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# Issues in NASA Program and Project Management

Special Edition—  
A Collection of Papers on  
NASA Procedures and Guidance 7120.5A

edited by

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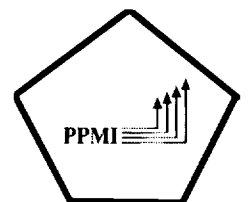
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# Issues in NASA Program and Project Management

## A Collection of Papers on NASA Procedures and Guidance 7120.5A

National Aeronautics and Space Administration

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# Issues in NASA Program and Project Management

# Introduction

by General John R. Dailey

The Government Performance and Results Act (GPRA) passed by Congress and signed by the President in 1993 provides a new tool to improve the efficiency of all Federal agencies and to ensure that intended results are delivered to agencies' customers. This Act requires that, beginning in the FY99 budget request, agencies submit a strategic plan for program activities and an annual performance plan covering those activities set forth in the budget. NASA has established a Strategic Management System to implement our Strategic Plan and provide the information and results to fulfill the planning and reporting requirements of the GPRA. The System is described in the recently released fourth installment of the *NASA Strategic Plan* and is further defined in the *NASA Strategic Management Handbook*. NASA's GPRA submittals to the Office of Management and Budget and Congress are fully compliant with the GPRA and address outcome- and output-oriented performance measures, ISO 9000, and full cost management. Consistent with these initiatives, NASA continues to revolutionize the way we do business using the Strategic Plan framework of four Strategic Enterprises and four Crosscutting Processes described in the *Strategic Plan* and *Strategic Management Handbook*.

A key aspect of NASA's new Strategic Management System is improving the way we plan, approve, execute and evaluate our programs and projects. To this end, NASA has developed the NASA Program and Project Management Processes and Requirements—NASA Procedures and Guidelines

(NPG) 7120.5A, which formally documents the "Provide Aerospace Products and Capabilities" crosscutting process, and defines the processes and requirements that are responsive to the Program/Project Management—NASA Policy Directive (NPD) 7120.4A. The Program/Project Management—NPD 7120.4A, issued November 14, 1996, provides the policy for managing programs and projects in a new way that is aligned with the new NASA environment. An Agencywide team has spent thousands of hours developing the NASA Program and Project Management Processes and Requirements—NPG 7120.5A. We have created significant flexibility, authority and discretion for the program and project managers to exercise and carry out their duties, and have delegated the responsibility and the accountability for their programs and projects.

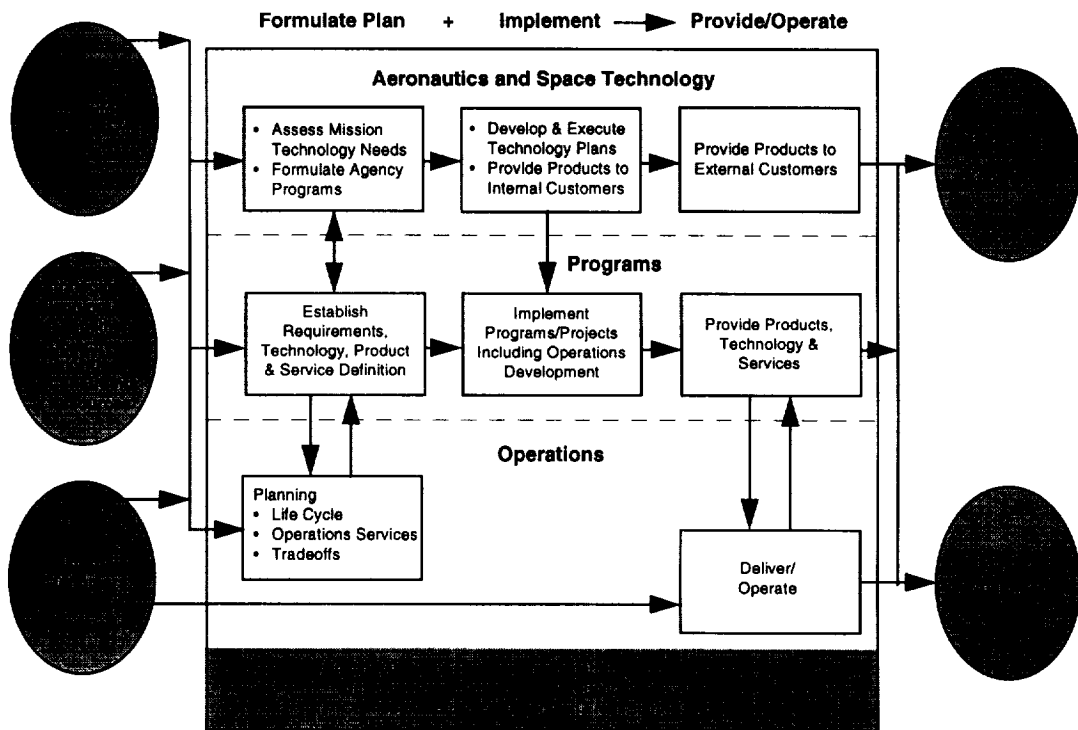
Now that we have formally described how we will do business, it is incumbent upon program and project managers to read and understand NASA's policy and processes. It is up to each of us to understand the guiding documentation within the process we are operating. Over the last several years, we've heard people say: "I never realized that's how we were supposed to do it." We spend a significant amount of time writing and coordinating NPDs and NPGs only to get them published, and then fail to read and follow them. The GPRA establishes a clear focus on achieving results and this documentation establishes the criteria by which we conduct our business. We will be graded on our ability to meet the program requirements established in Pro-

gram Commitment Agreements as required by the NASA Program and Project Management Processes and Requirements—NPG 7120.5A. It is going to be a significant change because it won't just be performing "close" to what we said, but rather, we either did, or didn't, do it as defined, and it's going to be easy for the Government Accounting Office, Inspector General, ISO 9000 auditors and others to evaluate whether that's the case. It is essential that we say what we will do, and do what we say.

We must quickly and efficiently implement the NASA Program and Project Management Processes and Requirements—NPG 7120.5A throughout NASA. The articles that follow are designed to provide the background for beginning this implementation process. Visits to each Center have been arranged to communicate the new pro-

cess and to facilitate rapid ownership and implementation. In addition, a training session will be included as part of these Center visits to communicate the NASA Program and Project Management Processes and Requirements—NPG 7120.5A personnel training available to sustain the process.

The description of our processes and requirements in the NASA Program and Project Management Processes and Requirements—NPG 7120.5A provides the over-arching description of "what" program and project managers must do in this new NASA environment—it provides for us the way we will produce for the future and achieve the results promised in our GPRA Strategic and Performance Plans. I encourage each of you to use the NASA "can do" attitude to weave this new management process into the fabric of the Agency.



**Figure 1. "Provide Aerospace Products and Capabilities" Top-Level Process Flow**

# NASA Procedures and Guidance 7120.5A: An Overview

by Carolyn S. Griner

Over the past few years we have faced a significantly different environment, with generally smaller projects and less time to do our projects and programs. The revolution within the Agency of the new *Strategic Management Handbook* and the change in management structure and responsibilities has driven changes in both process and requirements. We have diminishing resources with increasing work to do, which means we must be more effective and efficient. There is also a government-wide emphasis on commercialization and technology transfer that has really not been incorporated into the mainstream of our program and project management process. There are more and more opportunities for improvement in terms of changing acquisition rules and changing processes in government, providing us with more options to procure and develop our goods and services. NASA also has the obligation under the Government Performance and Result Act to make sure our performance can be measured and reported to our customers' expectations.

The revolution and shaping of the Agency to meet the imperatives of the new environment is continuing, and NPG 7120.5A is the next step. The 1998 *NASA Strategic Plan* states that we are to deliver world-class programs and cutting-edge technology through a revolutionized NASA. Process and requirements must change to insure success in delivering those world-class pro-

grams. The 1996 *Strategic Management Handbook* defines the Agency's crosscutting processes: "Manage Strategically," "Provide Aerospace Products and Capabilities," "Generate Knowledge" and "Communicate Knowledge." The focus of this overview, and for the development of programs and projects, is the "Provide Aerospace Products and Capabilities" process.

NASA Policy Document 7120.4A specifies the management system policy for the development and operation of programs and projects. NPG 7120.5A describes the next tier of requirements, integrating those crosscutting processes and process-focused requirements, making sure we can be flexible and efficient, providing the right kind of product delivery that meets user requirements.

## Major Themes

Basic themes were developed to provide the foundation for the new processes and requirements. One certain fact in the program and project world today is that "one size does *not* fit all." We had to look at not only the process and requirements that we were going to use, but also how well they could be tailored to accommodate the very small NASA projects as well as the very large programs. That comes as no easy task, so "process tailoring" is a central theme throughout the document.

Another theme, derived from a finding of the initial process team under Joe Rothenberg at Goddard, is that the user and the customer need to be involved in the process end-to-end. We need to understand their requirements thoroughly, have them involved in the evaluation of the product throughout its development, and get some feedback as they use the product or service the Agency provides. We must have comprehensive definition and requirements control. We must do what we say we are going to do; therefore, we need a complete understanding of what it is we are trying to accomplish, when we are going to accomplish it, and what the requirements are. The process must be able to deal with the variations that are factors in all programs and projects.

Another theme focuses on risk management. What are the risks involved in a new program or project? How likely are they and how serious will the consequences be if the risks are realized? Which are the most important risks facing the program or project manager—the ones we really need to worry about? How can we mitigate the identified risks? Are the mitigation actions actually implemented and are they effective in reducing risk? If they are not effective, perhaps we need to rethink them. These are some of the questions that program and project managers need to be asking continuously—especially when we are applying cutting-edge technology to enable new missions (a departure from the past when we merely derived new technology from missions we currently had underway).

Aggressive technology commercialization is a theme that is critical to NASA and the nation. NASA is in the process of preparing for ISO 9000 registration.

This new approach for program and project management must be compliant and enable the process and requirements interface so Field Centers can link to top-level policy and guidance. The “Provide Aerospace Products and Capabilities” process, started under Joe Rothenberg at Goddard and currently under the leadership of NASA Chief Engineer Dan Mulville, provides an integrating roadmap for accomplishing our objectives.

### Major Objectives

In light of these themes and challenges, we established a set of objectives in dealing with the document in order to have a process-managed approach. And I would have to say there are a lot of us who are not sure exactly what that means. So, we are going to be learning as we go through this – but the first thing is to understand the process.

The 1996 *Strategic Management Handbook* has processes for technology development, ground systems and operations, and flight systems development, but they are separate. However, when we look at the way we should be doing business, they all should be integrated. Proper attention must be paid to the technology required for the space, ground, data and operations systems and then to the infrastructure required to get the job done. Unless you do all that on an integrated basis, you run a real risk of not putting the appropriate program or project in place.

Tailoring the program or project planning with the appropriate levels of insight leads to very high-level requirements. With the appropriate level of management oversight relative to both the risk and criticality, and the cost in



line with NASA policy, a particular product or service development could still be extremely tailorable.

Requirements are built around process, products and the interacting activities. The old NHB 7120.5 described a very serial operation — it was A, B, C, D and E. Few, if any, projects can follow a serial process without doing concurrent engineering or the concurrent coordination with the budget process and the congressional process. Therefore, a more flexible and concurrent approach was developed.

The interfaces with other NASA cross-cutting processes also need to be incorporated. It is not enough to say there are four of them; you must also understand how they interact with each other and how a program or project manager is affected by the four processes.

### **Implementing the Objectives**

Many very exciting things are going on in the Agency today, including innovation in program and project management. In NPG 7120.5A, we tried to capture all of that and yet allow and even encourage innovation. In the implementation of these objectives, this document is intended to be a Headquarters-level requirements document that authorizes and enables Center processes and requirements, consistent with the ISO 9000 approach. The tailoring of those processes and products to meet the needs of a program and project can easily be done. The requirement is to look at the all the elements and the activities in the process and address them. The decisions made on those elements must be documented and agreed to by the appropriate levels of management. You can change a lot of things, but the process requires a re-

view that creates thoughtful agreement: yes, we agree that's the right way to do business; yes, that's the right amount of risk; or yes, that's the right level of oversight. Early in this process we looked at whether we should differentiate categories of work or take large efforts and separate them from the smaller efforts. We found out that was very difficult to do.

So many different activities are going on in the Agency today. Some are small but critical, some are small and high risk, some are large but lower risk, and some are large, high risk and very visible. So there is no easy way to pre-classify the kind of work we are doing, going into it.

We think the process-based approach and the tailoring capability meet those differing needs more effectively. We have provided flexibility for different Enterprise and Center approaches. I think that you will find that if you understand the process and look at how you are doing business today, you will find a good "fit." It has been really interesting to look at the innovations in the Agency today, and then to define a helpful process for all kinds of business.

The application of risk management throughout the life cycle is very important and it is something we emphasized in NPG 7120.5A. We are trying to say that you do not just consider risk on the front end of your program during Formulation and then walk away from it. Risk management should be continuous and should be the basis of good decision making throughout the life cycle.

The management responsibility and accountability defined in the *Strategic Management Handbook* has been

somewhat expanded; it empowers program and project managers, and it incorporates insight and oversight mechanisms.

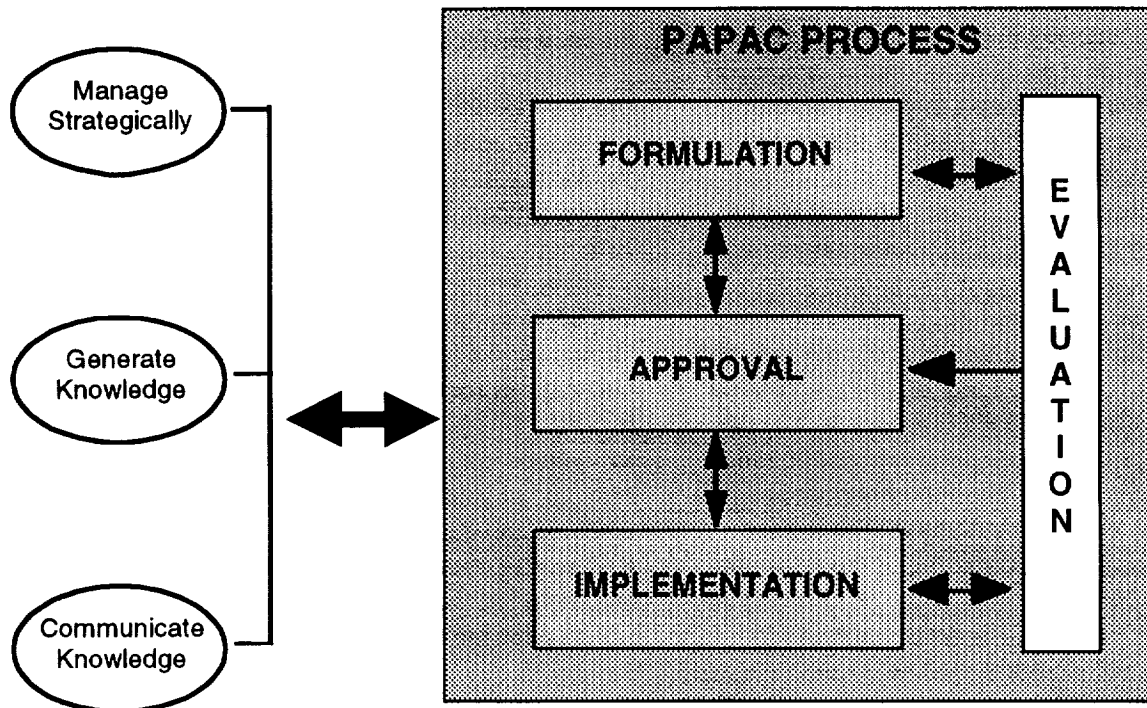
**Program/Project Management Process Elements**

Four basic process elements, called subprocesses, are contained in both NPD 7120.4A and NPG 7120.5A. One is "Formulation," which defines programs/projects that meet users' requirements. It consists of gathering requirements and concepts together, understanding what you are trying to accomplish, and defining the plans to get there. "Approval" is the governing Program Management Council process that approves or modifies a baseline program or project. It is active in the early stage of a program or project and throughout the life of the project.

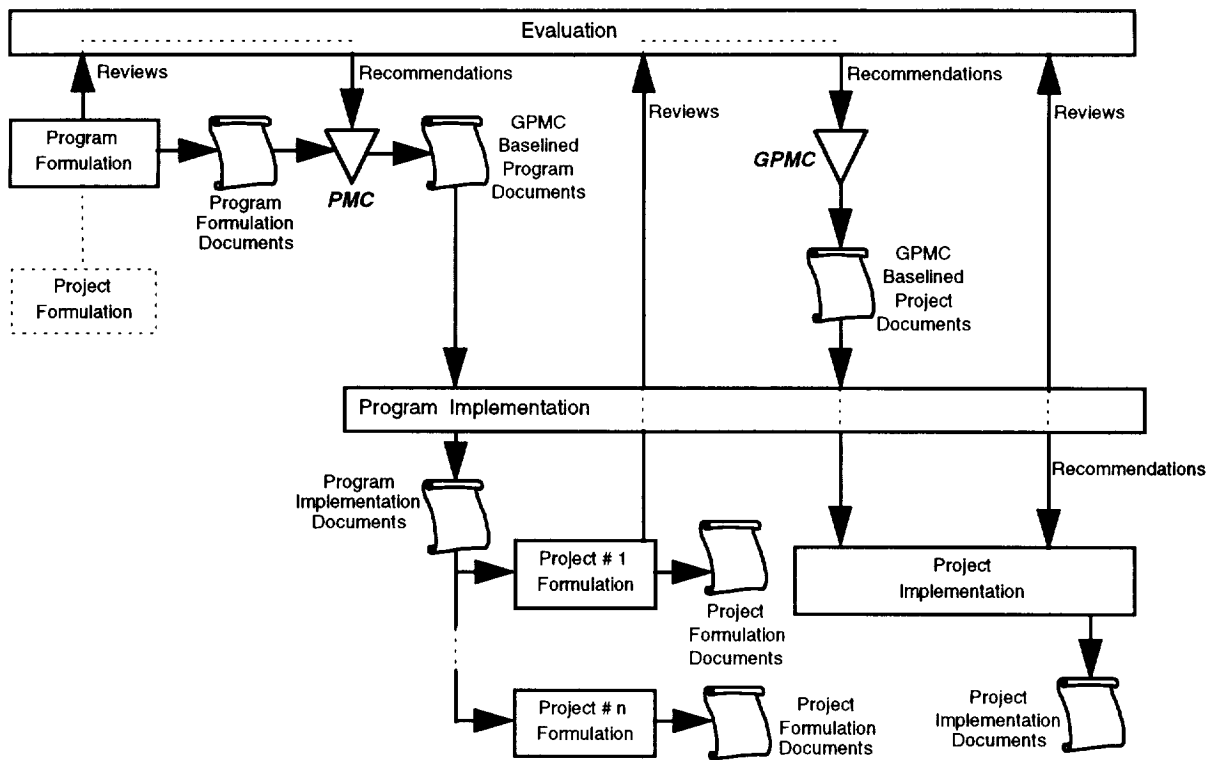
"Implementation" is the execution of the requirements and plans, puts all the pieces together, and measures against the metrics in the plans. "Evaluation" is the last subprocess, and it provides both customer and independent assessment. Evaluation is not used in this document as a term that includes the internal program/project reviews, such as design review, which are part of your internal program and project management process. The independent assessment has the customers involved so you understand that you are, in fact, meeting their requirements and addressing their specific concerns continuously throughout the process.

**Process Alignment**

The "Provide Aerospace Products and Capabilities" (PAPAC) process is represented on the right side of Figure 1.



**Figure 1. Top Level Process Activities Aligned with NPD 7120.4A**



**Figure 2. Program and Project Relationship**

It is important to note that the four sub-processes are highly interactive. You move from place to place within the larger process, depending on where you are in the program or project. All of those things interact in a process sense.

There is also active interaction with the other three crosscutting processes mentioned earlier: “Manage Strategically,” “Generate Knowledge” and “Communicate Knowledge.” Program and project managers have a responsibility for the interaction with those processes, too.

### Program/Project Flow

It is also important to see how programs and projects flow through the PAPAC process. Figure 2 is complex, but if you understand this chart, you will start to understand the process flow

you are going to see in the document. In the upper left is Program Formulation, the very early stage of program development under the responsibility of the Enterprise Associate Administrator who must define programs that meet both the *NASA Strategic Plan* and the *Enterprise Strategic Plan*. The documents justify the formulation of a particular program; that is, they authorize the expenditure of resources to get that work done. Formulation documents are then generated and go to the Agency Program Management Council (PMC). They go to the PMC, although only the Administrator is authorized to approve programs, but the PMC, under Deputy Administrator Jack Dailey, makes a recommendation to the Administrator, based on the completeness and appropriateness of the program that has been formulated. In the dotted box under Program Formulation, there may be

some projects being formulated during the same time frame. In other cases they are not, so we have to allow for that kind of timing and event flexibility.

During the Approval subprocess, the governing PMC is assigned and may be, for instance, the lead Center PMC for some programs. That is allowed after the Agency PMC has approved a particular program, then it is delegated to the appropriate level. Again, the keys to success are tailoring what you are trying to do and getting the decision documented across the board so that everyone understands the way you are doing business.

Once you accomplish Formulation, you are basically in the process of implementing the program itself. While generating Implementation documentation for the program, you may still be formulating projects. We have many ongoing programs that are developing projects as they go through their life cycle. Those additions can be accommodated in the budget process. An example of those additions would be Shuttle upgrades during its operational phase. The additional new projects also go through an approval process at a governing PMC. Your program plan will specify these projects to be formulated and cite the Approval mechanism. When the new projects are approved by the governing PMC, they are baselined and go into their Implementation process. Obviously, out of that process comes the project that is planned to meet the customers' requirements.

The bar across the top is that of Evaluation: the external and customer evaluations mentioned earlier. It is a process that is integrated throughout the life cycle of the program. You should con-

stantly have customers involved, both to understand what you are doing and to demonstrate that you are meeting their requirements. I would encourage you not to think of the PAPAC as a serial activity. In fact, you can go from Formulation into Implementation and then find events, such as a budget or a technical challenge, that force you to go back and readdress how you formulated a particular program or project in the first place.

### Document Structure

The document structure of NPG 7120.5A is fairly straightforward and is designed as a total package for the use of program and project managers alike. The Overview provides a summary of the concept behind the document, the process itself, and how it all works together. The Program Management section includes all the subprocesses mentioned earlier. This is where the program manager will be able to find a self-contained section. The same approach is provided for Project Management, which creates a great deal of duplication from one to the other. However, since the customers for this document are both program managers and project managers, it has been structured for their individual use. They will be able to pick up and have a total package to understand all aspects of the process.

Another section of the document includes a chapter on program and project management Systems Requirements. Examples are acquisition management and financial management. Then 7120.5A moves across all phases and parts of the process. There may be a different emphasis depending on where you are in the program or pro-

ject, but those are the things that program and project managers need to do, regardless.

The Agency has met the challenges of baselining the new paradigms in program and project management. The alignment of program and project man-

agement with the *Strategic Plan* is in place. It is now our job as Enterprise Associate Administrators, Center Directors, and program and project managers to use the more creative and flexible approach to, as Jack Dailey puts it, “produce the future.”

## **Issues in NASA Program and Project Management**

# The Impact of NPG 7120.5A upon Training and Development

by Dr. Edward J. Hoffman

NASA Procedures and Guidance 7120.5A for Program and Project Management Processes and Requirements should have minimal effect upon current Agency training and development programs — mainly because the new directive simply formalizes what we have been teaching and learning in the NASA Program/Project Management Initiative all along.

A frequent complaint we get from the 8,000 or so graduates of our PPMI courses over the years, however, deals with resistance to what they may have learned in the classroom or training site. Brimming with new ideas, these young men and women often run up against an entrenched program or project manager who insists that things be done “the old way,” too often perceived as “the NASA way” or even “the Goddard (Lewis, Kennedy, Johnson, JPL, Stennis, etc.) way.”

Management was all too often in the eyes of the manager; now we’re all reading from the same book, 7120.5A. Still, there is no single method or “one size fits all” approach to project management in NASA. While each Center is responsible for developing policies, processes and procedures to comply with the new NPG, individual program and project managers will still need to tailor their requirements to the specific needs of the project, consistent with the size, complexity, risk and criticality of the project. Under NPG 7120.5A, the results of such tailoring are to be documented in agreements among managers,

directors, Enterprise Associate Administrators and the Administrator.

The PPMI organization is ready to meet the challenge of the new 7120.5A directive. Fortunately, many of those currently involved (and in NASA most of us are) in program or project management are already familiar with and experienced in the new methods of project formulation, approval, implementation and evaluation. The management of finance, risk, performance and acquisition, as well as safety and mission assurance, is much the same as we have taught, learned and practiced in recent years in the NASA PPMI. In fact, right at the top of our Level One description of “Work/Development Experiences” in the PPMI Career Development manuals, the first items “most critical to job performance” are NASA Management Instruction 7120.4 and NPG 7120.5A. We ask our participants to read and be familiar with both, discuss them with experienced project managers, and use them as constant reference tools.

## A New Directive

The sweeping changes called for in NPG 7120.5A include a major emphasis on training, development and continuous learning for program and project managers. As the NPG says, “The people who manage, support and work on projects require a vast sum of knowledge, experience and skill in the profession of project management.” In the early days of NASA, project managers were expected to learn project manage-

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ment skills and knowledge on the job, but in the past decade the Agency has provided a wide array of development opportunities and resources through the NASA Program and Project Management Initiative (PPMI). These resources can be referenced through the PPMI home page (<http://ppmi.hq.nasa.gov>), the NASA PPMI Charter and the NASA *Project Management Development Process (PMDP) Handbook*.

As the *PMDP Handbook* and NPG 7120.5A indicate, the responsibility for proper project management development is shared by the individual and his or her manager. The NPG states: "Managers shall support employees in receiving the proper development and continuous learning." Specifically, all NASA program and project managers should receive:

- Formal training and developmental experiences which promote optimal PPM performance.
- Access to PPM tools and information services through the NASA Program/Project Management home page.
- Work assignments that provide growth and preparation for PPMI assignments.

NPG 7120.5A also establishes the following requirements for minimal formal training and continuous learning:

- a. Maintain competence in project management by making a commitment to continuous learning is essential. This learning can take place in the form of formal training, develop-

<b>Level of Development</b>	<b>Formal Training Courses (or equivalency)</b>
Program Manager	NASA Program Management (PGM) NASA Advanced Project Management (APM) An Overview of NASA Program/Project Management: 7120.5A
Project Manager (Systems Level and Above)	NASA Advanced Project Management (APM) An Overview of NASA Program/Project Management: 7120.5A
Project Manager (Subsystems Level)	NASA Project Management (PM) An Overview of NASA Program/Project Management: 7120.5A System Requirements Systems Engineering
Project Personnel	NASA Task Management (TM) An Overview of NASA Program/Project Management: 7120.5A Fundamentals of Program Management and Control

**Figure 1. Matrix of Required Training Courses by Career Level**



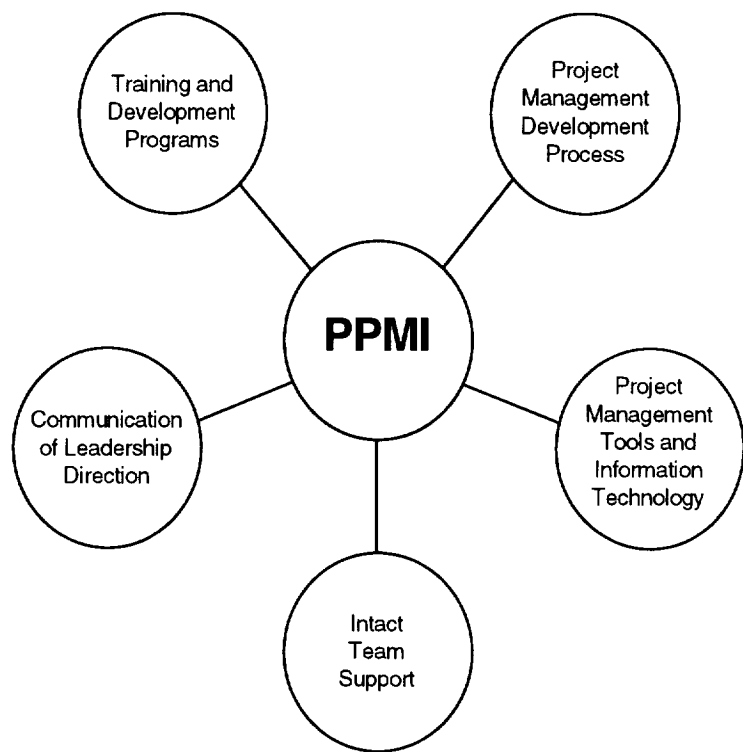
mental assignments, academic programs, or self-paced study. Program/project managers as well as program/project personnel shall have an annual minimum of 40 hours of project management-related learning and are strongly encouraged to participate in at least another 40 hours of general learning each year. In order to ensure personal and organizational commitment to learning, Individual Development Plans (IDP) shall be developed and supported by all project personnel and their managers. NASA Senior Management shall promote an environment which enables such continuous learning to occur.

- b. The matrix of required courses by career level (Figure 1) indicates the minimum formal training required. Program/project personnel should supplement these requirements by taking additional formal training which is person- and position-specific. A list of NASA PPM training and development resources can be found through local training and development organizations as well as the NASA PPMI.

### A Bigger Picture

PPMI is not just the source of training courses. Founded ten years ago on the assumption that commercial training materials would be tailored for NASA practitioners, PPMI was never meant to compete with academia or industry, but rather to complement and integrate areas of expertise into an orderly, sensible career development process.

PPMI has always endeavored to be inclusive, not exclusive; to synthesize learning and experience, not separate or categorize them. Lessons learned,



**Figure 2. Integrated PPMI Model**

shared experiences and best practices were key concepts then and now. PPMI is an integrated process of development with full support from senior leadership as well as clear customer interest and involvement.

The best way to see how PPMI can be used to train virtually an entire agency in NPG 7120.5A is to view PPMI in terms of a five-prong process of continuing development.

The Integrated PPMI Model shown in Figure 2 makes most sense when it is viewed as a well-rounded process of professional project management development, in contrast to a single training curriculum or “quick-hit” training events. NPG 7120.5A itself is multifaceted, and to focus on just one aspect could be myopic for the project manager.

<p><b>PPMI Training and Development Curriculum</b></p> <ul style="list-style-type: none"><li>• <b>Core Programs</b><ul style="list-style-type: none"><li>Project Management</li><li>Advanced Project Management</li><li>Program Management</li><li>Task Management</li></ul></li><li>• <b>Developmental Courses</b><ul style="list-style-type: none"><li>International Project Management</li><li>Systems Engineering</li><li>Technology Transfer and Commercialization</li><li>Topics in Project Management</li><li>Topics in Software Project Management</li><li>Software Acquisition Management</li><li>Software Process Improvement</li><li>System Requirements</li><li>Project Management Shared Experiences Program</li><li>Multi-Project Management</li><li>Project Planning and Scheduling</li><li>Construction of Facilities Management</li><li>Construction of Facilities Best Practices</li><li>Fundamentals of Program Management and Control</li><li>Program Control (seven modules)</li></ul></li><li>• <b>Project Management Development Process (PMDP) Assignments</b></li><li>• <b>Professional Development Program (PDP) Rotations</b></li></ul>
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**Figure 3. PPMI Training and Development Curriculum**

Instead, connections are made between Intact Team Support, for example, and the PM Tools and Information Technology that make it happen, help prepare it and become useful for follow-up. Besides the obvious connection between Intact Team Support and PPMI Training and Development courses, such support can and should feed into the overall NASA Project Management Development Process. All five feed into the Program/Project Management Initiative and emanate from it.

A closer analysis of all five aspects of PPMI will show how NPG 7120.5A can saturate the entire NASA program

and project management community quickly, efficiently and thoroughly.

### **1. PPMI Training and Development Programs**

The most visible aspect of PPMI has been duly noted by the authors of NPG 7120.5A, specifically the four core programs – Project Management, Advanced Project Management, Program Management and Task Management plus three of the developmental courses. More than 8,000 NASA employees have participated in PPMI’s core programs and skills courses, including more than 2,000 in one or more of the seven modules of Program Control.

Each of these courses is being updated to reflect the requirements of NPG 7120.5A. In early December our executive team of PPMI leaders and PPMI curriculum presenters met for four days in the Management Education Center at Wallops Flight Facility to make sure all instruction is aligned with the *NASA Strategic Plan, 7120.5A* and the Project Management Development Process. We looked at course objectives, prerequisites, target audiences, instructor qualifications, competency model fit/ placement, and experiential activities or substitutions. Presenters who could not attend were asked to participate in a 90-minute teleconference at the opening overview and a 120-minute session towards the end when they could answer questions or provide information to group leaders in breakout sessions. The materials at the latter sessions included course descriptions and outlines plus behavioral objectives, metrics and connections with American Council of Education accreditation/certification, 7120.5A, PMDP and the *NASA Strategic Plan*.

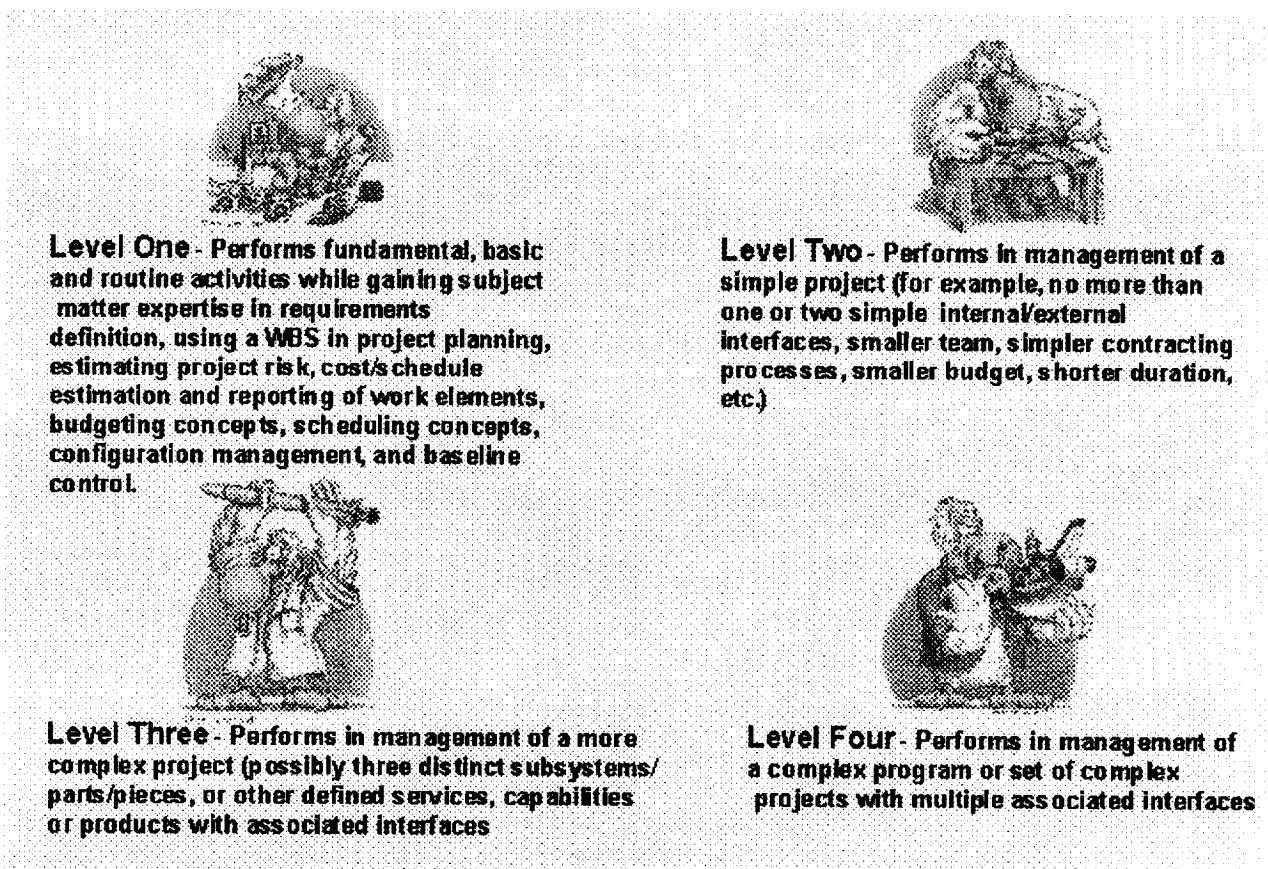
While our participants can be assured of the inclusion of the latest NPG 7120.5A requirements in PPMI programs, courses and sessions, they can also get annual updates at the Project Management Shared Experiences Program conducted each spring. Experts in their fields share their knowledge and skills at PMSEP gatherings as participants network with each other and discover new ways of managing programs and projects.

PPMI training and development programs are not limited to core training programs, skills courses and PMSEP. They also include informal mentoring. Part of career development at NASA involves transitional assignments in the PMDP or job rotations in the Profes-

sional Development Program. Informal mentoring can expose a candidate to 7120.5A requirements in performance, finance, risk, acquisition and safety and mission assurance in ways that textbooks and courses can only approximate. From the very beginning of PPMI, the stress has been on “both-and” instead of “either-or.” The well-rounded project manager has knowledge and experience, even if the latter is from a mentoring situation.

## 2. Project Management Development Process

Work assignments and job rotations in project management at NASA are usually made in the context of an “Individual Development Plan” or IDP,



**Figure 4. PMDP Process**

based upon a participant's past work record and career aspirations. The NPG 7120.5A becomes an essential guidebook for this process.

Just three years ago NASA launched the Project Management Development Process, an effort to provide every member of the project management community with a clear roadmap of the PPMI courses and work experiences needed to ascend the four traditional levels of skills and knowledge, from project team member to major program manager. With PMDP, participants can baseline and benchmark their current capabilities, identify competency requirements, and build their own personal development plans in conjunction with their supervisors and possibly a mentor.

The mentor and/or supervisor will examine the PMDP participant's education, training and work experiences before building an IDP together. The IDP may contain formal educational opportunities as well as informal learning such as self-study, reading, research, conferences and job-related professional activities. The IDP will also include work assignments and job rotations, and possibly special projects or service on a task force. Training components include PPMI courses, programs such as the Project Management Shared Experiences Program, seminars and workshops such as the briefings on NPG 7120.5A.

The PMDP is designed so that the participant is ultimately responsible for developing the IDP. The supervisor of-

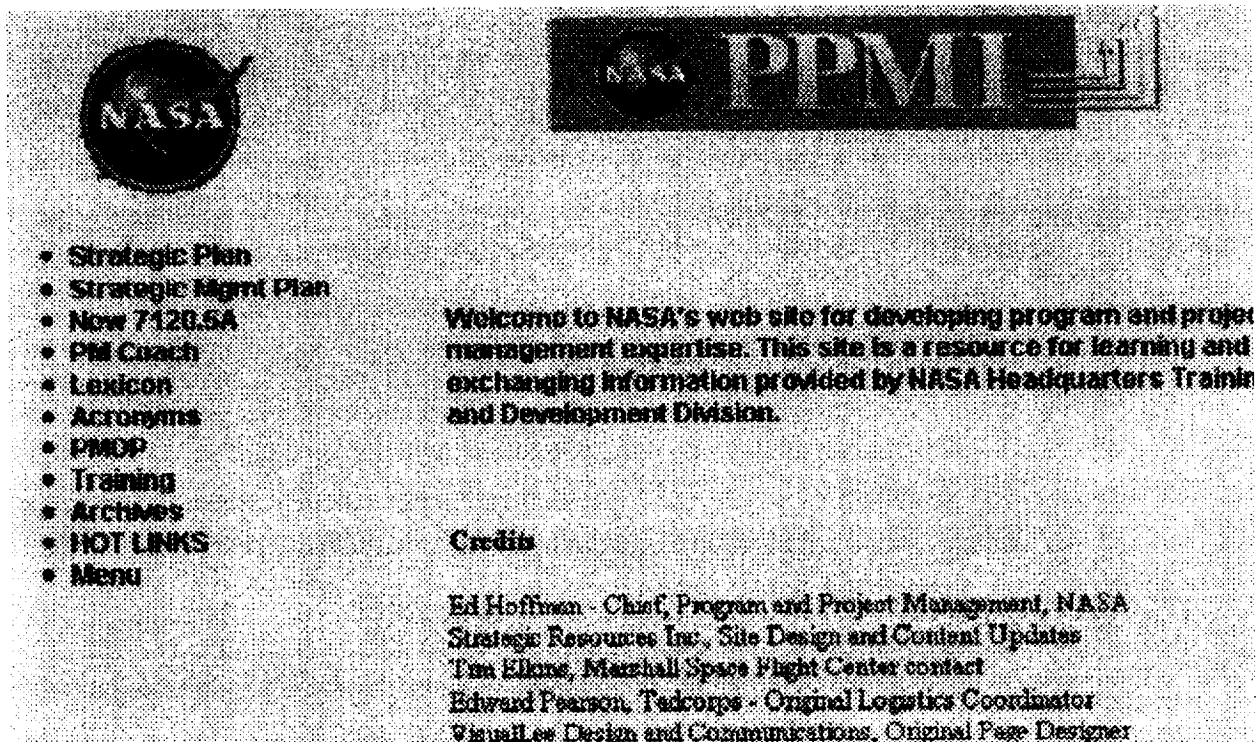


Figure 5. PPMI Home Page < <http://ppmi.hq.nasa.gov> >



**Figure 6. NASA's Site for On-line Learning and Resources (SOLAR)**

ten helps with new work assignments, and the mentor is a valuable source of encouragement and advice. But the participant sets up meetings with the supervisor and mentor and decides to follow the first piece of advice in the PMDP Handbook: “the most critical to job performance” are NASA Management Instruction 7120.4 and NPG 7120.5A.

### **3. Project Management Tools and Information Technology**

All planning efforts to train the entire NASA project management community in NPG 7120.5A begin and end with

information technology and management tools.

For well over a year, the PPMI home page has been providing the latest information on training opportunities, idea exchanges and research archives.

In a work environment where timely information is crucial to mission success, the PPMI home page is available to the entire NASA project management community, including trainers, contractors and managers at every level. The site is available at <http://ppmi.hq.nasa.gov>.

The PPMI home page provides a link to the new indexed version of the NPG 7120.5A, as well as direct links to the *NASA Strategic Plan* and the *NASA Strategic Management Handbook*. With a click of the mouse, a user can search a listing for current NASA acronyms and submit new ones. A path to the *NASA Lexicon* provides a quick explanation of NASA technical terms and abbreviations. The training button shows what NASA training is available, when and where it will be held, and how to reply. An Archives section includes presentations, active projects, research studies, lessons learned and other materials valuable to program/project personnel.

Behind the “Archives” button, vast project management resources are available for reference, reading and downloading, whatever the information needs of the visitor. NASA’s *Tools Information Guide* is a handy reference to project management techniques used at NASA, and *The Systems Engineering Handbook* is a comprehensive reference to aerospace systems management. Two other PPMI publications are also online: *Readings in Systems Engineering* and *Readings in Program Control*, with a third on the management of major system programs in preparation. All 14 editions of *Issues in NASA Program and Project Management*, including this one, can be found online as well.

The newest addition to the NASA PPMI site is the PPMI Coach. Although currently under construction, the Coach will soon provide quick and effective guidance (and materials to download) for project managers and support staff. Topics covered will include: Work Breakdown Structure, Configuration Management, Procurements Process, Earned Value Manage-

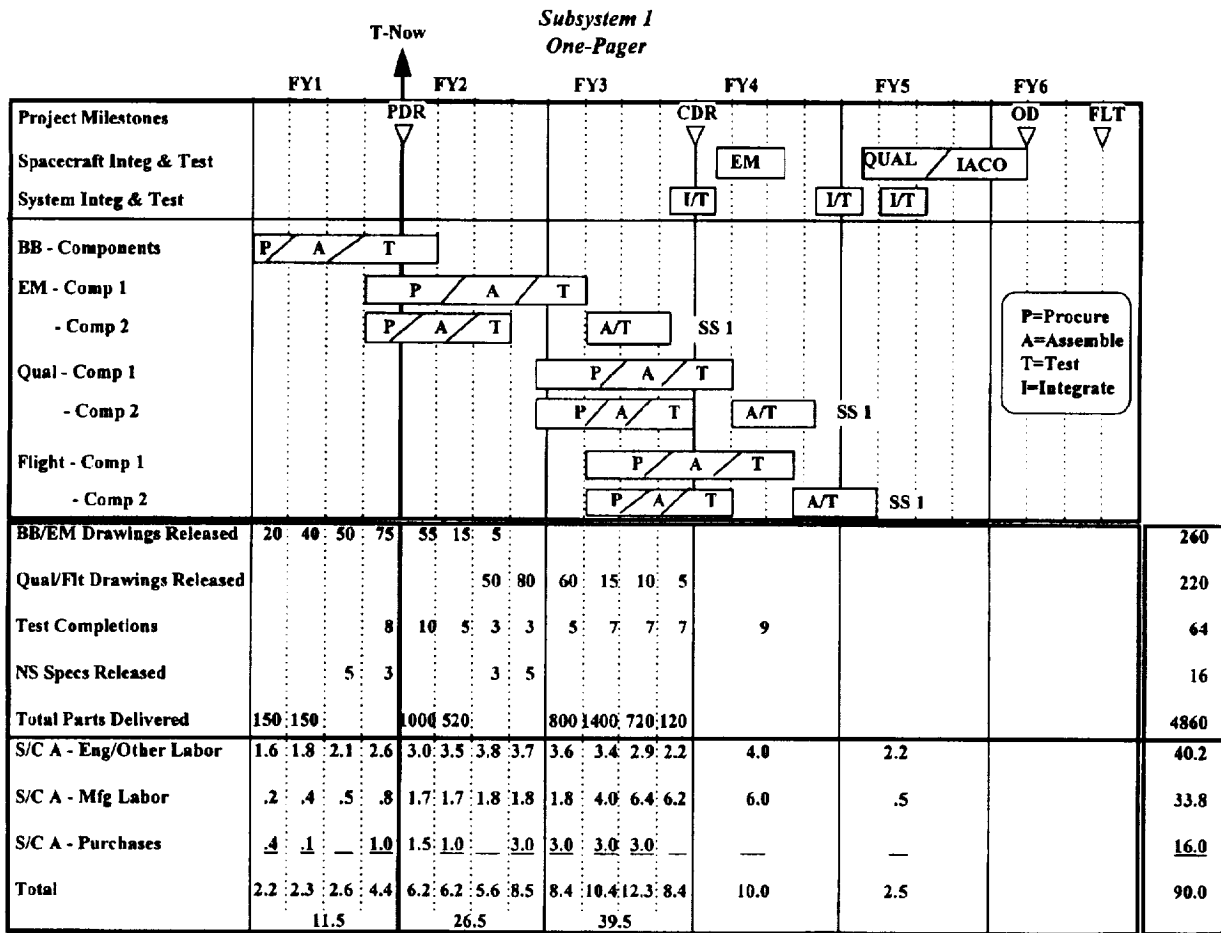
ment, Parametric Cost Estimating and Project Planning and Scheduling. Coming soon to the PPMI site will be “NASA Best Practices” and “Ask the Experts,” an interactive forum to elicit guidance from NASA experts across the agency.

This special edition of *Issues* reaches more than 4,000 project managers inside and outside of NASA about twice a year. In the previous edition, for example, readers could find the latest about ISO 9000, Earned Value concepts and a half-dozen new acquisition initiatives. This current edition was planned to satisfy the information needs of those who want to know more about NPG 7120.5A.

Anticipating new ways of self-paced learning, the NASA Training Office and PPMI sponsor the NASA Site for On-line Learning and Resources (SOLAR) online training with the Office of Safety and Mission Assurance to teach web-based modules on Safety, Mission Assurance, Non-Destructive Evaluation and a growing number of topics. On the horizon are a NASA Distance Learning Lab; AdminStar, an automated tool for training registration; and an electronic meeting system that goes beyond our current capabilities with VITS and PictureTel.

#### 4. Intact Project Team Support

Recent PPMI advances in information technology ostensibly save time, cut down on travel and provide specific information when it is needed. Similarly, we have received a number of requests in the past three years for “intact project team support”—made-to-order, just-in-time performance support for project teams. This training is tailored to the needs of the team, such as start-



**Figure 7. One-Pager Sample**

ups, requirements definition, risk management or team building.

PPMI has already provided Intact Team Support for project management training, project simulation and consultation to large and small projects at various stages in their life cycles. For example, Project Planning and Scheduling for smaller projects may involve four long days and nights of tracking milestones, deliverables and handoffs, resulting in a computer printout of several feet or meters that shows how one component can depend on a dozen or more tasks coming together at the same time.

Larger, complex projects use a One-Pager approach, developed originally for NASA, showing at a glance how project managers can chart and integrate cost, schedule and content (metrics) for a particular end item. The One-Pager is ideal for projects with high cost, long schedule, technical risk or key integration intersections. Smaller, simpler projects depend on input/output cards arranged along a long wall and connected with color-keyed strings to capture the Work Breakdown Structure.

Intact project team support fully supports the program and project manage-

ment processes and requirements described in NPG 7120.5A. More and more NASA work today is being accomplished by teams, not individuals working alone. As seen all too frequently, new tools or techniques are brought by an individual from a PPMI course or other training course to a team or project, but the new learning is not always relevant to the particular project, or it is relevant and yet not translated readily into the project or recognized as relevant by the other team members.

In a flattened organizational structure such as a functional team, all key team members are trained simultaneously with intact project team support, and the training is always adapted to the team's work at hand, not some hypothetical situation. Team members can apply the new learning immediately and make observable progress on their projects.

We fully expect to see more requests for intact project team support once NPG 7120.5A takes hold. Under the new management directive, a project that is well-planned and properly scheduled will have a much better chance of survival in the new competitive project environment.

### **5. Communication of Organizational Policy**

Communication of NPG 7120.5A falls in line with the four other goals of PPMI. In fact, communication of NASA policy integrates these efforts and directs each toward a single source and summit: the *NASA Strategic Plan*.

Any effort designed to train, educate and enhance the competency of the NASA work force should carry out the

strategic plan of the Agency. Policy communication and implementation support is all the more important in any large bureaucracy, corporation or institution. PPMI seeks to provide useful and timely information about NPG 7120.5A to the NASA project management community and communicate Agency goals and objectives. Plans are already in place to explain the new directive in print, on CD-ROM, on the PPMI home page, through Internet discussion groups, in specialized training efforts, in revamping the PPMI curriculum and eventually in a new set of *Readings*, insightful probes of the new policy procedures and guidelines.

This integrated effort to promulgate and explain new project management policy at NASA thus is five-pronged. The NPG 7120.5A now guides the revision of all PPMI training and development programs and leads to creation of a new one—a briefing on the NPG itself. The PMDP will be reshaped to take the participating manager through a new project management process and functional requirements, from Formulation and Approval through Implementation and Evaluation. Project management tools and information technology will be augmented with specifics from NPG 7120.5A, and intact project team support will now incorporate the new policy directives. Finally, the new procedures and guidelines will become part of everything PPMI is involved in, including promulgation and explanation of the new directive itself.

In summary, these five-pronged efforts will facilitate NASA dialogue across all levels of the organization and promote a common language across projects and function groups in what appears to be the most significant change in 40 years in the way NASA does business. Just



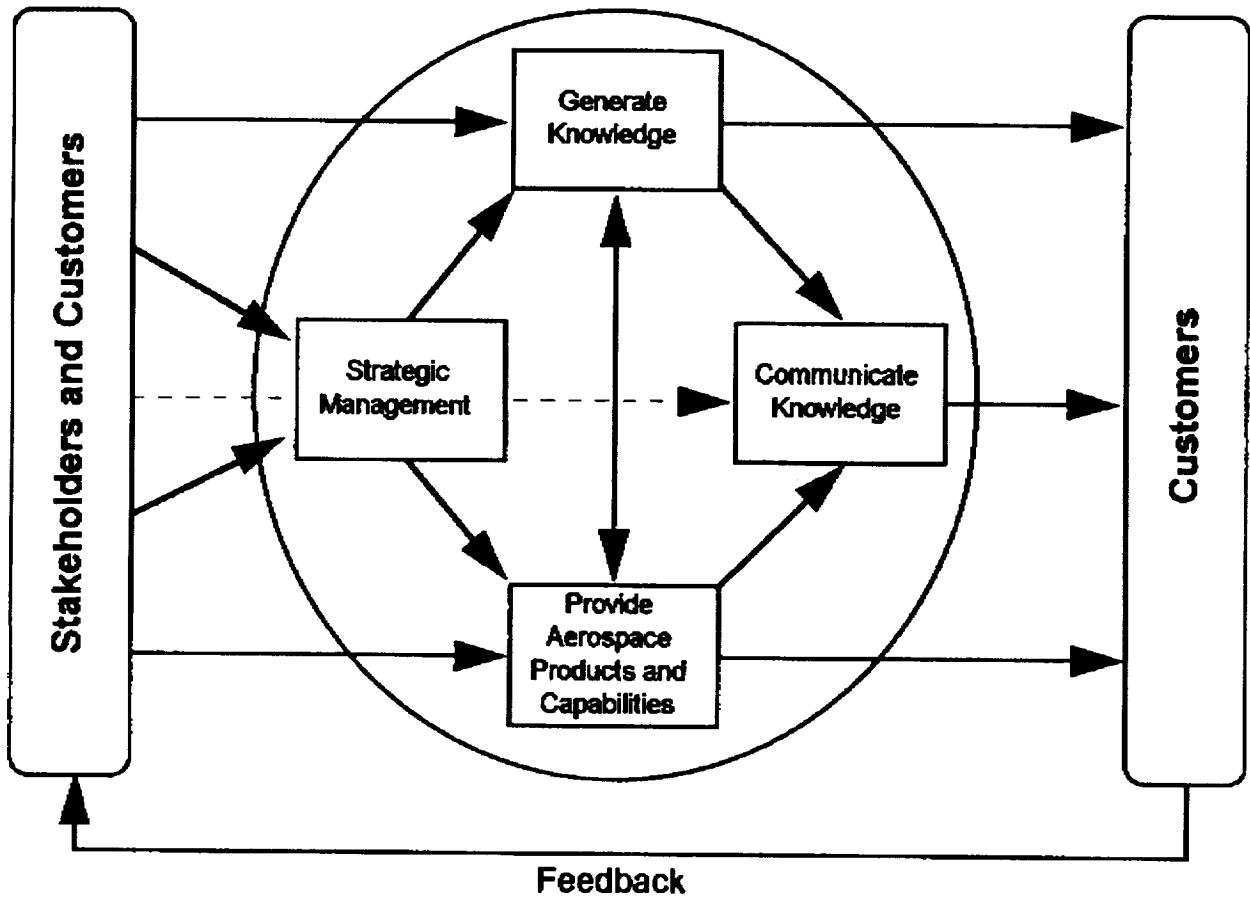
as NPG 7120.5A aims to address program and project management in a systematic, thorough and integrated way, PPMI aims to promulgate it in the same integrated fashion.

**NASA's Crosscutting Processes**

In NPG 7120.5A, we are called to manage strategically. As trainers we have to remind project managers to keep in mind the mandates and requirements of our customers, international partners and the project's stakeholders. We need to communicate Agency direction and decisions clearly, quickly and understandably. As we align our human, material and financial resources with cus-

tomers requirements, we need to improve our acquisition methods and foster leadership. Finally, we must advance and expand our efforts with information technology to provide more links with experts through our online group communications, and leverage the valuable experience of 1,600 NASA PPMI alumni so we can get timely answers to our urgent technical and managerial questions.

To achieve all this, we need to integrate our efforts and interconnect with NASA's crosscutting processes, as outlined in the *NASA Strategic Plan*. At every level, performance will be measured twice a year against the goals and



*Figure 8. NASA's Crosscutting Processes*

objectives outlined in the *Strategic Plan*. Performance-based Contracting and other initiatives will change our relationship with contractors as civil service employees continue to move away from detailed operations management toward contract oversight roles. And while employees will be empowered to perform their jobs and project managers operate in the new NASA of the 7120.5A era, all will be held accountable through performance plans for

meeting their own objectives. Here is how the *NASA Strategic Plan* expresses this new way of managing strategically.

- We will measure our performance and communicate our results, demonstrating NASA's relevance and contributions to national needs.
- We will change the way we work with our contractors and streamline regulations.

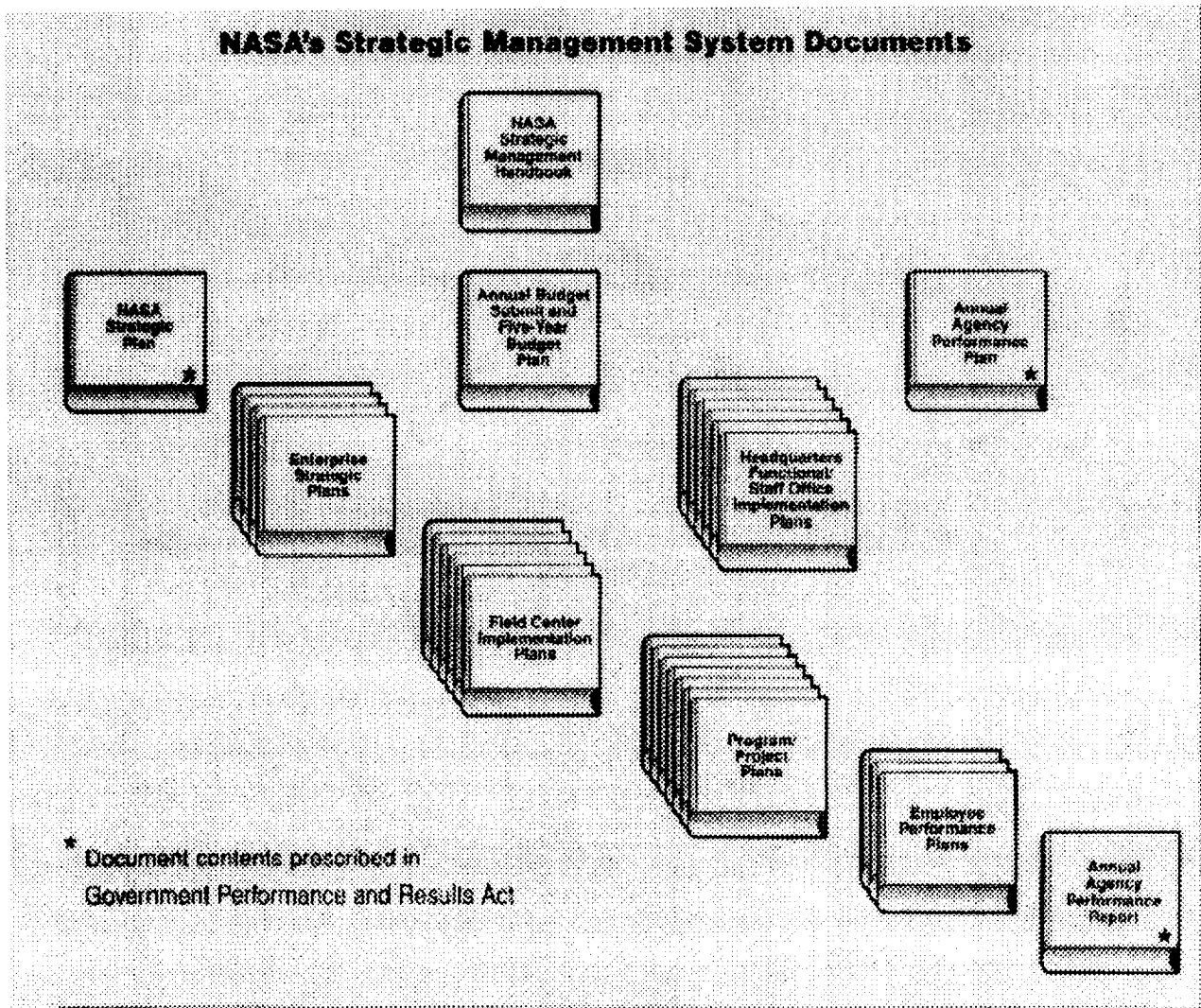


Figure 9. NASA's Strategic Management System Documents

- We will deliver on our commitment, be accountable for the success of our programs, and provide a balanced and stable aeronautics and space program by implementing strategic management throughout NASA.

To implement strategic management, we must keep the customer and the “big picture” in mind. Our challenge in PPMI is to make training more useful, more focused, and directed more toward supporting competency development. PPMI now offers 20 courses – 21 if you include the new 7120.5A briefing – more than most universities offer in the field of program and project management. Yet, our career development participants want their knowledge more focused than ever. Our training materi-

als need to reflect the four life cycle levels presented in NPG 7120.5A, and both our tools and information technology systems must be expanded to support this task.

Finally, the 7120.5A briefings themselves present a performance challenge as we try to meet the information needs of trainers and diverse audiences. Currently, we plan several one-hour sessions for top-level NASA managers, and a three-hour session for all personnel, followed closely by a two-day 7120.5A overview course at each of the Centers. Eventually this new way of doing business will spread throughout NASA and its project management community, resulting in procedures and practices that will keep this Agency at the forefront of successful innovation.



# The NPG 7120.5A Electronic Review Process

by Robert O. McBrayer with Mark Ives

The use of electronics to review a document is well within the technical realm of today's state-of-the-art workplace. File servers and web site interaction are common tools for many NASA employees.

The electronic comment processing described here was developed for the NPG 7120.5A review to augment the existing NASA Online Directives Information System (NODIS). The NODIS system is NASA's official system for formal review, approval and storage of NASA Directives.

The electronic review process worked so well that NASA and other agencies may want to consider it as one of our "best practices." It was participatory decision making at its very best, a process that attracted dozens of very good ideas to improve the document as well as the way we can be managing projects far more effectively.

The revision of NPG 7120.5A has significant implications for the way all elements of the Agency accomplish program and project management. Therefore, the review of NPG 7120.5A was an Agencywide effort with high visibility, heavy participation and a short schedule. The level of involvement created interest in supplementing the formal NODIS system with a system to collect comments efficiently and to allow the Centers and Codes to review and consolidate their comments into the official system in a short period of time.

In addition, the Program Management Council Working Group (PMCWG), responsible for the revision of the document and the disposition of official comments, needed an electronic system to manage the disposition of comments, obtain PMCWG consensus on each disposition, and coordinate the disposition with the appropriate Headquarters Code that had submitted the official comment. The combined NASA and contractor talents and resources provided a system that supplemented the NODIS system and its operating personnel to produce a thorough review and approval of NPG 7120.5A on April 3, 1998, 7.5 months from the start of the process. The original six-month schedule is indicated on Figure 1. All milestones occurred on time, except for completion of comment disposition, which required an additional 30 days. Approval of the document occurred sixteen days after completion of the "Purple Package."

## The Electronic System

The NPG 7120.5A electronic comment processing system was comprised of three consecutive stages: collection, consolidation, and disposition (see Figure 1). Each of these stages had its unique requirements, but the combined use of web sites and file servers was consistent across all the stages. In addition, an Excel spreadsheet was used consistently as a data format for the last two stages. The first stage, collection, used the NASA Program/Project

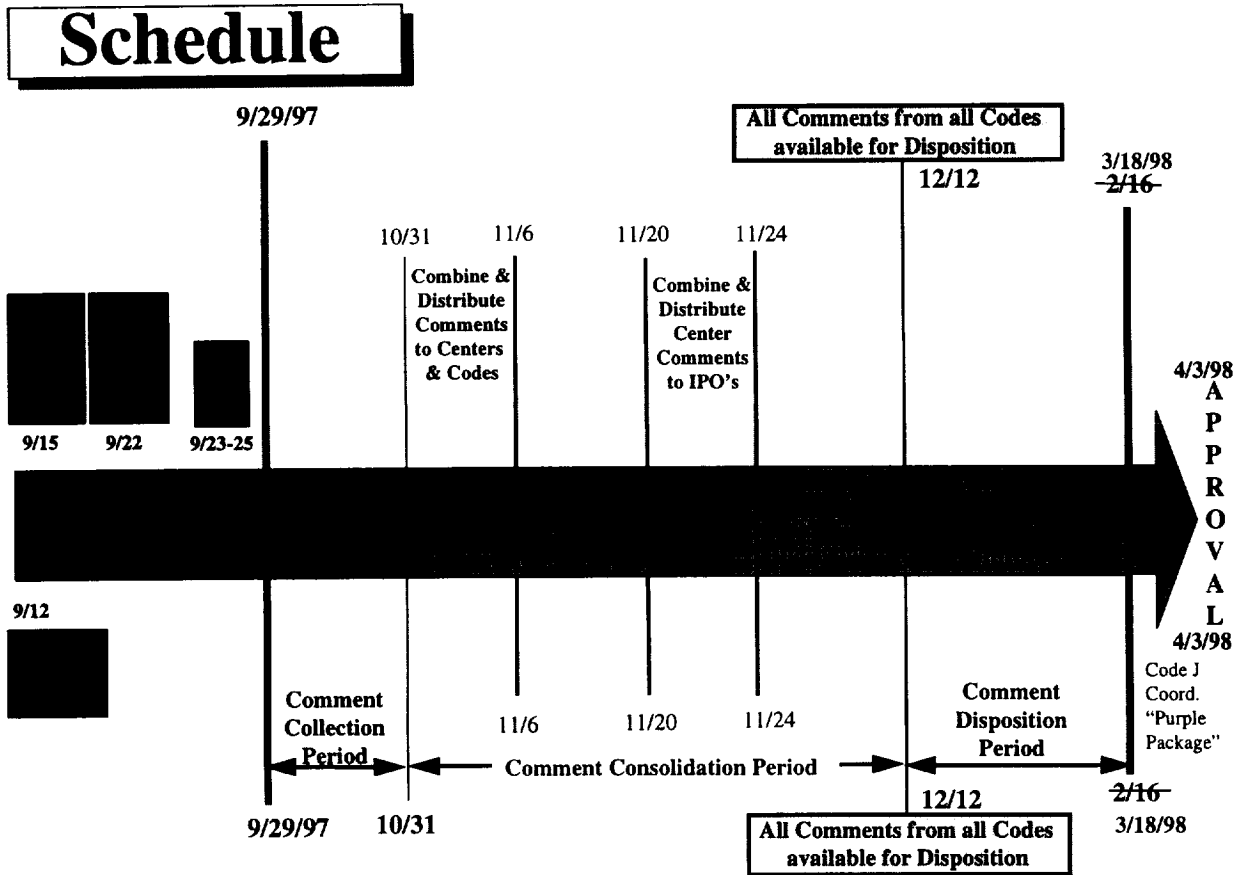


Figure 1.

Management (PPMI) web site to display the document and comment form. The NASA NODIS system also provided a link to the document on the PPMI web site. The Netscape browser could access the web site and submit the comments by e-mail to a file server data base.

The second stage, consolidation, used the standard NASA e-mail system to provide an Excel spreadsheet to each of the NODIS Directives Managers for comment consolidation. After consolidation, the comments were transmitted electronically to a file server to build a new data base and configure comments to be either placed in NODIS electronically or combined in a new spread-

sheet for additional consolidation. The third stage, disposition, required a web site for displaying the document revisions as comments were disposed of and approved, plus a file server to support the dispositioning process. The NODIS system was used as the official document approval system throughout the end of the second stage and the entire third stage.

**The First Stage**

The first stage consisted of developing an online, Internet-based system, testing the system in a focus group review, updating the system, and using the system to collect comments during the Agency review process. The system

was created to accommodate rapid access to the document and electronic comment forms, comment collection, and redistribution of comments, using the following guidelines:

- a. Display the document and comment form in a location easily accessible electronically, Agency-wide.
- b. Provide for collection of comments in a file server as a data base.
- c. Provide for each recipient of the comment data to sort the comments easily according to any of the elements of the data base.

A resizable, split-screen layout was designed for the PPMI web page. The top of the screen contained the draft NPG 7120.5A and the bottom of the screen contained the comment form. This layout was added to the PPMI web page under "What's New." A Netscape 3.0 (or higher) browser was required to interact with the system, and Netscape was used to transmit comments to the file server upon completion of the form. The comment form initially contained the following fields: Type of Comment (General, Specific, Editorial), Chapter number, Paragraph number, Issue and Comment. An index number, to identify each comment uniquely, and the e-mail address of the sender were added to the data base and included in reports.

All submitted information was automatically downloaded and stored in a data base, which allowed quick conversion of data to word processing, graphical and spreadsheet formats. The reports were provided in an Excel spreadsheet format for ease of sorting, and because it is a widely used appli-

cation. One disadvantage of Excel is the 250-character limit on each cell. To accommodate longer comments (a few exceeded one page), additional cells were added adjacent to the initial comment cell. In some cases, the comments were provided in a Microsoft Word Table for ease of review and consolidation. The Word Table did not provide the sorting capability that was such a valuable feature of the Excel spreadsheet. However, the combination of these two applications served the process very well.

The PMCWG decided to distribute a draft of the NPG 7120.5A to a small focus group (less than 100 people) that included personnel across the Agency. Representatives from Headquarters, MSFC, JSC, JPL, LeRC, LaRC, GSFC, KSC, Provide Aerospace Products and Capabilities, the Engineering Management Council, Procurement, and graduates of PPMI training were asked to participate. The purpose of this focus group review was two-fold: 1) determine if the revision was ready for Agencywide review; and 2) test the comment collection system for potential use in the Agencywide review. The focus group review occurred August 18-21, 1997, employing user name and password access to the electronic document and comment form. This review produced 657 comments that resulted in a complete reformatting of the document and in revisions to the comment collection system.

A meeting of the PMCWG was held August 25-28, 1997, to assess the results of the focus group review and prepare the draft NPG 7120.5A for Agency Review. The PMCWG used an Electronic Meeting System, developed by the Training and Development Division of NASA Headquarters, to obtain a group priority on the comments

received. As a result of the focus group review, several changes were made in the system that would be used to support the Agency review:

- a. A support team was formed to provide on-site assistance to commentors and Directive Managers at all the Centers and Headquarters Codes.
- b. The document would remain on the split screen, but the capability to download the entire review draft in Microsoft Word was added to the web page.
- c. The commentor's Center and Mail Code were added to the comment form fields to aid sorting.
- d. The Excel spreadsheet was retained as the report format. Additional columns were added to contain comments longer than 250 characters.
- e. Weekly reports to the Directive Managers were instituted.
- f. No user name/password would be used for the Agency Review, but access to the PPMI web page excluded any e-mail address that did not end in "nasa.gov."
- g. Video/telecons (ViTS), similar to the focus group review, were scheduled to brief the content of the document and the process for the Agencywide review.
- h. A test period, similar to the focus group review, was scheduled for participants to access the web site and submit test comments.

## Comment Processing

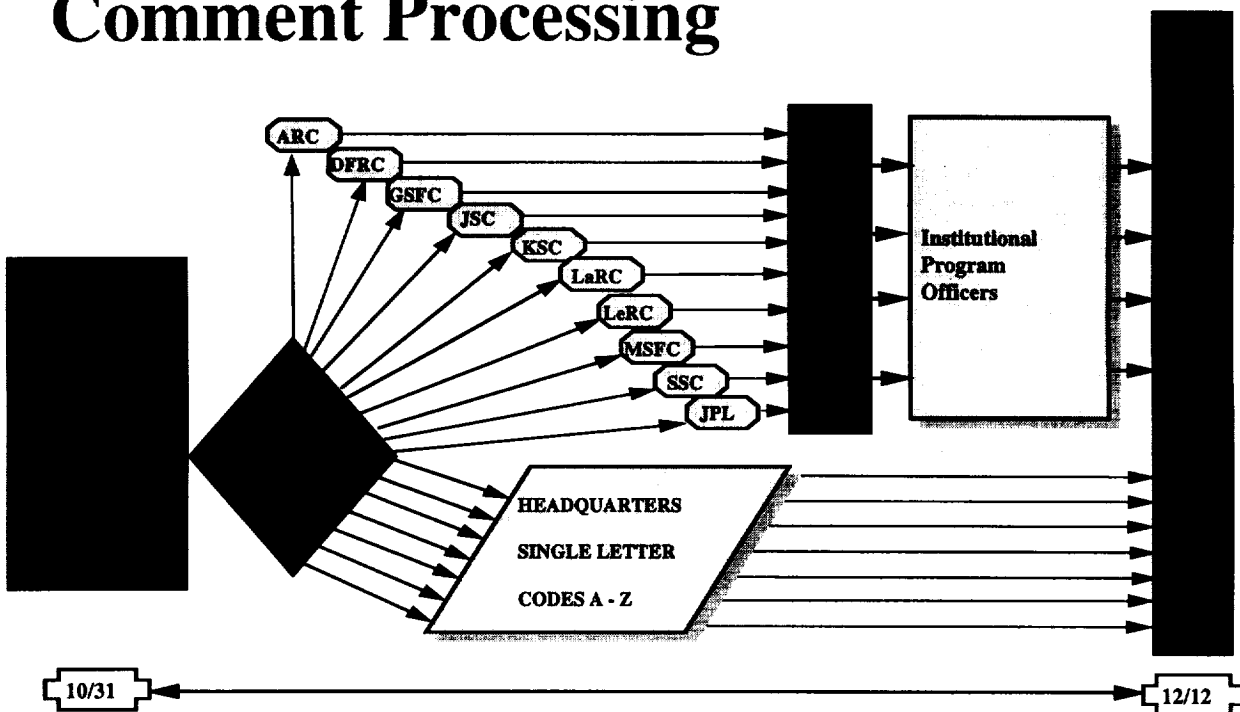


Figure 2.



The support team formed to provide on-site assistance to commentors and Directive Managers at all Centers and Headquarters Codes was intended to focus key elements on the review process. Each Center/Code support team was comprised of the Directives Manager (responsible for the document review), a PMCWG representative (to answer any questions about the document and help with comment consolidation), and a computer support representative (to help with the electronic exchange or recompiling of comments). A special briefing on the review system and process, directed at the support team, was held September 22, 1997.

The results outlined above were incorporated into the system and the process for the Agency Review and comment collection. The Agency Review began on September 29, 1997, and closed on October 31, 1997; a total of 1,672 comments were submitted. The totals by week were: first week, 21 comments; second week, 65 comments; third week, 168; and the fourth week, 578 comments. The electronic system handled 1,094 comments in the final week. All 1,672 comments were then collected by Center and Code, and the individual Excel spreadsheets were returned to the respective Centers and Codes in four days, two days ahead of schedule, for consolidation.

### **The Second Stage**

The second stage was comprised of sorting and returning the comments, Center and Code review and consolidation, and placing the final comments into NODIS, as indicated in Figure 2. The electronic form of the comments provided the capability to quickly sort, package and distribute the comments back to the source organizations for

consolidation. Each Center and Code received the comments that came from their organization in an Excel spreadsheet. The 250-character limit on cells was a disadvantage for lengthy comments, but the flexibility offered by Excel to sort the comments according to any field was a significant advantage.

After October 31, 1997, a data base of all the comments was entered into the system. Each comment was given a unique index number and packaged in the Excel spreadsheet. The spreadsheets were sent to all the different Centers, and they contained all the comments that came from that Center. The Centers then took those comments and went through a discarding and consolidating process. The resulting data was sent back and combined and distributed to the Institution Program Officers (IPOs). They went through a similar comment combination and consolidation process that would result in final comments to go in the NODIS for disposition. The Headquarters Codes, other than IPOs, received their comments, and had more time to process their comments and get theirs entered into NODIS. This all took place between October 31 and December 12, 1997. Many of the Centers did an excellent job of consolidating the comments for their IPOs.

The PMCWG worked with the Headquarters Code JM, Management Assessment Division, to prepare the final comments for electronic entry into NODIS. After consolidation by the IPOs and other Headquarters codes, the comments were provided to us electronically. We indexed the comments and put them in a format that could be electronically inserted into NODIS under the appropriate Code. This ensured that all comments had a

unique index number and relieved the Directives Managers from having to enter their comments manually. A total of 547 comments were entered into NODIS for dispositioning.

At the same time the comments were released into NODIS, we placed the comments into a separate electronic system that would permit the PMCWG to work throughout the disposition stage.

**The Third Stage**

The third stage included disposition of the final comments, revising the document to include the dispositions and obtaining concurrence of the Officials-in-Charge. The responsibility for disposition of each Headquarters Code's comments was assigned to PMCWG members located at Headquarters.

These assignments were essentially the same as assignments for the Agency Review Support Team. Support was provided from other PMCWG members and other Center and Headquarters personnel. The process for PMCWG processing of the comment dispositions is depicted in Figure 3.

The web page developed for this activity is shown in Figure 4.

Each box included the comments from the respective codes and a form for entering the comment disposition (Figure 5).

Upon completion of the disposition, comments were sent to a file server and was placed in the "Proposed Disposition" file. The dispositions in that file were reviewed in a series of PMCWG telecons. The purpose of the

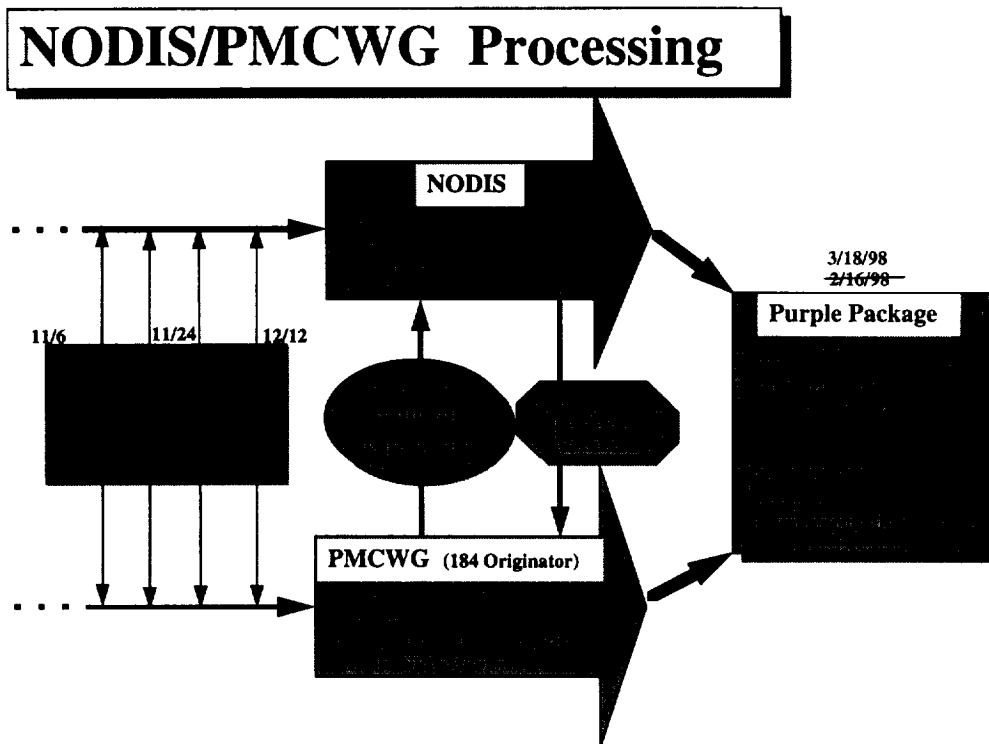


Figure 3.

The screenshot shows a Netscape browser window with the title "[7120.5a Start]". The main content is a table with four columns and three rows of data, plus a final row with links.

<u>Codes</u> A, C, M, and U <u>Keith Hudkins</u>	<u>Codes</u> B, G, L and R <u>Jo Gunderson</u>	<u>Codes</u> E, F, I and W <u>Ed Hoffman</u>	<u>Codes</u> H, P and K <u>Ken Sateriale</u>
<u>Code</u> S <u>Ken Ledbetter</u>	<u>Codes</u> J and Z <u>Andrea Norris</u>	<u>Code</u> Q <u>Michael Greenfield</u>	<u>Code</u> Y <u>Cheryl Yuhas</u>
<u>Major-Code Issues</u> <u>Robert McBrayer</u>	<u>View Proposed Dispositions</u>	<u>Final Comment Status</u>	<u>NPG 7120.5A Update Log</u>
<u>Help</u>	<u>Downloads</u>		<u>Modified NPG 7120.5A</u>

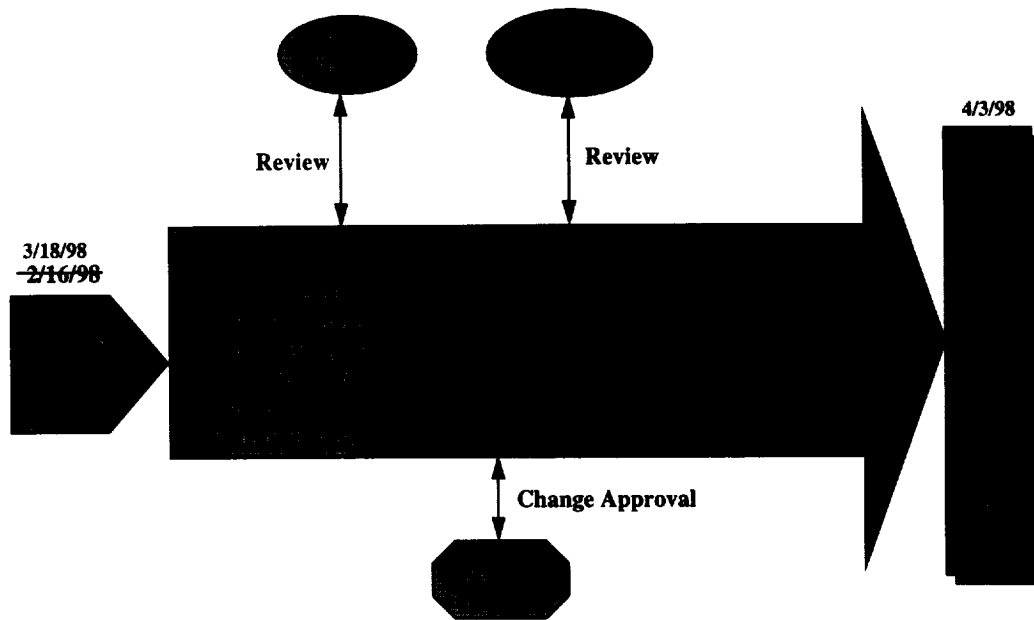
Figure 4.

The screenshot shows a Netscape browser window with the title "[Codes J and Z]". The main content is a table with six columns: Index, oldindex, code, Chapter, Issue, and Comment. The table contains three rows of data.

Index	oldindex	code	Chapter	Issue	Comment
84	813	R	a Table of Contents	Improve usability of T.O.C.	Carry the table of contents down to the three digit level - it will enhance its utility significantly.
102	1502	R	All	Program/Project Reserves	At numerous places in the document, program/project reserves have been advocated as a means to mitigate risk. Program/project managers across the Agency, however, have been directed not to maintain budget reserves. Is this a change in Agency policy (written or stated)? Sound program/project management principles would indicate that the maintenance of reserves is an essential practice.  We need to make a distinction between the sponsor's

Figure 5.

# Code J Approval Process



**Figure 6.**

telecons was for the PMCWG to agree on the disposition of each comment. All dispositions provided by Friday close of business were included in the following Wednesday telecon. The typical agenda for these telecons included: major issues status, lead reports and proposed disposition discussion. After approval by the PMCWG, the disposition was integrated into a copy of NPG 7120.5A; revision notes and a log were kept to indicate where each comment was included in the document. In addition, the approved disposition was inserted in the NODIS disposition block. A hyperlink was provided in NODIS to permit those reviewing the NODIS dispositions to see where the comments had been incorporated into the revised document. This process was used in the disposition of all the final comments. Upon completion of the dispositioning, the revised

document was reviewed by technical editors and finalized. Officials-in-Charge concurred in the dispositions, or the dispositions were presented to senior management for resolution. A summary of substantive comments was prepared and included with the final document and the concurrences. This package was provided to Headquarters Code JM for processing. The Code JM package was provided to the Headquarters Legal office and the Administrator's Correspondence Office for their concurrence, and then sent to the Administrator for signature. The flow diagram for the Code JM processing of the Agency Review products is shown in Figure 6.

Throughout this comment disposition stage the dispositions were developed, coordinated and approved by the PMCWG. The approved dispositions

were used to revise a draft of NPG 7120.5A, and this draft was available for viewing by the Headquarters Directive Managers and Officials-in-Charge. Code JM ensured that the NODIS system concurrences were included for all comments and dispositions, assembled the “Purple Package” and staffed it through the final approval phase of the process.

In summary, the electronic comment processing system collection, consolidation and disposition required careful planning and close coordina-

tion between NASA and contractor personnel. The process was quick, efficient and thorough; it exceeded our expectations and resulted in a better, richer document.

The technology is now available to allow faster, cheaper and better reviews using electronic systems that are already in place within NASA. The system described here should be used as a springboard to develop even better ways to conduct electronic reviews, and improve the efficiency of the NASA work force in meeting future challenges.



# Risk Management Structured for Today's Environment

by Dr. Michael A. Greenfield

Today's project management environment provides NASA with myriad challenges. We have smaller budgets and, consequently, smaller programs and shorter lead times. We have less money for development, and no money to recover from contingencies or mishaps. The NASA Administrator is leading the Agency away from operations, instilling a renewed focus on scientific research and the development and application of new cutting-edge technologies. We are using performance-based and fixed-price contracts with industry, and we are forming more and more partnerships with the international community. In addition to the environment, we have many NASA-unique conditions that challenge mission success. They include a higher level of performance requirements, limited production numbers, higher development efforts and cost, the inability to operate a space element fully under realistic conditions on the ground, limited access to the product during operation, and, of course, the need for more science for fewer dollars and on a shorter schedule.

Faced with these new challenges, we quickly realized that only a robust, Agencywide approach to risk management would provide the assurance of success we required. In NPG 7120.5A, we define risk management as "an organized, systematic decision-making process that efficiently identifies, analyzes, plans, tracks, controls, and communicates and documents risk in order

to increase the likelihood of achieving program/project goals." Effective risk management depends upon a thorough understanding of the concept of risk, the principles of risk management and the formation of a disciplined risk management process.

In human spaceflight programs, NASA has always maintained a rigorous and highly structured risk management effort. When lives are at stake, NASA's missions must be 100% safe; the risk management approach used in human spaceflight has always been comprehensive.

In spacecraft and technology programs, however, NASA's history of risk management implementation has been sporadic. In some cases, the deployment of risk management resources and assistance was not based solely on objective data, but rather on the "squeaky wheel" principle. The most vocal subsystem manager received risk mitigating resources. Furthermore, risk management was interpreted, more often than not, as risk aversion. Massive resources were poured into large programs late in the life cycle to make sure that risks were avoided at all costs. This uneven approach to risk made it difficult to gather and use past risk management experience, and there was no formal process for the communication of risks and impacts.

In addition to being inconsistent, NASA's traditional risk management efforts in spacecraft and technology

programs can be described as risk management by rote, or as a rule-based approach. The rules were based upon the mission classification, and NASA missions were classified on the basis of their importance and priority to the Agency.

NASA Management Instruction (NMI) 8010.1A established the risk management rules for each classification. This policy delineated the elements for mission success and safety, reliability, maintainability and quality assurance (SRM&QA). It provided requirements for engineering models, the number of spares, treatment of single failure points, the grade of EEE parts, testing, types of reviews and other factors for each classification, regardless of the specifics of the mission. This rule-based approach did not provide the program manager with any flexibility to tailor the effort to the program needs.

Thus, the requirements for risk management were inflexible and the application inconsistent. But without a doubt, the most significant void in NASA's previous risk management approach was the failure to completely integrate risk management into program management. NPG 7120.5A improves NASA's risk management process to correct these deficiencies.

NPG 7120.5A establishes the management system to support the development and operation of aeronautical, space, ground and flight systems and technologies that make up the Agency crosscutting process titled "Provide Aerospace Products and Capabilities." NPG 7120.5A documents the processes, requirements and responsibilities comprising an ISO 9000-compliant management system for implementing NASA's programs and projects. It pro-

vides the guidance necessary to transfer methods used in the disciplined risk management process associated with human spaceflight programs into all NASA programs, including spacecraft and technology programs.

Risk management is an overarching theme of NPG 7120.5A. Specifically, the guidelines require that program decisions be based upon an orderly risk management effort, including the identification, analysis, planning, tracking, and control of risks throughout the life cycle. (The new NPG breaks out a program life cycle into four subprocesses: Formulation, Approval, Implementation and Evaluation.) NPG 7120.5A requires that program managers develop a risk management plan upfront in the Formulation stage of a program, and then execute and maintain the plan during the Implementation phase. The implementation and maintenance of a safety management program is a required element of the *Risk Management Plan*.

### Concept of Risk

Before we look more in depth at NASA's risk management process, we should first establish what we mean by "risk." Risk means different things to different people. "Risk" can mean an event—like the loss of communications. "Risk" can mean a possibility or probability—like a 10% likelihood of mission failure. For some, "risk" is the product of likelihood times severity. Some think "risk" is what you take; some think "risk" is what you avoid. NASA has defined "risk" as "the combination of 1) the probability (qualitative or quantitative) that a program or project will experience an undesired event such as cost overrun, schedule slippage, safety mishap, or failure to achieve a needed technologi-



cal breakthrough; and 2) the consequences, impact, or severity of the undesired event were it to occur.” Primary risks are those undesirable events having both high probability and high impact. Risk management, then, is an organized and systematic decision-making process that identifies risks, assesses their impact and likelihood, and effectively prioritizes them for mitigation or elimination.

Risk management activities are prescribed throughout the entire program, from Formulation to Evaluation. The initial Program Commitment Agreement, in which the program manager details the entire program, requires the program to identify and document the areas of highest risk, including the specific primary risks, the proposed actions to mitigate risks, and the reserves and allowance for program adjustment (APA) allocations. This upfront requirement to address risk management formally is a critical step toward successful programs. In addition, the Program Plan requires documentation of the risk management strategy and provides a template to make sure that risk management planning is complete. The Project Plan requires similar risk management planning.

In the past, NASA’s development processes were characterized by extensive analyses, numerous reviews and multiple, conservative tests. This methodology was consistent with the long available schedules for developing the hardware and software for very large, billion-dollar missions. Today’s environment calls for value-based tests and analysis, and knowledge-based rather than rule-based risk management. In other words, the program manager will not conduct a series of tests from a prescribed checklist. Rather, the pro-

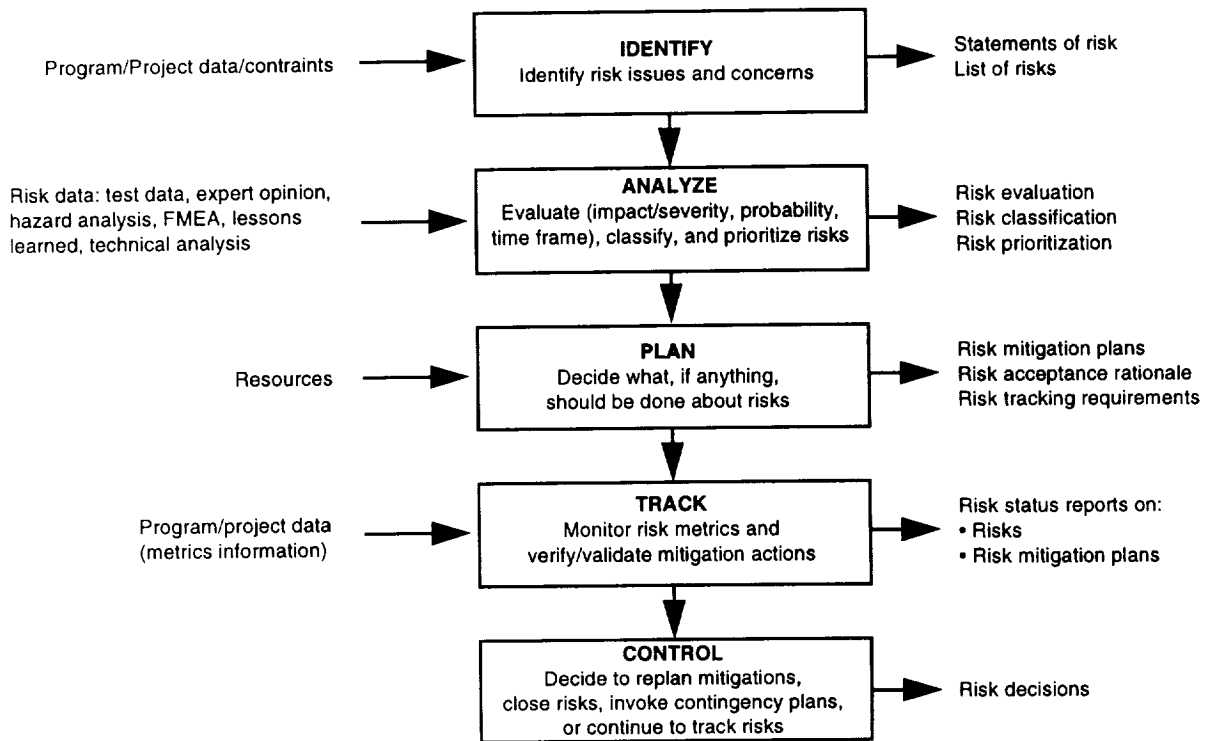
gram manager will determine the appropriate level of tests, tailored to the specific program. From the results of value-based testing and analysis, the program manager can categorize and quantify the risks according to probability, impact, and the time frame in which mitigating action must be taken.

### **Principles of Risk Management**

The Risk Management Plan is developed in the Formulation phase. It clearly defines the process by which the program/project manager will address risk issues and decisions. Much like a Project Plan, it defines who has risk management responsibility, what processes will be used for risk identification, analysis, and ranking, and how decisions will be tracked.

Figure 1 shows the primary elements of the risk management process required by NPG 7120.5A. The first input into the process is the definition of project constraints. Project constraints include those factors that affect the success of the overall program and, therefore, guide the development of the policy that will be used to make risk decisions. Examples may include mission success criteria, schedule, budget, international partner participation, human spaceflight safety issues, technology readiness, oversight requirements and legal, environmental or political issues.

Once the program constraints are defined and understood, the program manager can identify general risk issues and concerns. These relate to questions such as “What objectives are at risk in such key areas as management, technology development, engineering, manufacturing, and operations?”



**Figure 1. Risk Management Process.**  
**NOTE: Communication and documentation extend throughout all of the functions.**

The second step in the risk management process involves risk analysis. It is during this step that you quantify your risks, an initial screening that will produce a prioritized risk list for action. Most risks will fall into a category of having little likelihood of occurrence or only limited consequences. These must be tracked, but real attention must be paid to those that represent severe threats to the program.

In step three you ask the question: "What can I do about these high consequence, high likelihood risks?" Mitigation actions can reduce the likelihood of occurrence or the severity of the consequence to the project. Actions can include such things as redesign, changing requirements, acquisition of more resources (both in dollars and time), the development of contingency plans, etc. Risk mitigation includes re-

sponsibilities, methods, schedules and outcomes. A word of warning—too much risk aversion is a natural tendency but this approach can actually increase other risks by absorbing too many critical resources that might be better deployed elsewhere.

### Risk as a Tradable Resource

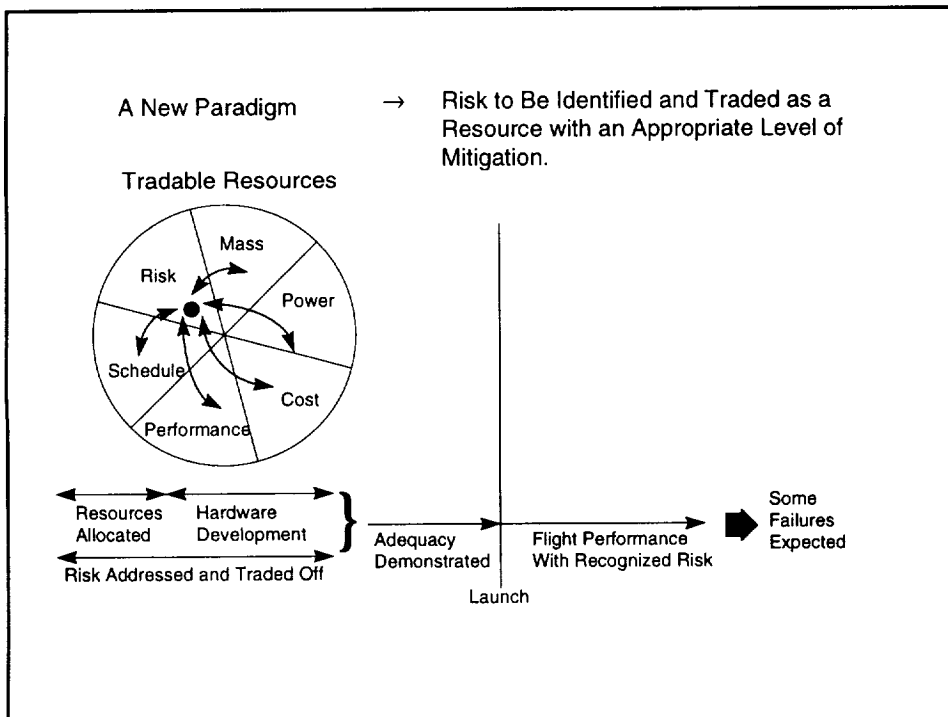
When analyzing risks and determining appropriate mitigation, particularly in an environment of limited resources, the project manager knows tailoring plays an important role in mission success. In the human spaceflight area, program managers are constrained in the amount of safety risk that can be accepted, and rightly so. However, when developing risk mitigation for non-human spaceflight programs, the program manager has more latitude to optimize overall risk posture through

accepting risk in one area to benefit another. Figure 2 depicts risk as a tradable resource. Throughout the resource allocation and hardware development phases of a project, risks are addressed and resources traded off, including mass, power, cost, performance, schedule and risk. Benefit analysis is key. This new paradigm, "Risk as a Resource," allows for recognized risks and concedes that there may be some failures. However, the Agency can afford to conduct many more missions by employing risk as a resource in an integrated approach to risk management.

Once the risk mitigation actions have been completed, the risk management process calls for tracking, which includes verification and validation (V&V) of mitigation actions. V&V usually involves a combination of inspections and tests to assure that a mitigation action has been imple-

mented and that it works. Once V&V is complete, all primary risks must be controlled (the next step of the risk management process). A risk is considered "controlled" or "retired" when any one of the following conditions are satisfied:

- Risk mitigation options that reduce the probability of occurrence to an acceptable level have been planned and will be implemented;
- All reasonable mitigation options (within cost, schedule and technical constraints) have been instituted, and the risk has been judged to be "acceptable" by a governing PMC; or
- Reserve funds are available to recover from cost, schedule and technical impact, should the risk actually occur.



**Figure 2. Risk as a Resource**

## Issues in NASA Program and Project Management

The risks and mitigation actions are continually documented and communicated throughout the program life cycle. This documentation supports assessment of the effectiveness of the mitigation, reevaluation of the risk, and the ability to understand how other project actions may affect decisions already made. Additionally, such documentation serves as a valuable source of lessons learned for future programs.

NPG 7120.5A establishes risk management as an integral part of program management, to be implemented throughout the program life cycle. The process and documentation requirements, when complete, constitute a thorough risk management effort. It calls for an upfront risk management plan, and provides guidelines to ensure that the appropriate risk analysis is conducted and proper mitigation is in

place, commensurate with the specific needs of the program.

NASA's environment, both fiscally and programmatically, has changed dramatically in the past few years. We must adapt to the changes and understand the unique conditions that face the Agency. The rule-based approach that we used to control risks in large budget programs will not work with today's lower cost missions. We must tailor our risk analysis and mitigation to the specific needs of the program, and now consider resource trading, including risk, to achieve the maximum return on investment.

Effective risk management, as outlined in NPG 7120.5A, is a necessary and practical aspect of improved program management now and in the new millennium.

# Resources

by Dr. William M. Lawbaugh

NASA maintains an online library for official documents called NASA On-line Directives Information System (NODIS) Library that provides access to a wide range of requirements applicable to NASA programs and projects. This library is updated as new requirements are approved.

To access the NODIS Library page, go to URL: <http://nodis.hq.nasa.gov> This will provide you access to the *NASA Strategic Plan*, *NASA Management Handbook* and Agency and Center Directives. Access is also provided to Federal regulations, Executive orders, OMB Circulars, Technical Standards, Charters and Financial Management Manuals.

**Technical Standards.** The Agency-preferred standards may be viewed at URL: <http://standards.nasa.gov>

**Charters.** The Agency Program Management Council Charter may be viewed at URL: [http://nodis.hq.nasa.gov/Nodis1.1/attachments/pmc\\_charter.doc](http://nodis.hq.nasa.gov/Nodis1.1/attachments/pmc_charter.doc)

**Information Sites.** The NASA Program and Project Management Initiative (PPMI) may be viewed at URL: <http://ppmi.hq.nasa.gov>

The PPMI Home Page also provides an ever-expanding number of links to supporting resources for program and project management, as well as for NPG 7120.5A.

- *Training and Curriculum*  
All PPMI courses are listed and described
- *PMDP*  
NASA's Project Management Development Process is charted and explained
- *NASA Lexicon*  
References, definitions and acronyms for NPG 7120.5A and Agency programs
- *NASA Strategic Plan*  
The latest version, an indispensable resource
- *NASA Strategic Management Handbook*  
The guidebook for integrating strategic planning with the NASA budget process

The PPMI web site will also link you to a vast array of learning resources for enlightened project management.

- *NASA Fast Tracks Study*  
Details of best practices, lessons learned and success stories on "better, faster, cheaper" projects
- *Superior Projects Team Study*  
A new study of successful NASA work teams, based on Dr. David Kinlaw's research

## Issues in NASA Program and Project Management

- *Project Excellence Through Storytelling*  
A novel approach to the study of successful NASA projects by the leaders sharing their experiences
- *Best Practices*  
Results of online surveys of NASA project managers, arranged in a matrix with direct links to the best practitioners
- *Distance Learning*  
An ongoing survey of successes and failures in other government agencies and leading edge companies in online instruction
- *Case Studies and Lessons Learned*  
Analysis of successful strategies used on “better, faster, cheaper” projects like NEAR
- *PM Coach*  
Under construction, in-depth coaching on key tools and techniques specified in NPG 7120.5A
- *PPMI Listserv*  
An email list service of PPMI program alumni used to raise questions and broadcast topical information. The list contains more than 1,500 addresses. Request subscription by typing “subscribe” in the message area (leaving the subject line blank) and send to [ppmi@hq.nasa.gov](mailto:ppmi@hq.nasa.gov)
- *SOLAR*  
NASA’s Site for On-line Learning and Resources for SMA training plus curricula and catalogs  
<http://solar.msfc.nasa.gov>
- *Lessons Learned Information System*  
Lessons learned from nearly 40 years in the aeronautics and space business for better safety, reliability, maintainability and quality.  
<http://llis.gsfc.nasa.gov>

# NASA Program/Project Management Training Resources At-A-Glance

<b>Resource</b>	<b>Purpose</b>	<b>Audience</b>	<b>Topics</b>	<b>Contact</b>
<b>Task Management (TM)</b> <i>An Introduction to Project Management</i>	To provide an understanding of management principles, tools and techniques at the task level through discussion and a task simulation exercise.	Personnel seeking an interactive, hands-on introduction to basic project management principles and techniques. GS 9-14	Staff/line responsibilities, risk management, work breakdown structure, communication, planning, directing. Highly interactive; uses hands-on techniques.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>Project Management (PM)</b>	To provide early career exposure to basic management principles, skills, and techniques used in the management of successful NASA projects.	Personnel working at the subsystem level of a project with first-time management responsibilities. Typically engineers or scientists. GS 11-14	NASA framework, acquisition and budgeting, program control, problem solving, project planning, decision making.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>Advanced Project Management (APM)</b>	To provide mid-career project managers with in-depth training in the disciplines and techniques of NASA project management.	Personnel working at the systems level of projects with substantial project management experience. Typically experienced engineers or scientists. GS 14-SES	NASA project life cycle, systems engineering, contract management, scheduling, acquisition logistics, subcontracting, risk management.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>International Project Management (IPM)</b>	To provide NASA employees involved in managing international projects with state-of-the-art information, best practices, tools and management strategies.	Personnel should have current or anticipated experience in working on international projects. GS 13-SES	Cross-cultural communications, international technology transfer, negotiations, international space policy and law, multinational budget allocations, assessing individuals for international assignments and shared experience panels.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>Program Management (PGM)</b>	To provide high-level, broad exposure to the organizational, budgetary and legislative issues involved in managing NASA programs.	Program managers involved in managing large, complex programs. Typically managers with responsibility for multiple projects within a program. GS 13-SES	NASA goals and strategic plans, advocacy, relationship with Capitol Hill, executing the budget, negotiations, working with OMB.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>Systems Engineering (SE)</b>	To provide an understanding of the systems engineering process and the associated tools and techniques used by the NASA systems engineer.	Personnel who are heavily involved in conducting scientific and engineering projects. GS 12-SES	Need definitions, hierarchical analysis, verification and validation, risk management, concept selection.	Tony Maturro (757) 864-2590 a.j.maturro@larc.nasa.gov

<b>Resource</b>	<b>Purpose</b>	<b>Audience</b>	<b>Topics</b>	<b>Contact</b>
<b>Project Management Shared Experiences Program (PMSEP)</b> (Theme varies)	To provide a forum to understand key initiatives influencing NASA project management, and to learn about state-of-the-art project management tools and techniques used in other agencies and industry.	Personnel with at least five years of project management experience and expected involvement in project management for the next five years. GS 13-SES	Past topics have included international cooperation, controlling and identifying costs, cooperative programming, industry view of the future, human resources and employee development trends.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>Construction of Facilities Management (CoF)</b>	To provide an understanding of the NASA CoF process and to enhance CoF project management skills.	CoF project managers with experience in design or construction who are involved in managing CoF projects. GS 12-SES	Legal issues, planning, design, construction, project activation, tools, shared experiences, procurement.	Howard Kass (202) 358-1128 hkass@hq.nasa.gov
<b>Construction of Facilities Best Practices (CBP)</b>	To provide the tools for more timely, cost effective, higher quality and safer project delivery through CoF operations and maintenance phases.	Those involved in the CoF process including engineers, procurement, financial and administrative personnel. May be contract personnel. GS 12-SES	Pre-project planning, the project team, performance and small project management, value engineering and constructability.	Howard Kass (202) 358-1128 hkass@hq.nasa.gov
<b>Project Planning and Scheduling (PPS)</b>	To provide project teams with an understanding of the principles of planning and scheduling, and an opportunity to apply those principles to their current project.	Project teams, including NASA staff and their contractor(s), working on a project in either the initial planning stages or a project in progress. GS 12-SES	Fundamentals of planning, generation and use of a WBS, creation of a project logic network, generation of a project schedule, definition and management of the critical path, maximum opportunity for hands-on application to the team's current project.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>Technology Transfer and Commercialization (TTC)</b>	To provide the project manager with knowledge and skills required to become more proactive in the commercialization process for new technologies developed as a result of NASA contracts or internal NASA R&D.	Personnel who are program and project managers including system and subsystem managers on large projects. GS 11-SES	Context and process of technology transfer and commercialization within NASA, hands-on practice with TechTracS, and develop and update TechTracS records.	Janelle Turner (202) 358-0704 jturner@hq.nasa.gov



Resource	Purpose	Audience	Topics	Contact
<b>Software Acquisition Management (SAM)</b>	To provide an understanding of the state-of-practice in software engineering and software project management in terms of the concepts, vocabulary, activities, work products, languages, methods and tools.	Personnel who have responsibility for managing the acquisition of software systems or systems in which the software is a major challenge. GS 12-SES	Uniqueness of software engineering/management, selecting software contracts, planning software projects, verification, validation and testing, selecting software development models, reviewing maintenance and design code, estimating schedule and cost, selecting software metrics, determining user requirements, critiquing software and requirements specification.	Pat Patterson (202) 358-2171 pat.patterson@hq.nasa.gov
<b>Enterprise-wide Project Management (EPM)</b>  <i>A Strategic Approach</i> formerly Multi-Project Management (MPM)	To provide a better understanding of the organization systems and personnel issues that must be managed when dealing with matrices and multiple projects as well as develop abilities in formulating effective priorities, objectives and strategies within a dynamic business environment.	Experienced in senior level management of programs, projects, resources or line functions. GS 14-SES	Strategic planning, program management, budget, human resources management, line vs. functional units, organization systems, and new technology development.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>System Requirements (REQ)</b>	To allow participation in exercises and seminars that span many aspects of systems, focusing on developing high quality system requirements and expressing them as effective system specifications. The ideas, concepts, models, approaches, techniques and principles for systems specification, as documented by the leaders in systems, are presented.	Personnel who are responsible for generating requirements, such as engineers, managers and procurement analysts. GS 12-SES	A methodology for the creation of very high quality system requirements, including the purpose of specifications in the engineering of systems; roles of the requirements engineer; design alternatives in requirements specification; environmental constraints; composability; requirements reuse; conceptualization and creation of a product line architecture; test requirements; role of requirements in the engineering life cycle; and nature and use of prototyping.	Pat Patterson (202) 358-2171 pat.patterson@hq.nasa.gov

Resource	Purpose	Audience	Topics	Contact
<b>Software Process Improvement (SPI)</b>	To introduce the Software Process Improvement methods and tools of the GSFC Software Engineering Laboratory (SEL) in the context of the SEI Software Capability Maturity Model (CMM).	Software engineers, programmers and software project managers. GS 13-SES	Lectures and exercises. Primary textbooks (furnished at class time) include <i>The Capability Maturity Model: Guidelines for Improving the Software Process</i> and the <i>GSFC Software Process Improvement Handbook</i> . The purpose, function, and five-level structure of the CMM are presented. The methodology of the SEL, based upon process measurement, is represented as a premier example of a level-5 CMM organization.	Pat Patterson (202) 358-2171 pat.patterson@hq.nasa.gov
<b>Topics in Project Management (TPM)</b>  (Theme Varies)	To maintain the level of knowledge and skills in areas that relate to managing projects in the NASA environment.	Recent graduates of NASA Advanced Project Management, Project Management and Program Management training courses.	A single contemporary topic in project management designed to update PPMI graduates on relevant issues, concepts and practices in the field.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>Topics in Engineering (TE)</b>  Formerly Topics in Software Project Management (TSPM)	To maintain the level of knowledge and skills in areas that relate to managing software projects in the NASA environment, as a follow-on to initial software project management training.	Personnel who have responsibility in the engineering of large systems at NASA. GS 14-SES	Engineering methods, tools and approaches at the frontier of available technology, focusing on the NASA Intelligent Synthesis Environment (ISE).	Pat Patterson (202) 358-2171 pat.patterson@hq.nasa.gov

## Program Management & Control Modules

Resource	Purpose	Audience	Topics	Contact
<p><b>Program Management and Control Fundamentals (PM&amp;C)</b></p>	<p>To provide a synopsis of implementing a NASA project through the life cycle from conceptual designs in Phase A through operations in Phase E, and how the management control systems and processes are used to manage NASA projects.</p>	<p>NASA program analysts, budget analysts, procurement, technical and business management personnel, with at least one year of project management and control experience.</p>	<p>NASA project life cycle phases, program control processes including planning and requirements, configuration management, project planning, schedule and risk management, cost estimating, budgeting, contract engineering, procurement processes, information management and data documentation, and earned value management.</p>	<p>NASA Installation Training Office</p>
<p><b>Parametric Cost Estimating (PCE)</b></p>	<p>To provide technical and program control communities with an understanding of how to effectively work with the parametric cost estimators and know what role they should play. This course builds on the knowledge and skills taught in <i>Program Management and Control Fundamentals</i>.</p>	<p>NASA project technical, program control, procurement and business management personnel who have completed the <i>Program Management and Control Fundamentals</i>.</p>	<p>The cost estimating process, the parametric estimating process, Cost Estimating Relationships (CER), subsystem CER based-cost estimating models, project level costs, beat curves for spreading costs, risk analysis, application of the time value of money in the cost estimating process, and application of learning curves in the cost estimating process.</p>	<p>NASA Installation Training Office</p>
<p><b>Project Scheduling</b></p>	<p>To provide the basic principles necessary for use of the scheduling techniques and resources for NASA programs and projects. This course builds on the knowledge and skills taught in <i>Program Management and Control Fundamentals</i>.</p>	<p>NASA project technical, program control, procurement and business management personnel who have completed the <i>Program Management and Control Fundamentals</i> and <i>Work Breakdown Structure</i> training.</p>	<p>Scheduling system components, scheduling methodologies and characteristics schedule development process, schedule management system and production scheduling techniques.</p>	<p>NASA Installation Training Office</p>

Resource	Purpose	Audience	Topics	Contact
<p><b>Program Management and Control Fundamentals (PM&amp;C)</b></p>	<p>To provide a synopsis of implementing a NASA project through the life cycle from conceptual designs in Phase A through operations in Phase E, and how the management control systems and processes are used to manage NASA projects.</p>	<p>NASA program analysts, budget analysis, procurement, technical and business management personnel, with at least one year of project management and control experience.</p>	<p>NASA project life cycle phases, program control processes including planning and requirements, configuration management, project planning, schedule and risk management, cost estimating, budgeting, contract engineering, procurement processes, information management and data documentation, and earned value management.</p>	<p>NASA Installation Training Office</p>
<p><b>Work Breakdown Structure (WBS)</b></p>	<p>To provide an under-standing of NASA's policy, requirements, guidelines and procedures used in preparing WBS that apply to both contract statements of work and NASA in-house project work. This course builds on the knowledge and skills taught in <i>Program Management and Control Fundamentals</i>.</p>	<p>NASA project technical, program control, procurement and business management personnel who have completed the <i>Program Management and Control Fundamentals</i>.</p>	<p>Fundamentals of WBS, requirements and guidelines for WBS and Contract WBS (CWBS), preparing WBS and CWBS, WBS relationship to Agencywide coding, contractor's reporting, performing organizations, management organizations and program contract process.</p>	<p>NASA Installation Training Office</p>
<p><b>Configuration Management (CM)</b></p>	<p>To provide an understanding of how to effectively work with CM experts in implementing configuration controls and what role CM experts play. This course builds on the knowledge and skills taught in <i>Program Management and Control Fundamentals</i>.</p>	<p>NASA project technical, program control, procurement and business management personnel who have completed <i>Program Management and Control Fundamentals</i>.</p>	<p>CM requirements, configuration identification, configuration control, configuration accounting, configuration verification.</p>	<p>NASA Installation Training Office</p>
<p><b>Earned Value Management (EVM)</b></p>	<p>To sharpen the knowledge and skills of project life cycle and provide an understanding of the criteria that contractor EVM systems must comply with for Government certification. This course builds on the knowledge and skills taught in <i>Program Management and Control Fundamentals</i>.</p>	<p>NASA project technical, program control, procurement and business management personnel who have completed the <i>Program Management and Control Fundamentals</i>.</p>	<p>EVM systems as project management tools, importance and effective-ness of WBS on EVM, certification criteria for contractor's internal system, EVM status reporting requirements, interpretative analysis of EVM status reporting, determination of contract estimate at completion.</p>	<p>NASA Installation Training Office</p>

<b>Resource</b>	<b>Purpose</b>	<b>Audience</b>	<b>Topics</b>	<b>Contact</b>
<b>Program Management and Control Fundamentals (PM&amp;C)</b>	To provide a synopsis of implementing a NASA project through the life cycle from conceptual designs in Phase A through operations in Phase E, and how the management control systems and processes are used to manage NASA projects.	NASA program analysts, budget analysts, procurement, technical and business management personnel, with at least one year of project management and control experience.	NASA project life cycle phases, program control processes including planning and requirements, configuration management, project planning, schedule and risk management, cost estimating, budgeting, contract engineering, procurement processes, information management and data documentation, and earned value management.	NASA Installation Training Office
<b>Procurement Process</b>	To provide a synopsis of responsibilities of technical and program control personnel in the procurement process for a NASA contract. This course summarizes roles from initial request through award and control. This course builds on the knowledge and skills taught in <i>Program Management and Control Fundamentals</i> .	NASA project technical, program control, procurement and business management personnel who have completed the <i>Program Management and Control Fundamentals</i> .	Pre-solicitation phase roles and responsibilities, award phase roles and responsibilities, acquisition planning packages.	NASA Installation Training Office

**PPMI Publications and Videotapes**

<b>Resource</b>	<b>Purpose</b>	<b>Audience</b>	<b>Topics</b>	<b>Contact</b>
<b>Tools Information Guide</b>	To provide information about effective project management tools to the NASA work force. Tools used by NASA program/ project managers are reviewed.	NASA program/project management work force, including subsystems, systems and project level managers, program control personnel and systems engineers.	Software systems, training resources, management practice lessons learned and documentation.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>Lexicon</b>	To outline a common lexicon for NASA and aerospace abbreviation and acronyms to facilitate communication between Centers and NASA and their contractors.	All NASA personnel, their contractors and other agencies collaborating with NASA.	Multiple definition for commonly used acronyms and abbreviations.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>Readings in Systems Engineering</b>	To collect and disseminate the best information on systems engineering for the better understanding and application of a vital discipline in NASA program/project management.	Current and future generations of systems engineers and program/project managers. Of interest and value to aspiring NASA managers and those involved in large, complex systems.	Robert A. Froesch's classic (1969) formulation, plus lessons learned from two failures in the 1970s, specially commissioned NASA Alumni League papers and other studies of systems engineering in government and industry.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>Readings in Program Control</b>	To collect and share some of the best insights on program control in the aerospace community. Opinions and approaches differ widely on program control, which has taken on new importance.	NASA program and project managers and those who currently or will specialize in program control in the management of large, complex endeavors. Of particular interest to cost estimators, planners and schedulers.	Longime Comptroller Bill Lilly gives an overview of program control in NASA, and Nancy Abell describes Goddard's performance measurement system. A variety of classic, innovative and handbook approaches is followed by George Low's historic attack on costs.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov
<b>Issues in NASA Program and Project Management SP 6101-(2-13)</b>	To share experiences and lessons learned in the management of NASA and related programs and projects in a collection of papers and reviews on a semiannual basis.	Current and future NASA program and project managers, instructors and training program participants, plus a wide variety of managers and trainers from industry and commerce.	Management of complex systems, systems engineering, program control, requirements definition, project scheduling, acquisition and budgeting, international partnerships, NASA culture, program planning, book/video reviews and PPMI Library holdings.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov

Resource	Purpose	Audience	Topics	Contact
<b>NASA Systems Engineering Handbook SP6105</b>	A generic description of systems engineering as it should be applied throughout NASA. Field Center handbooks are encouraged for Center-specific detail of implementation.	NASA systems engineers for reference and participants in various NASA-sponsored systems engineering courses, as well as industry and other government agencies interested in NASA's SE process.	Tools and techniques for the system being developed (the product system) as well as the system that does the developing (the producing system).	Bob Shishko (818) 354-1282 robert.shishko@jpl.nasa.gov
<b>PPMI Videotapes</b> (listed below)	To summarize the experiences and lessons learned on various NASA programs and projects.	All NASA personnel, especially those in project management.	Specific project management issues or topics covered in the PPMI courses.	Ed Hoffman (202) 358-2182 ed.hoffman@hq.nasa.gov

**Videos:**

- Multimission Module Spacecraft (MMS) Experience
  - Explorer Satellites Program: Shared Experiences
  - Project Management from a Scientist's Perspective
  - Award Fee Contracting vs. Other Contracts
  - Shared Experiences in NASA Projects (A. Gustafarro)
  - Experience in Managing Award Fee Contracts
  - Project Management at Johnson Space Center
  - Shared Experiences in NASA Projects (A. Thomas Young)
  - Cosmic Background Explorer (COBE) Project: Lessons Learned
  - International Sun Earth Explorer (ISEE): Shared Experiences
  - International Ultraviolet Explorer (IUE): Shared Experiences
  - Upper Atmosphere Research Satellite (UARS)
- CDs:**
- Apollo
  - SOHO (Solar Heliospheric Observatory)
  - GRO (Gamma Ray Observatory)

