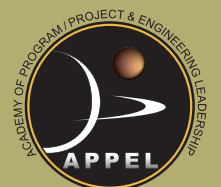# PROFESSIONAL DEVELOPMENT
FOR THE MOON, MARS, AND BEYOND

BY ED HOFFMAN

APPEL
ACADEMY OF PROGRAM / PROJECT & ENGINEERING LEADERSHIP

From the beginning, the Academy of Program/Project and Engineering Leadership (APPEL) and its precursors have been shaped by direction from NASA's senior management at major turning points in NASA's history. In 1989, in response to the *Challenger* accident, then–Deputy Administrator J.R. Thompson called for the creation of an organization within NASA that would provide training in program and project management. That was the first step toward the establishment of today's Academy.

Our current focus is similarly driven by the challenges of the day. To ensure that NASA's technical workforce has the capability to execute the missions that will comprise the Vision for Space Exploration, Administrator Michael Griffin and Chief Engineer Chris Scolese directed us to do for systems engineering what we have done over fifteen years to build program and project management capability at NASA. We merged the Academy of Program/Project Leadership (APPL) with NASA Engineering Training (NET) to create APPEL, and over the past year we have conducted an intensive requirements-driven process to address systems engineering development.

This is the most dynamic time at the Agency since I arrived in 1982. The portfolio of human and robotic missions required to implement the vision is on a scale that has never before been attempted. These missions will span more than a single generation, so our strategic planning for professional development has to include developing multigenerational capability. Given the complexity of the missions ahead, it's essential for NASA to provide its workforce with the professional development opportunities it needs to succeed.

Budgets are already tight, and there's skepticism outside NASA about the real cost of these missions. As a result, we can't afford to be anything less than optimally efficient; a trial-and-error approach won't suffice. For its part, APPEL has focused its efforts on developing the technical excellence of the workforce on three levels: individuals, project or engineering teams, and the institution as a whole.

At the individual level, APPEL offers an updated, integrated core curriculum that addresses program/project management and systems engineering at all stages of a career: entry-level, mid-career, and executive. Teaching new hires about electrical engineering or propulsion systems is not APPEL's job. Members of our technical community come to NASA with a great deal of education and often with previous professional training, and APPEL is not a substitute for either. Rather, we address a unique need by delivering NASA-specific knowledge to our practitioners. For example, our course for new hires, "Foundations in Aerospace at NASA,"

Making Sure People Know What They Need to Know

APPEL has developed a conceptual framework for building project team capacity that focuses on four essential elements of success: teamwork, leadership, process utilization, and knowledge. APPEL addresses these elements through a variety of approaches, from coaching to coursework to online learning.

While the new NPR 7120.5D clearly concerns process, it also represents a compendium of NASA knowledge about the practices for space flight program/project management that are most likely to result in mission success. It strives to facilitate better leadership by clearly delineating roles and responsibilities across the project life cycle and to foster teamwork—one of NASA's core values—by establishing an open environment in which all opinions are heard and respected. To varying degrees, it touches all the bases that enable team success.

Most of us, and perhaps most particularly NASA program and project managers, live in habitual "time starvation." It seems there is never enough time to deal with the urgent matters of the day, much less educate ourselves on the content of documents like 7120.5D. Yet, if program/project team members fail to understand and then implement the policies and processes covered in the document, they may place their endeavors in peril.

To address this dilemma, we built a quick-response online learning tool (available at http://teambuilding.4-dsystems.com/public). Our team converted the most important 7120.5D information into about 190 question-and-answer (Q&A) sets, with each question requiring about thirty seconds. Ninety minutes is an acceptable amount of time to dedicate to this important subject.
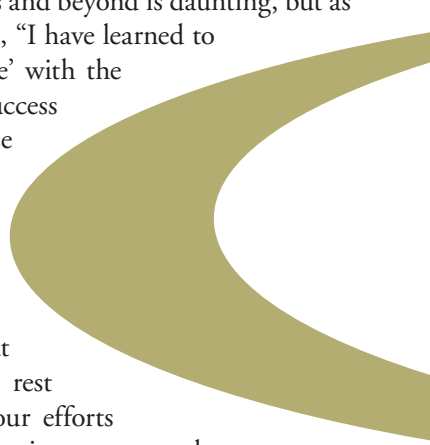
covers topics including the NASA governance model; the roles and responsibilities of the field centers and headquarters; NASA's vision, mission, and history; awareness of agency directives, policies, and procedures; the essentials of systems engineering; and an introduction to the various engineering disciplines. At the mid-career level we offer "Project Management and Systems Engineering" for subsystem managers and engineers and advanced versions of each for system-level leaders. Our executive-level course is designed to give emerging senior leaders realistic simulations of top-level issues such as launch decisions. We also offer in-depth courses tailored for specific needs in areas such as risk management, requirements development, system architecture, verification and validation, program control, and project planning and scheduling.

For project or engineering teams, APPEL offers support at any phase of the project life cycle. Team members begin by completing an online assessment that takes no more than ten minutes to fill out. The team then typically has a three-day workshop, followed by one-on-one coaching sessions for individuals who request them. Expert practitioners with decades of experience in every discipline within NASA are also available for consultations on subjects ranging from instrument development to cost estimation. Follow-up assessments after workshops, coaching, and consultations show that these services produce measurable team improvements.

On an institutional level, APPEL seeks to build, maintain, and share knowledge that will be critical for this multigenerational effort. To do this, we are developing a series of online tools to measure knowledge and process utilization, the first of which is an online assessment of NPR 7120.5D. (See "Making Sure People Know What They Need to Know" below.) Process tools will cover areas such as acquisition management, safety and mission assurance, and requirements management. We also facilitate knowledge sharing through storytelling at the PM Challenge conference and invitational Masters Forums, and through *ASK Magazine* and the *ASK OCE* e-newsletter.

The challenge of establishing a permanent lunar base and sending humans to Mars and beyond is daunting, but as Wernher von Braun said, "I have learned to use the word 'impossible' with the greatest caution." Our success in accomplishing these objectives will depend on many things, ranging from sound financial management to sustained political support, but without technical excellence the rest is irrelevant. Through our efforts to develop individuals, project teams, and our institutional knowledge base, APPEL is committed to helping NASA develop the technical excellence required to make the vision a reality. ●

The Q&A set for 7120.5D has three components. The first dozen questions address the salient parts of NPD 1000.0, the *NASA Strategic Governance and Management Handbook*. The next hundred address core concepts from parts 1, 2, and 3 of 7120.5D. The last eighty or so address part 4, which covers the program/project life cycle.

The tool has no evaluative scoring. At the start, all Q&As are displayed in a bucket labeled "These Remain." The tool moves correctly answered Q&As into "I Know These." Incorrect answers move into "Still Need to Learn These." When "These Remain" is empty, the tool resets by moving all the "Still Need to Learn These" into "These Remain," and the process continues. All answer screens show the correct answer, so anyone with persistence can complete the learning process.

Team leads or management selects participants. The system automatically issues status reports indicating whether individuals have started and how far along they are. (Individuals can also voluntarily take the assessment.) The system does not routinely generate reports for management other than the team leaders; its primary purpose is education, not evaluation. It can, however, mine the data if needed.

Every answer page offers an opportunity to comment with a box to check if people want to remain anonymous. We also anticipated that there might be Q&As that people think are incorrect or annoying. Rather than force them to give a "correct" answer, there is a radio button choice labeled "Flawed question—I'll comment instead of answering." They must enter text into the comment box, and the question is removed from their process.

We have tested the system with several groups, and people consistently reported that they enjoyed taking the assessment. The online 7120.5D knowledge tool is Web-based, self-directed, and easy to use, all of which make it an appropriate way to reach a vast workforce of civil servants and contractors at ten geographically dispersed centers. It is a key part of APPEL's effort to support the rollout of 7120.5D and, in doing so, build project team capacity for NASA. ●