for addressing those uncertainties?

An oft-used exemplar for NASA's workforce is a plot of the age distribution. Two aspects of this distribution are usually mentioned; that the age of the peak has been steadily increasing over the past several years, and that those members at the upper end of the distribution will soon be retirement eligible. While it is the case that there has been an aging of the workforce distribution, a comparison with the other aerospace workforce sectors shows that NASA's workforce is not significantly different than the aerospace workforce generally (Figure 3).

The Committee would emphasize several points regarding this characterization of the NASA workforce. It does not capture a key aspect of the workforce, viz., the experience associated with the bodies that are represented in the data, and as the Committee has emphasized it is the lack of experienced personnel that lies at the heart of NASA's workforce issues. Moreover, the Committee was unable to find evidence that NASA, or anyone else for that matter, was able to say what the "right" distribution should be for an employer with NASA's needs and challenges. A key element here is how one can model this distribution so as to understand the "sources and sinks" that alter the distribution, understand the time scales over which those sources and sinks operate and hence alter the distribution. The Com-

mittee feels that any strategic plan that NASA develops for workforce development must include an effort to model and ultimately understand the dynamics of its workforce age distribution. The Committee was not able to conduct an extensive search for people or organizations that do, or could do, this type of analysis, but it seems clear that it lies outside of NASA, most probably in the academic community. We would strongly encourage studies in this area. We would also encourage NASA to periodically reevaluate its model and update its data both for the results and as a way of keeping focus on these critical workforce concerns.

In closing my prepared remarks Mr. Chairman, I would reiterate that the NRC Committee feels strongly that NASA needs to look outside of itself in assessing the nature, scope, and possible solutions for its skill mix. NASA has historically been a "can-do" agency, but also one afflicted to some extent with the "not invented here" syndrome. The issues NASA faces in terms of workforce are national in character; they reverberate through other government agencies involved in space-related work, as well as the private sector including universities. NASA should not, in our Committee's view, try to structure a solution in isolation from consultation with the broader set of communities noted above. I believe I can speak for many people in saying that the Nation's space programs would benefit if the issue of workforce is addressed by involving the representatives of the workforce ecosystem in both the assessment of the problem and the range of possible solutions.

Thank you again for the opportunity to share with your committee the perspectives on this important issue that the NRC Committee has developed over the past year.

I would be happy to expand on my remarks or address additional questions should you wish.

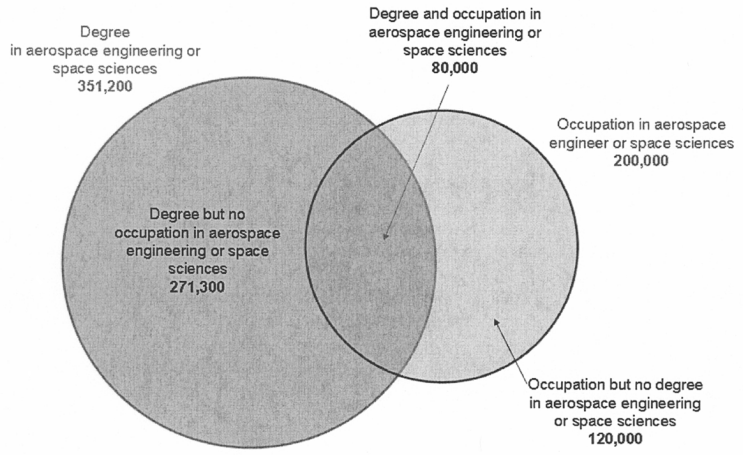


FIGURE 1: Degrees versus occupations in 2003, illustrating that people with specific degrees often work outside their areas. NOTE: Space sciences here include atmospheric sciences, physics, and astronomy. SOURCE: National Science Foundation/Division of Science Resources Statistics, Scientists and Engineers Statistical Data System.

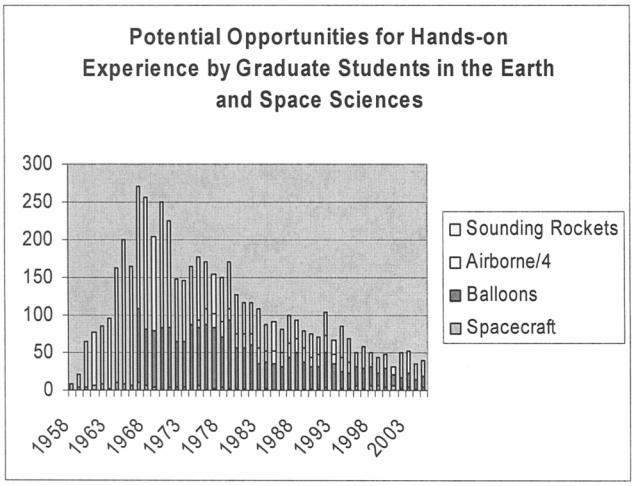


FIGURE 2: NASA's suborbital programs by year, from 1959 to 2005. These hands-on flight programs can provide critical experience to students and entry-level employees.

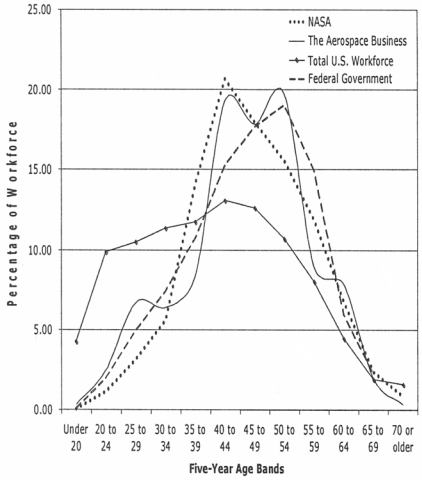


FIGURE 3: The age distribution of NASA's current workforce compared to the age distributions for the aerospace sector, the federal government, and the total U.S. workforce. NOTE: The line for aerospace business is based on very imprecise data. SOURCE: Garth Henning and Richard Leshner, NASA, presentation to the Committee on Meeting the Workforce Needs for the National Vision for Space Exploration, February 22, 2005.

BIOGRAPHY FOR DAVID C. BLACK

DAVID C. BLACK, is President Emeritus of the Universities Space Research Association (USRA), a consortium of 97 different colleges and universities having graduate programs in space science or engineering. He is also adjunct professor of space physics and astronomy at Rice University. Between 1970 and 1975 Dr. Black served in various capacities at NASA's Ames Research Center, including chief of the Theoretical Studies Branch and deputy chief of the Space Science Division, and he was the first chair of the Ames Basic Research Council. Dr. Black was selected as the first chief scientist for the space station program at NASA Headquarters in 1985. He returned to NASA Ames in 1987 as the chief scientist for space research. He spent an academic year as a visiting professor at the University of London (1974–1975). Dr. Black is an internationally recognized researcher in theoretical astrophysics and planetary science, specializing in studies of star and planetary system formation. He has also done pioneering experimental research involving the isotopic composition of noble gases in meteorites, was the first to discover and correctly identify evidence for non-solar material in solar system matter, and was the first to show that the isotopic composition of solar flare noble gases differs from that of solar wind noble gases. He is a leader in the current effort to search for and study other planetary systems. He is past chair of the Solar System Exploration Subcommittee and the Origins Subcommittee of NASA's Space Science Advisory Committee. Dr. Black also served as a member of the NRC Planetary and Lunar Exploration Task Group (1984–1988) and the Working Group on Search for Extraterrestrial Intelligence (1979–1983).

Dr. Black served as Co-Chair with Dr. Daniel Hastings of the National Research Council (NRC)'s Committee on Issues Affecting the Future of the U.S. Space Science and Engineering Workforce. Dr. Hastings is a Professor of Aeronautics and Astronautics and Engineering Systems and Dean for Undergraduate Education at the Massachusetts Institute of Technology (MIT). The other committee members were:

BURT S. BARNOW, Johns Hopkins University

JOHN W. DOUGLASS, Aerospace Industries Association of America, Inc.

RAY M. HAYNES, Northrop Grumman Space Technology

MARGARET G. KIVELSON, University of California, Los Angeles

WILLIAM POMERANTZ, X PRIZE Foundation

JOSEPH H. ROTHENBERG, Universal Space Network

KATHRYN C. THORNTON, University of Virginia

Chairman UDALL. Thank you, Dr. Black, and we worked through the audiovisual glitch, and that is important data. We will put that in the record.

Dr. Stone, five minutes is yours, and welcome.

STATEMENT OF DR. LEE STONE, LEGISLATIVE REPRESENTATIVE, NASA COUNCIL OF IFPTE LOCALS, INTERNATIONAL FEDERATION OF PROFESSIONAL AND TECHNICAL ENGINEERS

Dr. STONE. Thank you, Chairman Udall and Ranking Member Hall for providing the International Federation of Professional and Technical Engineers, NASA's largest federal employee union, the opportunity to present our perspective on the workforce challenges facing NASA today.

IFPTE's primary interest in testifying is to provide advocacy for maintaining the technical excellence and independence of NASA's civil service workforce. However, our interests extend more broadly to a deep commitment to NASA's success, not only in the near-term, but more important, in the long-term, consistent with the true spirit of the *Vision for Space Exploration*.

NASA is not facing a workforce crisis. It is facing a fiscal crisis. The President's Vision outlines a bold and ambitious set of milestones, yet NASA is not being given a bold and ambitious budget needed for success. As long as the Vision remains largely an un-

funded mandate, all of NASA's missions and its workforce will remain at risk, and that is the primary issue.

The last time a President asked NASA to send humans to the Moon, NASA had nearly 36,000 civil servants onboard, and an annual budget of more than $30 billion, adjusted for inflation, and they were not being asked to fix design problems with the Shuttle or to build a Space Station at the same time. Yet today, NASA's civil service workforce has been halved, and its budget reduced by more than 40 percent. Until the fundamental discrepancy between mission and budget is corrected, NASA's problems cannot be properly solved.

First slide, please, or the only slide, please. A workforce demographic problem is readily apparent in Figure 2–2 of the NRC report. The real problem is the five-fold reduction in the 30- to 34-year-old range between 1993 and 2005, indicated by the vertical blue arrows on the left, a fivefold reduction. Management, however, remains obsessed with the faux problem of the right hand tail of the distribution to the right of the vertical red line, which represents only about five percent of the workforce, and has been stable for more than a decade, yet there is where they keep pounding to reduce it.

IFPTE applauds the National Research Council for its thoughtful analysis and recommendations on NASA's Workforce Plan. The report recognizes the immediate need to engage aggressively in the education, the hands-on training, and recruitment of the next generation of NASA employees. IFPTE, however, is disappointed with the National Academy of Public Administration's report, as it fails to question management's assertions. It accepts as fact uncertain and mistaken premises that NASA's budget will not grow, that its current employee skills are seriously mismatched with NASA's new mission, and thus, that NASA must reduce it science, aeronautics, and technology development activities and workforce. We fundamentally disagree.

IFPTE, however, continues to support the ten healthy centers philosophy initiated by Dr. Griffin, and we reject the criticism of that plan in the NAPA report. We encourage Dr. Griffin to persevere in his efforts to decentralize the Constellation Program. Unfortunately, current policies continue to severely stress NASA's research centers. The solutions should not be, and cannot be to convert them into mini-operational centers, or to subject them to some BRAC-like process. Rather, the revitalization of cutting edge R&D at the field centers is crucial for the safe and meaningful return to the Moon, as well as for delivering on our promises in science and aeronautics.

To reinvigorate NASA's workforce in support of all of its missions, and to maintain America's prestige and leadership in science and aerospace R&D, IFPTE offers the following seven recommendations.

First, Congress should fund NASA at close to the authorized level as possible, and prohibit transfer authority across major accounts. IFPTE proposes at least an additional $300 million for science, $420 million for exploration systems, $200 million for aeronautics, $30 million for education, and $50 million for critical facilities over the President's Fiscal Year 2008 proposal.

Second, Congress should preserve the technical excellence and independence of NASA's civil service workforce. NASA should fund civil servant salaries directly to the centers, independent of programs, to allow for the effective use of matrix management, and to end the scapegoating of civil service employees.

Third, NASA should provide stability for its current workforce, to reassure its future workforce. The Administrator should publicly reject any use of RIFs, so that the best and the brightest young engineers and science graduates can once again see NASA as a great career move.

Fourth, IFPTE supports the NRC recommendations. NASA must begin an aggressive campaign to recruit young employees while the current staff is still on board to transfer its critical knowledge.

Fifth, IFPTE strongly opposes three of NAPA's recommendations. IFPTE opposes any authorization to use a BRAC-like process to close centers, any streamlining of the RIF procedures, and any authority to unilaterally terminate retirement eligible employees.

Sixth, IFPTE supports enhancing voluntary buy-out authority. We support the post-employment extension of medical coverage, and an increase in the buy-out incentive up to an individual's severance pay, capped at one year's salary.

Seven, IFPTE strongly opposes any new authority to facilitate the conversion of permanent positions to term positions, and therefore, we oppose the Administration's proposed term conversion legislation.

In closing, IFPTE is very grateful for the bipartisan Congressional rescue that has thus far protected NASA's workforce from a misguided RIF. Let us now turn from the era of workforce damage control to a more positive era of rebuilding NASA's future workforce.

Once again, Chairman Udall and Ranking Member Hall, IFPTE thanks you for inviting us to bring these important issues to the attention of the Subcommittee.

[The prepared statement of Dr. Stone follows:]

PREPARED STATEMENT OF LEE STONE

Thank you, Chairman Udall and Ranking Member Calvert, for providing the International Federation of Professional and Technical Engineers, NASA's largest Union, this opportunity to present our perspective on the workforce challenges facing NASA today. It is a privilege and honor for me to speak for IFPTE and for the thousands of NASA employees we represent.

IFPTE's primary interest in testifying today is to provide advocacy for maintaining the technical excellence and independence of NASA's civil service workforce that has served the Agency so well for decades. However, our interest extends more broadly to a deep commitment to NASA's success not only in the near term but, more importantly, in the long term, consistent with the true spirit of the *Vision for Space Exploration* (VSE). NASA's rank-and-file employees are not only the heart and soul of the Agency, but also provide much of its brain power. They are hard working and dedicated to mission success, but see this success as including all of NASA's critical missions. Indeed, many of our nation's best and brightest came to NASA primarily to be part of endeavors greater and nobler than more lucrative pursuits available to them in the private sector. They came to discover and to explore so that America can lead mankind in aerospace science, engineering, and exploration. That dream is in jeopardy today, not because of a failure of technical competence or innovation, but because of a failure of political will.

NASA is not facing a workforce crisis; it is facing a fiscal crisis. The President's Vision outlines a bold and ambitious set of milestones for NASA, ultimately leading to permanent human presence on the Moon and a safe manned mission to Mars. Yet unfortunately, the White House has thus far been unwilling to propose a bold

and ambitious NASA budget to match. The misguided policy decision to make the VSE an unfunded mandate is the driving force behind all of NASA's current woes. IFPTE calls on Congress to redirect this policy and to fund NASA at the levels Authorized less than two years ago with overwhelming bipartisan support. This course of action is essential for enabling NASA's success, for maintaining America's prestige and leadership in aerospace R&D, and ultimately for safeguarding our national security.

- Unless NASA's budget is increased significantly, commensurate with its full set of responsibilities, mission failure is a real possibility. Something has to give. Either the Constellation schedule will need to be significantly slipped, or Shuttle and Space Station activities will need to be curtailed even further, or, as the Administration would now have it, critical Aeronautics, Science and Technology activities will be severely cut, leaving Orion and Ares vehicles with ill-defined missions and NASA's Science and Aeronautics responsibilities unfulfilled. This is not a partisan concern; for example, Representative Calvert, the former Chairman (and now Ranking Member) of this subcommittee, recently expressed concern about how cuts in NASA Aeronautics R&D impact the Nation's effort, coordinated by the newly established inter-agency Joint Program Development Office (JPDO), to develop the next generation airspace system:

  ". . .Congress anticipated that the Federal Aviation Administration, as the operator of our nation's ATM system, and the National Aeronautics and Space Administration, as our nation's leading aeronautics R&D organization, would continue to work collaboratively as they have for more than forty years: NASA researching and developing long-lead, high risk technologies; FAA adapting their research products to incorporate them into the national airspace system. . .. The JPDO recognized NASA's expertise early on by selecting them to lead the 'Agile Airspace' integrated product team. . .. In the last eighteen months, however, and subsequent to the creation of the JPDO, NASA's aeronautics R&D program has undergone a major reorganization. . . I remain concerned that so early in this grand endeavor now known as NextGen, one of the two key partners is changing the rules of the game, and it's happening at a time when R&D roadmaps are being finalized, and spending for developing and integrating new technologies is about to ramp up. I would strongly prefer that NASA's Airspace Management program continue to advance promising technologies to a high level. . . It is my sincere hope that NASA's actions don't hinder JPDO's efforts to develop technologies upon which NextGen is reliant."

  IFPTE shares this concern and urges Congress to properly fund NASA's Aeronautics R&D mission, which will not only address this and other critical national needs, but will also greatly reduce the workforce instability at the Agency.

- The Administration's fiscal policy is driving the indefinite postponement of the recruitment of NASA's next generation of scientists and engineers thereby seriously compromising the long-term health of the Agency. At an All-Hands meeting at Ames Research Center on February 22nd 2007, Administrator Griffin responded to a query about what NASA is doing to recruit young scientists and engineers by saying:

  "I cannot grow the Agency by bringing in even all-stars right now that I want to bring in, unless and until folks like us who, as you said, are getting older, until and unless these folks retire."

  While we sympathize with the Administrator, given the untenable position he is in of trying to meet NASA's many awesome responsibilities without an honest budget, we must stand in opposition to any further stalling. This defeatist statement, coming directly from the Administrator, reveals that the current workforce plan is simply to punt, effectively sacrificing NASA's future to meet its immediate milestones, leaving his successor to deal with an even more serious problem down the road.

IFPTE applauds the National Research Council (NRC) for its thoughtful report and recommendations on NASA's workforce planning. The report properly recognizes the symbiotic relationship between NASA's in-house scientists and their academic colleagues, as well as the immediate need to engage aggressively in the education, hands-on training, and recruitment of the next generation of NASA employees. We fully endorse their key recommendations.

- Although the NRC primary interest is in maintaining NASA's support of academic research and IFPTE does not agree with all of the statements made in the report, nonetheless, IFPTE believes that NASA's entire multi-sector workforce would be well served by following their recommendations.
- One concern however is the references made about government conflict-of-interest rules hindering the recruitment of senior program/project managers from industry. IFPTE strongly believes that these ethics rules are absolutely essential for protecting the government and the taxpayer from the corrupting influence of private profit motives. The influence of the aerospace industry on NASA policies is powerful enough already, any weakening of government ethics rules would be unwise.

IFPTE is disappointed with the National Association of Public Administration (NAPA) report and strongly objects to the fact that it blindly accepts the Administration's assertions about NASA's fiscal and programmatic constraints and uses them to bolster their argument that some dramatic workforce realignment with a significant reduction of civil service component is somehow required for the success of the VSE. This simply is not the case and indeed, we believe the converse is true. We also strongly object to their recommendations that NASA management be given new authority for streamlined Reductions-In-Force (RIFs) and for termination based on retirement eligibility.

- For example, the NAPA report (p. 164) makes the astounding statement that:

  "Most employees who have been "uncovered" in the past are concentrated in various legacy programs and related occupations, such as engineering and science support (technicians); . . .program/project management; computer science and information technology; space sciences; . . .various systems engineering competencies; electrical and electronics systems; . . .The April 2006 NASA Workforce Strategy recognized this reality."

  The above statement that NASA does not now need and is not going to need these "legacy" competencies to meet its future missions in Science, Aeronautics, and Human Space Flight is absurd. Yet, assertions like this are used throughout the report to justify a persistent call to target CS employees for layoffs. Indeed, the NRC report correctly points that NASA desperately needs to recruit more talent in the areas of program/project management and in systems engineering (and talented Aeronautics program/project managers and systems engineers can clearly be quickly cross-trained to support space flight programs). Furthermore, the NAPA report's lack of objectivity is revealed as it repeatedly uses the term "reality" to describe unchallenged assertions by NASA management, while they refer to Union statements as "views."
- The fatal flaw in the NAPA report is that most of its recommendations are based on mistaken or uncertain premises presented as facts. The budgetary and the programmatic assertions made are not the clear cut "reality" that NAPA would have one believe; for example, the drastic and unwise cuts to Science, Aeronautics, and Technology Development in the President's proposed FY 2008 budget will not become reality unless Congress agrees to them. Over the last few years, a bipartisan coalition in Congress has repeatedly shown its willingness to restore NASA funding in these areas.

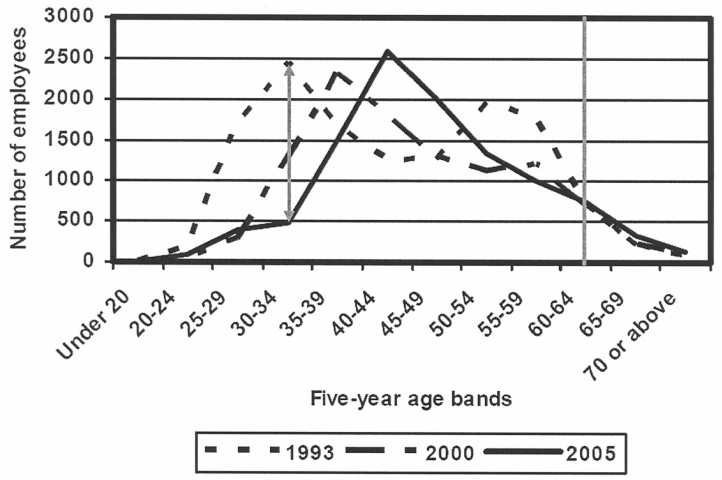
IFPTE continues to support the "ten healthy Centers" philosophy put forward by Dr. Griffin; we reject criticism of his plan within the NAPA report. Unfortunately, the implementation has been spotty. In particular, as noted in the NAPA report (p. 57), current policies have severely stressed NASA's research centers. The solution to this problem cannot be to convert them into mini-operational centers or to subject them to a BRAC-like process. Rather, the Administration must recognize that revitalized R&D at NASA's research centers is crucial for the success of the VSE and NASA's Science and Aeronautics missions. NASA's research centers and their academic partners must be provided with the resources needed for them to continue to make their contributions to NASA's longer-term missions.

- Specifically, healthy Aeronautics and Exploration research budgets should be fully sequestered from the manned space flight operational and exploration development budgets and should be managed by the research centers. This is necessary to prevent continued pilfering of longer-term research projects in support of shorter-term Constellation milestones, and to make sure that the technologies needed to support productive and safe long-duration lunar missions are available when the rockets are ready to get us there. In particular, the Advanced Capabilities programs should be managed by research centers with their R&D activities primarily at the research centers. This will protect

these vital efforts from being usurped by Constellation and will foster innovation, unfettered by the constraints of current operational thinking. Constellation must be kept healthy by direct funding, not by co-opting R&D funds.

- As recommended in the NRC report (recommendation 6), small scale flight projects (e.g., small sats, free flyers, balloon launches) should be revitalized thereby enhancing synergistic links between academia, the smaller emerging "new" space industry, and the research centers. This not only has the potential to produce good space, Earth, life and microgravity science for less money, but will also provide the key hands-on experience needed to develop strong in-house program/project managers/scientists and to educate/recruit the next generation of employees.

NASA's aging workforce:



The key problem and the misguided nature of the current management approach are readily apparent in Fig. 2–2 of the NRC report (see above).

- The real problem is the nearly five-fold reduction in the number in the 30–34 year old range between 1993 and 2005 (see vertical blue arrow). The last two Administrations share the blame for dereliction of their duty to renew and replenish this critical national capability.
- NASA management (and the NAPA report) is obsessed with the faux problem of the right-hand tail of the distribution (to the right of the vertical red line), which represents only about five percent of the workforce and has demonstrated itself to be stable for more than the last decade. Furthermore, this tail represents the older, experienced and dedicated, scientific and engineering workforce, whose retention is often critical for mission success because of the priceless corporate memory they possess.

Matrix management and full-cost recovery of civil-service salaries:

NASA's peculiar version of matrix management, in which programs wield all budgetary power and line management is effectively impotent, is harming morale and productivity at most centers among both the rank-and-file and line managers.

- When NASA claimed to convert over to "full-cost accounting" in FY04, it actually converted over to a full-cost recovery system. This system unwisely empowered distant program managers to siphon salary and facilities money away from field centers. By giving so much power to senior program managers (for Constellation, program management is often indistinguishable or closely aligned with line management at Johnson Space Center), a low priority has been placed on preserving long-term institutional assets and capabilities at the less-powerful centers. Labor costs at these centers can thus be

low-balled by pitting competing centers against each other and they have ended up being forced to provide technical support to programs at below actual cost simply because a half FTE for full time work is better than nothing. This has created the artificially inflated "uncovered capacity" that is being exaggerated by anti-CS proponents to justify layoffs.

- The Administration has only recently begun to pay adequate attention to the agency-wide consequences of full-cost recovery on core technical competencies and facilities. There is little incentive within program management (which controls nearly all of NASA funds and is under terrible pressure to meet current fiscal-year milestones) to be interested in any long-term agency-wide workforce planning.
- Matrix management coupled with full-cost recovery is seriously undermining line/center management authority and morale. For matrix management to work properly, line and program management must have equal, complementary authorities. Line managers should control CS labor and travel costs (provided directly to each center); while program managers should control procurement and contractor labor costs. This more equitable balance would then force greater cooperation between line and program management to the benefit of the Agency, its programs, and all of its employees.

Abuse of term hiring:

NASA management has been systematically abusing its authority to create term civil-servant positions with strict quotas on hiring permanent positions, thus forcing centers to make improper term hires to fill long-term technical needs more properly served by a permanent hire.

- The percentage of NASA's civil service workforce that is employed under a term contract has increased more than 7-fold since the beginning of FY2003. Of the current term positions, 80 percent are scientists or engineers and many of them will leave the Agency in two to six years, despite NASA's considerable investment in training them.
- The number of outside hires into permanent science and engineering positions decreased more than 9-fold between FY 2000 and FY 2006.
- The ratio of permanent to non-permanent outside hires shifted from 1.3 in FY 2000 to 0.4 in FY 2006.
- As noted in the NAPA report (p. 160), "NASA has used term employment as a vehicle to extend the typical one-year probationary period." Even if this is meant to be benevolent, this common rationale for using a term hire instead of a permanent hire improperly circumvents the intent of Title 5 and the Flexibility Act.
- IFPTE agrees with the NAPA recommendation that the decision to offer term or permanent status should be based on a careful analysis of the job requirements and of the long-term need for the relevant skills. NASA must develop transparent, consistent, and compelling criteria for denying full civil-service rights to any new hire. However, IFPTE is troubled by the conclusion of Chapter VI of the NAPA report that asserts that

  "Term employment may be preferable to permanent employment options given the great deal of budget and programmatic uncertainty."

  This statement openly advocates for the improper use of term positions to compensate for political instability at the Agency. Every year, NASA's budget and programs are uncertain, so this cannot be used as a criterion for determining whether a position is best filled by a permanent or term hire. That decision should be based on the position's skill requirements and the long- vs. short-term need for the specific competency being hired.
- The exploding use of term positions is threatening the quality and independence of our technical staff. The best and brightest new scientist and engineering graduates are being wooed by MIT, Johns Hopkins, Carnegie Mellon, Stanford, Cal Tech, UC–Berkeley and many other high-caliber academic institutions. Premier academic institutions offer tenure. In the past, NASA has been able to get its fair share of these candidates because it offered tenure, better benefits, and a similarly excellent intellectual environment. The NRC report (p. 41) notes that the reduction in federal pension benefits made under the Reagan Administration is hindering NASA's ability to recruit senior staff away from more lucrative private-sector positions with better benefits than the government. Any diminution of tenure rights will only make recruitment

even more difficult as it will make cold cash the only usable currency to compete for top talent and the government is not in a good position to win based on that criterion. More critically, tenure provides technical employees with the security they need to speak truth to power.

- A more extensive analysis of the crucial value of civil-service tenure can be found in IFPTE's testimony to this Subcommittee on June 13th, 2006.

Balancing the public and private workforce components:

IFPTE reiterates its prior testimony stating that NASA benefits greatly from the synergy generated by its combined federal and private-sector workforce. However, we also believe that NASA has achieved the minimum healthy balance between its current 18,020 civil servants on duty (16,299 full-time permanent) and its dedicated contractor workforce of around 40,000. The latest CS number represents a nearly a two-fold change from the 35,860 civil servants on board in FY1967, the last time NASA was working to send Americans to the moon and back safely. Any further decrease in the civil-service component would appear unwarranted and would put mission success at increased risk.

IFPTE is concerned that neither the NRC nor the NAPA report emphasized the many important reasons for maintaining a strong civil-service component to NASA's workforce especially when facing budgetary and schedule pressures. A few of these reasons are:

- Civil servants serve as smart buyers so the taxpayer buys good products at a fair price.
- Civil servants are needed to provide proper technical monitoring and financial oversight of NASA's contractor and academic efforts.
- Civil servants are needed to balance out private-sector profit motives in order to maintain safety. The *Columbia* Accident Investigations Board (p. 198) indeed pointed out that increases in the industry workforce together with reductions in the CS workforce contributed to the disaster and that, over time, NASA management tends to forget this.

  Prior to Challenger, *Shuttle Program structure had hindered information flows, leading the Rogers Commission to conclude that critical information about technical problems was not conveyed effectively through the hierarchy. The Space Shuttle Program had altered its structure by outsourcing to contractors, which added to communication problems. The Commission recommended many changes to remedy these problems, and NASA made many of them. However, the Board found that those post-*Challenger *changes were undone over time by management actions. NASA administrators, reacting to government pressures, transferred more functions and responsibilities to the private sector. The change was cost-efficient, but personnel cuts reduced oversight of contractors at the same time that the Agency's dependence upon contractor engineering judgment increased.*

The Agency also needs to engage more scientists, engineers, and technicians, and fewer managers, deputy managers, associate managers, and assistant managers. NASA's dedicated technical workforce at all of its centers, both civil servant and contractor, stands ready, willing, and able to support all of NASA's missions and there is more than enough technical work to go around. NASA headquarters needs to reduce the load of self-generated program-reporting busy work that it dumps on its front-line managers, which then reduces real productivity and drives the "need" for excess management.

Decentralizing the Constellation program:

Administrator Griffin deserves considerable praise for realizing that all of NASA Centers should share in the work opportunities (and responsibilities) provided by the Constellation program, according to their capabilities and facilities. This idea, however, has been difficult to implement fully and is not a long-term solution.

- Constellation program management is too closely allied with Johnson Space Center management and has therefore been very reluctant to comply fully with the decentralization process. As stated in the minutes of the NASA Strategic Management Council's February 21st 2007 meeting:

  ". . .flight centers seem reluctant to place development work at research centers. . ."

  Indeed, when Constellation work-packages have been transferred to other centers, JSC has only minimally complied by transferring the CS Full Time

Equivalent (FTE) portion of the funds, while retaining the procurement dollars and contractor work-year equivalent (WYE) funds, thereby making it impossible for other centers to match JSC's apparent productivity. JSC continues to prefer hiring within their local JSC contractor teams and to resist transferring the full budget associated with Constellation work-packages to CS-contractor-academic teams at other centers.

- IFPTE concurs with the NRC report finding that rigorous requirement management is a critical factor in mission success (Box 4.1). It would therefore appear troubling that Constellation and JSC management have chosen to use employees of the Orion prime contractor to help define the development, validation, and verification of Orion's requirements; this creates an obvious conflict of interest as these requirements impact the profitability of the prime contract. To protect the taxpayer, civil-service ethics rules would disqualify any civil-servant employee from working on a NASA project in which they had a direct financial interest. Furthermore, this questionable out-sourcing is particularly harmful when the expertise contracted out already exists in-house at another NASA center.
- The Constellation work is largely short-term technical oversight tasks of hardware-software development programs, with the lion's share of the real work ultimately performed by the Orion prime and sub-contractors. These work assignments are generally not full-time and do not generally cover NASA's world-class scientists and technology developers, whose innovative research is critical for the long-term health of the Agency and the ultimate success of the VSE. The only sustainable long-term solution is to revitalize NASA's Aeronautics, Exploration Research and Technology, and Science programs.

The Administration's proposed new flexibilities:

IFPTE supports NASA's efforts to obtain enhanced voluntary buy-out authority. However, we strongly opposed the effort to obtain legislation to enhance their authority to convert permanent positions to term positions as this would only exacerbate the current abuse of term hiring.

Recommendations:

In order for NASA to move forward towards reinvigorating its workforce to better support all of its missions, IFPTE offers the following recommendations:

1. **Congress should fund NASA as close to the authorized level as possible and prohibit executive transfer authority.**
   - In its endorsement of the VSE, Congress authorized $18.7 billion for FY08, yet the President has proposed only $17.3 billion. This $1.4 billion shortfall is at the core of all of NASA's problems.
   - None of the National Research Council recommendations on NASA workforce revitalization can come to fruition without adequate Appropriation.
   - Congress' direction will not have the intended impact unless all major Appropriations accounts are unambiguously specified, with executive transfer authority limited to moving funds within these major accounts (e.g., Education funds should be specifically appropriated with transfer to other activities prohibited).
   - IFPTE proposes an additional $300 million for Science above that in the President's budget (including increased funding for the Research & Analysis activities called for by the NRC to support both in-house and academic research), an additional $120 million for Exploration Advanced Capabilities (to support the longer-term R&D needed to maintain healthy and strong technology development both in-house and externally), an additional $30 million for Education (to encourage our youth to devote themselves to a technical education leading to a career in aerospace), and an additional $200 million for Aeronautics (to support NASA's traditional forte in Aeronautics R&D as well as its traditional relationship with the aviation industry and its new commitments to the JPDO). In addition to fully supporting NASA's key missions, these specific Appropriations proposals also form the basis of an implementation plan for workforce renewal, consistent with the NRC report.
2. **Congress should preserve and protect the technical integrity and independence of NASA's civil-service workforce.**

- All talk of downsizing should cease immediately and be replaced by talk of sustained recruitment of NASA's new generation of employees.
- Congress should prohibit the disruptive and misguided policy of full-cost recovery of civil-service salaries, thereby re-empowering rank-and-file employees and their line management with the flexibility to assign and perform work as needed within a balanced partnership with program management.
- Congress should require NASA to fund CS salaries and travel directly to the centers, independent of programs, to allow for more balanced and effective matrix management. This would put an end to the scapegoating of the CS workforce for NASA's overall budgetary shortfall.
- Congress should ask the Government Accountability Office to audit NASA's use of term positions.
- Although Congress has temporarily prohibited layoffs, as seen in the recent NAPA report, some within NASA management continue to promulgate anti-civil service rhetoric. Without adequate factual justification, NAPA has endorsed a plan to consider downsizing NASA's CS workforce (i.e., they want to put RIFs back on the table with weaker safeguards, with management's latest target being 2,000 Shuttle employees primarily at JSC and KSC as we near 2010). Clearly, most of these employees can be retrained to work on Constellation or they will simply retire, yet NASA is asking for legislation to go after them.

3. NASA management should provide visible and sustained stability for its current workforce to support the inspiration then recruitment of its future workforce.

- The best and brightest young engineering and science graduates need once again to see aerospace as a stable career option in general and NASA as a great career move in particular, comparable to accepting a job at a premier academic or private-sector research institution (e.g., MIT or Google or Lockheed Martin). They need to feel confident of stable job opportunities at NASA early in their education to inspire them to embark on the demanding educational paths of science, engineering, and math.
- NASA should re-embrace its Aeronautics, Science, and Technology missions as these activities are a major component of the attraction to NASA for the best and brightest young minds.

4. IFPTE supports the NRC recommendations, especially #2, #4, and #6.

- NASA must begin an aggressive campaign to recruit young employees while the current senior staff is still on board to transfer its knowledge.
- NASA must aggressively establish hands-on training programs and research opportunities for both current employees and students (aka future employees) to help forge a strong future workforce.
- NASA must maintain a portfolio of smaller flight programs to both provide valuable, yet less expensive, scientific return (especially given that the Shuttle is no longer available to support Life or Microgravity Science) and to train young project managers/scientists within more modest projects.

5. IFPTE strongly opposes three NAPA recommendations.

- The NAPA report is deeply flawed as it accepts, unchallenged, erroneous premises associated with the Administration's policies. In particular, the argument that NASA's mission is changing dramatically thereby requiring a smaller CS workforce is fallacious. NASA's mission has been and will continue to be to perform aerospace-related scientific research & engineering development. The current transient emphasis on spacecraft design and development will pass and should not be the pretext for a massive downsizing of NASA's civil service workforce. The crisis is artificial; without adequate funds for Constellation, the Administrator has resorted to cannibalizing the Science and Aeronautics budgets and their associated employees. Rather than advocating for a fictitious realignment, the NAPA report should have performed a more neutral and vigorous examination of the budgetary and programmatic premises provided to them by the Administration.
- The recommendation that NASA should contemplate a BRAC-like process to consider the closure of one or more of its research centers completely

misses the mark. BRAC was a unique response to America winning the cold war. The US therefore needed to dramatically transition its military posture to be more appropriate for the completely different post-cold-war world. NASA, on the other hand, is preparing to re-invigorate its human space flight mission in response to the VSE. It is moving back to the future to re-invent Apollo, while also maintaining its traditional portfolio of Aeronautics and Science. The VSE does not represent a dramatic change in NASA's mission but rather only a transient re-emphasis on spacecraft design and development. Furthermore, NASA's research centers function as a lifeline to academia and are absolutely essential if NASA is going to solve the very real technology development obstacles on the critical path to lunar outpost and Mars. NASA's highly-respected research centers need to be rescued from the Administration's current misguided policies, not sacrificed to meet short-term budgetary shortfalls.

- The recommendation that NASA management be allowed to streamline its RIF procedures fails completely to acknowledge the fundamental principles behind the creation of the civil service. Hiring and firing employees nearly at will, as is sometimes done in the private sector, may provide management with the flexibility it craves, but it does not work well when management is playing with the taxpayers' money. The usual market-force feedback is not present and thus very stringent regulations are absolutely necessary to prevent patronage, cronyism, and other forms of corruption. Furthermore, given that Chapter IV of the NAPA report laments that NASA management currently is not properly following existing federal law related to contractor employees, it would seem imprudent to reward NASA management with greater authority to fire CS employees. Again, NASA's primary workforce challenge, as repeatedly highlighted in the NRC report, is to recruit and build its future workforce. The obsession with layoffs is misplaced, is wasting taxpayer dollars, and harming morale and productivity.
- The recommendation that NASA management be allowed to declare an emergency and terminate its older annuity-eligible employees is not only wrong-headed, it is overtly discriminatory. Retirement eligibility (which correlates strongly with age) should never be used as a criterion for termination or any other adverse employment action. When all other criteria are the same, using retirement eligibility to decide who stays and who is fired is unconscionable. IFPTE is simply shocked that the NAPA would openly advocate for age discrimination. NASA employees generally become annuity eligible at 50 years young; IFPTE believes that rather than considering employees over 50 as liabilities, NASA management should acknowledge that the maturity, wisdom, and hands-on experience that our older scientists and engineers provide are critical for mission success.

6. IFPTE supports enhancing NASA's voluntary buy-out authority.

- Congress should consider legislation to allow enhanced buy-out authority for NASA. We therefore support the temporary continuation of medical coverage in Section 102 of the Administration's proposed flexibility legislation.
- Many non-critical employees would like to retire immediately, but need to stay on a few additional years for financial reasons. A more reasonable compensation package would greatly help NASA persuade these employees to retire without impacting morale and would ultimately save the taxpayer a lot of money.
- The NAPA recommendation that NASA management be allowed to increase its voluntary buy-out cap from $25,000 to $35,000 is simply inadequate to effectively enhance this incentive. The high-tech industry standard is generally one year's pay, which is much more than NASA's current $25,000 or the proposed $35,000.
- IFPTE proposes a more realistic incentive, in line with those available to many untenured private-sector employees, with the buy-out calculation equal to the individual's severance pay (regardless of annuity eligibility) capped at one-year's salary.

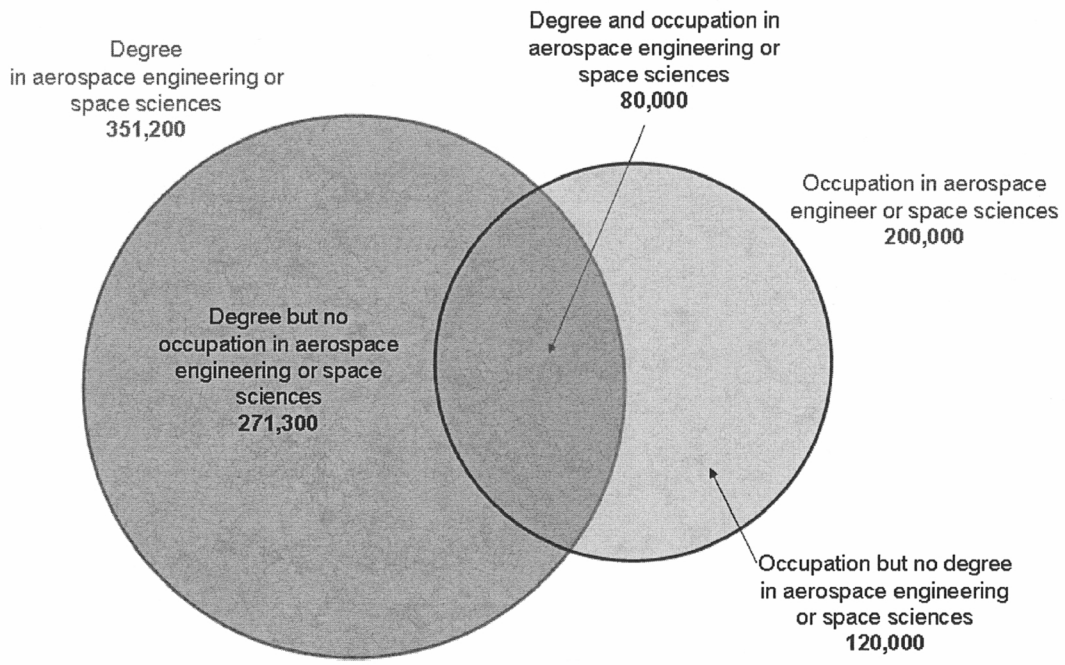
7. IFPTE strongly opposes any new authority to facilitate the conversion of permanent positions to term positions.

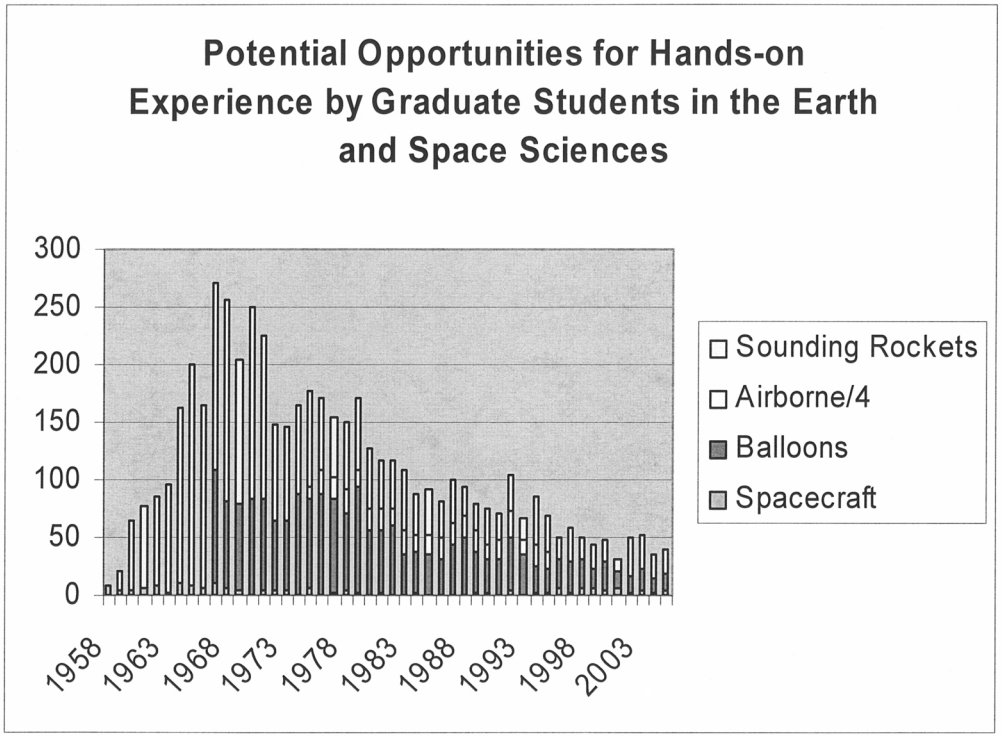
- NASA management is already abusing its current expanded term authority and should not be given additional authority to undermine civil-serv-

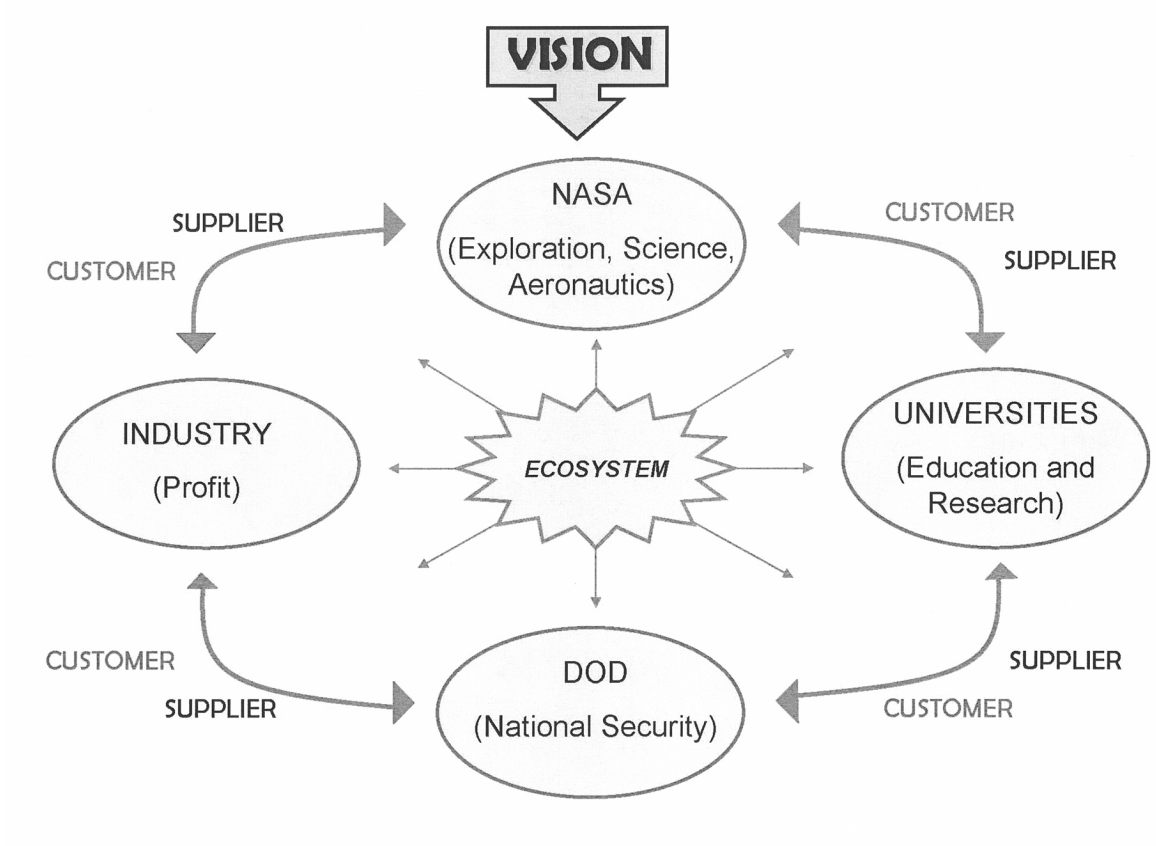
ice independence. We therefore oppose Section 101 of the Administration's proposed flexibility legislation.

In conclusion, IFPTE is encouraged by the recent effort to distribute Constellation work more fairly and intelligently across the centers, and is very grateful for the bipartisan Congressional rescue that protected NASA's workforce from the Administration's reckless RIF plan. We must now turn from the era of workforce damage control to the more positive task of re-building NASA's future multi-sector workforce. We hope that the Subcommittee will seriously consider our recommendations above, as well as those of the NRC panel.

Once again, Chairman Udall and Ranking Member Calvert, IFPTE thanks you very much for the opportunity to bring these important issues to the attention of the Subcommittee.


Degree
in aerospace engineering or
space sciences
351,200
Degree and occupation in
aerospace engineering or
space sciences
80,000
Occupation in aerospace
engineer or space sciences
200,000
Degree but no
occupation in aerospace
engineering or space
sciences
271,300
Occupation but no degree
in aerospace engineering
or space sciences
120,000


Potential Opportunities for Hands-on Experience by Graduate Students in the Earth and Space Sciences
300
250
200
150
100
50
0
1958
1963
1968
1973
1978
1983
1988
1993
1998
2003
Sounding Rockets
Airborne/4
Balloons
Spacecraft


VISION
NASA
(Exploration, Science, Aeronautics)
SUPPLIER
CUSTOMER
CUSTOMER
SUPPLIER
INDUSTRY
(Profit)
ECOSYSTEM
UNIVERSITIES
(Education and Research)
CUSTOMER
SUPPLIER
DOD
(National Security)
SUPPLIER
CUSTOMER

DISCUSSION

Chairman UDALL. Thank you, Dr. Stone. At this point, let us open up our first round of questions, and the chair will recognize himself for five minutes.

I am going to direct my first round of questions to Dr. Black and Mr. Stewart. Ms. Dawsey's testimony notes that to a large degree, these reports, and that is the National Academies' and the NAPA reports, confirm our assessments of the challenges facing us in the workforce arena, and validate the actions that we have initiated to address the most critical and encompassing issues.

Do you agree with NASA's response to the findings and recommendations of these reports, and if not, which of your recommendations do you think need the most attention by NASA?

Dr. Stone, let us start with you, and then, we will move to Mr. Stewart, and then, if Ms. Dawsey has—if there is time left, we will give you a chance to share your point of view. So, Dr. Stone.

Dr. STONE. So, your question is what do I think of NASA's response to these reports?

OPINIONS ON NASA'S RESPONSE TO NATIONAL ACADEMIES' AND NAPA'S REPORTS

Chairman UDALL. Yes, yeah, and if you don't agree with all of them or most of them, or some of them, which of your recommendations do you think need most attention by NASA?

Dr. STONE. Okay. I would say that NASA has, indeed, basically, except for the most extreme proposals at the end of the NAPA report, that I would like to address separately. The NAPA report basically is just a rubber stamping of the approach that NASA has been taking, of trying to realign its workforce through a process that largely involves the flexibility to enhance attrition, and to reduce the civil service complement, and I think there is a strange mixture in the goals of NASA's management, between trying to adjust to the real goal of the Vision, and trying to implement a civil service reshaping that involves a reduction of several thousand employees.

And I think the latter is a political decision that isn't linked to any reality to the Vision, and so, there is some schizophrenia to their response, in that some of it is addressing real issues, and some of it is really just addressing that, what seems to be a predetermined goal to reduce the civil service complement.

As far as the NRC report, I don't see much of a response at all to what they have suggested, and indeed, they seem to be continuing to shrink their education budget, continuing to reduce efforts to bring in young people, and in my longer testimony, there is a quote from the Administrator on this that I think is really telling. And there was a question asked at an all hands meeting at Ames a few months ago by a very prominent scientist, and the scientist asked: "What is NASA doing to recruit young people?" which is the largest effort in the NRC recommendations, and the Administrator's response was: "I cannot grow the Agency by bringing in even all stars right now, that I want to bring in, unless and until folks like us, who as you said, are getting older, until and unless these folks retire." And indeed, I don't think this is official policy,

but I think there is a quota of three to one, where centers are not allowed, the research centers are not allowed to hire someone until three people retire.

And so, I think that there is a fundamental resistance from management to actually seriously take on the question of solving that fivefold reduction in the younger employees, and on one side, I find that reprehensible, and on the other side, it is understandable. It comes back to the point that I said at the beginning. There isn't enough money for Dr. Griffin to meet all the challenging needs of Constellation, and also, rebuild the workforce. And he is choosing to meet the short-term milestones of Constellation, and leave the workforce rebuilding problem to his successor, and he is doing so, I believe, not because he wants to, but because he is not being given adequate budget to do it right.

Chairman UDALL. Thank you, Dr. Stone. I am going to try and give Dr. Black a minute or so here to respond, and then, we will, in the next round, I will give Mr. Stewart and Ms. Dawsey a chance as well.

Dr. BLACK. Thank you, Chairman.

The problem of the workforce is a daunting one, and I think NASA has made at least good initial strides in trying to deal with this. As has been pointed out by Dr. Stone, our committee's concerns as regards young people and fresh hires, I think that they have not yet done all that well there.

One of the things to understand is this is a very, very difficult problem. If you look at the kind of curve that Dr. Stone showed, one of the things that I think NASA has not done is to characterize its people both by the true level of their experience, their expertise, they count belly buttons in bins by job categorization, but not whether they really have the skills necessary.

And the other thing that is really crucial in the strategic sense is to understand the dynamics of that curve. What are the sources and sinks? How do you adjust? Over what time scales? Different things have different timescales. Graduate students have certain timescales, industry has timescales. So, I think they really need somebody, and I don't believe this expertise exists in the Agency. We did a modest search. We were unable to find things, but I am sure somebody in the university community knows how to do this, to really understand what are the forces that shape and evolve that curve that Dr. Stone showed. And I think essentially, you are going to have to have that, if you are going to truly have a strategic plan to deal with workforce issues.

Thank you, Dr. Black, and at this time, I will recognize the Ranking Member, Mr. Hall, for five minutes.

Mr. HALL. Thank you, Mr. Chairman. Ms. Dawsey, it seems to me that we all agree that NASA's workforce is likely to face some changes—we expect that—that is given—in order to meet new goals that we have in exploration, science, and aeronautics, and NASA sent us a Workforce Strategy over a year ago, and I presume that you have been busy over the past year trying to implement some of this strategy. I think that is a good presumption.

Would you please give me some specifics about what NASA is doing to bring its workforce into appropriate alignment to meet our

exploration, science, and aero goals, and specifically, to answer the in-house problems, as set out by Dr. Black?

HOW NASA IS ACHIEVING WORKFORCE GOALS

Ms. DAWSEY. Yes, sir. We have been working very hard over the past year to implement the Workforce Strategy. The Workforce Strategy is still current. What we have done is we have developed a comprehensive implementation plan, and that implementation plan, as I said, is worked around three goals, and one of them is workforce planning.

Over the past year, we have set up a governance structure which includes human capital as, I believe, Mr. Stewart recommended, in all of the workforce planning decisions, aligned with other key officials in the Agency. We have also set up in that governance structure a standing workforce planning team, technical team, that includes human capital and workforce planning, workforce transition, staff from around the Agency, and we have specific sub-teams that will address specific issues, for example, for any skill mix issues, or the Shuttle transition. We have a team set up to do the mapping of Shuttle employees from Shuttle to Constellation.

In terms of alignment, we have redesigned our leadership development programs. Basically, what we are working on is while our entry level pipeline is getting some criticism here this morning, we do have that pipeline. We have students, co-op students at NASA. We have about 400 of them at any given time. We also have over 400 graduate students working on NASA projects.

The other part of the alignment, though, is to make sure, as also was suggested this morning, that we have program managers, project managers, senior technical, and senior executive service pipelines, and so, we are building career paths and training programs that start fairly early in our employees' career, and give them experience as needed, not only to build within their own career, but to understand NASA as a whole, both the program side of the house and the institution side of the house.

And finally, we have taken our systems that have been operating pretty much independently of one another, the systems that would inform our leadership, and we are integrating them, so that they have all the workforce data they need, all the demographic data they need, to make decisions for the workforce.

Mr. HALL. I thank you for that. So, the NASA Workforce Strategy, the ten healthy centers, I think the Administrator pretty well put that to bed.

Ms. DAWSEY. Yes.

Mr. HALL. That there was talk of closing them at one time, and maybe some others on here think that might be the thing to do, but I think he has taken a pretty firm position on that, and I think a lot of us up here recognize how very capable he is.

The second one is to maximize the existing workforce, as you have pointed out, and I think we have to do that, and third, then, you said three goals, and is the third one to evolve to a more flexible civil service, by—in your workforce, you pointed out the temporary people that you were using, and how many different universities they were from. Does that kind of summarize what—the three that you have said, or have I left out something?

Ms. DAWSEY. No, those are the three.

Mr. HALL. All right. I think my time is almost up, and I yield back, and I do thank all four of you. Thank you, Dr. Black.

Chairman UDALL. Thank you, Judge Hall, and at this point, yield five minutes, to recognize for five minutes the gentleman from California, Mr. Rohrabacher.

Mr. ROHRABACHER. Thank you very much, and well, first of all, let me ask Dr. Stone. You made suggestions about spending large amounts of money. Could you suggest to us where that money will be coming from?

SUGGESTED RESOURCES FOR FUNDING NASA

Dr. STONE. First of all, I don't think they are large amounts of money that we are talking about, asking for——

Mr. ROHRABACHER. Anytime you talk about over $100 million, it is a lot of money.

Dr. STONE. Okay. But——

Mr. ROHRABACHER. Where is it supposed to come from? You want to take it from the military? You want to take it from health research? To be taken seriously, when someone testifies here nowadays, you can't just come up and say you want hundreds of millions of more dollars here, hundreds of millions of dollars more there, and just expect we are going to come up with it like the Tooth Fairy is going to deliver it. If you want to be taken seriously, it is like any engineer, you have to know that you can't build something out of nothing. So, where do you want to get that money?

Dr. STONE. With all due respect——

Mr. ROHRABACHER. I am asking a specific question. You can——

Dr. STONE. The numbers that we quoted there were right out of the Authorization Bill. The Authorization Bill was passed almost unanimously by both sides of Congress.

Mr. ROHRABACHER. Well, fine.

Dr. STONE. And so I didn't invent——

Mr. ROHRABACHER. Fine.

Dr. STONE. But secondly——

Mr. ROHRABACHER. Well, I will have to tell you that I disagree with—quite often, when this Congress irresponsibly authorizes money, and doesn't say where it is coming from. You are an engineer, where do you want us to take it from?

Dr. STONE. Well, you mentioned the military. The military has well over $22 billion——

Mr. ROHRABACHER. Okay.

Dr. STONE.—for its space research program. A lot of the Constellation efforts——

Mr. ROHRABACHER. Okay.

Dr. STONE.—are efforts that could be leveraged by the military. Indeed, when the Shuttle is gone, satellites are going to need to be repaired in different ways, and I would think that a lot of the technology that would be developed under the Constellation program would be dual use, and so, it would not be unfair to leverage some of those funds.

Mr. ROHRABACHER. All right. That is a good answer. That is what I was looking for. So, you think that we can actually find more funds by finding, by looking into what is now in the DOD

budget, and either rechanneling them, or leveraging them, and making sure that they pick up some of the costs for what you want to do on the NASA side. Is that what you are talking about?

Dr. STONE. That was one suggestion. The bottom line question is, though, if you ask NASA to do something, then you have to pay for it, so if you are not going to give us the billion dollars, then you have to decide what we are not going to do.

Mr. ROHRABACHER. And I agree with that as well, but let us just note that when people are advocating that we are going to end up spending so much more money, it has got to come from somewhere, and almost, you know, in my 18 years here, at least the Democrats now are suggesting that we have pay go, you have got to know where the money is coming from in order to advocate something, and I think to be taken seriously, and the suggestion you just gave, I think, is a good suggestion.

Dr. STONE. Thank you.

Mr. ROHRABACHER. All right. Let me note that when we are talking about the workforce and future workforce, which you also stressed, we should be, I think NASA should be focusing more, although we just heard the testimony that there are 400, was it interns?

Ms. DAWSEY. There are 400 cooperative program interns at NASA.

Mr. ROHRABACHER. Right. It would seem to me that there should be more than that. That is a very cost-effective program. We have passed scholarship concepts here, which I have pushed for over the years, to try to target those people who are getting their education, and may not be able to afford it, unless we help them. The scholarships and the internships and apprentice programs, these are all things that I think are very cost-effective that should address some of the concerns of Dr. Stone and others that have testified today.

Let me note that for a long time, I have been on this committee now for 19 years, and for at least 15 of those years, we were begging for a space strategy, and no President gave it to us except this President, and I have my differences with this President on a number of issues, but I will suggest that he did give us a space strategy. He wants us to focus on the Moon, he puts that forward, back to the Moon is the primary mission, and if we now know that that is the space strategy, and we all were begging for one, shouldn't NASA be restructured so that it meets that strategy as its primary goal?

And you are not going to do it by keeping NASA exactly the same number of, you know, of employees, exactly the same number of centers. There has to be a prioritization in order to meet a goal. We finally have somebody set a goal, and I would suggest that we are going to have, Mr. Chairman, I would suggest that we are going to have to do some serious reform if we are to suggest to the people that we are serious. Now, I just asked Dr. Stone to be serious about it, give us an example, we have got to prioritize as well, and we have accepted the space strategy, let us get to work on it, and I am very, very pleased that Mr. Feeney is going to be the Ranking Member, and working with you, Chairman Udall, and you can count on my active support to try to make sure we reach that goal of back to the Moon, set that strategy, as the President has,

and do the things that are necessary to responsibly reach those goals. Other goals have to be secondary, and it might mean closing some of the centers and letting some of the people go, mainly because you can't, as you say, you have got to spend money. The money hasn't been allocated, so let us spend the money that we have got wisely, to achieve the specific goals that have been set by the President. And I might say, approved by Congress.

With that said, thank you very much, Mr. Chairman.

Chairman UDALL. Thank you, Congressman Rohrabacher, for your spirited interchange with the Panel. I would acknowledge and point out that all of us on the Committee know that we have to find some additional resources, and we are working in a bipartisan way to do so. At this point, I want to yield to——

Mr. ROHRABACHER. Mr. Chairman, could—just one note.

Chairman UDALL. Yes.

Mr. ROHRABACHER. It is finding additional resources or making the system more efficient.

Chairman UDALL. My opinion would be we need to both. Thank you for that question, Congressman Rohrabacher. At this point, I want to yield to Judge Hall, we want to start the clock for a special announcement and acknowledgment. Judge Hall.

INTRODUCTION OF MR. FEENEY AS RANKING MEMBER

Mr. HALL. Mr. Chairman and Members on both sides of the docket, I am honored to say that when Ken Calvert was moved to Appropriations, it meant that we selected from among our group one to be ranking with you, Mr. Chairman, here, and the selection has been made. It is Mr. Feeney. He represents the Kennedy area, and is a very great supporter and very knowledgeable about space and aeronautics, and I think to demonstrate that I recognize him, that I will abandon this area, and let him come on and take my place, and I will go about looking for another job or something. Yield back.

Chairman UDALL. Thank you, Congressman Hall, and as Congressman Feeney moves over here, I will filibuster for a minute or so before I recognize Congressman Feeney. I would tell you that, as Judge Hall mentioned, Congressman Calvert has taken an important position on the Appropriations Committee. He has, I am sure, committed to all of us that we will take this particular committee's interests to heart on the Appropriations Committee, but I feel like we have actually generated a dual benefit, because as Congressman Calvert moves to the Appropriations Committee, we now have a new Ranking Member, Mr. Feeney from Florida, who represents the Kennedy Space Center, and I know will be a strong advocate for all things NASA.

I had a chance to get to know Congressman Feeney a little bit better when we traveled together last summer to see the new series of Shuttle launches. We, as we often do, as Members of Congress, jinxed the launch for that particular day, but those of you remember the narrative, the Shuttle was launched on the 4th of July, which was very appropriate, and I know Mr. Feeney was one of the proud observers that day.

So, Congressman Feeney, I am looking forward to working with you. Welcome, as the new Ranking Member of the Committee, and

the floor is yours to provide questions to the Panel, and to make any comments you would like to make.

Mr. FEENEY. Well, thank you, chairman. I am really honored. I am especially honored that my friend, Ralph Hall, would ask me to take this position. In the interest of full disclosure, you know, I am a real estate lawyer by background. I don't know much about science or space. I have got a lot of people in my district that do, including my wife, who spent about two decades as an engineer for a major contractor at Kennedy Space Center, and I like to point out that my political adversaries regularly say I am no rocket scientist, and that is true, but I am married to one, or she is pretty close, anyway, and that is about the best I can do, but having said that, I appreciate the chairman's leadership, and I agree with him that we are going to need both more resources and more efficient use of our resources, and I think that is an attitude that the both of us share, and I am very excited about pursuing ways to do that.

I am particularly interested in some of the criticism of the strategy that Ms. Dawsey has laid out today, and I think there is a lot of good things in it, but some of the criticism focuses, and I think Congressman Rohrabacher mentioned it, on a lack of an aggressive enough plan for young people. And I should share with you that along with Mark Kirk and Rick Larsen, I was the first American allowed to see the Chinese civil space launch facility in Jiuquan, and that was a year and a half ago, and one of the remarkable things about what the Chinese are doing is that they are having young people develop a next generation rocket. What they admitted to us, and of course, all of their program is in their military budget, and they intentionally obfuscate what they are doing, but they admitted that they have over 100 university centers working on things involved in future space issues, whether it is creating robots to explore the Moon. Whether it is different types of technology. And one of my concerns is, and I think Dr. Black had a great analogy, no matter how talented you are, you can't walk onto a baseball field. I mean, try explaining the rules of baseball to a foreigner. It is almost impossible, and it takes time to understand the rules, let alone develop the specific skills. And I am concerned, Dr. Stone, I think, pointed out with the retirement that we are facing, I am very concerned that we do not have the long-term plan in place to attract the young people that we are going to need to maintain space predominance, and failure to maintain space predominance is simply not an option. We don't know what the Chinese long-term intentions are, for example, but we cannot permit space predominance, anybody other that even potentially could be hostile to peaceful interests, and I think it is very important.

Dr. Black, would you elaborate, because you talk about the fact that we ought to visualize the workforce as more than just the 80,000 people that are working directly in aerospace and also trained in aerospace, but we have got a much larger pool, DOD, aerospace industries, can you give us some idea how we can better use the available pool today, but also, develop a larger pool for tomorrow, of young people?

SUGGESTIONS FOR UTILIZING THE CURRENT POOL OF WORKERS AND DEVELOPING A WORKFORCE FOR THE FUTURE

Dr. BLACK. Well, there actually is, as you are well aware, I am sure, there is an Interagency Aerospace Workforce Revitalization Taskforce Act, which you have been involved with, and that is, I believe, a term thing that is involved, focuses strictly on government entities. One thing I would encourage you to do is try and broaden that. The ecosystem that we talk about includes not only the government, but also, the university community, as well, and the private sector of the contractors, and it is in that context that I think the solution must be sought, in terms of how to balance, move, have flexibility for the overall aerospace workforce.

I would say that if you take your point on China, I think China now is much like it was when I was a kid, at the beginning of the Apollo, I am giving my age away here. It is——

Mr. FEENEY. You mean, much like we were.

Much like—right. And as, I think that it is one thing to maintain existing space capabilities. It is another thing to have young people actually develop new——

Dr. BLACK. Well, that is right. And I think the enthusiasm, what the Chinese youth are probably seeing now is much what the youth of America saw in the late '50s and early '60s.

Mr. FEENEY. I can tell you, their taikonauts are heroes over there. We are——

Dr. BLACK. Oh, you bet. You bet. And so, and I think that is one of the things we have lost, if you—as we listen to various witnesses that came before us and our committee, one of the things that emerged is that NASA is no longer the place, necessarily, where the people in universities are recommending their best students go, and in fact, many of the best students no longer do go there. And one of the reasons for that is programs take so much longer. If you look at what has happened with—I was the first chief scientist for the Space Station Program. I came here in 1985 for that function, and left in '87. I don't have to tell you where we are on that right now.

So, that is the kind of thing that if you are today's youth, and by the way, today's youth, I think, as a professor at Rice University, are—my experience and my colleagues' experiences are that they are much more oriented toward quick return. They are not as career-oriented as many of us were, so I think the ability to attract young people is a much more difficult challenge, and to keep them in the workforce, than it was when we were growing up.

But I think it is important to do that, and Ms. Dawsey points out the 400 kids working. The problem is, many of those are associated with what is truly the sort of crown jewel of NASA, the science programs. They are very excited, and they come over, and that is great, and I don't think that should be discouraged, but the shortage that the Committee noticed was more in the systems engineering, project and program management, and there are very few programs that NASA has to bring youth in those areas. They are very strong in the science areas, but not so strong in those areas, so I think if they are going to truly address the shortages that they have, they need to pay more attention to that aspect, as well.

Chairman UDALL. Thank you, Congressman Feeney. Thank you, Dr. Black. I wanted to acknowledge that a contributing and a very engaged Member of the Committee has joined us, Mr. Melancon from Louisiana. I know at this time, he doesn't have any questions and wants to learn from the panel, so at this time, I will recognize the Member from Alabama, Mr. Bonner, and we all envy Alabama's delegation, and its commitment to aerospace and aeronautics, and the tremendous set of facilities and operations they have down there. So, Congressman Bonner.

Mr. BONNER. Thank you, Mr. Chairman, and thanks to each of the panel members.

I am going to give you an unscripted question, because a lot of times, we get questions given to us that we think we need to put on the record. As a nation, we have often looked to our President or to the head of NASA, or other leaders in the field to set out a vision, and I think it is safe to say that each of the four of you have a passion for NASA, and have a passion for the mission of NASA. But as President Kennedy in the 1960s, and as other Presidents in more recent years have done, in describing their vision of where they would like NASA to be in the 10, 15, 20 years in front of us, where would you like to see NASA be? If you differ from what Congressman Rohrabacher indicated President Bush's mission of taking us back to the Moon, and possibly on to Mars, where would you like, and this is not a loaded question.

I would just like to know from your experience, where would you like to see NASA go in the next 20, 30 years? And it is open to all four of you.

FUTURE VISION FOR NASA

Mr. STEWART. Well, I think in fact, I think that the Vision that President Bush set out is a pretty good one, and it is a very challenging one. I mean, we have been talking this morning as though this is going to be a piece of cake. Well, I mean, given the realities of the budget situation that the Congress faces, and given the realities of the existing NASA workforce, and given the fact that one of the first things that Administrator Griffin mentioned when he took responsibility for that position was that he wanted to bring the core responsibilities back into NASA. He wanted NASA to have the expertise and the experience to take charge of developing the various elements that are going to be needed to achieve the Vision.

And that was exactly the right thing to say. I mean, that was precisely on target, but it laid out a very daunting agenda, because the fact is, and I think both our reports indicate that, the expertise and the technical expertise that is needed to do that does not currently exist in NASA to the degree that it needs to if they are going to accomplish it. So, that is why this workforce thing is so important.

And so, it is a challenging Vision that the President has set out, and it is one that I think has it, I mean, you know, the Shuttle has been, in many ways, a real triumph, in many ways, a great tragedy, but because it never really went anywhere, you know, it just went around in circles, so to speak, it didn't have quite the same excitement associated with the Apollo Program.

Well, that is going to change now. And I think when we are actually another couple of years down the road, and the young people of this country see, in fact, that we are going to go back to the Moon, I think there is going to be a lot of them who are going to get very excited about that, as they did before, and I certainly hope that that is what happens. I think it will, and that is—if we could achieve that, I would think we would be—and don't forget, the Vision includes not stopping at the Moon. And so, if you really take that seriously, you have really got yourself an agenda.

Ms. DAWSEY. Congressman, I agree with Mr. Stewart. I think that the Vision set before us is an exciting Vision, and it is where NASA should go.

I would like to say that our Administrator, Mike Griffin, is doing his best to carry out that Vision. He has reorganized NASA back to the, almost to look like the organization under, during the Apollo era, and we are all tasked, Mike Griffin has spoken very directly, as many of you may know, he is a very open, direct person, and he has told us what he expects of us. And yes, it is a daunting challenge, but I really feel convinced that NASA is doing everything it can, given what people are calling challenges in terms of budget and FTEs, but what we have done in the past year is remarkable.

In terms of workforce planning, for example, I have talked about a governance structure, but we took 75 separate systems just in HR that didn't talk to one another, and we pulled them together, to give the leadership an idea of who is working on what, and when and where. We have a competency management system that now is loaded with personal competencies, as well as position competencies, and they are validated by supervisors or expert panels. That system is married now with the Workforce Information Management System, to show, the CMS shows supply, the Workforce Information Management System shows demand, and together, they are showing us where our gaps and surpluses are, so that we can start building recruitment programs around those.

The other thing that we are doing, in terms of setting, making sure we are moving quickly enough and in the right direction, is we have mapping plans of Shuttle to Constellation, so again, we are watching that workforce, and where we don't have, we have ceiling restrictions, when I mentioned that we had 400 cooperative education students in NASA, they are across all centers. They are in science and engineering, and where most of the science funds are going are to the graduate students, and yes, most of the money for the graduate student program is science.

The other part of the problem is we do have a workforce that has been at NASA a long time. People love NASA. It is an exciting place to work. They come to work there, and it is their career. They are not looking to move on. The newer generation might be, but our experience so far is they want to be there. So, we are putting in place really serious retraining programs. We are developing program project management training programs. We have engineering programs going. We are sending people to colleges and universities, as well as doing internal training. We have realized that we used to be ten centers, and we realized that we need to be one NASA, and Mike Griffin is really pushing that. So, when we look at the exploration program, if work can be done at other centers, the work

goes there. And NASA has educated, intelligent engineers and scientists in all ten of those centers, and so, we have been really, really successful.

Two years ago, we had over 2,000 unfunded FTEs, we have that down to 200 now, because we have moved work judiciously, and we have reassigned people. We have offered buy-outs and early outs to allow us to recruit, and over 1,300 people have left, because we have that flexibility. It is very difficult to explain how all of this is coming together. We are working very hard on the institution side of the house to support the program side of the house, and there are a lot of exciting activities going on. And we also have updated——

Chairman UDALL. Ms. Dawsey, if I might, the gentleman's time has expired, and I appreciate your passion for the subject, and if the other witnesses would like to comment for the record on the question that Mr. Bonner directed, we would be happy to accept those comments.

I want to make a comment and make an acknowledgment before we recognize Dr. Wu. Congressman Bonner talked about unscripted remarks. He is now in a very exclusive group, because Congressman Rohrabacher never makes scripted remarks, to his great credit.

I did want to acknowledge we were talking about heroes in the Chinese society, and we have just been joined by a true American hero, and that is Buzz Aldrin is here, sitting on the front row, and we want to acknowledge the great Buzz Aldrin. Thank you. Thank you for your service and your example, and we are honored to have you here, sir.

I would be honored to yield five minutes to Congressman Wu.

AGE DEMOGRAPHICS OF THE NASA WORKFORCE

Mr. WU. Thank you very much, Mr. Chairman, and thanks for making me a doctor. I have really disappointed my parents by not going down, further down that road. But I am making up for it today.

Ms. Dawsey, perhaps I will give you an opportunity to follow up on the answer that you were making, and I am asking this question just based on anecdotal evidence, personal experience of visiting three or four NASA centers, and attending several lectures of folks who were with the Mercury, Gemini, and Apollo Programs, and these were active participants. If you did the arithmetic, you sort of thought oh my gosh, you know, these are folks who were in their early to mid 30s when they were in charge of major parts of the program.

That is one information set, if you will, and then, during my walkthroughs, and this could be anecdotal and not accurate, it could be because of the people I was with, and what I was looking at, but it sure seemed to me like, and I hate to use the term old, because these were folks about my age, maybe slightly older, maybe slightly younger, but there were a whole bunch of folks who were sort of longer in the tooth, like me, than coming to the younger age groups, there seem to be precipitous dive-downs statistically, and then, as you get to the youngest of the professional groups, or out in the assembly areas, there might be a little blip of younger

people. But there seem to be a real collection of people at the older end of the spectrum, and then, at least as a significant valley of people in the in between range, and a shortage of younger people.

And I just, when I observe that, and this was, you know, over a period of a few years, and I have not been back in the last 12 months or so, at least, I have a concern in the back of my head about whether we have the right, whether we will have the right personnel mix to accomplish the missions that have been set out for us, and it is not that you don't learn a lot, get better at things, as one hopes, also, as one gets older, but I am just wondering about the age distribution of the workforce that we have today, as compared to the early exploration phases that NASA engaged in, whether that has something to do with NASA budgets, whether that has something to do with the competitive arena that you all are engaged in, with the private sector or others, and I would like to just turn it over to you and the rest of the panel to address that as best you can.

Ms. DAWSEY. I will try to keep my response shorter. One of the reasons that what you observed is true is NASA has always worked hard not to conduct reductions in force, and in the '90s, when there was major downsizing across government, NASA, attrited through natural attrition, and did not conduct reductions in force when most other government agencies did. So, that is why you see that gap in the middle.

As I said, when we are able to hire, we are trying to hire to fill that, to do the succession management kind of hiring, so that we have people who are filling in the middle group, and bringing in younger students. We recognize we do have an issue, and we are working to address it.

One of the ways we are addressing it is we are having different—Constellation is relatively new, and we are just finishing the systems requirements, and the systems requirements reviews this month, and we are going to do a program baseline synchronization following that, and that will show, give us a better idea of what the new requirements are for Constellation and where we need to direct our recruiting, and so, that is another effort to know what kinds of skills and when we can start hiring to fill those skills, those skill needs.

Mr. WU. Thank you. Would any of the other panelists like to make a comment?

Mr. STEWART. You are right about the age distribution and so on. It is very striking, and a good part of this is due to the fact that in the '90s, there was a job freeze in most areas of NASA, and it was very difficult to deal with that, and there weren't any fresh outs coming in in several of those years. And I was on the Aerospace Safety Advisory Panel in those years, and we wrote specific reports on the safety implications of not having adequate workforce dealing with the Space Shuttle, and it got to be 2000, 2001, those restrictions were relaxed, and we could begin to hire young people and so on.

But there are going on in NASA today, and we talk about it in our report, various experiments, which are very encouraging—let me see if I can get the right title on it—the Contracting Intern Program—which has been done in the Office of Procurement, to go out

and find young people, bring them in, circulate them around through the centers, so they don't get a headquarters mentality, has been very successful.

There are a number of examples in other federal agencies, which we talk about in our report, that I think NASA could usefully adopt, and not at any great additional funding, none of these are going to cost more money, but there are examples, and I think the panel agrees, I don't agree with much of what Dr. Stone said, let me say, but I do agree that we have got to get more young people in.

Chairman UDALL. Mr. Stewart, thank you. The gentleman's time has expired. We have just had a series of votes called, but I think we will try and get another round from the Chairman and from the Ranking Member, if you all would be willing to stay, and then, we will have to adjourn the hearing.

WORKFORCE IMPLEMENTATION PLAN

Ms. Dawsey, you stated that NASA has a Workforce Implementation Plan to accompany the Workforce Strategy. Does that plan have specific objective, steps to achieve those objectives, specific milestones and resources requirements, and if not, why not, and would you please either way, provide the Implementation Plan to the Subcommittee?

Ms. DAWSEY. Yes, I think it is on, the Implementation Plan is on its way to the Subcommittee, if you don't already have it. It was requested on Monday, so you may have it by now.

The Workforce Implementation Plan is very comprehensive. I mentioned the three goals that we had, and each of those goals has three objectives, but the total is 150 tasks to implement the strategy.

Chairman UDALL. Does it have timetables and milestones?

Ms. DAWSEY. Yes, it has timetables and milestones, and we have an automatic tracking system, and the automatic tracking system shows the milestones, the metrics, timetables, and the leads. And it is agency-wide, we have—some of our centers are some of the leads on the projects, on the tasks.

Chairman UDALL. Thank you, and we look forward to reviewing that plan when you send it over to us. Thank you.

Dr. Black, the National Academies report notes that it is critical to maintain in-house scientific competence to provide leadership and to maintain expertise in specialty areas that are not broadly practiced in universities and industry. Would you elaborate on that point?

IMPORTANCE OF IN-HOUSE SCIENTISTS AT NASA

Dr. BLACK. You know, the in-house scientists at NASA play a very special role. They provide the linkage with the project and the science objectives of the missions. They help translate the requirements. They are, in a sense, the guardians of the sciences, as the trades need to be made, and as the mission goes forward.

And these are the kinds of activities that typically university people do not have the time or the inclination to stay involved with. So, it is very important that NASA maintain a core scientific

expertise with people who have the ability to work with the projects, work with the engineers, to make sure that the projects are being done in a way that really realizes the scientific objectives that are set out. And so, these are the kinds of skills, if I understand your question, that we think that it is important to maintain inside the Agency.

We did remark in our report that it would probably be worthwhile at least doing a head count, and see whether, in fact, all of the scientists associated with NASA need to still be involved that way, but that is a separate issue.

Chairman UDALL. In the couple of minutes I have remaining, anybody else on the panel want to comment on that particular question? Mr. Stewart.

Mr. STEWART. Well, somewhere before the hearing is over, I want to just say clearly for the record, that I think Dr. Stone has seriously mischaracterized the NAPA report, and I take real exception to some of the things that he said. I just want to get that on the record. For example, nowhere in our report do we talk about BRAC commission. It just isn't there. I mean, we talk about the fact that there ought to be a systematic methodology for looking at the centers, for matching the responsibilities of the centers to the workforce that they have, and providing the flexibility and tools that are necessary to get the right people to the right place at the right time.

The Senate Appropriations Committee, when they asked us to do this report, I don't think anticipated that we were going to come back to them and say well, you know what, folks, what you need to do is appropriate more money. I don't think that was what they had in mind when they gave us that assignment. We didn't get into the issue of what the NASA budget ought to be. That was not our assignment. Our assignment was how do you make a flexible, scalable workforce a reality in NASA, given the tasks that they have to accomplish, and the budget restraints that are part of their world, and we have attempted to do that.

And if one reads the report carefully, you will see we are saying you need data, you need data at the right places, you need data that is integrated. You need mechanisms, and we have provided several, that will help you make sense out of that data, and then, you need the tools that you can then act on that data. That is essentially what the report is all about.

Chairman UDALL. Thank you, Mr. Stewart, and you can certainly submit additional testimony on that line of thinking.

Mr. STEWART. I think we will.

Chairman UDALL. Dr. Stone, you want the last 38 seconds?

Dr. STONE. Just check the PDF file and do a search for BRAC. You will find it.

Chairman UDALL. Let me turn, at this time, to the gentleman from Florida for the final round of questioning. Mr. Feeney.

Mr. FEENEY. Well, thank you. Again, I want to thank Chairman Udall, and we have to run off, and we have got a series of about eight votes, so this will probably be the end, so that you guys can go to lunch, and we can get about our business.

RATIO OF PERMANENT AND NONPERMANENT CIVIL SERVANTS

I focused earlier on the need to recruit youth, whether directly in NASA, or DOD, or the aerospace community, that are excited about this, and now, I want to address a question that Dr. Stone has raised and Mr. Stewart has raised, and that is the question of what the proper balance is, being the strategy that Ms. Dawsey described, talks about a more appropriate blend of permanent and nonpermanent civil servants.

And I guess I would like very briefly, because we only have a few minutes, I think I know Dr. Stone's answer here, but I would like to have the, maybe he can address this very quickly, but then the others. What is the proper ratio? How do we determine that, and for Ms. Dawsey, who I guess we will let finish up, how is NASA going to make these judgments and decisions about who ought to be permanent, as opposed—who ought to be nonpermanent civil servants.

Dr. Stone, you want to start?

Dr. STONE. Just briefly. As I said in the beginning of my opening statement, there were 36,000 NASA civil servant employees the last time we went to the Moon, and we went there successfully. And now, we have only 16,300 permanent, full-time civil servants left.

And rather than give a long answer right now, I would just encourage the Subcommittee Members to take a look at the *Columbia* Accident Investigation Board and their advice on this topic, because I think there is a detailed analysis done by an objective panel about the role of over-outsourcing technical responsibilities to the private sector, and undermining the internal technical abilities of the agencies, and that contribution to the *Columbia* disaster, and I think that analysis is thorough, and that would give you an idea of what our concerns are. I can't give you a magic number, but I think when you look at the situation today, and you look at the graph that I showed you up there, the biggest problem facing NASA today is not to reduce its civil service workforce, and so, the obsession with this is a little bit troubling, considering that is not what the big problem is.

And secondly, in one of the responses made earlier by Mr. Stewart, he said that the problem of recruiting young people was only in the '90s, but if you take a look at the graph, half of that fivefold reduction in the employees between 30 and 35 was between 1993 and 2000, and the other half of it was between 2000 and 2005. So, all I am saying is we are not hiring young civil servants, and the few young civil servants that we are hiring, we are hiring into term positions, which are much less attractive than the positions that were open to young people when I was looking at the Agency.

Mr. FEENEY. We are running out of time very quickly. Dr. Black and Mr. Stewart.

Dr. BLACK. I just want to know if I get hazardous duty pay for sitting between these two.

No, I don't really have that much to add. I think it is, the only thing I would say here is that, do not fall into the trap of just looking at a simple curve or two, and listening to numbers about how

many are in this bin or in that bin. This is a far more complex issue than that, and to look at the dynamics of how you get people in, as I said earlier, to look at the differing timescales for the sources and sinks of these people, understanding the evolution of this workforce is a very, very daunting problem, and I don't think we have our arms anywhere near yet around how to do that.

Mr. FEENEY. Mr. Stewart.

Mr. STEWART. You can't give a precise ratio off the top of your head. It is a position by position decision that the hiring authority has to make, and it is the nature of the position, the nature of the responsibilities that person would hold, along with a number of other factors, and we have a very precise decision guide in our report that will help managers make that decision in a coherent, rational way.

In some cases, a term employee fits the position very well. In other cases, the term employee would not be a good decision, but you have to make that in a kind of rational way, and not just sort of grab something out of the air, and what we have tried to do here is to provide a mechanism for doing that in a rational and coherent way, and if that is done, we think that the actual ratio will take care of itself.

Mr. FEENEY. Ms. Dawsey, you have got about 10, 20 seconds.

Ms. DAWSEY. Okay, first of all, using term appointments is not for the purpose of attriting civil servants. The purpose of the term appointment is to look at work that is changing over the next 20 years, and making sure, as Mr. Stewart said, that the position dictates the type of appointment. Term appointments are for two years initially, but can be extended up to six years, and with our new term flexibility, we can convert without further competition to permanent if we, in fact, still need the skills. Right now, we have a skills mix issue that using term appointments will help us prevent in the future.

Chairman UDALL. Thank you. We are in a bit of a hurry, so you will understand as we depart quickly, but I want to thank the panel particularly, and for the very forthright and impassioned conversation we have had. And Dr. Black, you can apply for hazard pay at the site office. But I think that as a service we all care deeply about NASA. We have a passion for its future, and we also have great pride in what it has accomplished, and that is the point of the hearing, and the point of your all's appearance.

If there is no objection, the record will remain open for additional statements from the Members, and for answers to any follow-up questions the Subcommittee may ask of you all, the witnesses. Without objection, so ordered.

The hearing is now adjourned.

[Whereupon, at 11:30 a.m., the Subcommittee was adjourned.]

Appendix 1:

Answers to Post-Hearing Questions

ANSWERS TO POST-HEARING QUESTIONS

Responses by Toni Dawsey, Assistant Administrator, Human Capital Management; Chief Human Capital Officer, National Aeronautics and Space Administration (NASA)

Questions submitted by Chairman Mark Udall

Q1. What are the critical milestones for NASA's workforce planning over the next few years, and do you anticipate any difficulties in reaching those milestones?

A1. The single most critical milestone for NASA's workforce planning over the next few years is the end of the Shuttle Program in 2010. As the new Constellation Program begins, NASA is shifting from a primary mode of operating and sustaining two major legacy systems, to a period of concurrent development of several new systems, and then to a period of transitioning from exploration back to operations. Operations personnel will be critical elements of developmental design, testing, and verification activities for Orion and Ares I initially. Once operational, the next developmental iteration of Ares V, the Earth Departure Stage, and the Lunar Surface Access Module will begin, thereby concurrently driving the need for a substantial developmental workforce. Thus, the NASA paradigm must shift more than once over the next few years. First, toward our new focus on development, and then to operations cycles that allow the Vision laid out in the *NASA Authorization Act of 2005* to be fully executed on the schedule and funding profile outlined by the President and Congress. NASA's overarching goal is to preserve its critical skill base, ensure the viability of its core competencies, and execute the bold missions assigned to the Agency—this will be challenging, dynamic, and evolutionary. The major milestones for workforce planning related to transition are tied to the design milestones for the Constellation program (including initial operational capability for the Orion/Crew Exploration Vehicle currently planned for March 2015) as well as the retirement of the Shuttle program in 2010. NASA will evaluate these milestones, and revise them as appropriate, as part of the annual Planning, Programming, Budget and Execution process.

Workforce and critical skills must be retained for safe execution of the remaining Shuttle missions, managed appropriately during the transition to ensure that the new developmental program workforce requirements are met, and engaged during the period following Shuttle retirement in 2010 prior to initial operational capability of the Orion/Crew Exploration Vehicle. For those elements of our new spacecraft systems that are based upon heritage Shuttle hardware or existing designs, the skill set requirements will be directly transferable to the new programs. In other cases, some of our workforce will have to shift roles, jobs, and possibly duty locations as the needs of the new programs require. The inherently more efficient design of the new systems will result in a need for fewer direct operations, support, and processing skills. Thus, some of the operations-focused workforce will be leveraged and shifted to more development-focused activities such as planning, design, testing and verification, and integration in order to build a workforce capacity that enables future developmental cycles spanning the transition from initial Ares I/Crew Launch Vehicle and Orion capability, to development and fielding of Ares V, Earth Departure Stage, Lunar Surface Access Module, Lunar Outpost, and then to systems that will take America to Mars.

NASA plans to maintain this vital workforce and experience through final fly out of the Shuttle through: applying some of the new processes required for the new Ares and Orion vehicles to Space Shuttle processing in order to give workers the skills and hands-on experience they need to qualify for future work; non-monetary award based strategies; financial incentives when necessary; conversion to temporary and term appointments; and solid leadership. In addition, NASA is developing integrated workforce requirements across the Shuttle, International Space Station and Constellation programs. This will help with scenario planning, identification of gaps and overlaps in skills availability, and further refinement of the workforce profile. All of these steps will ensure we maintain the proper workforce for continued safe operations.

Q2. Your testimony notes that "with an enhanced workforce planning capability, NASA will be able to determine the demand for, and supply of workforce skills based on current and projected work requirements." What is the timetable for having the enhanced workforce planning capability, and how are decisions on workforce being made in the meantime?

A2. NASA's workforce planning capability is being enhanced in two key areas: (1) the Planning, Programming, Budget and Execution (PPBE) process; and, (2) the improvement of the quality of planning data used to determine gaps between workforce supply and demand.

As explained more fully in the response to Question for the Record number nine below, workforce planning at NASA is programmatically driven through the PPBE process. Formulation of the FY 2009 budget is the first time that NASA is fully integrating workforce planning into the PPBE process. FY 2009 budget formulation is currently in process, and the impact of enhanced workforce planning integration is already being seen as workforce analysis drives Agency mission and work distribution planning. In addition to the normal PPBE data collection, the Agency is using the NASA Workforce Integrated Management System to improve its ability to track and manage the Available for New Work pool (uncovered capacity; i.e., civil service employees at NASA that are not currently assigned or supporting Agency programs) through new data collection formats.

NASA plans to complete several efforts to improve the quality of workforce planning data for use outside of the budget process by the end of the calendar year. One important initiative is the development of a Strategic Workforce Management Model which will be an Agency-wide "FTE demand" (i.e., the anticipated long-term need for workforce FTE, to accomplish funded programs and projects) model to be used in workforce planning activities. In addition, NASA is holding Agency-wide capability assessment forums to further refine the Agency's workforce planning picture. Finally, the Agency is now evaluating several modeling, simulation and analytical tools in an effort to better capture system dynamics and requirements-driven workforce and skill-mix forecasting.

Q3. The National Academies report recommends that NASA increase opportunities for younger workers to obtain hands-on flight development experience through NASA's sub-orbital programs. The report also suggests that NASA fund these hands-on training opportunities through the Education Office. Does NASA have any plans for adopting this recommendation and has it been discussed with NASA's Education Office?

A3. Experience has shown that exciting and compelling NASA missions truly can inspire the next generation of explorers, innovators, and leaders. NASA's unique program content, people, and facilities can be leveraged to spark interest, capture imaginations, and guide students toward careers in STEM fields while increasing their scientific and technologic literacy to the benefit of the Nation.

A top priority for the new management of NASA's Science Mission Directorate (SMD) is to provide greater hands-on development and flight opportunities as a way to prepare undergraduate and graduate students in science and engineering to lead larger missions in the future. Through NASA's suborbital sounding rocket, balloon, and aircraft research programs, as well as flight projects, SMD is currently conducting a comprehensive study of student hands-on opportunities to better prepare new scientists and engineers in the scientific exploration of space through a Student Collaboration Definition Team. This team was established to: 1) explore best practices in project-based learning exemplifying the nature of NASA's scientific exploration in space; 2) explore additional learning opportunities of a similar character that is not part of a flight missions; and, 3) provide opportunities for input from the community engaged with SMD. This team held its first meeting in early May 2007. A white paper is under development and a community workshop will be held at the end of 2007 or early 2008. The sub-orbital research programs continue their involvement of students in relevant authentic research opportunities. In addition, four new sounding rocket payloads were recently selected for flight, with research launches planned between 2008 and 2010.

NASA's Office of Education in collaboration with the Agency's four Mission Directorates provides additional opportunities for students to engage in NASA mission related experiences. For example, within SMD, a broad spectrum of education activities are sponsored ranging from kindergarten to postgraduate levels. All of NASA's science missions and programs are required to have an education and public outreach component. Through a competitive, peer-review selection process, NASA provides funding dedicated to education and public outreach to researchers. NASA also sponsors graduate and post-doctoral fellowship opportunities. In addition, the Agency is looking for new ways to provide increased opportunities for students to gain greater experience developing and launching their own science instruments, either in conjunction with science missions or through its sub-orbital rocket and balloon programs.

Examples of successful collaborations include:

- Launched in January 2006 as part of the New Horizons Mission, the Student Dust Counter is the first student-built instrument selected by NASA to fly on a planetary mission. Built by students at the University of Colorado at Boulder, the counter will monitor the density of dust grains in space. This data is of particular interest to researchers. Given the nine-year travel time, discoveries from this mission will engage today's elementary school student until college when this spacecraft encounters Pluto.
- Aeronomy of Ice in the Mesosphere (AIM) began its two-year mission on April 25, 2007, after a flawless ride to Earth orbit aboard an Orbital Sciences Pegasus XL rocket. AIM is the first mission dedicated to exploring mysterious ice clouds that dot the edge of space in Earth's Polar Regions. With AIM, Hampton University in Virginia has become the first Historically Black College and University to lead a NASA satellite mission. Undergraduate and graduate students from various STEM disciplines will have an opportunity to join faculty researchers in the analysis of collected data.
- On February 17, 2007, NASA launched five Time History of Events and Macroscale Interactions during Substorms (THEMIS) micro-satellites to study the Earth's magnetosphere. THEMIS will help scientists understand how and why space storms create havoc on satellites, power grids, and communication systems. Students will work with scientists to unravel a variety of scientific mysteries.
- Between the International Space Station, the Space Shuttle, sounding rockets and high altitude balloons, NASA's Education Flight Projects provide hands-on experiences to inspire and motivate students to pursue studies and careers in STEM through participation in NASA research applications. NASA is using its unique assets like the C–9 better known as "The Vomit Comet" to allow students to study microgravity. The Agency is launching student experiments more than 25 miles above the Earth on sounding rockets. And NASA astronauts make phone calls from 240 miles above Earth's atmosphere to students to involve them in current research aboard the International Space Station. All these opportunities take advantage of NASA's flight hardware projects provide real, hands-on experiences to inspire the minds, imaginations, and career ambitions of America's young people.
- NASA's support of higher education students is embodied by the National Space Grant College and Fellowship Program, which continues to provide fellowships and scholarships to students across the country. Recent statistics show that, of the pool of students who completed their degrees, 31 percent were employed in STEM careers and 48 percent continued their education to the Master's, Ph.D., or postdoctoral levels. Many consortia have implemented hands-on, university student-led projects in aeronautics, rocketry, scientific ballooning, rocketry, and nano- and micro-satellite development. These types of projects provide the professional training that enable students to be fully prepared to enter the STEM workforce.
- NASA, in collaborations with the International Space Education Board (ISEB), is increasing science, technology, engineering, and mathematics literacy and enhancing future workforce needs with the development of Global Education Ground Station Network. The network will serve the interest of all universities wishing to launch small satellites, by providing near continuous ground station coverage for all educational satellites. NASA is funding California Polytechnic University (Cal Poly) to collaboratively develop software in support of the Global Educational Ground Station Network. The software will schedule passes autonomously, monitor for errors, perform error correction, prioritize utilization, etc. The network is to be developed by students for students.
- The Office of Education is sponsoring one Science, Engineering, Mathematics and Aerospace Academy (SEMAA) team to participate in ARLISS (A Rocket Launch for International Student Satellites). ARLISS is designed to provide an educational experience to students in the design, flight, and data analysis of a space experiment (an experiment housed in a coke can). This program is to prepare students for an exciting, technical challenge that may lead to launching space experiments into low-Earth orbits and beyond. University aeronautics/astronautics students, high school students, robotic clubs, and hobbyists get together each year to fly their satellite projects in rockets supplied by Aero-pac. Stanford University and others around the world sponsor this project.

Q4. According to the list of NASA workforce competencies provided in the National Academies report, there are 106 NASA workers with competency in astronomy and astrophysics, eight with competency in hydrological science, 36 in air traffic systems, and so on. How is NASA making decisions about how many individuals are needed to maintain core competencies in science and aeronautics areas?

A4. The NASA centers use the Agency's Workforce Integrated Management System (WIMS) to plan the individuals and competencies required for future work elements. WIMS aggregates the numerical data expressing workforce requirements for each center. Center management reviews this planning data and makes adjustments as necessary, including adjustments to the size of specific workforce components. Each center is the focus for specific key capabilities required for the overall NASA mission, including space flight, aeronautics and science capabilities. Through the annual budget process, centers work with Headquarters in making decisions that affect the workforce strength available in the future to provide key capabilities.

Q5a. With respect to the "Ten Healthy Centers" component of NASA's Workforce strategy, Dr. Black questions whether the Centers will have the appropriate staff to handle work that is sent to the Centers. Mr. Stewart raises concerns about how NASA plans to measure the health of its Centers. What are NASA's current plans for implementing the "Ten Healthy Centers" approach?

A5a. NASA has implemented and intends to maintain the "Ten Healthy Centers" approach.

Q5b. What criteria is NASA using to evaluate the health of its Centers?

A5b. An essential attribute of a healthy center is a skilled and flexible blended workforce with sufficient depth and breadth to meet the Agency's challenges. Recognizing that NASA must be able to assess the capability (or "health") of its workforce to meet mission goals, the Agency recently developed six measures of workforce capability that are being used to monitor multiple dimensions of workforce health at the centers and identify areas of misalignment. These measures are: scalability, skill availability and access, performance and proficiency, sufficiency, sustainability, and utilization. They are defined below.

- *Scalability:* Extent to which a center is able to adjust the number of FTE (civil service employees) and WYE (contractor employees) of different types quickly enough to meet changes in workforce demand within an anticipated range of future work.
- *Skill Availability and Access:* Extent to which a center has access to needed competencies at an acceptable quality level for range of anticipated work.
- *Performance and Proficiency:* Extent to which civil service and contractor performance is (or is anticipated to be) reliable for range of work—particularly with work that is new, high risk or inflexible in terms of schedule or cost.
- *Sufficiency:* Degree to which a center has sufficient capacity, appropriate skill mix, and competence within the civil service workforce to fulfill management and oversight responsibilities.
- *Sustainability:* Extent to which a center has sufficient "bench strength" over time to sustain appropriate level of internal capacity in key business, technical, and managerial positions to grow in-house skills and replace workforce as they move up or out.
- *Utilization:* Degree to which civil service workforce is used efficiently to perform the work of the center, in terms of "coverage" of workforce by budgeted FTE dollars as well as efficient and effective use of staff to funded work.

Associated with each measure are qualitative and/or quantitative indicators (including demographic patterns, refresh rates, attrition patterns, career development paths) that each center uses to assess its workforce relative to that measure. The measures can be used individually to describe specific areas of misalignment, but are intended to operate as a set to demonstrate the overall "health" (or capability) of a center's workforce and indicate potential tradeoffs that may be necessary to meet particular workforce objectives.

It is important for the Agency to identify potential misalignments sufficiently early that there is adequate lead time to develop and implement effective strategies to correct the misalignments. For that reason, we have integrated this assessment process with the annual Planning, Programming, Budgeting, and Execution process. The objective is to have centers provide information to the Agency regarding the capability of their workforce over the budget planning horizon using a consistent and systematic approach.

Q6. How are decisions currently being made on whether NASA projects should be conducted by in-house civil servants or by contractors?

A6. NASA has a policy directive in place to address distinguishing between contractor and civil service functions. NASA also has identified specific activities that it has determined to be vital to keep in house. These include: strategic guidance, oversight, fundamental decision-making, sustaining program momentum, retention of institutional memory, decisions about cost trade-offs, and architectural understanding. Decisions regarding whether projects should be conducted by in-house civil servants or by contractors are made within the framework of the NASA Strategic Acquisition Approach. During acquisition strategy planning, leadership considers issues such as alignment with the Agency Strategic Plan and the NASA Ten Healthy Centers policy. Prior to acquisition or to partnership commitments, Acquisition Strategy Meetings are held to validate make-buy rationales and to make final make-buy decisions.

Q6a. How does NASA determine whether it has the right level of in-house expertise to make "smart-buyer" decisions?

A6a. Assuring "smart-buyer" capability is inherent in Agency and center leadership's responsibility to manage NASA's multi-sector workforce. It is inextricably linked with responsible institutional and technical management practiced at NASA. Several major Agency-level processes come together to ensure that NASA has the right level of in-house expertise to make "smart-buyer" decisions. Within the acquisition process, NASA leadership at both the Agency and center level work together in the Strategic Acquisition Approach to make sure that all pertinent considerations (such as key activities and Agency strategy and policy described above) are taken into account in determining which work to contract out and which to perform in-house. Within the budget process, the Agency makes decisions about the assignment of work to centers such that risk to the long term viability of centers and their "smartbuyer" capability is minimized and center health assured. Within the human capital process, recruitment, staffing and development actions are undertaken continually to improve NASA's "smart-buyer" capability.

Q6b. Does NASA plan to use the tools for decisions about the mix of contractors and civil servants in NASA projects provided in the NAPA report?

A6b. It is important to note that NAPA's eight major categories of critical importance in deciding whether to hire a civil servant or use a contractor are not conceptually new to NASA. Considerations of Function, Resources, Workload, Labor Market, Accountability, Risk, Quality/Service Level, and Employment/Flexibility are already part of NASA's decision-making. What is new about NAPA's *NASA Civil Servant-Contractor Decision-Making Guide* is its quantitative approach to using the scoring and rating of multiple criteria within each category to drive Agency make-buy decisions. NASA is currently in the process of coordinating analysis and evaluation of NAPA's *Guide* to determine how it may be incorporated into Agency practice.

Q7. Your testimony refers to the creation of a Workforce Planning Governance Structure. How often does this group meet and could you please provide some examples of the types of decisions that they are making?

A7. The Workforce Planning Governance Structure, established to strengthen NASA's human capital strategic planning capability, has representation from the Agency's human resources community, mission directorates, other mission support offices, and the NASA centers. The governance process will be used to align the Agency's resources in a manner that ensures the effective utilization of the workforce and the skills needed to accomplish the Agency's mission. The focus will be on increasing the level of integration and collaboration across workforce planning functions, improving the quality of information used to make decisions, and balancing short- and long-term planning needs.

There are three main components of the Governance Structure: the Agency Governance Group, a Workforce Planning Technical Team, and other issue-specific ad hoc technical teams that are formed as needed.

The Agency Governance Group is responsible for surfacing high-risk issues and recommendations to senior management, evaluating the results of planning activities, monitoring the progress of the operational groups, and developing workforce planning capabilities.

The Workforce Planning Technical Team is a standing, on-going group that implements workforce planning guidance and policies; helps develop and implement center workforce planning capabilities; and assists in collecting data in support of work-

force activities undertaken by the team. It is the hub of workforce planning information collection, distribution, analysis, and reporting across NASA.

The ad hoc technical teams are formed to deal with specific issues. Their purpose is limited to the issue they are tasked with solving, with a defined scope and timeline.

The Workforce Planning Technical Team is the element that meets regularly to address important workforce issues facing the Agency and to develop strategies to address the issues. It is not the group that makes the key decisions for the Agency; instead, it functions as a working, representative team that studies significant workforce issues and provides information, data, and recommendations to Agency senior management to consider. This team held its first meeting in mid-February and meets (via telecon) every two weeks. This group has focused on a number of significant workforce planning initiatives over the past four months, including:

- establishing a greatly improved process for identifying the Available for New Work (uncovered capacity) segment of the workforce to facilitate finding solutions to mitigate the problem; and,
- ensuring that centers understand the new "Measures of Workforce Capability" adopted by the Agency to assess workforce health at the centers so that the information centers provide will generate valuable insights into the workforce challenges they face, enabling Agency leadership to identify the actions needed to strengthen and sustain workforce health.

Q8a. At the June 13, 2006, Subcommittee hearing, you testified that NASA had reduced its uncovered capacity through retraining, job fairs, and buy-outs, among other measures. What is the current status of NASA's uncovered capacity and how does NASA track who is uncovered and by how much?

A8a. As stated in the NASA response to Questions for the Record number two above and number nine below the Agency plans individuals to programs and projects at one tenth of an FTE level by program and project at the work breakdown (WBS) level by name in the current year and next two years in the Agency Workforce Integrated Management System (WIMS). WIMS identifies which of the workforce is not fully assigned to a WBS and by how much.

NASA's level of Available for New Work has been reduced to less than 100 FTE in FY 2008, an amount that is historically manageable as it is owed primarily to normal starting and stopping of tasks or projects. The success in reducing the level of uncovered capacity is due primarily to assigning Constellation Program work to every NASA center so that all centers are vested in the space exploration mission. While NASA still has skill mix imbalances at the centers the Agency continues to address those through early out/buy-out measures.

Q8b. At last year's hearing, you noted that NASA had established retraining programs lasting several months at research Centers to allow staff to develop the skills needed to handle new work sent to the Centers. What is the result of those training programs and how are you assessing the effectiveness of those programs?

A8b. Many NASA centers have initiatives in place to ensure they have employees in place with the skills necessary to take on Constellation work. The retraining efforts predominantly focus on program and project management and systems engineering. Many of these initiatives are in their infancy, with identified employees still working on competency and skills development. NASA's Academy for Program Project and Engineering Leadership, which provides the bulk of this type of training within the Agency, conducted over 1,600 instances of related training in FY 2006. Training instances in FY 2007 will exceed last year's number.

NASA's Langley Research Center (LaRC) in Virginia has begun a program of retraining that includes technicians. LaRC has also offered open enrollment courses on program management. In addition, LaRC has begun a series on program management and exploration which consists of courses, mentoring, projects, and details to other centers. To date, the participants have completed all the course work and are scheduling other aspects of the curriculum. NASA's Glenn Research Center in Ohio has recently begun its second class of systems engineering. They are conducting a mid-point evaluation of the first class and will make needed adjustments. Program effectiveness will eventually be assessed by engineering and project management feedback.

In addition, other centers have transition teams in place to manage retraining efforts. NASA's Johnson Space Center in Texas has established an Engineering Academy designed to provide a comprehensive training program for the next generation of engineers. This effort will prove especially useful to those engineers currently

supporting the Space Shuttle Program, as they gain knowledge & training in design and development competencies. NASA's Kennedy Space Center in Florida centralized all day-to-day engineering functions into a new Engineering Directorate in October 2006. The realignment effort will enable them to more efficiently and effectively utilize current engineering skills and resources as well as position themselves to be prepared for meeting Constellation workforce and skills requirements. NASA's Marshall Space Flight Center in Alabama has created a Shuttle Transition Team that is heavily engaged with human resources staff to define skill gaps, recruitment and retraining strategies.

Not all of the research centers have been conducting retraining. NASA's Dryden Flight Research Center in California, for example, was able to hire within the past year. Individuals were selected with the needed skill set to support the Center's Constellation work.

The centers are working to ensure that they have the necessary competencies and skill sets to support the Vision for Exploration. They have positioned themselves well as the workforce plan more sharply focuses on the competencies needed for the Agency's future.

Q9a. Your testimony states that NASA has "integrated and synchronized workforce planning with the development of program and project budgets." Could you please describe in concrete terms how workforce planning is integrated with programs and with project budgets?

A9a. NASA utilizes the Planning, Programming, Budget and Execution (PPBE) process as an Agency-wide methodology for aligning resources in a comprehensive, top-down approach that supports the Agency's vision and mission. It focuses on translating Agency strategy, priorities and planned outcomes into actionable programs. Workforce planning at NASA is programmatically driven through this budget process. The preparation of the FY 2009 budget is the first year that we have fully integrated workforce planning into the PPBE process through all phases.

Several of the annual PPBE process milestones incorporate workforce planning: (1) Both the Strategic Program Guidance and the Program and Resource Guidance incorporate workforce planning policy guidance; (2) Interim snapshots of workforce distribution data inform all of the milestones within the programming phase of PPBE; (3) The Institutional Infrastructure Analysis includes the evaluation of qualitative Workforce Measures of Capability (e.g., sustainability, scalability, etc.) and quantitative workforce planning data focused on areas of concern collected from the NASA centers; (4) Workforce data and analysis informs make-buy decisions made under NASA's new Strategic Acquisition Approach, as well as final Programming decisions; and, (5) Outputs of the PPBE Programming phase include a comprehensive plan for work and workforce distribution for the current and next five fiscal years.

Data collection, tracking and reporting for PPBE workforce planning is managed through the NASA Workforce Integrated Management System (WIMS). Within WIMS, the *supply* of current and planned civil servants is aligned with planned program-based work *demand* and funding sources. WIMS outputs include a workforce plan that ties each employee (to the 1/10 of an FTE level) to a specific project work breakdown structure (WBS) element for the current and next two years. For the following three years, FTE-competencies are planned by WBS. Because of these plans, each NASA center understands how many FTEs and what type of FTE is funded for the various projects assigned to it, and it can plan its human capital programs accordingly.

Q9b. Prior to this integration, how were workforce decisions made with respect to program developments and project budgets?

A9b. Prior to the implementation of the Planning, Programming, Budget and Execution (PPBE) process, there was a greater separation between budget planning and workforce planning. The processes were more sequential, with workforce planning being secondary. Budget decisions were made first, and these drove workforce planning. In recent years, key aspects of budget planning and workforce planning take place concurrently. NASA's implementation of full cost accounting has shed light on the workforce impacts of what previously might have been understood as primarily budget decisions. Currently, analysis of the workforce frequently influences and even drives budget and mission planning decisions; for example, in determining at what NASA center work packages will be directed.

Q10a. Your testimony notes that "Competencies are the common thread that tie the elements of workforce management together. CMS is a relatively new system that we are continually working to improve. By integrating CMS with other

workforce planning tools, we are able to not only identify, the critical current and future competency gaps and surpluses, but we can weave that competency information throughout the workforce management process." Could you please describe the history of the CMS development along with milestones for improvements that are being made or are planned to be made.

A10a. The Competency Management System (CMS) is managed and operated by the Office of Human Capital Management at NASA Headquarters, working with mission directorates, mission support offices and the NASA centers. The primary objectives of CMS are to maintain a listing of workforce competencies across the Agency, align the expertise of the workforce to the mission via the budget planning process, and enable the Agency to build the level of expertise in targeted knowledge areas.

The CMS was deployed in multiple phases as it grew in scope and operations. The goal was to try and minimize the impact and work at the centers, so early deployment was limited to a small audience at each of the centers. This also allowed greater flexibility with the design by allowing the team to incorporate lessons learned from one phase into the next.

Since the start of the program, the Agency has undergone several major strategic and operational changes. Therefore, the CMS must, and does continue, to adjust and adapt to the changing business environment in order to maintain its relevancy and usefulness to the Agency's mission.

The history of CMS development along with milestones for improvements:

Development/Center Implementation Pilot Phase (2000–2001)

- Developed the competency model (concepts, data structure and business process)
- Developed a Competency Dictionary at one center (content from subject matter experts)
- Collected competency data from all 1,800 employees at the center over a three month period
- Supervisors and peer reviewers conducted validation of employee competencies over a five month period

Agency Implementation Pilot Phase (2001–2003)

- Developed the Competency Dictionary for the entire Agency (consensus by subject matter experts from the centers)
- Generated an initial Position Level Competency Inventory (based on NASA Classification Codes)
- Centers refined the position inventory
- Performed FY 2005 interim budget assessment of workforce FTE needs in terms of competencies
- Performed first GAP analysis and identification of critical competencies

Agency Implementation Deployment Phase (2004–2006)

- Performed FY 2006 budget assessment of workforce FTE needs
- Conducted revision 5 of the Competency Dictionary (increased review audience to include functional offices at the corporate level)
- Requested competency data from all employees in the Agency
- Supervisors performed validation of employee competencies
- Planned deployment of additional functionality (2007–2008)
- Integrated with the employee development process and the Agency's new Learning Management System
- Modified the Agency workforce gap analysis process to adapt to changes of the Agency budget planning process

Operational & Maintenance Phase (2008–)

- Perform annual review and revision of the workforce competency dictionary
- Perform annual Agency workforce gap analysis in conjunction with the Agency budget submittal
- Supervisors and human resource specialists maintain accurate and updated competency requirements for job positions
- Employees and supervisors develop and implement individual learning plans to build and maintain employee's expertise

Q10b. What are the other workforce planning tools being integrated with CMS and what is the plan for that integration process?

A10b. Competency Management System (CMS) data, plus a comprehensive set of other workforce data currently available, are already providing good definition of the current workforce. The Workforce Information Management System, in conjunction CMS, provides the Agency with good information about current workforce gaps and surpluses. Additionally, the Agency has a business intelligence tool populated with current and historical workforce data. This business intelligence tool enables multi-dimensional analysis of workforce trends and forecasts future retirements in specific organizational, occupational and skills areas. Forecasting of retirements enables the Agency to do one aspect of advanced planning for the workforce, determining if there are workforce components which are at increased risk due to future losses.

Q10c. When will NASA be in a position to identify current and future competency gaps and surpluses using workforce-planning tools such as CMS?

A10c. Currently, NASA is planning to utilize CMS in the fall of 2007 to perform workforce competency gap analysis based on the proposed FY 2009 budget. This information will show trends in planned competency needs over the next five years and the forecasted ability of the workforce to meet those needs. From this analysis, areas of potential competency shortages and surpluses should be identified.

The second aspect of workforce planning requires effective processes for getting good definition of future work requirements. This is directly related to program planning and budget formulation, and, for the first time, NASA is integrating workforce planning with the budget process for the FY 2009 budget. NASA anticipates successful identification of potential workforce gaps and surpluses. The Agency also anticipates it will have learned important lessons to apply to the FY 2010 budget and workforce planning processes.

Q11a. Your testimony states that "The capabilities of HCIE (Human Capital Information Environment) are enormous, limited only by our ingenuity in identifying the boundless ways in which information can be woven together to drive decisions and enable success." Could you please describe the requirements for the development of the HCIE?

A11a. Developing the Human Capital Information Environment (HCIE) is the first step in creating a fully integrated, strategically focused, business management environment for online, near-real-time access to comprehensive information needed for rapid and accurate decision-making. The basic requirement for HCIE development is inter-operability and close integration with NASA's financial management system through a shared database to provide dependable human capital information, integrated with information from other business areas, such as finance, for all organizational elements. This common, robust data source will eliminate the need for stand alone, non-integrated systems, which often offer redundant capabilities. The authoritative data repository, HCIE, will furnish a wealth of information in support of the demands of this mission-driven, project-oriented Agency. HCIE supports the President's Management Agenda (PMA), implementation of the Vision for Space Exploration, and our NASA Workforce Transformation; and aligns with our Information Resource Management Strategy and the HR Lines, Business, and EGov requirements. Finally, HCIE has been developed using a service-oriented architecture which provides point integration and inter-operability with our non-human capital applications such as identify management, safety, security, legal, facilities, and financial management.

Q11b. What is the relationship of the CMS and other workforce planning tools to the HCIE?

A11b. The HCIE is the vehicle to enable integration of all human capital tools, including CMS and the other workforce planning tools. NASA has already integrated information from CMS, WIMS (workforce planning tool), the Agency's Labor Distribution System and the Agency's budget system with the HCIE data warehouse. By integrating authoritative data from each of NASA's workforce planning and financial systems within a single data warehouse, the Agency enables the generation of complex queries, analysis and reporting of information most useful to project managers, program managers and workforce planners.

ANSWERS TO POST-HEARING QUESTIONS

Responses by John G. Stewart, National Academy of Public Administration Fellow; Member, Panel on NASA Multi-sector Workforce

Questions submitted by Chairman Mark Udall

Q1. Both the NAPA and the National Academies reports call for more detailed information on the workforce at NASA's Centers. Could you please discuss in specific terms what information the Agency needs in order to support long-term workforce planning?

A1. The Panel believes that NASA's workforce planning processes and data collection should address the total workforce, including the work for which it will hire staff as well as for the work it will buy. While the Panel acknowledges the key differences in NASA's relationship with its contractors and noted that NASA is not responsible for managing contractor personnel on a daily basis, the Agency should nonetheless do a competency analysis for this group that comprises two-thirds of the Agency's multi-sector workforce. The contractor competency assessment should be done on an aggregate basis, focusing on cost effectiveness, timeliness of deliverables, and return on investment. In addition to detailed information about needed competencies across programs, NASA needs information on its required skills, certifications, and programmatic/project assignments.

For the contracting organizations, NASA needs such information as:

- Appropriate roles of contractors—for example, the Agency should specifically identify work that is not inherently governmental, is located off-site, is not a NASA core competency, is not needed long-term, requires a unique expertise, or results in a distinct product appropriately delivered by a contractor.
- Contract duration and flexibilities for surge capacity.
- Penalties associated with early termination.
- Cost-effectiveness.
- Return-on-investment.

In terms of its current workforce, NASA will need to identify competing demands across programs and projects. It will need to fully understand the current workforce's availability and competencies and project future workforce requirements across the organization in the short-term, intermediate-term, and longer-term time horizons.

While gathering information on the current civil service workforce, NASA should consider the extent to which current recruiting sources and programs, as well as current training and development programs, are meeting its needs. In addition to the standard information typically collected in workforce planning processes, NASA particularly needs information that allows it to track skill mismatches by individual employees and field centers. It particularly needs information such as:

- Existing competencies, especially for key occupations
- Potential desirability of retraining or redirecting competencies and the cost of retraining, if needed and feasible
- Occupational mix

This information should be collected by center and aggregated for the Agency as a whole.

In order to project future work requirements, NASA needs to collect data in such areas as:

- Specific program demand changes over the short-term, intermediate-term, and longer-term
- Competencies needed during these time frames based on business projections
- Nature of the work to be done, including volume, location, duration, and appropriate component of the multi-sector workforce (tenured or limited duration civil servant, contractor, grantee, university, military, etc.)

As part of this analysis, NASA should consider several key questions:

- How will the structure of the work and its organization, as well as the underlying job functions, need to change to meet these demands?
- How will technology continue to impact the way work is accomplished?
- How can the Agency respond to unexpected requirements or contingencies?

NASA also needs to determine the core workforce required to maintain competencies that may be required over the longer-term, but for which the Agency has a declining current need. By quantifying core workforce requirements, the Agency could ensure a critical mass is available in the future in case of a resurging need. To this end, the Panel urged NASA to use a methodology, such as RAND's, to quantify the "core" workforce required to maintain its critical aeronautics and scientific competencies. Consistent with the Panel's emphasis on the total NASA workforce, the analysis should include both civil service and contractor components. The Panel further recommended that this same methodology be applied to the Shuttle transition process to assist with long-term scheduling projections, quantification of core competencies and proficiencies, and analysis of overlapping mission needs.

Q2. The NAPA and National Academies reports emphasize that NASA should make full use of the NASA Flexibility Act of 2004. *Did your committee conclude that NASA was under-utilizing the Flexibility Act, and if so, why?*

A2. The Panel believes that NASA could make greater use of certain key provisions of the Flexibility Act. One provision that NASA has made extensive use of is the term appointment authority. In this area, however, the dominant practice or intention at most centers has been to convert successfully performing terms, without regard to whether the work they are performing is permanent. The major exception has been Kennedy Space Center, which has no plans to routinely convert terms given the planned retirement of the Space Shuttle.

In addition to the term appointment authority, the *NASA Flexibility Act of 2004* provides the Agency with additional authorities in the following areas:

- Pay a "re-designation" bonus to a current federal employee, who accepts a position with NASA designated as a critical need.
- Pay a retention bonus of up to 50 percent of basic pay if the position meets a critical need.
- Pay a salary of up to the Vice President's for a position when the Administrator finds it necessary to recruit or retain an exceptionally highly qualified individual for a critical position (limit to 10 employees).
- Direct hiring authority for GS–7 through GS–12 scientific and professional positions with qualifying GPA (Distinguished Scholar program).
- Ability to extend Intergovernmental Personnel Act assignments beyond the initial two-year period for up to four additional years.
- Travel and transportation expenses for certain new appointees.
- Annual leave enhancements for certain non-federal experiences.
- Limited term appointment to "career reserved" SES positions to fill a temporary need.
- Qualifications pay to encourage employees to accept a new set of duties or new position.
- Increased maximum rate of pay for NASA–excepted (NEX) employees.

The Panel recommended that NASA use formal decision metrics to ensure that decisions about hiring or converting terms are grounded in work-based criteria. This will ensure that NASA acts strategically, not tactically, in filling its term and permanent positions. Regarding conversions, the Panel believes that they should occur not simply because of a satisfactory performance by an individual, but based on an evaluation of the nature of the work—for example, a core competency inadequately represented in the current workforce or a required proficiency level best achieved through a permanent civil service hire.

NASA has made virtually no use of the Distinguished Scholar program, relying heavily on its long-established co-op program. The Panel believes that NASA would be more effective over the long-term by expanding its recruitment strategy to hire Distinguished Scholars as a way to recruit the next generation of agency scientists, engineers, and administrators. Despite some differences on how best to respond to NASA's workforce challenges, our Panel, the National Academy of Sciences Committee, and the International Federation of Professional and Technical Engineers all agree that rebuilding NASA's early and mid-career workforce is critical.

Likewise, the Panel noted that NASA has made limited use of its IPA authority for external placements, with no more than seven each in FY 2004 and FY 2005. For an agency with changing program needs and priorities and identified underutilized competencies, the IPA program offers an excellent opportunity to leverage scarce salary dollars and FTE through negotiated cost-sharing arrangements with universities, non-profits, State/local governments, and others that might need NASA expertise. Such a mechanism would allow NASA employees with unfunded work, for

example, to contribute meaningfully to another institution and further enhance their skill base.

Q3. The NAPA report mentions strategic partnerships with other federal agencies that demand technical skills as a potential opportunity for managing NASA employees whose skills do not align with current NASA projects. Could you please elaborate on this aspect of the NAPA report?

A3. Given NASA's workforce misalignments, the Panel believes that the Agency could make greater efforts to partner with other federal agencies. Near the beginning of this study, the Academy offered to broker a partnership between NASA and the U.S. Patent and Trademark Office (USPTO) to help alleviate NASA's uncovered capacity problem. Officials at the highest level of PTO were interested in a block of NASA's scientific and technical personnel becoming patent examiners, on a temporary or preferably permanent basis, to reduce patent processing backlogs. It was also interested in accessing NASA expertise to train its patent examiners in state-of-the art aeronautics, nanotechnology, and other scientific disciplines for which the Agency typically receives patent applications. PTO was open to reimbursing NASA, relocating NASA employees, and considering the use of NASA employees at their home centers. In response to this offer, NASA offered no official or strategic agency encouragement for employees to participate, but chose to refer the offer only to Ames Research Center, which posted the information as an opportunity for individual center employees to voluntarily explore on their own.

Despite its stated commitment to a "flexible, scalable workforce," NASA has not vigorously pursued other out-placement options in the belief that future work assignments will require the skills of current NASA employees, and it would therefore be imprudent to put significant effort into out-placement. In interviews, some NASA officials expressed reluctance to directly communicate with employees, both individually and collectively, about the need to manage their careers and take advantage of all available opportunities—both inside and outside of NASA. Some NASA officials even said they were concerned that being too forthright with individual employees about their options would be construed as harassment.

In addition to PTO, the Panel identified other possible federal agencies that could make use of NASA's excess competencies:

- The Environmental Protection Agency, with whom NASA shares an interest in climate change and wind tunnels
- The National Institutes of Health, with whom NASA shares an interest in space implications for medical technology improvements and the lessons to be learned about microgravity's impact on health
- The Department of Energy, with whom NASA shares an interest in basic research as well in various elaborate batteries used in space missions
- The Department of Defense, which has similar need for project and program managers within varied engineering disciplines

This is a challenge across the Federal Government. Some agencies have excess competencies in areas that are critical needs for other federal agencies. It may be useful for the Federal Government to have an informed broker, such as OPM or OMB, to identify opportunities for competency sharing and trading among federal agencies. The broker would be responsible for making matches between federal agencies with skill deficiencies, whether temporary or long-term, with agencies with excess capacity, undergoing low attrition, or mission changes. In today's environment, with such rapidly changing technology, the government's role as financial and human capital steward is likely to require additional adaptive mechanisms to facilitate the government's effective use and development of its human capital resources.

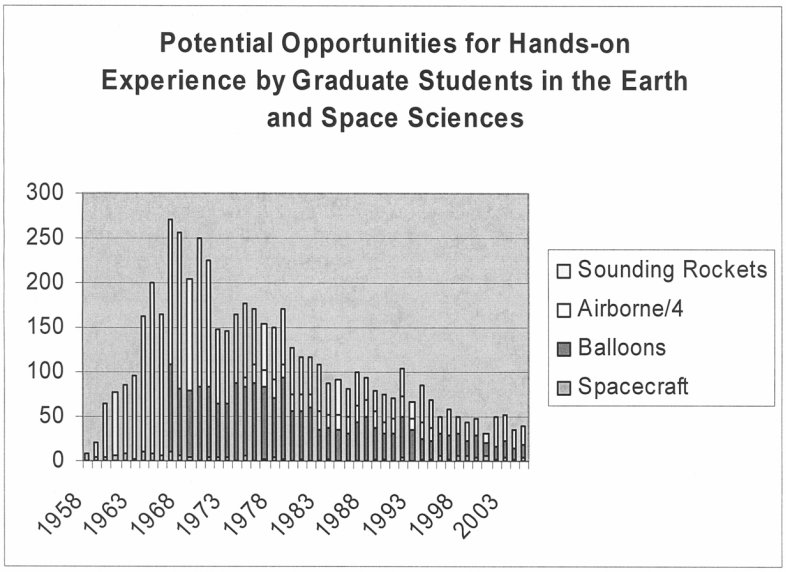
ANSWERS TO POST-HEARING QUESTIONS

Responses by David C. Black, President Emeritus, Universities Space Research Association; Adjunct Professor, Physics and Astronomy Department, Rice University; Co-Chair, Committee on Issues Affecting the Future of the U.S. Space Science and Engineering Workforce, National Research Council, The National Academies

Questions submitted by Chairman Mark Udall

Q1. During your oral testimony, you showed a figure that indicates that the number of opportunities for students to gain hands-on training has been declining. Could you please elaborate on this point and describe which opportunities have been declining and why?

A1. The figure shown during my testimony is included below for your reference. There are two major messages in this figure. One is that the vast majority of opportunities for students to gain space experience via involvement in payloads is found in the suborbital programs—typically sounding rockets, balloons, and aircraft-based research (primarily high-altitude aircraft such as NASA's WB–57 and ER–2 airplanes). While the Explorer and other deep space missions do have student involvement, it is typically at the instrument level rather than the full spacecraft level. Moreover, owing to the cost of Explorer missions, relative to that of suborbital missions, and the associated longer timescale for project development, the deep space missions do not lend themselves as readily to substantial student involvement.



The second message is that all opportunities for student involvement have been in steady decline over the past few decades. This is most notable in the sub-orbital program that includes sounding rockets, balloons, and aircraft (where the involvement is primarily at the instrument level). The reasons for this decline are varied. One of the contributors to the decline is the heavy emphasis on science return as the justification for these missions. This emphasis, while valid, places the lower cost sub-orbital missions at a disadvantage when compared with an Explorer mission, for example. In general, NASA's science leadership argues that the "quality" of science, measured in terms of papers published or influence on other researchers, is less for a sub-orbital mission. Also, the quantity of science is less, as judged by the amount of data returned. This emphasis on science for the lower cost, more student-oriented missions ignores one of the key aspects of these missions, workforce development. These missions give a cradle-to-grave training experience in project

management and systems engineering, both key skills that are currently in short supply at NASA. Our committee would like to see proposals for suborbital programs be judged much higher (some committee members believe at least 50 percent) on the merits of the workforce development aspect of the proposal, with the rest of the weighting in the review process being the science that would be accomplished by the proposed mission.

Another factor in reduction of these opportunities is a combination of funding reductions as NASA managers look everywhere for funds to cover the increasing costs of their higher profile missions, as well as a past lack of support for sub-orbital missions by senior management at NASA. One further point to note here is that launch opportunities in this country have diminished over time making it harder to find suitable, that is low cost and relatively frequent, rides into low-Earth orbit for student satellites.

Q2. Your testimony referred to the value of sub-orbital programs in providing systems engineering and project management skills. Could you please explain in detail how the sub-orbital programs help develop these skills?

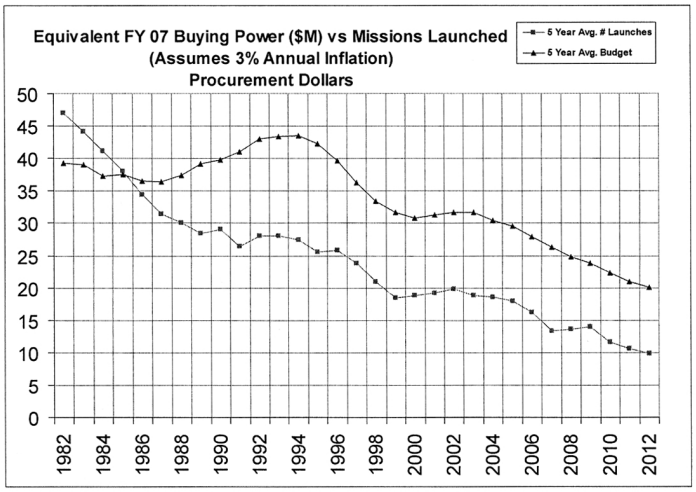
A2. Sub-orbital programs typically can be conducted from beginning to end in a year or two, while more complex Earth orbital projects may take at least two to four years. Both of these timescales are consistent with meaningful involvement of students. The shorter timescale is well matched to design and build classes for undergraduates, or even high school students, while the longer timescale matches well with graduate student experiences. In addition to the time match to student activity, there is an opportunity in these projects for students to see and experience all facets of a major project. They see what happens if inadequate attention is paid to interface issues, for example. They learn to manage a project on a schedule and a budget. Also, they can learn from a failure as much as a success. NASA's main missions now cost so much and have so much visibility that many more procedures and additional backup systems are added to reduce risk. This drives cost up and keeps students out of meaningful career development experiences.

Q3. How much do sub-orbital programs typically cost and what is the end-to-end duration of such programs? What, if any recommendations did your committee make on how these programs should be funded?

A3. Since our report was issued there has been some change in NASA's sub-orbital programs, particularly the sounding rocket program. The sounding rocket program appeared to be in continuing and serious decline even as late as the issuance of our report. However, a new NASA Associate Administrator for Science has indicated his intention to revive the sounding rocket program by increasing its funding and returning to a launch rate of 24 flights a year by FY10. However, I would note that his goal for this is to solidify the sub-orbital program's role in developing science and also producing experienced principal investigators for science missions. Our committee emphasized that sub-orbital programs are a value to the entire agency—not simply science—because they can provide experience in program/project management and systems engineering that can eventually be used in other programs, including human space flight.

According to a presentation made by NASA's sounding rocket program office to the Space Studies Board in June 2007, after our report was completed, NASA's sounding rocket program has seen a dramatic drop in flights over the past decade. The program currently supports about 10 principal investigators per year and an annual flight rate of 10 to 20 flights per year. In contrast to promised increased funding following the announcement of the *Vision for Space Exploration* in January 2004, NASA made severe cuts to the sounding rocket program budget: $4.2M in FY05, $10.9M in FY06, $9.4M in FY07, and $11.7M in FY08—a $36M cut over a four-year period. Our committee found that implementing the Vision will require precisely the kinds of skills that the sounding rocket programs provide.

Each launch costs between $2.5M–$3M including operating costs, and a typical project lasts from one to three years (the actual flight times, however, are measured in minutes). NASA's sounding rocket program has a success rate of about 98 percent. These factors make sounding rocket programs ideal for educational uses and allows for students to see a project through from the beginning to the end. The committee recommended NASA increase its investment in sounding rockets to provide ample-opportunities from hands-on flight development experience at a relatively low cost of failure.



Source: Sounding Rockets Program Office, 28 June 2007

Q4. Both the NAPA and the National Academies reports call for more detailed information on the workforce at NASA's Centers. Could you please discuss in specific terms what information the Agency needs in order to support long-term workforce planning?

A4. NASA is slowly coming to grips with understanding its workforce issues. In my view and that of the NRC committee, NASA does not yet understand how to model its workforce and its evolution. They need far better insight into the skills that reside at the Agency, a better understanding of the flow of programs and how that affects the civil service workforce, and they need to look outside of NASA to understand better the sources and movements of experienced as well as entry-level professional talent that is available. This is a skill that does not reside at NASA. They will need to look to outside expertise to help them in both identifying the type of information that is needed to do good workforce modeling, and in constructing the models to use the data. NASA, in my opinion, has lost track to some extent that it is an enabler of the Nation's civil space program. It has evolved to a point where it sees itself as an independent entity and makes policy and other decisions, particularly workforce matters, based on survival of the Agency and its centers rather than doing the job for the country.

Q5. The NAPA and National Academies reports emphasize that NASA should make full use of the NASA Flexibility Act of 2004.

Q5a. Did your committee conclude that NASA was underutilizing the Flexibility Act, and if so, why?

A5a. The committee heard anecdotal information from a number of speakers that although the *NASA Flexibility Act* had helped the Agency, it was still relatively recent and therefore the Agency had not yet been able to adopt it to the fullest extent (for instance, not all of the relevant offices were aware of the Act's provisions). The committee did not conclude that there was resistance to the Act at NASA, but did hear some comments from NASA officials that indicated that even if the Agency was able to make full use of it, some fine-tuning may still be necessary. This is probably a subject that is best left to discussions directly between Congress and NASA.

ANSWERS TO POST-HEARING QUESTIONS

Responses by Lee Stone, Legislative Representative, NASA Council of IFPTE Locals, International Federation of Professional and Technical Engineers

Questions submitted by Chairman Mark Udall

Centralized HQ Versus Decentralized Center-based Decision-making

Q1. NASA's workforce strategy involves a transition from a more decentralized Center-led decision-making process to an agency-wide, integrated approach. What are the Centers' and the IFPTE's perspectives on how smoothly this transition is occurring?

A1. The value of centralized versus de-centralized governance depends on the mission. NASA is designing and preparing to build one Orion crew exploration vehicle and two Aries launch vehicles using essentially existing technologies. It is absolutely critical for everyone to be on the same page; the value of a single centralized focal point for Constellation program planning and decision making is self-evident. However, for NASA's multifaceted Science, Aeronautics, and Technology Development missions, the value of centralized governance at Headquarters (HQ) is far from obvious. Rigid centralization schemes are known to stymie innovation and creativity, which are generally the fruits of smaller, more agile, and independent teams that can tolerate failure within a less rigid schedule and budget structure. Indeed, the Exploration Systems Architecture Study (ESAS) plan is anything but innovative, born of the necessity of meeting an urgent schedule to replace the Shuttle with a budget half that the last time NASA was asked to design a manned lunar spacecraft. So up front, it should be noted that NASA's new management governance model embraced to support the Constellation program may not be appropriate for NASA's other equally important endeavors.

The wisdom of NASA's management plan aside, its centralized, matrix management model has been unevenly applied. At its essence, matrix management is designed to split management into two equal branches: 1) centralized programmatic management authority is retained at HQ, and 2) de-centralized line management authority is delegated to the Centers. There are however two problems with NASA's current implementation of matrix management. First, HQ has delegated line management responsibilities, yet has not provided the necessary resources and authority to the Centers to perform this task. NASA's current governance model has therefore seriously weakened line management, which is not the co-equal partner it needs to be for mission success. This has resulted in program management controlling all of the financial resources and micromanaging program implementation, and has prevented line management from being able to function properly to the detriment of the Agency, its Centers, and its missions. Second, as a result of this first point, in order to salvage power for its line management, center management at Johnson Space Center (and to some extent at the other manned space flight Centers) has simply hijacked key program management authority and uses that power to protect its Center from the adverse consequences of NASA's implementation of lopsided matrix management and full-cost recovery of salary and facilities costs. While JSC's success at collapsing matrix management by combining key line and program management nodes is an understandable, and indeed predictable, reaction to NASA's flawed matrix management implementation, the sustained centralization of program and fiscal authority for manned space programs at JSC continues to be an obstacle to any *bone fide* matrix management system centralized at HQ and is a major obstacle to the 10 healthy centers plan.

The governance model and Exploration:

NASA's manned spacecraft development and manned space flight implementation are endeavors so massive and ambitious that they benefit from a more centralized authoritarian leadership strategy. The transition to centralized authority at HQ continues to be slow and remains incomplete. Indeed, the initial artificial uncovered capacity crisis of the last few years was generated by the programmatic transfer of a large chunk of NASA's personnel funds to Constellation by the Administration, followed by the refusal by Constellation program management (largely overlapping with JSC line management) to share these resources appropriately across all NASA Centers. The Administration's initial plan was to retain funding and personnel at JSC and eliminate across the rest of the Agency, nearly 3,000 highly skilled and experienced federal employees, predominately at the Research Centers, who were improperly deemed unworthy of Constellation dollars because of a fictitious "skills-mix" problem. If the House and Senate Science committees had not intervened with

a Reduction-In-Force (RIF) moratorium (subsequently extended by the Commerce-Justice-Science Appropriators), that plan would have been fully implemented last year. Indeed, the phase-one harassment and buy-out portion of the plan was implemented resulting in the loss of more than a thousand largely technical employees and a significant decrease in morale across the Research Centers, but phase-two of the employee elimination plan was luckily averted by direct Congressional intervention. IFPTE and NASA's civil service workforce remain extremely grateful for the strong bipartisan leadership shown by Chairman Gordon and former Chairman Boehlert in their timely opposition to the Administration's ill-devised plan.

In the summer of 2006, IFPTE testified that NASA's uncovered capacity crisis was a fiction created by a deeply flawed accounting process and a program management unwilling to accept that the technical staff at Research Centers should play a major role in Constellation. Squeezed by the RIF moratorium, last fall, Administrator Griffin finally simply directed JSC to transfer meaningful work packages to the Research Centers and the "crisis" dissipated. Indeed, Centers that last year reported hundreds of employees with skills/competencies deemed surplus have now received funding to assign Constellation work to nearly all of them. The magical disappearance of the uncovered capacity confirms that the initial crisis was a fiction created by management failures, and not by any skills problem with the technical staff across the Agency. We now have empirical proof that employees at Ames, Glenn, JPL, Langley, and Goddard can work well together with employees at JSC, Marshall, and KSC to the benefit of the Exploration mission, the Agency, and the Nation. NASA's employees, distributed across all Centers, stand ready to make Constellation a success and look forward to that opportunity and challenge.

So why isn't this the happy ending of this scary fairy tale? There are two lingering clouds that loom ominously. First, sustained underfunding of the Agency is still squeezing NASA's scientists and researchers who do not fully benefit from Constellation work packages that only cover Constellation development activities. This problem requires the re-balancing and/or additional appropriation of funds to Science, Aeronautics, and Technology research activities that have taken a disproportionate and unwise share of the fiscal hit imposed by NASA's inadequate budget. Congress should act to force a modest yet essential rebalancing, which would only involve about five percent of NASA's budget. Second, the distribution of work packages from JSC are still being made begrudgingly so that inadequate numbers of civil servant Full-Time Equivalents (FTEs) are being transferred to cover the required work and few procurement funds are being transferred to cover associated local expenses. Furthermore, JSC management continues to co-opt Advanced Capabilities funds that should be used to cover scientists and researchers engaged in longer term, non-Constellation, Research and Development (R&D) activities. Advanced Capabilities funding is being diverted to meet unfunded Constellation requirements and to cover disproportionately JSC personnel and contract support staff. Congress should act to prevent the diversion of the few remaining R&D funds within the Exploration Systems Mission to non-R&D activities and away from the Research Centers.

The governance model and Science & Aeronautics:

NASA's broad research missions in Science and Aeronautics are less well served by a centralized, distant, and bureaucratic leadership at HQ, detached from the nitty gritty R&D process and overly influenced by transient political interests. Succinctly stated, NASA's long-term R&D should be managed by those most qualified to manage NASA's R&D activities, NASA's Research Centers, with greater independence from the vicissitudes of the personalities and political winds at HQ. Indeed, the director of National Institutes of Health understands that he is merely the custodian of a distributed brain trust that needs nurturing, oversight, and advocacy, not intrusive technical direction. The Institutes are largely autonomous, the Lab Chiefs are largely autonomous, and even the individual PIs are largely autonomous. That more decentralized structure not only gets the job done, it fosters creativity and innovation. The Associate Administrators for the Science and Aeronautics Research Mission Directorates should follow that example and embrace more muted and humble roles. In the ideal matrix governance model, program management sets budgets, goals, and milestones, while line management assigns the technical work to the appropriate personnel, decides on the needed procurement and procurement mechanisms, implements the program plan, and is accountable for meeting the milestones. Unfortunately, program management has abused its near absolute fiscal authority to co-opt line management's authority to assign work, to direct local procurements, to manage day-to-day activities at the performing centers, and thus to undermine collective bargaining rights (because all Union contracts are with center line management, which is becoming somewhat irrelevant). Any transition to a *bone fide*

matrix management model will require equalizing the balance of authority between program and line management.

Specific recommendations:

IFPTE asks that Congress:

- Increase NASA's Science, Aeronautics, and Advanced Capabilities budgets and protect them from being reprogrammed overtly or covertly to Constellation.
- Direct NASA to provide civil-servant salaries and non-programmatic travel along with CM&O directly to the centers, independent of programs, to allow for effective matrix management and to maintain Center capabilities.
  - Line management would then be empowered (i.e., funded) to perform its critical immediate roles of assigning and supervising work as well as its longer term role of keeping local intellectual capabilities and facilities healthy. Re-empowering center management to perform the latter role is essential because the currently unchecked Program management funding structure benefits from exploiting current resources for near-term milestone at the expense of long-term milestones and institutional infrastructure. Program management should, however, continue to control procurement funding levels and programmatic travel funds to perform its critical role of setting budgets, goals, and milestones. With this more equitable division of resources and authorities, the short-term programmatic and longer term institutional interests can be properly balanced through cooperation between the two branches of management. Program management would have to negotiate with Center management for civil service labor, yet Center management would still need to align its workforce to meet program needs in order to acquire procurement and most travel funds.
- Direct NASA to move program management of the research activities of the Advanced Capabilities programs to the Research Centers to prevent their subjugation by Constellation or JSC management, and to allow them to maintain crucial independent research and technology development capabilities across NASA's research Centers.
  - Inter-center competition and cooperation across multiple research programs assigned evenly across co-equal research centers will prevent parochial interests from dominating programmatic interests.

Abuse of Term Hiring Authority

Q2. Your testimony notes that NASA's increasing use of "term" hires [hiring for work that is expected to last between 1–6 years] rather than tenured civil service hires is, in part jeopardizing NASA's ability to attract the best and brightest science and engineering staff.

Q2a. Why do you believe that the use of term hires jeopardizes NASA's ability to attract the best and brightest?

A2a. When young scientists receive their Ph.D. from a world-class institution (thereby completing 20+ years of formal education), most begin to plot a future for themselves whereby they can expect a stable and productive research career in their field of choice. In some instances, a one-to-three-year postdoctoral fellowship is sought in order to obtain additional training to broaden their skills and experience under the mentorship of a well-respected researcher at another elite institution. However, within a year or two of receiving their Ph.D., the best and brightest young scientists begin to seek a tenure track (hard money) research professorships at a prestigious university and eschew non-tenure track (soft money) adjunct professorships that are contingent on external funding sources. Young biotech scientists and aerospace engineers have highly lucrative private-sector opportunities in addition to this traditional academic option. In the past, NASA has competed successfully for its fair share of these individuals by offering a package of advantages that academia cannot match: accelerated tenure, no teaching requirements, and access to numerous sources of competed and even directed Research and Analysis funding for mission-related research projects that nonetheless are largely self-generated. NASA has been successful in the past in recruiting even the most competitive candidates by offering better job security, more comprehensive benefits, cutting-edge research opportunities, and a very high quality of life. In particular, one of the most rewarding aspects of a career at NASA has been the ability to remain engaged with an exciting

long-term project throughout its lifetime so that one is still around to see one's technical contribution finally comes to fruition, as opposed to being terminated after a few years of performing piece work.

In the early 1980's, the Federal Government lost some of its recruiting leverage in the arena of benefits when they converted to a less competitive 401k-style dominated and less desirable retirement system (i.e., private sector and academia now often offer better benefits). Over the last few years, NASA's recruiting problems have been exacerbated by three critical factors: the policy of improperly using term offers to circumvent the federal employee tenure process and to assert greater daily control over its technical staff, the dramatic reduction of NASA research opportunities available to in-house scientists and engineers to perform self-generated mission-related R&D, and the full-cost recovery of employee salaries. The latter has created a hostile and demeaning time-clock punching environment that 1) prevents our best scientists and engineers from devoting an appropriate portion of their time to difficult longer-term technical problems (and thus improving/sustaining their technical skills) and 2) forces them into a full-time preoccupation with short-term milestones within an autocratic program management system. NASA's best and brightest scientists and engineers have no problem saluting the flag and working diligently towards NASA's mission goals, but they do not thrive when bossed around on a daily basis by non-technical administrative task masters obsessed with weekly performance metrics, and when deprived of nearly all independent research funding opportunities.

As a result of these factors, the current senior technical workforce can no longer aggressively recruit the graduating students of their academic colleagues because they cannot say, in good conscience, that coming to NASA is the best career move for that young student compared to tenure track options at prestigious academic institutions or lucrative stock options at cutting-edge private high-tech ventures. Word of mouth recruiting by NASA's technical staff (not by HR) is how NASA has traditionally gained access to the best and brightest technical employees before they are even on the market, so that NASA could bring them on board as pre- and post-doctoral fellows to focus on NASA relevant training and then hire many of them as permanent civil servants. That proven recruiting process is now breaking down to NASA's peril; as NASA's pre- and post-doctoral fellowships and permanent S&E positions dry up, so does its future.

In brief, the best and brightest will not consider term positions at a fiscally unstable and programmatically chaotic NASA a promising career move when they can take prestigious positions at UC–Berkeley, MIT, Google, or other elite academic or private-sector institutions that will offer them greater intellectual latitude and genuine respect often with more lucrative compensation packages. The bottom line is that the key to successful recruiting of NASA's future workforce is to be able to promise candidates exciting and stable careers within an intellectually open and respectful work environment that values and features independent research opportunities. Note also that with term positions, recruitment becomes a recurring task as the Agency must bid again and again for skills as terms expire, or risk losing increasingly experienced talent in which it has already invested considerable resources.

Over the last four years, NASA's management has been so overly disrespectful to its technical staff (term hiring being only one facet of this disrespect) that serious harm has already taken place. This disrespect has been part of a well-orchestrated and ill-conceived campaign to accelerate the attrition of NASA's senior technical staff, a strategy that remains ongoing, albeit tempered in recent months. The other side of respect is loyalty. NASA employees have traditionally shown tremendous loyalty that drives them to work nights and weekends, and to forfeit annual leave without financial compensation. But loyalty is a two-way street and permanent status is at the core of the Agency's loyalty to its staff. NASA employees were rudely awakened in February 2004 to discover that Administrator O'Keefe had commissioned a secret plan for the mass lay off of nearly 3,000 employees to cover the unfunded mandate of the *Vision for Space Exploration.* That betrayal and the attendant scapegoating of NASA's technical staff will not soon be forgotten. Although the situation has improved recently, unless the Administration fully and openly re-embraces a policy of respect for and loyalty to NASA's civil service workforce, NASA will no longer enjoy the recruiting power it has relied on for decades and unwisely takes for granted.

Q2b. To what extent are term hires being used for the science and engineering staff at present?

A2b. In addition to affecting recruitment, the use of term positions also has adverse ramifications for mission success because a transient Science and Engineering

(S&E) workforce threatens safety (as esoteric yet crucial knowledge/experience leaves the Agency when experienced staff leave at the end of their term) and squanders precious training resources (as trained personnel leave the Agency setting up a requirement to train new arrivals). Even more importantly, one of the primary reasons for according civil servants tenure is so that they can speak truth to power; tenured employees can speak up and say something is unsafe without the fear of losing their jobs, but term employees know full well that the future renewal or conversion of their position will be jeopardized if they challenge their management chain. The CAIB report warned us clearly that NASA's schedule and budget driven management culture was a primary cause of the *Columbia* disaster; that management culture is dangerously reinforced by the use of term hires who are dis-empowered, relative to permanent hires, to speak up when schedule or budget is undermining safety and/or mission success.

In fiscal year 1994 (FY 1994), NASA made 181 outside hires for Full-Time Permanent (FTP) Science & Engineering (S&E) staff and only four-term S&E hires. The S&E term percentage (2.2 percent) was less than that found across all employees: NASA hired a total of 337 FTP employees that year and only 19 term hires (5.6 percent).

Over the last three years, NASA's hiring actions have shown a dramatically different trend. FTP S&E hires numbered only 64, 53, and 36 in FY 2005, in FY 2006, and so far in FY 2007, respectively, while term S&E hires numbered 174, 227, and 161. So we have gone from a tiny fraction of S&E employees being hired as term employees in the early 90's to more than three quarters now.

Even more troubling is that the above term hiring trend appears to be more highly focused on S&E staff. In the same three periods, FTP Professional Administrative hires numbered 77, 100, and 63, respectively, while term PA hires numbered 154, 215, and 121 yielding a ratio closer to about two-thirds term hiring.

In sum, over the last three years, NASA has been hiring about three-quarters of its new S&E full-time outside hires under term contracts (as opposed to less than three percent in 1994) and has been hiring more than twice as many managers as scientists and engineers (as opposed to less than half as many in 1994).

NASA management has created the alarming trends above by imposing strict quotas on the hiring of new permanent employees, thus forcing Centers to make improper term hires to fill long-term technical needs more properly served by a permanent hire. In other words, one of the premises of the question "that term hiring is for work expected to last between 1–6 years" is simply false within NASA's current implementation. Term hiring is performed because it is generally the only hiring permitted by HQ, not because of the specifics of the position. Furthermore, center-based quotas of permanent hires are linked to the number of permanent employees who leave each center. By arbitrarily linking the departure of ~3 permanent employees to each permanent new hire each Center can have, HQ is also increasing its pressure on center management to harass older employees to retire.

The data above are as of 6/23/07 and were acquired from *http://hqpowerplay.hq.nasa.gov/workforce/moredata.html*

Specific Recommendations:

IFPTE asks Congress to:

- Commission the GAO to audit NASA's use of term positions over the last three years and determine to what extent that authority has been abused.
    - It appears that NASA is not the only federal agency that has been using non-permanent S&E hiring strategies that weaken the independence of government technical experts, so perhaps this investigation should be extended to all government agencies across the executive branch that perform scientific or engineering R&D.
- Direct NASA to convert all current terms positions to permanent status unless they can explicitly demonstrate that, for each term position, the Agency's need for the position's skill/competency has an unambiguous programmatically defined endpoint by the end of the term.
    - Merely stating that future funding is unsure is not an adequate rationale as all future federal funding is by definition uncertain.
- Require NASA to return to a hiring policy whereby all new hires default to permanent unless an explicit, written justification is provided explaining why NASA's programmatic need for that skill/competency clearly ends within a specified term of less than six years.

- This exercise should be performed as proper Human Resource protocol in the first place so this proposal should not be considered burdensome.

- Cap NASA's use of term hires at 10 percent of outside hires annually.

In closing, IFPTE is very encouraged by recent changes in NASA's workforce posture that appear to indicate a renewed respect for in-house talent and skills. Nonetheless, there are a number of remaining obstacles in the road ahead; those discussed above are only a few of them. The bottom line is that the National Research Council (NRC) report indicates that NASA will face a workforce crisis in the not-to-distant future unless it immediately starts to educate, recruit, and train the next generation of technical employees, who should apprentice under the current NASA senior technical staff before they retire (indeed, this was the rationale for the rarely used retention bonuses in the Flexibility Act). The Administration is not heeding that advice because, as the Administrator has publicly stated, NASA has not been given adequate funds to do so. Over the last decade and a half, NASA has steadily lost 80 percent of its 35-year-old workforce and nothing is being done to stop that alarming trend. IFPTE adds its voice to the urgent call by the NRC and others for NASA to renew its intellectual infrastructure before the chain of knowledge and experience is broken. Congress should act to remedy this increasingly serious situation by appropriating and sequestering adequate funds for this endeavor and by directing the Administrator to begin an aggressive workforce renewal.

Once again, IFPTE thanks Chairman Udall and Ranking Member Feeney for their keen interest in and dedication to NASA's success, and for the opportunity to bring the concerns of the NASA federal employees we represent to the attention of your subcommittee.

Appendix 2:

Additional Material for the Record

SUPPLEMENTAL INFORMATION FOR THE RECORD

STATEMENT OF DR. JOHN STEWART,
ACADEMY FELLOW AND MEMBER OF THE
NASA MULTI-SECTOR WORKFORCE PANEL

Mr. Chairman, I appreciated the opportunity to testify before the U.S. House Subcommittee on Space and Aeronautics on May 17, 2007 on behalf of the National Academy of Public Administration's NASA Multi-sector Workforce Panel. The Panel's goal is the same as the Subcommittee's: to ensure the health and vitality of NASA's greatest asset, its civil service and contractor workforce. At the outset, it is important to understand that the Panel's recommendation for additional human capital flexibilities was designed to provide NASA with authority to restructure its workforce to meet new competency requirements while maintaining essential employees regardless of age. The Panel's recommendation does not authorize NASA to arbitrarily reduce staff or to discriminate based on age. Unlike the mandatory retirement of civil servants required by federal law until 1979, the proposal would protect NASA's ability to maintain essential employees of all ages.

I am taking this opportunity to submit additional information for the record in four major areas:

- Scope of the Academy's project
- NASA's budgetary context
- NASA's need for proactive workforce management
- Proposals to overcome NASA's existing civil service constraints

Scope of the Project

This nearly year-long study was not conducted in a vacuum. The Panel and study team reached out to a wide range of stakeholders, traveled to eight of NASA's field centers, and conducted more than one hundred interviews, including meetings with labor representatives and contractor organizations. I was pleased to serve along-side five other Panel members who believe strongly in NASA. I am a longstanding former member of the Aerospace Safety Advisory Panel and for two years served as staff director of the U.S. Senate's Subcommittee on Science, Technology, and Space (1977–1979). Three of the other Panel members were long-time NASA executives at headquarters and at Goddard Space Flight Center. All of us care about NASA and want to be responsible stewards of its future.

As explained in my testimony, the Panel was asked to answer some very specific questions about NASA's current workforce and field structure. Neither the Senate Appropriation Subcommittee nor NASA asked the Panel to evaluate the sufficiency of NASA's current or projected level of funding. Similarly, we were not asked to conduct a detailed assessment of the planned timeline for phasing-out the Space Shuttle, completing the International Space Station, developing the next-generation launch vehicles, or establishing a permanent lunar outpost. The Administrator did not expect the Panel to make recommendations for dramatic changes to existing program plans, timetables, or budgets. The Panel believed its responsibility was to determine what kind of workforce would be required by NASA and to provide guidance on the work-based criteria and policies needed for the Agency to achieve this desired state. Recognizing that aeronautics and scientific competencies will be critical components of NASA's future workforce, for example, the Panel did recommend that NASA quantify the core workforce required to maintain and nurture these competencies over the long-term. The Panel cautioned, however, that NASA needs to avoid looking at disciplines and programs in isolation. Instead, it should evaluate competency needs and excesses across all programs and avoid a stove-piped approach to competency management.

Budgetary Context

In order to resolve NASA's workforce challenges, others have strongly advocated for increased funding, a dramatic reduction in contractor support, and a return to the civil service levels of the 1960s as the panacea for NASA's workforce challenges. The Panel believes this approach is inconsistent with the notion of managerial and taxpayer accountability. It also ignores the fact that, with a proposed 3.1 percent increase in the President's FY 08 request, NASA's budget is already slated for a larger increase than the one percent average rate of growth for other domestic discretionary agencies. Although Congress certainly may appropriate additional funds for NASA, I personally believe this is unlikely given the "pay-go" system, which would require any increases to NASA to be paid for with cuts to other important federal programs.

Unless Congress does decide to make significant, long-term increases to NASA's appropriation, NASA will have to deal with its 21st century challenges by developing a more balanced, optimally-sized, and skilled workforce tailored to current and projected mission needs. NASA could facilitate this transition by adopting a more proactive workforce strategy based on the use of innovative strategic planning mechanisms, objective data reliance, focused organizational health assessments, and work-based human capital reforms. This would enhance NASA's health and ensure its ability to safely meet its program milestones in a cost effective manner.

Given the long-term fiscal challenges facing this country, I believe it would have been irresponsible, unrealistic, and inaccurate for the Panel to tell the Senate Appropriations Subcommittee that NASA's workforce problems could or should simply be solved with more money. Within the confines of the projected budget, the Panel provided an objective assessment of the alignment of the current NASA workforce with the new programs, the Agency's management strategies, and the tools required by NASA.

The Panel believes that NASA management must be accountable for implementing the *Vision,* approved by the President and Congress, and setting priorities consistent with that *Vision* and within the budget appropriated.

Proactive Workforce Management

The Panel applauds the work of NASA's civil servants and contractors, acknowledging them as the Agency's greatest asset. In examining the civil service portion of NASA's workforce, however, the Panel believed that NASA should be more proactive in making use of all available flexibilities—both those available to all federal agencies and those specifically authorized in the *NASA Flexibilities Act of 2004*—to develop the workforce of the future. Specifically, we recommended that NASA expand its existing recruiting practices by establishing a nationally recognized, prestigious program to:

- Attract exemplary applicants with technical and administrative strengths.
- Focus on long-term core competency needs of the Agency.
- Replenish the workforce after decades of hiring freezes.

We believed that the existing Distinguished Scholar Authority, authorized by the *NASA Flexibilities Act,* could be used as the lynchpin for establishing such a program and help NASA to recruit its next generation of leaders.

In addition, we urged NASA to be much more proactive in establishing strategic partnerships with Federal, State, and local governments, as well as universities and non-profits. In many cases, NASA has an excess of certain competencies that may be useful to other organizations. By formally establishing a program to temporarily or permanently out-place blocks of employees with competencies no longer needed by the Agency, NASA would be able to widely share its talent with the Nation. We recommended that NASA:

- Use inter-agency details for assignments with other federal partners.
- Partner with non-federal entities through the IPA program.

We also encouraged NASA to explore the possibility of strategically out-placing some existing research programs that NASA will not need in the future, but are important to the Nation as a whole. To this end, we recommended that NASA headquarters identify potential opportunities across the Agency and provide initial seed-money to the university, non-profit, or foundation assuming responsibility for the function. Affected field centers would then be expected to identify potential candidate institutions within their area and negotiate with them.

Overcoming Constraints

At the same time, we were struck by the significance of existing civil service constraints. Even if NASA took all available discretionary actions, we believed it would not have sufficient flexibility to develop the required workforce. Accordingly, we recommended a package of additional statutory flexibilities. Several of these seem relatively uncontroversial:

- Congress should increase the monetary cap on buy-outs to $35,000 and adjust for inflation in following years.
- OPM should grant NASA blanket authority to conduct buy-outs over the next five years.
- Congress should authorize NASA to temporarily pay the government's share of health care premiums for non-retiring employees who agree to resign and are not otherwise eligible to carry their benefits with them.

- OPM should grant NASA blanket authority to waive salary offsets when recruiting reemployed federal annuitants for critical areas.

The Panel had two other recommendations that were more controversial and would require greater change within the existing civil service system. First, we believe that NASA deserves the same Reduction-in-Force (RIF) framework as the National Institutes of Standards and Technology (NIST). The existing RIF system is widely acknowledged to be counterproductive and expensive, as well as harmful to federal employees and organizational health. Accordingly, we urged Congress to exempt NASA from the Title 5 RIF rules by establishing a new RIF framework modeled on NIST's Alternative Personnel Management System. This system would:

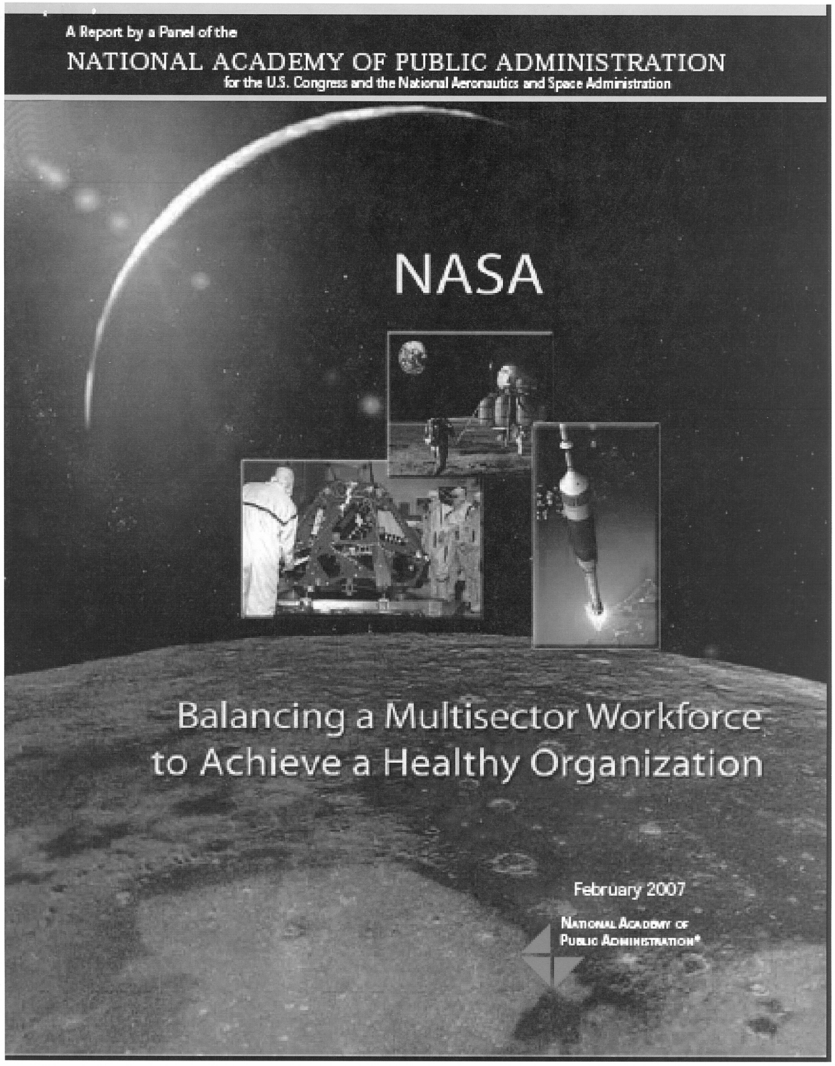
- Define competitive areas in a more targeted manner, such as career path.
- Limit both "bumping" and "retreating" to within the same occupational series or specialty.
- Give enhanced weight to performance.

Second, the Panel believes that Congress should provide NASA with limited emergency authority to invoke a fully eligible individual's retirement if he or she can no longer reasonably be utilized by the Agency. Some or all of the following criteria would have to be met:

- The employee's skills are no longer required for mission accomplishment.
- The employee's skills are outdated or unnecessary, and management determines that retraining would not be practical, or the employee is unwilling to update skills.
- Funding for the employee's existing work is not available.
- The employee's skills are not easily transferred to other work.

We believe retiring employees should be compensated fairly by being given severance pay in addition to earned annuities. This emergency statutory authority would provide NASA with one means to secure the expertise required for its highly complex mission, while protecting the safety and integrity of the space program.

In conclusion, the Panel took very seriously its charge to think creatively about ways in which NASA might most effectively plan for its workforce of the future. The Panel did not make these recommendations without considerable study and forethought. Each recommendation is consistent with the goal articulated in NASA's Workforce Strategy: to develop a flexible, scalable workforce. While providing certain additional flexibilities to NASA to help it address critical competency shortfalls and excesses, the Panel's proposed package of flexibilities would preserve the best of the civil service system for the 21st century.


A Report by a Panel of the
NATIONAL ACADEMY OF PUBLIC ADMINISTRATION
for the U.S. Congress and the National Aeronautics and Space Administration
NASA
Balancing a Multisector Workforce
to Achieve a Healthy Organization
February 2007
National Academy of
Public Administration®

A Report by a Panel of the

NATIONAL ACADEMY OF
PUBLIC ADMINISTRATION

*For the National Aeronautics and Space Administration
and the Senate Appropriations Subcommittee on Commerce,
Justice, Science, and Related Agencies*

February 2007

NASA: BALANCING A MULTISECTOR WORKFORCE TO ACHIEVE A HEALTHY ORGANIZATION

Panel

Sallyanne Harper,* *Chair*
Benita A. Cooper
Harold B. Finger*
Harriett G. Jenkins*
Bernard D. Rostker*
John G. Stewart*

* *Academy Fellow*

Officers of the Academy

Valerie A. Lemmie, *Chair of the Board*
G. Edward DeSeve, *Vice Chair*
Howard M. Messner, *President*
J. Christopher Mihm, *Secretary*
Franklin S. Reeder, *Treasurer*

Project Staff

J. William Gadsby, *Vice President for Academy Studies*
Alethea Long-Green, *Program Area Director*
Laurie J. May, *Project Director*
Joseph P. Mitchell, III, *Senior Research Analyst*
Sherrie Russ, *Senior Project Advisor*
Julia Mensah, *Research Associate*
Martha S. Ditmeyer, *Senior Administrative Specialist*

The views expressed in this report are those of the Panel. They do not necessarily reflect the views of the Academy as an institution.

National Academy of Public Administration
900 Seventh Street, N.W.
Suite 600
Washington, D.C. 20001-3888
www.napawash.org

Printed in the United States of America
ISBN 1-57744-141-9

Academy Project Number: 2035

PANEL MESSAGE

The National Aeronautics and Space Administration (NASA) is experiencing a fundamental mission shift. Initially established in 1958 as a response to the *Sputnik* challenge, the agency's mission has long included space exploration, aeronautics research, and other scientific pursuits. Under the newly established Vision for Space Exploration *(Vision)*, NASA has an ambitious agenda to expand its role in exploration not only to establish a permanent lunar outpost on the Moon, but also to go to Mars and beyond. The *Vision*, along with the agency's planned phase-out of the Shuttle Program and reductions in various aeronautics and scientific programs, will require significant workforce and programmatic changes. Because NASA's organizational structure and workforce grew up around its previous mission, the agency is experiencing an inevitable tension between the need to make significant changes to adjust to the new direction while also protecting its current workforce. NASA is constrained by its budget, Title 5's civil service rules and requirements, and a Congressional ban on reduction-in-force. In order to respond to changing mission objectives, program redirection, and budget imperatives, NASA recognized that it must develop a flexible, scalable workforce. The Administrator has emphasized the need for a strong, technically competent civil service to provide oversight and smart buyer capability. The Panel believes it is critical for the agency to develop processes that ensure it has the right people, with the right skills, at the right time, in the right place.

In March 2006, the Senate Appropriations Subcommittee and NASA asked the Academy to provide the agency with its recommendations as to how NASA might approach these challenges. In particular, they asked the Panel to focus on the challenges of transitioning from the Shuttle Program to the *Vision* and acquiring the right balance within its multisector workforce of approximately 18,000 civil servants and 40,000 contractors. Over the course of this project, the Panel and study team have conducted over a hundred interviews at headquarters and eight of the ten centers, as well as with important stakeholders, including union representatives and contractor organizations. These interviews have helped the Panel identify emerging practices and develop tools for improving NASA decision-making, as well as workforce and acquisition planning

The Panel believes that, if NASA is to achieve a flexible, scalable workforce, it must establish, align, and achieve a high-level of integration in its acquisition and workforce planning processes. The component supporting offices—the Office of Human Capital Management and the Office of Procurement—need to work creatively to surmount the planning challenges presented by a multisector workforce in a rapidly evolving environment. NASA must go beyond the traditional, functional, stove-piped approach by bringing agency leaders and experts together early in the planning cycle to make decisions about the human capital assets and resources needed to accomplish the mission, with a specific focus on the allocation of civil servant and contractor resources. Other federal agencies face similar challenges as they, too, are forced to adapt to the 21st century challenges confronting them. They will benefit from NASA's leadership and experience. Because the federal workforce is far more than the sum of its civil servants, comprehensive workforce planning must consider all the elements and resources the government leverages to accomplish its tasks. These resources include intergovernmental and interagency partnerships, as well as private and non-profit organizations, and universities.

A major driver behind NASA's current workforce planning and management is the agency's desire to have ten healthy centers—each with a critical role in the new exploration program and a fully funded civil service workforce. The research centers will have the most difficulty transitioning to the agency's new development focus. The Panel understands the constraints facing NASA. In an environment of constrained resources, however, the potential danger of the ten healthy centers approach is that actions intended to help the struggling centers could harm the other centers. Therefore, supporting all ten field installations could come at the expense of NASA as an agency.

The fundamental theme of this report is that NASA— if it is to ensure its institutional health—needs to be a knowledge-based, data-driven organization. The Panel believes that NASA should rigorously collect and analyze work and workforce data, share the evaluation of that information in a transparent manner, and make decisions based on these analyses. NASA has historically used this approach for its major mission programs. Now it must apply the same rigor and objective approach to strategic planning for its internal support capabilities, management, and workforce and acquisition decision processes. This approach would help the agency to be proactive in the identification of trends and timely development of appropriate responses. In addition to providing a solid base for its own decision-making, this would generate useful information for stakeholders and may help NASA garner support for budgetary resources and statutory authorizations needed to implement the *Vision.*

As part of this study, NASA asked the Academy to provide policies, procedures, tools, and effective practices to help it make the following key management decisions:

- How should NASA decide whether to obtain the services/deliverables of a contractor, or hire a civil service employee?
- If NASA decides to hire a civil servant, what kind of appointment should be used (tenured permanent or multi-year term)?
- What is a healthy center? How should NASA measure it?

The Panel developed tools to assist NASA in each of these areas. The report includes a proposed Decision Guide to help the agency focus on the most important work criteria for deciding whether to use civil servants or contractors. If the decision is to hire a civil servant, the Panel proposes work-based criteria for assessing the appropriate type of appointment. Use of these tools will provide the agency with a consistent, quantifiable approach, based on rigorous analysis, and should facilitate management discussions across NASA. These tools should help NASA set acquisition and workforce priorities in a transparent and strategic manner. The Panel believes term employment is an important element in the agency's human capital change arsenal.

In examining the agency's overall workforce strategy, the Panel found NASA's approach to healthy centers to be people-focused, with a primary emphasis on fully funding civil servants. To evaluate center health, the Panel developed a more comprehensive framework that includes twelve critical factors and performance metrics. This framework will help establish a more

extensive and rational means to balance changing mission requirements, within budget constraints, with the desire to protect the permanent workforce. The Panel recommends that NASA use this framework to conduct an annual evaluation of center health, identify effective practices worth transferring, and, if necessary, pursue other organizational options over the long-term for centers that continue to struggle. While it is valuable to assess the health of individual centers, the Panel believes the ultimate test of this cornerstone of NASA's *Workforce Strategy* is whether the pursuit of ten healthy centers will yield a *healthy NASA*.

The Panel also believes that the agency must use all available flexibilities, including those provided in the 2004 NASA Flexibilities Act. Given its legacy workforce, skill mismatches, and long-term limited ability to hire, the agency is faced with a challenge to accomplish its changing mission with its current workforce. With a stable mission, such balancing would not present insurmountable obstacles. When agencies have significantly evolving missions, however, the government's rigid, rule-bound civil service system does not facilitate or encourage flexibility in the civil service workforce. Although the nature of an agency's work requirements changes over time, permanent civil servants with tenure are not forced to adapt. While NASA's employees are among the most highly educated in the federal workforce and extremely dedicated to the agency's mission, the *Vision's* work requirements have, nonetheless, resulted in working-level skill mismatches that appear to be significant, but have not been quantified. In examining this issue, the Panel found it significant that centers, regardless of their circumstances, expressed concerns about agency skill mismatches.

In looking for ways to help the agency overcome these challenges, the Panel identified new authorities that NASA and Congress should consider. NASA's *Workforce Strategy* acknowledges a significant over-supply of existing competencies and significant demand for new competencies. Given the constraints of the current civil service system and voluntary nature of employee decisions regarding their career lifecycle, the agency finds this to be its biggest workforce challenge. The problem is most prevalent among NASA's scientists and engineers, who comprise 60 percent of the agency's workforce. In addition to making maximum use of existing authorities for recruitment and retention, as well as intergovernmental and interagency partnerships, the Panel believes that NASA needs a package of new flexibilities. Among these are modified RIF rules, blanket buyout authority with a higher dollar value incentive, and limited statutory authority for emergency retirement reform.

If NASA successfully adopts a more knowledge-based management decision model, the Panel believes that the agency will be in an improved position to work with Congress to obtain the flexibilities required to implement the *Vision*. Together, Congress and NASA have the opportunity to break new ground by demonstrating the government's agility in responding to change. Today's broader, multisector workforce requires the high-level integration of acquisition and human capital planning, which is long overdue for the federal sector. NASA will then be at the forefront of 21st century governance—pointing the way for other federal agencies facing similar challenges.

PANEL

Sallyanne Harper,* *Panel Chair*—Chief Administrative Officer and Chief Financial Officer, U.S. Government Accountability Office. Former positions with the U.S. Environmental Protection Agency: Chief Financial Officer/Acting Assistant Administrator for Administration and Resources Management; Deputy Assistant Administrator for Management and Administration/Deputy Chief Financial Officer; Finance Director; Associate Director, Superfund Procurement Operations. Former Contract Specialist and Contracting Officer in major weapons systems acquisition with the Naval Air Systems Command and the Naval Regional Contracting Office.

John G. Stewart* *(May 17, 2007, Hearing Witness)*—Partner, Stewart, Wright & Associates, LLC. Former Executive Director, Consortium of Research Institutions; Vice President, Resource Development, Manager of Corporate Administration, and Manager of Planning and Budget, Tennessee Valley Authority; Member, Aerospace Safety Advisory Panel, National Aeronautics and Space Administration; Staff Director, Subcommittee on Science, Technology, and Space, U.S. Senate; Staff Director, Subcommittee on Energy, Joint Economic Committee, U.S. Congress; Executive Assistant to the Vice President of the United States.

Benita A. Cooper—Consultant. Former Associate Administrator for Management Systems and Facilities, National Aeronautics and Space Administration (NASA); Assistant Administrator for Headquarters Operations (NASA); Director of Management Operations for Goddard Space Flight Center (NASA); and Director of Manpower Utilization, Goddard Space Flight Center. Recipient of Meritorious and Distinguished Executive Rank awards, NASA Exceptional Performance Award, and NASA Exceptional Service Medal. Education: BA Political Science—Earlham College; MA Government—Indiana University; and MS Management—Massachusetts Institute of Technology.

Harold B. Finger*—Consultant. Former President and Chief Executive Officer, U.S. Council for Energy Awareness; Vice President for Strategic Planning and Development Operations, and General Manager, Center for Energy Systems, General Electric Company; Assistant Secretary for Research and Technology, U.S. Department of Housing and Urban Development; Associate Administrator for Organization and Management, NASA; Director, NASA Space Power and Nuclear Systems.

Harriett G. Jenkins*—Consultant. Former Director, Office of Senate Fair Employment Practices, U.S. Senate; Assistant Administrator, Equal Opportunity Programs, National Aeronautics and Space Administration; Teacher, Principal, Director of Elementary Education, and Assistant Superintendent for Instruction, Berkeley Public School System.

Bernard D. Rostker*—Senior Fellow, RAND Corporation. Former Under Secretary of Defense (Personnel and Readiness); Special Assistant to the Secretary of Defense for Gulf War Illnesses, Medical Readiness, and Military Deployment; Under Secretary of the Army. Former positions with the Department of the Navy: Assistant Secretary for Manpower and Reserve Affairs; Principal Deputy Assistant Secretary for Manpower and Reserve Affairs; Economist, Office of the Assistant Secretary of Defense for Systems Analysis. Former positions with RAND Corporation: Director, Defense Manpower Research Center, National Defense Research Institute; Program Director, Force Development and Employment Program; Associate Director, Arroyo Center.

* *Academy Fellow*