
Resources for NASA Managers

by William M. Lawbaugh

Book Reviews

Liftoff: The Story of America's Adventure in Space

by Michael Collins

(New York: Grove Press, 1988)

Michael Collins, best known as the guy who stayed above in the Apollo 11 command module while Neil Armstrong and Buzz Aldrin became the first to walk on the moon, was asked to write "the" story of America's space flight experiences. He agreed, but only if he could do it independently. The result is "a" story of manned space flight, but a compelling one.

His successful *Carrying the Fire* was more personal and revealing, and the ingredients which worked so well for his autobiography are the strengths of this more technical and historical volume. It is ably illustrated by form NASA art director James Dean, who worked with Collins when they were curator and director of Smithsonian National Air and Space Museum.

While *Liftoff* covers much the same territory as other surveys of space flight, Collins' viewpoints and firsthand observations make it interesting. For example, more space is devoted to Gemini (he flew on Gemini X) than Shuttle, and more space on Gemini X than all the other 11 missions, and the book opens with a wonderful account of Apollo 11.

Collins clearly set up his heroes and his adversaries, and he spends an inordinate amount of space on recent events reflected by past experiences. "I cannot imagine von Braun sitting on a problem like the O-rings," he says in his analysis of the Challenger disaster. And "Jim Webb would have known about the O-ring problem," he claims. "He might not have known the difference between a tang and a clevis, but he would have known that one of his contractors was out there waving a distress flag. His people would have told him." In 1988, two years after Challenger, he laments a NASA in which "the magic is missing."

In contrast, he points to George Low's Configuration Control Board which considered 1,697 changes and approved 1,341 of them in the two years following the 1967 Apollo disaster, a fire on board that took the lives of Grissom, White and Chaffee. He quotes Low as saying: "Arguments sometimes got pretty hot ... In the end I would decide usually on the spot, always explaining my decision openly and in front of those who liked it the least," including the astronauts, Collins' most important people.

In a concluding chapter, "Ad Inexplorata," Collins endorses the Paine Commission report starting with a permanent space station and culminating in a mission to Mars. For the near future, he predicted, "The Hubble's successful launch will, I feel, be the most important piece of work NASA has done in recent years, and one that I hope will herald the agency's return to the forefront of science and exploration."

Ethics in Engineering 2nd edition
by Mike W. Martin and
Roland Schinzinger
(New York: McGraw-Hill, 1989)

The authors, professors of philosophy and electrical engineering from the University of California, Irvine, do a credible job of offering an ethical system for engineers, applying it consistently to some of the engineering dilemmas of our time: Chernobyl, Three-Mile Island, Bhopal, Love Canal, the Pinto, all-terrain vehicles and asbestos.

While the authors list and explain each of the major ethical approaches in Western philosophy, their main approach is synthesis. They start with the psychological theories of moral development of Piaget-Kohlberg and modify it with insights from Kohlberg's student and colleague, Carol Gilligan. Piaget and Kohlberg perceived three levels of moral development: pre-conventional (self-interest), conventional (obedience to authority) and postconventional (autonomy). Few reach this "highest" level of isolated, individual, altruistic morality. Yet, Gilligan suggests a synthesis of second and third levels, balancing one's own needs with the needs of others "toward an ethic of caring."

Likewise, a synthesis is sought between actions and people, or personal and professional life, through Aristotle's Golden Mean. In other words, the authors favor an ethic based upon virtues, particularly those of trustworthiness (honesty in action and word, competence, diligence, loyalty and discretion) and benevolence (gentleness, compassion, and generosity). These virtues are particularly important for responsible and responsive engineers, and they incorporate Gilligan's theory of moral develop-

ment. Rarely do we choose an action for one reason alone. An engineer may do engineering for money and fulfillment (self-interest), to serve the family and company or institution (social convention) and to serve humanity and one's destiny (postconventional morality), not just one or the other.

With that ethical framework, the authors explore the duties and the rights of engineers on the job. As the engineer attempts to provide creative solutions to practical problems, there is always an element of risk. The authors even define engineering as "experimentation" stressing "learning from the past." The overriding duty of the engineer is to balance the demands of risks and safety. They suggest that top officers at Morton Thiokol decided not to convey the vigorous, unanimous warnings of the 14 O-ring engineers to NASA officials who had to make the decision to launch the Challenger in 1986. The moral dilemma seems to be in the reporting system, the authors suggest.

The rights of engineers include whistle-blowing as a practical moral necessity of last resort, but the authors go beyond that to suggest that there is a better method: to remove the need for whistle-blowing with "greater freedom and openness of communication within the organization." Engineer rights also include the right of self-determination through enlightened unionism, and the elimination of sexism and racism in an institution. Balance and Aristotle's Golden Mean are considerations here between the duties of management and the rights of individuals, the rights of management and the duties of individuals. Collaboration and compromise are paramount concerns.

In a final section of *Ethics in Engineering*, the authors consider global issues such as environmental concerns and computer ethics, and then wax poetic on “the existential pleasures of engineering” as a vocation, suggesting that engineering attracts the best and the brightest of creative, yet practical, people. The medical profession may dispute this claim, but the authors quote Herbert Hoover, an engineer who said the engineer, at least, “cannot bury his mistakes in the grave like the doctors.” The book concludes with codes of ethics from ABET, AAES, NSPE and IEEE, plus an extensive bibliography.

Influence Without Authority

by Allan R. Cohen and David L. Bradford
(New York: John Wiley & Sons, 1990)

How do you get people (bosses, peers, subordinates) to do what you want? According to the authors: “We have discovered that it is the process of give and take that governs influence. Making exchanges is the way to gain influence; and that process leads to cooperation rather than retaliation or refusal to engage. People cooperate because they see something of value that they will gain in return.”

While this rather simple but often overlooked prescription seems like manipulation, the authors go to great length to insist that lies and deceptions will be uncovered sooner or later, and all gains of influence will thus be jeopardized. Nor is “influence” merely directed at the other’s self-interest, or “what’s in it for me?” More often, it is directed at doing what is right, pursuing excellence, realizing the organization’s goals and doing challenging work. Also at great lengths, the authors fill more than half this 319-page book with hypotheticals, little and

long dramatizations of the principles in case study format.

The idea of this book is to “replace the crutch of authority with the engine of influence.” Even in hostile situations, where hardball strategy is required for the obstinant or nasty superior, the authors stress the self-interest of the ally, accentuating the negative. For example, the influential subordinate will want to show the possible consequences or ramifications of not cooperating. This sounds like a threat, but the authors suggest “breathing room options,” including putting your job on the line. In the hypothetical, the boss appreciated the candor and spunk of a harsh memo-writer.

Influence without authority, raised to the highest level, is to become a partner with your boss. The authors point to three typical attitudes toward authority (dependence, counterdependence, and independence) and suggest that a higher ideal is interdependence. What manager wouldn’t want “subordinate partners who own the unit’s problems, carry out their responsibilities, ask for help when they need it, are loyal with them enough to prevent mistakes rather than letting them slip by as long as someone else’s (usually the boss’) head will roll, and make sure that important issues are raised at the right time”?

This is a book for subordinates, not bosses, though. Few bosses are “enlightened” enough to share power and responsibility. For those bosses, the authors recommend their previous book, *Managing for Excellence* (New York: Wiley, 1984), where they claim that “managers can no longer be effective by heroically trying to be responsible for everything; they must make heroes out of their subordinates by sharing responsibility.”

Quality Circle Management: The Human Side of Quality

by Harry Katzman, Jr.
(Blue Ridge Summit, PA: Tab Books, 1989)

This small, 150-page book is more of a handbook of suggestions than a text or study of quality circles, defined as "a small group of workers who meet regularly on a voluntary basis to analyze problems and recommend solutions to management." Described as a quality control discipline originating in Japanese manufacturing, quality circles can be instituted in any organization to spot problems and to manage solutions.

The author covers quality circle principles, methods and strategic planning, with supplementary material on automation, group decision-making and human relations in a clear, understandable way, but sacrificing depth and examples.

One interesting tool he discusses and illustrates is the Johari Window, named after originators Joe Luft and Harry Ingham. The four "panes" of the window are labeled Open Area (information known to all), Blind Area (known to workers), Hidden Area (known to managers) and Unknown Area (information not known to any). The fourth quadrant can lead to new opportunities for greater productivity. Quality circles should enlarge the Open Area and shrink the other three through feedback, communication and joint exploration, respectively.

The New Realities

by Peter F. Drucker
(New York: Harper & Row, 1989)

When Peter Drucker talks, managers listen, but there is little on management in

his latest book, *The New Realities*. Here, Drucker claims that 1973 marked the end of New Deal ideology and the beginning of confusion in economics, politics and society. That was the year of the Arab oil embargo following the end of the gold standard.

However, in a single chapter on management in this new age, Drucker asserts it is not "a bundle of tools like those taught in business schools." Rather, it is about human beings, "deeply imbedded in culture." Management is, or should be, common goals and shared values in an organization. The real job of management is to enable people to grow as needs and opportunities change, not just the "bottom line" or quantity of output. Most importantly, "results exist only on the outside," in a satisfied user or customer.

"Large organizations will have little choice but to become information based," he concludes. Typical of his cryptic style, Drucker defines his terms in ways that send readers into thought: "Information is data endowed with relevance and purpose."

Managing Projects in Organizations

by J. Davidson Frame
(San Francisco: Jossey-Bass Publishers, 1989)

J. Davidson Frame is professor of management science at George Washington University, a computer system expert, and a specialist in international economics. Observing that instructional materials abound for project managers in defense and construction industries (where "deliverables" are concrete), Frame says little can be found for smaller, information-age projects resulting in software or intangibles. His 240-page book fills that void in a very readable way.

Two key lessons he emphasizes in the nine chapters are: avoiding pitfalls, and making things happen. After definitions and overview, Frame discusses and illustrates resources, team structure, end-user needs, defining requirements (like "trying to nail jelly to a wall"), tasks and techniques for planning control (WBS, Gantt charts, PERT/CPM, etc.), and rudimentary principles for achieving results.

Perhaps his best chapter is "Capable People: The Heart of Every Project." Frame notes how management rediscovered the people ingredient in the early 1980s though such best-sellers as *In Search of Excellence* (1982), *The One Minute Manager* (1982), *Theory Z* (1981) and Tracy Kidder's *The Soul of a New Machine* (1981). Frame approvingly quotes one executive who always looks for the busiest people in forming a project. "I stayed away from those people who were readily available." The rest of this fine chapter is devoted to the Myers-Briggs Type Indicator in selecting staff, reducing conflict and improving staff relations.

While this book, subtitled "How to Make the Best Use of Time, Techniques, and People," covers the basics of project management on a beginner's level, it does deal with three planning and control tools not often discussed: the earned value approach, gap analysis and the bureaucratic milestone review technique.

The earned value technique is attributed to DoD, DoE and NASA for very large projects, but Frame suggests it is useful for small projects as well. He uses Gantt charts of the budgeted cost of work scheduled (BCWS) and the actual cost of work performed (ACWP) of each subtask or

work package to determine the budgeted cost of work performed (BCWP), which shows the earned value. Schedule variance is determined in monetary terms by subtracting the BCWS from the BCWP. Thus, while most of the work may be completed ahead of schedule, the earned value may be less or more than raw figures may show. For example, a pyramid may be 90 percent complete but the last pieces will take more time and cost to cut, lift and place. Earned value shows that.

Gap analysis is useful for planning of multiple projects that are co-managed, such as a data processing department or an R&D department which works on many projects simultaneously. Allocations of time and money, investment and output, are charted along with a projected budget and a current budget. The gap between the two budgets is the focus for analysis: "What should the project portfolio look like in order to fill the gap?"

The bureaucratic milestone review technique, as described by Frame, was developed by the U.S. Navy project managers who had seen their projects defunded, not on the basis of technical merit but simply due to missing deadlines for funding. "Technical people often pay little attention to bureaucratic milestones," Frame asserts. So he suggests a three-tier set of deadlines, starting with the technical or performance level design document, reviewed by the project management level, and submitted on time to the organizational level. What makes this milestone technique work is the advice and consent of workers at the performance level. Frame ends with common sense reminders, including: "Be as flexible as possible; don't get sucked into unnecessary rigidity and formality."

The Leader-Manager: Guidelines for Action

by William D. Hilt
(Columbus: Battelle Press, 1988)

The Director of Manager Development at Battelle Memorial Institute likes to think this book is third in a trilogy. James McGregor Burns developed a seminal theory of political leadership in *Leadership* (1978), distinguishing transactional leadership (reward and punishment, carrot and stick, bribes and threats) and transforming leadership (recognizing needs and demands, and "lifting people into their better selves"). Second is Bennis and Nanus' *Leaders* (1985), extending that theory to organizational leadership ("Managers do things right while leaders do the right thing," with vision). *The Leader-Manager* tries to translate such theory into practice.

Hilt's leader-manager is a dreamer and a doer: a pragmatic idealist. Ultimately, such a leader is a "change agent," one who views change as growth, self-development and higher levels of achievement. Change is viewed as "a friend:" leaders will see change itself as inevitable, as the norm; others yearn for "things to return to normal." The central question of *The Leader-Manager* is: What should I do to become an effective leader? Hilt answers that question in a chapter entitled "Empowering," which is really a chapter on motivation. First he points out the limitations of the transactional leadership model by noting that the image evoked by this carrot-and-stick approach is that of a jackass. The transformational leadership model, on the other hand, empowers workers to operate on seven or eight cylinders instead of the typical four.

Such a theory of empowering others as a leader is based upon Abraham Maslow's hierarchy of needs. Hilt offers 25 specific guidelines to move from theory to practice, five each for Maslow's five steps to self-actualization. The focus, of course, is not on product or profit, but rather people. Practical tips, such as making sure people take vacations, equitable pay, joint goal setting and planning, recognition, and good personal coaching, are listed and explained.

"High tech without high touch is sterile," he concludes. But that is not to suggest that the "nice-guy" leader-manager is without competence and vision, for "high touch without high tech is blind." Such a synthesis points to the main strength of this 268-page book. Hilt constantly refers to and quotes the leaders in the field of management, suggesting that "nothing is so practical as good theory." This book will pull together and place in context some of the major management theories of the day, such as Tom Peters' MBWA and Peter Drucker's customer responsiveness. A Leadership Assessment Inventory and a case study in the appendix enable the reader to review the material and apply it to self.

Keeping the Dream Alive: Managing the Space Station Program, 1982-1986

by Thomas J. Levine and V.K. Narayanan
(Washington, D.C.: NASA Contractor Report 4272, 1990)

The authors, professors at University of Kansas and Rutgers, respectively, trace the history of internal management of the space station program from program approval to the decision to locate program management in Reston, Virginia. This methodology con-

sisted of archival research and interviews conducted between December 1987 and July 1988. Their 185 pages of text and notes were prepared for the NASA History Office under contract and do not necessarily represent the views of NASA.

The main problem with the content is chronology. Instead of a gradual unfolding of the story or developing a theme, the authors go back and forth, often and needlessly repeating basic information and even duplicating identical quotations. The table of contents suggests chronology — leading up to and the reversal of the “lead center” management approach — but rarely does one chapter lead into or follow another. Such may be the peril of dual authorship.

The title comes from a quotation of James M. Beggs, NASA’s sixth Administrator from 1981 to 1985, who hoped that his epitaph would read: “He tried to keep the dream alive.” Even before his confirmation hearings, Beggs, along with his designated Deputy Administrator Hans Mark, knew what kind of management would work best for the nation’s first permanent presence in space: “One that is well decentralized, where the guy who has to do the work has the resources and the responsibility and the authority to get the job done.”

His first job was to establish the Space Station Task Force to reflect what the professors call his “crescive” style of leadership, which, they explain, encourages “intrapreneurship” (innovation in large organizations). Whatever the theory, the Task Force, due to its “participative, open culture, . . . brought the entire Agency together and involved all the Centers in the definition of the space station program, . . . [and] established the planning guidelines for the station for both management and engineer-

ing,” the authors assert. Later, however, “with the gearing up of the program office it became apparent that the change in management style, although successful in the Task Force, was not to become a NASA standard.”

Instead, the space station program became the battleground for internecine turf battles among the Centers. The authors suggest that “over the years NASA had evolved into a decentralized organization, and the field centers had become more or less autonomous.” Thus, the lead center concept won out, for awhile, with Johnson Space Center effectively in control. However, the other center directors are quoted as telling the Phillips study group under acting Administrator Graham, “you can’t have centers telling other centers what to do. It won’t work.”

Ultimately, Administrator Fletcher decided to abandon the lead center management concept, and the space station program was reorganized, very much as it is today. The authors do point out that a “skunk works” group formed in Houston during the interim period “did not take advantage of the concepts developed by the Space Station Task Force,” nor did Phase B study groups. Also at this time, NASA lost its Administrator, Deputy Administrator, Associate Administrator for space station, the lead center director and the Level B program manager, not to mention problems with the Space Shuttle and then scrutiny of the Rogers Commission into all NASA management processes.

The underlying theme of this book — decision and reversal — roughly parallels the configuration studies of the station, from power tower to dual keel to single boom. While the authors seem to lament the passing of the early days, when the space sta-

tion concept was hatched and then approved by President Reagan, the main text does end on a hopeful note with another quotation from Jim Beggs: "Oh, well, I think NASA will come back strong," because NASA "puts a halo over all of science and technology."

The upbeat ending may compensate for all the flaws of this slim volume. In a biographical profile, for example, the authors have Beggs working at Westinghouse for 13 years between 1974 and 1981. Chapters have more footnotes than footnote numbers. And one candidate for space station manager is first described as "NASA's finest program manager" and then a page later as not having had any program experience.

Keeping the Dream Alive is hardly the last word on the subject, but, as the authors point out, a history of space station constituency building by Howard McCurdy is due out soon, along with a book by John Logsdon. The shortcomings of this book may inspire others to take up the pen before this chapter of corporate memory is lost forever.

Augustine's Laws

by Norman R. Augustine
(New York: Penguin, 1987)

Norm Augustine, president and CEO of Martin Marietta Corporation, has written one book — several times — and each subsequent version is more readable and richer. First published by the AIAA a decade ago, *The Compleat Augustine's Laws* took off like a rocket, leading to a "revised and enlarged" second edition by AIAA in 1983, followed by a more complete Viking Penguin edition in 1986 and Penguin Books in 1987. The 1983 edition was subtitled

"And Major System Development Programs," containing only 45 "laws" instead of the current 52, "one for every week of the year." Originally written for the manager of large aerospace engineering projects, it has become a favorite among program and project managers in government and private industry.

Nearly all of the 52 "laws" are derogatory of current management practices. At times, they sound like the proverbial Murphy: "Most projects start out slowly — and then sort of taper off"; "The optimum committee has no members"; "Hiring consultants to conduct studies can be an excellent means of turning problems into gold — your problems into their gold." Augustine is down on not only committees ("a powerful technique for avoiding responsibilities, deferring difficult decisions, and averting blame while at the same time maintaining a semblance of action"), but meetings in general, acronyms ("a powerful means of increasing confusion"), lawyers, briefings, management reorganizations, most marketing techniques, most financial prognostications and even some how-to books. He does like Quality Circles, a management tool used by Martin Marietta on certain projects.

The key to Augustine's thinking on management has more to do with his approach rather than the content. In every chapter, the author counts, calculates and extrapolates figures. Whether they concern the tenure of football coaches, government spending or footnotes per author in the AIAA Journal (Augustine was once president of AIAA), he reduces every topic to percentages, ratios or figures on a chart. At one point, he counts (erroneously) the number of words in Lincoln's Gettysburg Address. At times, his analysis of data is pointed *ad absurdum*: "Modest extrapola-

tion of the College Board scores in Figure 25 reveals that, if the trend of the late 1960s and 1970s prevails, in just 142 years there will be no perceptible intelligence left whatsoever." While humor, such as ridicule of "bean counters," lightens the image, the picture that emerges is one of a manager who takes Augustine's favored MBO principles to the extremes and reduces every management issue to numerical equivalents, often involving people.

Augustine mentions NASA about a dozen times, usually to illustrate some managerial problem, such as "the perversity of software" (Mariner 1), "precise guesses" (chances of injury from a falling spacecraft) or "the perversity of nature" (a destroyed NASA wind tunnel). The military, however, after Augustine had served as Undersecretary of the Army, receives the bulk of his scorn and criticism. He quotes approvingly from Dr. Bob Frosch (against bureaucratic engineers) and Kelly Johnson (against aircraft design by committee).

If the book sounds cynical of government, it is criticism of the system, not the civil service employees. In fact, he dedicates the book to them and speaks glowingly of certain government employees — as individuals, not as part of "the system." In an epilogue, he mentions "people" as the first lesson to be learned in the book:

People are the key to success in most any undertaking, including business. The foremost distinguishing feature of effective managers seems to be their ability to recognize talent and to surround themselves with able colleagues. Once such colleagues are found, it is the ultimate in sound management to reward them generously to assure that they are not lost.

He follows "people" with other qualities such as teamwork, recognition, delegation, customer satisfaction, quality and integrity, trying to boil them all down to one trait: self-discipline.

Discipline, laws and mathematical calculations do not, on the surface, add up to a warm, wholesome work environment, but Augustine demonstrates a hearty sense of humor throughout the book which seems to flavor the bitter medicine. His prescriptions, all bunched and explained in the epilogue, are self-evident, but the epilogue seems tacked on, as an afterthought. Nevertheless, *Augustine's Laws* is insightful, clever and fun if not rigidly organized and fully developed. The fourth edition might be better coordinated.

The Silent War: Inside the Global Business Battles Shaping America's Future
by Ira C. Magaziner and Mark Patinkin
(New York: Random House, 1989)

Ira Magaziner is an international business consultant who has teamed up with a journalist to prove that the Europeans and the Japanese are beating America as economic and industrial world leaders through strategic planning in high tech development.

While "decline of the U.S." books are common, this one is based upon firsthand observation and analysis. Most such books catalog the dire warnings: a scary federal budget deficit, the U.S. as the world's biggest debtor nation, a lingering trade imbalance, and sharp decline in research and development — all created in the past decade.

Magaziner does not merely list these woes. Rather, he talks with CEOs and workers

alike, offering perspective and commentary. An extensive, hundred-page notes section carries the boring analysis and statistics to make the text readable. In brief, he asserts: "If a nation is to prosper, it has to succeed at world trade. And ninety percent of world trade is goods, not services." If indeed the U.S. economy is increasingly service-oriented, his warnings are poignant.

The authors structure the book around competition with low-wage and developed nations, and competition in future technologies, including aerospace. While most U.S. companies relocate to developing nations to escape unions and high wages, such "sourcing" eventually becomes real competition. Thus, the short-term gains of cheap labor eventually come back to haunt those companies which exploit the poor in low-wage countries as the latter gradually develop competing industries. Magaziner claims that "many of these products we source from them could be made competitively in the U.S." if only U.S. plants would modernize, automate and market for export.

Competing with developed nations, however, is different. Japanese, West German and Swedish workers earn 20 to 30 percent more than U.S. workers, and yet their products (especially autos, electronics and steel) are of higher quality and sell better than U.S. products, in the U.S. as well as the world market. How come? "Industrial policy," the authors claim. Fully developed countries, except the U.S., tend to erect trade barriers to protect their targeted industries, pump them full of subsidies and low-cost loans, and encourage them to export to the U.S. and elsewhere. While Magaziner does not suggest formation of an American version of Japan's Ministry of In-

ternational Trade and Industry (MITI), a government-industry planning consort, he does suggest that "with the proper investment strategies, we could have positive trade balances in these products."

Advanced Project Management

2nd edition

by F.L. Harrison

(Gower: Hants U.K., 1987)

Frederick Harrison has combined a 30-year career in project management with teaching in a business school and working for Britain's National Coal Board, and earlier Imperial Oil of Canada. When his first edition of *Advanced Project Management* came out 1981, it was virtually ignored. It was not even listed in a 300-plus item bibliography of project management recently published in the United States, for example. Perhaps this omission is due to Harrison's obscurity as director of operations in the largest public sector, direct labor organization in Western Europe. As Harrison notes, "effective project planning is difficult to carry out and puts much more emphasis on a manager's conceptual skills, than does the normal day-to-day management of operations."

Harrison stresses the value and importance of planning at appropriate detail for both project launch and control. Large projects will have a hierarchy of plans — less detail for reporting to top management, greater detail for supervisors — and he even presents a major section on "Planning the Planning Process."

This second edition of *Advanced Project Management* contains separate chapters on small and large projects and one on the use of computer-based systems. In his chapter

on planning the smaller project, Harrison lists "the line of balance technique" (LOB), not even mentioned in other project management books. The LOB is a method, developed by the U.S. Navy in the early 1950s, to plan and control repetitive activities, such as modular home-building. Diagonal lines are drawn down a Gantt chart to show the number of identical units or sub-assemblies accomplished simultaneously.

Larger projects will require the project manager to use other, more sophisticated planning and control tools such as work breakdown structure (WBS), hierarchical planning ("rolling waves" of plans for each level of activity), performance analysis of meaningful data, and systematic change control systems, each amply illustrated. A final chapter deals with the "people system," engineers as managers, and conflict resolution.

Harrison's 370-page book is described as a guide for managers and others concerned with project planning and control, and as a college-level textbook for those students of project or construction management. Most of the illustrations suggest construction management, but the book does serve as a handy compendium of tools and techniques from a European point of view.

NASA Video Reviews

Note: These and other videotapes, each about 50 minutes long, may be borrowed through Center or Headquarters librarians or directly from the NASA Program/Project Management Initiative, Code NHD.

"NASA Experiences in Program and Project Management" with Frank Cepollina

The story of the Multi-Mission Module Spacecraft (MMMS) begins in the mid-1970s at Goddard Space Flight Center. Cepollina and his team were challenged to "fly more science at less cost," due to inflationary pressures. In his design and cost study of 150-180 spacecraft, he came to these conclusions: there was no significant commonality in manufacture; but there was common equipment for payloads; one-third to 60 percent of program cost was in the integration and test phase; and performance was mixed. He settled on a single, standard spacecraft that could be used for four or five different space science missions, could be launched on any vehicle (Delta, Atlas or the upcoming Shuttle), that incorporated manageable risk, and could be serviced on orbit with common, modular components. The concept of a standard spacecraft was then first used on Solar Max.

The camera shifts to NASA Headquarters where Dr. Noel Hinners, Associate Deputy Administrator, and Dr. Anthony Calio, the former Associate Administrator for OSSA, recalled the lessons learned from the approval of Solar Max. Calio said the MMMS was a good concept to start with and praised Cepollina's "tenacious persistence." Hinners agrees, adding that such a project had a salesman to build support across a series of program offices, and that Goddard management had encouraged innovation by giving Cepollina plenty of leeway.

The camera switches back to Goddard with a discussion of the February 14, 1980 launch of Solar Max and to explore "the tragedy and the triumph" of the failure of

fine pointing equipment. In 1984, because of its modular design, the Solar Max was repaired on orbit and worked fine subsequently. Cepollina shows some components returned and refurbished for the next flight.

Cepollina concludes by noting that inflationary pressures are even greater today but advises, "Don't be afraid to grab the cutting edge of technology" and try to inspire staff and business people to follow the lead with three P's: Persistence, Patience and People-dedication.

"Shared Experiences in NASA Projects"

with Angelo Guastafarro

"Gus" Guastafarro, a former NASA official now with Lockheed, calls project formulation "the most critical part of any program." He explains how the Space Station Freedom Program, in its earliest phase, was a textbook example of how the project formulation team accomplished careful, flexible planning in conjunction with industry and the academic community. The Space Infrared Telescope Facility, however, peaked too early, lacked flexibility and was still on the drawing boards after 17 years. Project formulation failure may mean "delay" in NASA, he notes, but in private industry it is more decisive — go or no go.

His next topic is accountability, as opposed to responsibility or authority. Accountability suggests getting a commitment ("as if you were running your own business") with all three legs of the stool in place: cost, schedule and technical performance. The project manager needs quantifiable, measurable, objective standards, he advises. In industry, the bottom line for staying in business is critical; in NASA it is synthetic,

with performance first.

Forming a project team is also critical. Recalling his eight years on the Viking project, Guastafarro noted: "Jim Martin cared about my personal growth." The successful project manager in NASA treated people right, provided ample opportunities for personal and professional growth, and "the payback was tremendous." He notes that industry is more apt to use rather than develop human resources.

On the management side, flexibility and tradeoffs are essential. "Make sure you don't die of hardening of the categories," he warns. Furthermore, he cautions that with the emergence of the personal computer as a management tool, managers may tend to fall in love with their electronic PC and hole up in an office. Guastafarro recommends "management by walking around" and sees MBWA as an emerging trend.

He closes with nine personal "lessons learned" (reprinted in *Issues in NASA Program and Project Management*, Vol. 1 - SP-6101). The capstone of these valuable lessons is communication: "A good manager is a good communicator," he writes. A brief question and answer period follows.

"Project Management from a Scientific Perspective"

with Dr. Frank McDonald

"The future has never been brighter," says this 30-year veteran of NASA. At the time of taping (May 1989), McDonald was Associate Director and Chief Scientist at Goddard Space Flight Center. Despite the setbacks from the Challenger disaster, "18 operating satellites carried us through the past three years." And EOS is described as

“the largest pre-sold program NASA has ever put through.”

McDonald focuses on key issues for the future. First is to build a space infrastructure to increase our access to space, particularly ELVs. He is impressed with NASA’s new engineers and scientists, and recalls no conflict when they work one-on-one with other scientists and engineers in other Centers. However, pointing to the Hearth and Phillips reports, he sees big problems when work is carved up among several Centers on big projects. Finally, he sees more and more international involvement in NASA programs. Not only is international cooperation beneficial, but overseas competition stimulates more support for programs at home.

In terms of long-range issues, McDonald alludes to the Paine and Ride reports and concludes: “Mars is the next logical step.” Some argue that NASA needs a tightly focused program, but McDonald disagrees. “NASA needs a highly diversified program to keep it strong.” A mission to Mars or the moon will require a variety of disciplines and skills.

In a question and answer period from several Centers, McDonald noted that first and second tier universities are now in a position to attract NASA scientists and engineers with better pay. At the same time, the pool of good fresh-outs from top universities is shrinking.

“Shared Experiences in NASA Projects”

with A. Thomas Young

This interactive video teleconference linked the former Director of Goddard Space

Flight Center, now President and Chief of Martin Marietta, to NASA Headquarters and various Centers on April 11, 1990.

“Project management is the best job in aerospace,” Tom Young says, “and NASA is the absolute best in the field.” He added that project management is where the action is, where an individual can make a difference.

Young outlined four areas of importance in project management. First: people above all else. Select those scientists and engineers who have technical competence, good interpersonal skills, and the commitment to regard the project not as “uh job” but rather as “a cause.”

The goal is to create a work environment where average people overachieve, realizing there will be fringes of over- and under-achievers. Then, listen. He quotes Yogi Berra: “It’s amazing what you can hear when you listen.”

Secondly, attention to detail. “Failure is usually caused by a small problem,” he notes, “but success is the integration of thousands of small details.” In terms of cost, an excess of operating funds can cause bad habits, but too much of a squeeze can cause “the Three-Mile Island syndrome” of too many variances. “Even the smallest variance is significant,” he says.

Thirdly, the customer; one component rarely discussed. Yet, he says, “success is determined by the customer,” and quality, too — his fourth point. Quality is not inspection but rather an attitude: “Doing it right the first time.” Such an attitude is the project’s best hope for meeting cost and schedule. In response to questions from the Centers, Young stressed the need for genuine Total Quality Management (TQM) principles as

opposed to sloganeering, and his preference for participative management over authoritarian structures. He encouraged more women and minorities in the management career path, noting that "cultural diversity makes for better decisions."

"Experience in Managing Award Fee Contracts"

with William Keathley

"I don't believe in firm, fixed-price contracts for high-tech, one-of-a-kind development projects" declares the Associate Director for Programs at Goddard Space Flight Center. Keathley also doesn't think much of the fixed-price incentive contract, the cost-plus incentive contract or cost-reimbursable contract. In a well organized presentation, he lists all the pros and cons of the cost-plus award fee contract.

He describes the award fee contract as "win-win" for contractor and government in terms of profit and performance motives. At project milestones, such a contract has the flexibility to change emphasis on the project, to adjust to such realities as a shifting launch schedule. "The award fee contract will promote — no, demand — good government-industry communications," he notes, so essential for mutual understanding of each other's needs. The award fee report card "guarantees periodic attention

from contractors," and the award fees are nearly as high as fixed-priced profits, but with less risk involved.

On the downside, the award fee contract demands more civil service employees to meet, monitor and review the project. However, the additional personnel may be worth it, he says. Then there are those who say there is a tendency to be more lenient in the scoring of contractors since civil service workers are scored, too.

As for the ground rules to implement an award fee contract, Keathley insists that the government project manager chair the performance evaluation board and that contractors recognize his or her importance. Before every performance period, the milestones and criteria must be agreed upon in advance. "Surprises are unacceptable."

In the fee determination itself, "Be fair . . . don't play games." Appeals to the determined fee can be mitigated by a clear, factual award fee letter. A verbal appeal calls for a verbal explanation; a letter appeal calls for a written response, directed only to the disputed areas of concern. A lively discussion period follows his presentation, including amplification of "rollover" whereby the fee determination officer may take an unearned portion of the fee and apply it later in the project to a crucial milestone.