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ProgramManager

The Journal of the Defense Systems Management College

The Shape of
Management
in the Year
2000

**What Makes
for Defense
Program
Success?**

**The DSARC
Process:
How Effective
Is It?**
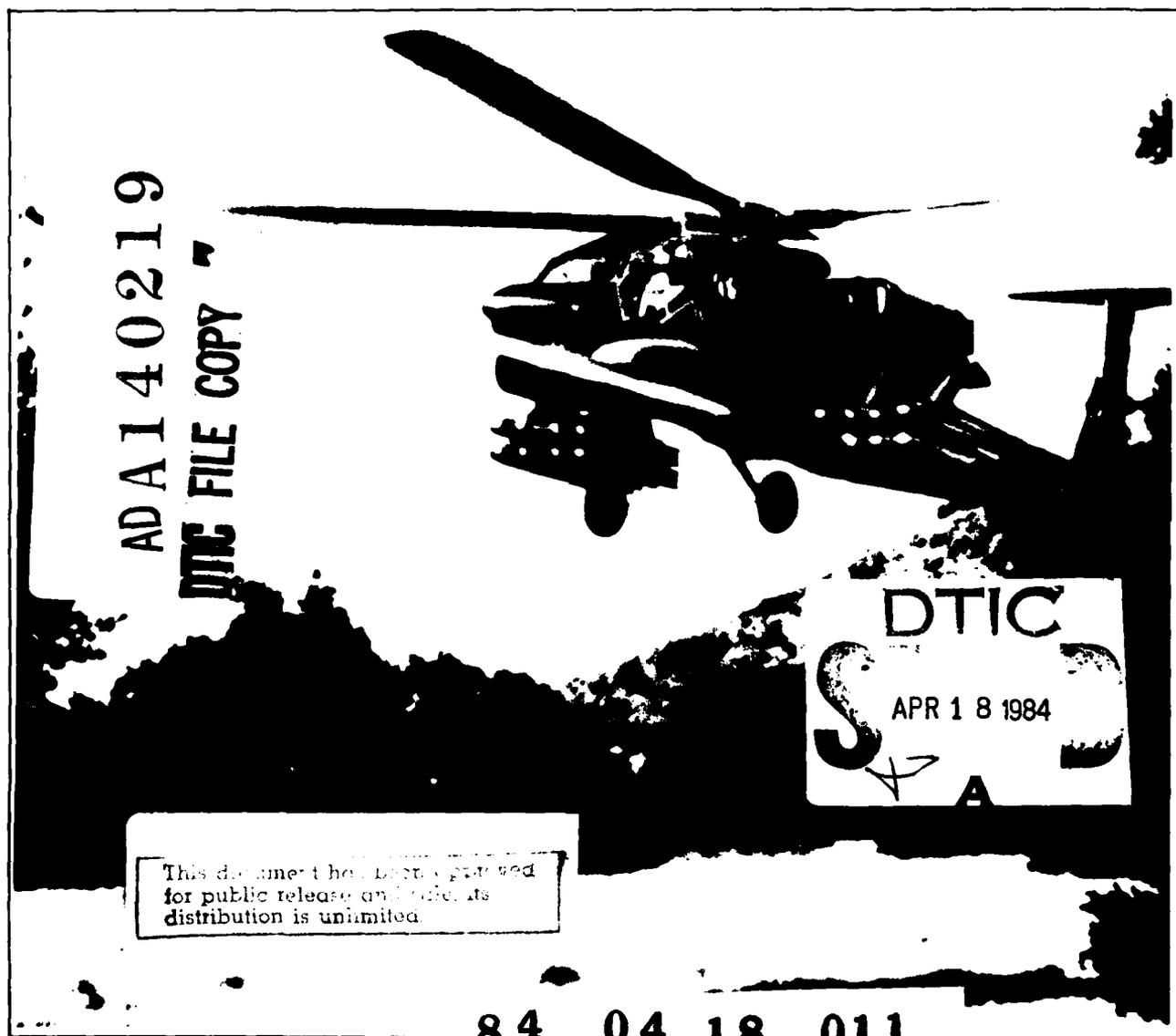
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Program Manager

Volume XIII, No. 1
DSMC 58
January-
February
1984

Cover: *The Army's new Apache (AH-64) helicopter firing the Hellfire missile. The development program for the Hellfire was one of the successful programs examined in the recent DSMC study reported on in this issue (page 31).*

Strengthening the
Government-Industry Partnership

There exists in American society today a true erosion of faith in government and in many programs conceived and carried out by government agencies. This erosion affects not only the institutions of government, but also the private-sector industries that support government programs.

Today, more than ever before, the public is demanding greater accountability for its tax dollars. The traditional ways we have spent our monies do not satisfy American taxpayers. They are challenging us to show just how efficiently and economically the business of government and, most important, the business of defense is being carried out. And they have a right to know.

Need to Manage the Defense Buildup

Recently, President Reagan outlined the buildup of both strategic and tactical forces by the Soviet Union, a buildup that has not abated for two decades. The President believes that the Soviet Union possesses a formidable military capability that threatens the security of the United States and its allies. Personally, I support a strong defense. However, I am worried about building up this defense posture too rapidly.

The number of major weapon systems planned for the defense inventory in the next few years is estimated by a recent DOD report to cost almost $600 billion. This, more than ever, requires a realistic and stable acquisition program over a period of years that will benefit our defense posture. But, if we have budget cuts and stretch-outs, we will again have to buy very expensive weapons in small quantities. I know personally the unsettling effects that budget cuts can have. I was in the Pentagon in 1968, '69, and '70 when $3 billion had to be cut from the defense budget each year.

Charles A. Bowsher
Comptroller General
of the United States

One way to achieve the needed defense buildup is to keep the American public on your side. If American voters think their tax dollars are being wisely spent for defense, they will continue to tell their representatives in Washington to vote for a strong defense. However, if they read in the press about shoddy work, large cost overruns, and claw hammers costing more than $400—that support will erode very quickly.

Civilian and military leaders in the Pentagon have been voicing their concerns about the poor quality, as well as the financial problems, of our major weapon systems. For example, Deputy Secretary of Defense Paul Thayer recently stated that military contractors could cut 10 to 30 percent from their costs if they made weapons and equipment right the first time. Rear Admiral Frank C. Collins, who was executive director for quality assurance at the Defense Logistics Agency, believes this figure is conservative. He estimates that the cost of many products could be cut in half if contractors made things right the first time.

Today, I would like to suggest how government and industry can work together to overcome some of these problems, primarily in the financial area. The areas I am going to discuss are (1) the need to simplify and improve the financial management, and especially the budgeting system, of the federal government; (2) the need to improve "project reporting" for our major weapon systems; (3) the need to maintain and update cost accounting standards in the defense industry; and (4) the need to periodically review the profit policy of the Department of Defense to assure that it is equitable.

Financial Management and Budgeting System

In 1802, Thomas Jefferson made the following statement in a letter to the Secretary of the Treasury. He said: "I think it an object of great importance . . . to simplify our systems of finance . . . so that every member of Congress . . . should be able to comprehend them to investigate abuses, and consequently to control them."

Today, annual expenditures of the government are more than 1,000 times greater than in Jefferson's day. Federal expenditures are ruled by an elaborate structure of decision processes and information systems, many of which are obsolete and unable to cope with the demands placed upon them.

The most visible evidence of this state of affairs is the difficulty that the Congress and the President face in trying to agree on the budget and the enormous cost in time, energy, and public confidence. The more recent effect of this problem has been the need for continuing resolutions instead of well-thought-out, debated,

■ *(This article is based on remarks by Mr. Bowsher at the Fortieth Annual Luncheon of the National Security Industrial Association in Washington, D.C., in October 1983.)*

and approved appropriations. As a result, contractors are left wondering whether their government contracts will continue to be funded. This is no way to manage the business of government or to maintain a solid government-industry partnership.

The government must make a major investment in improving its management of financial resources. Even if nothing else is done, computer systems dating from the 1950s must be replaced with more modern technology. Rebuilding a structure of financial management will be a long and expensive process.

Integrated Financial Management Reporting

Shortly, I will be issuing a report that presents a comprehensive framework for financial management in the federal government. In this report, I will be recommending specific actions to improve federal financial management. In particular, I will be proposing that the federal government adopt an integrated financial management reporting system that emphasizes costs, not just obligations. A cost-based budgeting and accounting system would have several benefits. First, it would allow both management and the Congress to compare actual costs with planned costs. Second, budgets could be estimated more accurately using data on actual past costs for specific projects and programs. Third, cost data, captured routinely by the financial reporting systems, would be current and more accurate and reliable than data developed on an *ad hoc* basis. Fourth, the proposal would encourage managers to use this cost data in their decision-making and permit greater managerial discipline.

The Atomic Energy Commission Experience

Developing an integrated financial management system is not an unrealistic task. In fact, the Atomic Energy Commission is one federal agency that did just that. In 1948, the Commission developed an accrual accounting system, with the cooperation of its major contractors from the private sector, that differed substantially from conventional governmental accounting concepts.

How was this done? Each contractor established a separate set of accounts compatible with the Commission's accrual accounting system and the contractor's accounting system. From these accounts, each contractor prepared financial and cost statements that the Commission could then use in preparing consolidated statements on its programs.

This basic approach enabled the Commission to combine accrual accounting, industrial cost accounting, budgeting, and governmental fund accounting into a single system that disclosed the financial results of operations and other needed information. If the Atomic Energy Commission could do it, why not the Department of Defense?

Project Reporting

The problem of accurate and reliable project reporting in relation to the major weapon systems deserves special comment, and I'd like to take a few minutes to talk about it at this point.

In the late 1960s, in response to a congressional request, the Department of Defense developed the quarterly *Selected Acquisition Report*, better known as the SAR, to track the cost growth of major weapon systems. The SAR indicates the total cost growth since the original estimate and the development estimate in the latest reporting period. It also identifies the percent of growth caused by such factors as inflation, quantity, changes, and technical modifications. However, the SARs rely on contractor information that does not tie to the accounting systems of the Department of Defense, and can be reconciled to the budget only with the December SAR report. The adoption of an integrated financial management system, which I proposed earlier, will correct this problem.

I'd like to spend my remaining time discussing two important issues of mutual interest—cost accounting standards and profit policy.

Cost Accounting Standards

I believe cost accounting standards continue to be a significant aid in establishing the integrity and credibility of numbers used by DOD and indus-

try. The Cost Accounting Standards Board was active from March 1971 to September 1980. During these years, the Board promulgated 19 standards covering most cost accounting matters. The Public Law establishing the Board required only that the standards apply to major national defense contracts and subcontracts. Because these standards are generally recognized as being the authoritative pronouncements on contract cost accounting, they were adopted in the Federal Procurement Regulations and apply to most negotiated government contracts.

The standards themselves are founded in well-reasoned accounting theory. The board and its staff put extensive effort into researching, drafting, and revising drafts of the standards after soliciting public comments. The board had lengthy discussions on each of the proposed standards and was not satisfied until it heard arguments from both sides. The board and its staff tried to establish in the standards as much uniformity and consistency as possible.

During the past 3 years without a Cost Accounting Standards Board, no governmental group has functioned to amend standards when desirable or to provide interpretations, waivers, exemptions, or do other duties previously performed by the board. The General Accounting Office (GAO), through its oversight role of government procurement operations, has reviewed the implementation of cost accounting standards. Our work has shown generally that federal departments and agencies are implementing the standards and that compliance reviews by the Defense Contract Audit Agency indicate that defense industry has done a fairly good job of adhering to the standards. Our defense environment continues to change, however, while the standards themselves remain unchanged.

A recent Supreme Court decision, the *Chadha* decision, regarding the legislative veto process, raised the issue of whether cost accounting standards are subject to change by legislative action or by each agency. This matter is still being studied in several quarters. Regardless of how this issue is decided, I hope that whatever action is taken will not

detract in any way from the integrity of the standards or lead to inconsistent requirements.

I consider it imperative that the group that continues to perform these functions have sufficient accounting expertise and experience to maintain the integrity of the standards. It is also critical that this group be independent from the economic and incentive factors that influence federal procurement policy. Independence was one of the primary features sought by the Congress in establishing the board as an agent of the Congress.

As I mentioned earlier, these cost accounting standards are recognized by most concerned parties as the authoritative statements on cost accounting. Whatever the outcome of the studies under way or the institutional arrangements that evolve to maintain the standards, I am prepared to offer the advice and review of the General Accounting Office before any regulation is issued or amended that would change a cost accounting standard or board rule now in effect. With such assistance and cooperation, I believe the integrity and credibility of standards can be retained for use in government contracting.

Profit Policy

Let me turn for a moment to the often-discussed subject of profit policy and its relationship to modernizing the defense industrial base. This subject not only invokes a discussion of cost accounting standards, but also of contractor profit levels on government contracts. There is one thing we all agree on: Adequate profit is an absolute necessity if contractors are going to invest shareholder resources in performing contracts for government purposes.

The issue of modernizing the industrial base is not new. In 1975, DOD was concerned with what was believed to be unacceptably low levels of investment by industrial-base contractors. In May 1975, the Deputy Secretary of Defense directed a major study of capital investment, profit, and productivity. This study, known as Profit '76, set out to develop policy revisions that would encourage contractors to invest in capital assets to reduce production costs. The result-

ing change was to adjust the weighted guidelines by reducing the percent of profit based on cost and by establishing a profit factor based on facilities used in a contract. By making this change, DOD believed it was creating an incentive for contractors to invest in capital facilities.

At the same time, DOD implemented another revision to its profit policy to take into account Cost Accounting Standard 414. This revision involved an additional reduction of the percent of profit based on cost and an explicit recognition of the cost of facilities capital as a contract cost. This cost had previously been implicitly recognized in profit.

Since these fundamental changes to DOD's profit policy have been made, various reports by GAO and others have raised questions regarding the results of DOD's action. Recently, a committee of the Congress asked us to review Cost Accounting Standard 414 and its effects on DOD profit policy. That study is now under way and should provide information on the extent to which profits awarded contractors under DOD contracts were reduced to offset the imputed costs recognized by Cost Accounting Standard 414. However, recent events within DOD lead me to conclude that a review limited to CAS 414 and its effect on DOD profit policy will not produce enough data to assess whether current government profit policy is equitable.

Let me mention some of these events. In 1979, the Renegotiation Board was eliminated. Some of the testimony at the hearings which resulted in the abolishment of the Renegotiation Board was that it was no longer necessary because of the protection afforded by the Cost Accounting Standards Board. But, in 1980, the Congress eliminated funding for the Cost Accounting Standards Board. Further, in 1981, peacetime application of the Vinson-Trammell Act was abolished and its application to defense profits in wartime was significantly weakened. Finally, in recent years, the country's economy has gone through some extreme fluctuations, especially in interest rates, and DOD profit policy is not designed to rapidly accommodate changing economic conditions.

A comprehensive review of DOD

profit policy is overdue. I believe that DOD, with the cooperation of the defense contractors, should initiate such a study as soon as possible, and I intend to discuss this matter with appropriate congressional committees in the near future. This study should consider those factors that will ensure a fair return to contractors and will encourage investment in government programs, while assuring taxpayers that their interests are being served properly. I am prepared to offer the advice and assistance of GAO in identifying the criteria and standards to be used in making the study. A review of DOD profit policy should be done periodically—say every 5 years. With such a program, we can enhance the credibility and integrity of the government procurement process and be a positive force in modernizing the industrial base.

Conclusion

In conclusion, I'd like to reiterate my support for a strong defense. However, the strongest defense is an efficient defense. And both depend on increased credibility in the financial information used to manage and oversee defense programs. Without this, everyone loses.

The charge before us is clear: to rebuild public confidence and support and improve management through financial credibility. I have outlined some of the steps that need to be taken to achieve this aim. We need to:

—Simplify and improve our financial management system;

—Improve our project reporting for major weapon systems;

—Maintain and update cost accounting standards; and

—Review defense industry profit policy periodically to assure that it is equitable.

We must keep in mind the statement made by Henry Clay that "Government is a trust, and the officers of the government are trustees; and both the trust and the trustees are created for the benefit of the people." I would add that those in industry who build and support government programs are also trustees. We must all work together to strengthen the government-industry partnership and carry out our responsibilities to the American taxpayer.■

Defense Systems Acquisition Review Process

A History and Evaluation

David D. Acker

Under a contract to the Defense Systems Management College (DSMC), Information Spectrum, Inc., conducted an evaluation of the effectiveness of the defense systems acquisition review process. Alvin M. Frager and Eric Taylor led the contractor effort. I served as the DSMC project officer and a member of the team that interviewed participants in Defense Systems Acquisition Review Council (DSARC) activities and past studies.

To begin, it was determined that the basic defense systems acquisition review process has remained relatively stable since its inception in 1969; however, the procedures have undergone a continual maturation. The defense systems acquisition review process involves decentralized management with centralized control of key decisions. Changes in political leadership, incorporation of the results of various studies, and the emergence of new management techniques have contributed to its evolution. The programs selected for this study are shown in Figure 1.

One hundred and sixty defense system acquisition programs have been subjected to the DSARC reviews since its inception. By the end of 1982, the DSARC had conducted a total of 319 milestone and program reviews. See Figure 2.

An abbreviated history of each program was developed, concentrating on the DSARC review ac-

■ *Mr. Acker is a Professor of Engineering Management in the Research Directorate, Department of Research and Information, at DSMC.*

tivities, and the histories were included in the appendices to the contractor's report. Figure 3 displays the spread of the DSARC reviews over the past 14 years for the programs included in this study. The review periods on each program, which encompassed both the DSARC preparation and decision/implementation time, covered 1-2 years—even more on some programs. Analysis of the programs indicated that certain events, which at first appeared to be program specific, had, in fact, many common characteristics with events on other programs.

Origin and Evolution of the DSARC

In May 1969, then Deputy Secretary of Defense David Packard issued a memorandum establishing the DSARC.[1] The DSARC was charged with evaluating major defense system programs at certain points (milestones) in the life cycle and advising him (or the Secretary of Defense) of the status and readiness of each pro-

Figure 1. Programs Selected for Study in the Evaluation of the Defense Systems Acquisition Review Process

PROGRAM	TYPE		
	SINGLE SERVICE	JOINT	MULTI-NATIONAL
Army			
Black Hawk (UH-60) Helicopter		X	
Bradley Fighting Vehicle System (FVS)	X		
ROLAND Air Defense System			X
Copperhead Cannon-Launched Guided Projectile	X		
Stand-Off Target Acquisition System (SOTAS)	X		
Navy/Marine Corps			
Harrier Attack Aircraft (AV-8B)			X
LAMPS MK III Ship/Air Weapon System	X		
TRIDENT System (submarine, missile)	X		
FFG-7 Guided-Missile Frigate	X		
HARPOON Anti-Ship Missile	X		
Tactical Towed-Array Sonar (TACTAS)	X		
Air Force			
A-10 Attack Aircraft	X		
F-16 Fighter Aircraft			X
Air-Launched Cruise Missile (ALCM)	X		
Ground-Launched Cruise Missile (GLCM)	X		
NAVSTAR Global Positioning System		X	

gram to advance to the next program phase. The memorandum required the establishment of three basic milestone reviews. These reviews were to be held prior to the start of each major phase in a defense system acquisition program ". . . to permit coordinated evaluation and deliberation among senior managers . . . to assure that advice given the Secretary of Defense is as complete and objective as possible prior to a decision to proceed to the next step of a system's life cycle."

Modifications to the review and evaluation process have been made since that memorandum was written. A series of DOD directives and instructions, along with service regulations, has evolved during the past 14 years. Figure 4 provides a chronology of the studies that have been made, as well as the directives and instructions.

Figure 2. Number of DSARC Reviews/Year
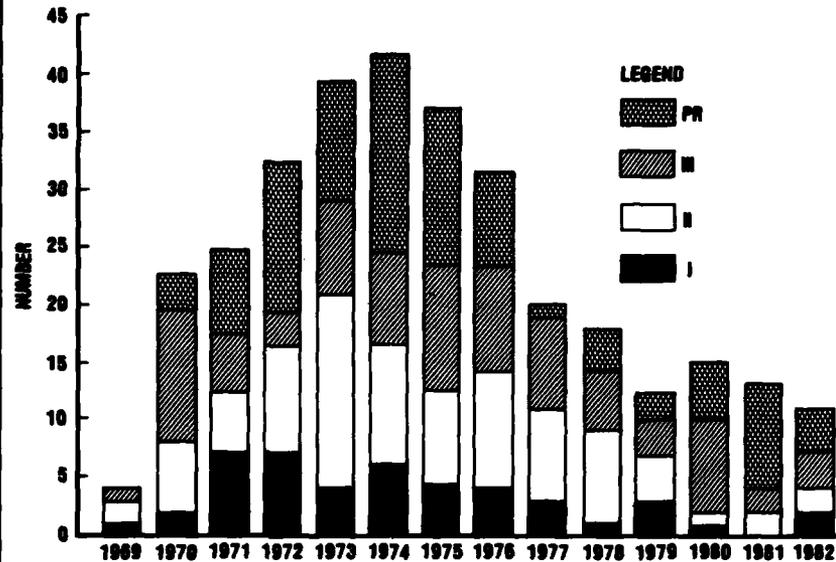
Figure 3. Spread of the DSARC Reviews on Selected Programs

Figure 4. Chronology of Studies, Directives and Instructions

Studies (top):

- (DSB Task Force R&D Mgt) — 1969
- (Blue Ribbon Panel DOD Mgt) — 1970
- (Commission on Gov't Proc.) — 1972
- ("Little Four Report") — 1972
- (Acq Advisory Group) — 1975
- (DSB Acquisition Cycle Task Force) — 1977
- (GAO Rpt on DSARC) — 1977
- (Defense Resource Mgt Study) — 1979
- (DepSecDef Acq Improvement Program (Apr 30)) — 1981

Timeline years: 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983

Directives & Instructions (bottom):

- DepSecDef Memo's -DSARC -Improve Wpn Sys Acq (May & Jul) — 1969
- DepSecDef Memo -Policy Guid on Wpns Sys Acq. (May) — 1970
- DODD 5000.1 (Jul) — 1971
- DODD 5000.26 DODI 5000.2 (Jan 21) — 1975
- DODD 5000.1 (Dec 22) — 1975
- DODD 5000.30 (Aug 20) — 1976
- DODD 5000.1 DODD 5000.2 (Jan 18) — 1976
- SecDef Memo DRB (Apr 7) — 1977
- DODD 5000.1 DODI 5000.2 (Mar 19) — 1979
- DepSecDef Memos -PPBS -Acq Sys (Mar) — 1981
- DODD 5000.1 (Mar 29) — 1981
- DODI 5000.2 (Mar 8) — 1982
- USDRE Memo (Oct 28) — 1982

Administrations:
- NIXON/FORD Administrations
- CARTER Administration
- REAGAN Administration

During this period, the political leadership changed several times, and with the leadership changes, the membership of the DSARC changed. Let's consider how the review process has matured since 1969.

When Packard issued his original memorandum, he emphasized that the primary responsibility for defense systems acquisition and its management on a particular program must rest with the cognizant service and the program manager (PM) it designates. The PM should serve as the focal point within the service. Packard wanted to ensure that each major program progressed through its life cycle according to a plan—an acquisition strategy. To do so, he created the DSARC to review major programs at significant milestone points; namely, prior to the start of the contract definition phase (now the demonstration and validation phase), prior to the engineering development phase (now the full-scale development phase), and prior to the production phase. The DSARC was assigned the task of evaluating each program with regard to issues, thresholds, and matters covered in the Development Concept Paper (DCP), a document that had been in existence since 1967. At the outset, the DSARC was chaired by the Director of Defense Research and Engineering (DDR&E),[2] with the Assistant Secretary of Defense (ASD) (Installations and Logistics), ASD (Comptroller), and ASD (Systems Analysis) serving as principals. The Council coordinated the milestone reviews, documented the findings, and made its recommendations to the Secretary of Defense through the chairman. In addition to the principals, the concerned component head was invited to participate in the first DSARC (milestone) review. Component head participation in later reviews was not required, but the head could be invited to participate at the discretion of the chairman.
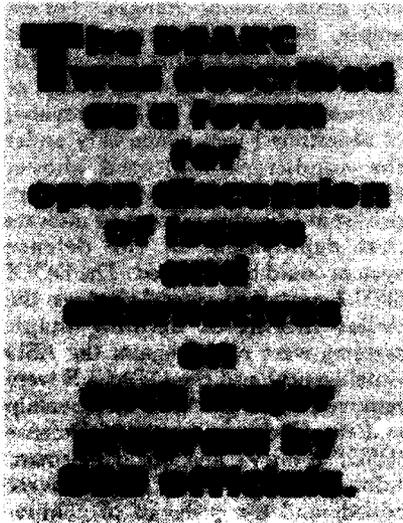
In July 1969, and again in May 1970, Packard issued additional memorandums stating his concern about the defense systems acquisition process. The 1969 memorandum requested help from the services in his search for ways to improve the process.[3] The 1970 memorandum provided policy guidance for acquiring major defense systems.[4] The services were encouraged to tailor their acquisition practices to the peculiarities of each program. This memorandum, which included discussions of such things as management practices, program phases, contract types, and integrated logistics support, became the foundation for DOD Directive 5000.1, issued in July 1971.[5]

In 1975, DOD Instruction 5000.2[6] was issued to provide the procedure for complying with the policy contained in DOD Directive 5000.1. Also, about the same time, DOD Directive 5000.26 was issued to provide a charter for the DSARC.[7] The DSARC was described as a forum for open discussion of issues and alternatives on each major program by DOD officials. Two members were added to the DSARC as principals for programs within their areas of responsibility: ASD (Intelligence) and the Director of Telecommunications and Command and Control Systems (DTACCS). The DODI 5000.2 expanded Packard's original DSARC

concept by adding more functions to its charter. The DCP (now called Decision Coordinating Paper) became the focal point for the DSARC review. The DSARC meeting associated with a specific program milestone complemented the Planning, Programming, Budgeting System (PPBS). The events leading to the DSARC meeting were defined with applicable time limits. Primary administrative responsibility for the DCP was given to the DSARC chairman's staff. Furthermore, the DSARC was given responsibility for review of program objectives memorandums. In December 1975, DODD 5000.1 was reissued, increasing the dollar amounts (based on 1972 dollars) used in defining a defense system as "major."[8]

In August 1976, the Director of Defense Research and Engineering was named the Defense Acquisition Executive, i.e., the principal advisor and staff assistant to the Secretary of Defense for acquisition of defense systems and equipment.[9] As such, he was to chair the DSARC. At that time, the ASD (Intelligence) and the DTACCS were made full-time members. The ASD (Systems Analysis) was redesignated Director of Program Analysis and Evaluation (PA&E).

Additional revisions to DODD 5000.1 and DODI 5000.2 became effective on January 18, 1977.[10] The 5000.2, which became a DOD directive and supplement to DODD 5000.1, provided additional policy and instructions designed to assist the Secretary of Defense in making decisions at program milestones. The major change to DODD 5000.1 was the incorporation of the concepts (not already a part of this Directive) contained in Office of Management and Budget (OMB) Circular A-109.[11] The OMB circular stressed the importance of considering alternatives at the front end of a program; accordingly, the revision to DODD 5000.1 added the requirement for a Mission Element Need Statement (MENS) at a new Milestone "0." Other significant changes and additions to DODD 5000.1 included raising the minimum dollar values of "major" new acquisitions, a new emphasis on decentralization, the addition of the service system acquisition review council

(SARC) reviews, and some revisions to the DSARC procedures.

The DSARC procedural changes (defined in DODD 5000.2) were as follows:
—DSARC would not participate at Milestone 0.
—DSARC would only be involved at Milestone I if the program under review was classified as strategic; nuclear; joint service; multinational; intelligence; or command; control, and communications.
—DSARC reviews would be held on all major acquisitions at Milestones II and III, unless waived by the Secretary of Defense.
—Administrative responsibility to process the various versions of the DCP was assigned to the services.

In March 1980, these 5000-series documents were reissued with changes. The DODD 5000.1 contained only minor content changes.[12] For example, the DSARC review was to take place at Milestones I, II, and III, unless waived by the Secretary of Defense. Previously, DSARC reviews at Milestone I took place only under the conditions indicated above. Henceforth, Secretary of Defense approval at Milestone II was to indicate that deployment of the defense system could be expected. The DODI 5000.2 contained several changes: the dollar thresholds defining major systems were raised again; the ASD (Intelligence) and the DTACCS were removed from DSARC membership and the Under Secretary of Defense (USD) (Policy) and the Chairman, Joint Chiefs of Staff (JCS), were added; and the presence of compo-

nent heads was permitted during pre- and post-DSARC review activities, but not in the DSARC review itself.[13]

In 1960, the pre-DSARC review activities changed significantly. Rather than just reviewing the DCP, the DSARC members were tasked with structuring the DCP. Because of this change, the timetable for pre-DSARC activities was fixed at 6 months. In addition to the DCP, an Integrated Program Summary (IPS) was created to provide details of the implementation plan for the life cycle of the system. The combined DCP/IPS became the governing document for DSARC reviews. Further, because the amount of information accumulated for each milestone review was increasing, a Milestone Reference File (MRF) was established. The MRF became a temporary library of all documents relevant to each milestone review of the system.

In March 1982, another revision to DODD 5000.1 was issued.[14] By cover letter, then Deputy Secretary of Defense Frank C. Carlucci directed DOD components to implement this revision, incorporating appropriate actions from the Department of Defense Acquisition Improvement Program, which he had launched in the spring of 1981. This revision to the directive emphasized the following with respect to defense systems acquisition reviews:
—Achieving program stability through:
  - Preplanned product improvement vs. new state-of-the-art program starts;
  - Realistic program funding at program initiation and projected in the funding documentation;
  - Emphasis on a DOD component-approved acquisition strategy throughout the acquisition process;

—Delegating program responsibility, decision-making, and accountability to the lowest organizational levels (decentralization). Program decisions made by line officials above the PM were to require documentation with appropriate accountability.
—Minimizing the acquisition time, including elimination or combination of program phases (with Secretary of Defense approval).

—Tying the defense systems acquisition review process to resource allocation, or the Planning, Programming, Budgeting System process by addressing program affordability at program initiation and throughout the acquisition cycle. The services were to prioritize their programs and identify resources they were willing to commit during design, development, production, test and evaluation, deployment, and support.

Considerable achievements were made in streamlining the acquisition process. Emphasis was placed on flexibility and tailoring to achieve what "makes sense" for each program. Four decision points and distinct program phases remained. The "Milestone 0" decision for program initiation was replaced with the term, "Mission Need Determination." The Secretary of Defense remained the decision-maker for program initiation and Milestones I and II. The production decision was delegated to the appropriate service secretary. On an exception basis, the Secretary of Defense could retain his decision authority at Milestone III, if he chose to do so.

According to this policy, the program initiation decision for a new major program will occur during the PPBS process. The DOD component will submit a Justification for Major System New Start (JMSNS), vice the Mission Element Need Statement, no later than that point in time when the service Program Objectives Memorandum (POM) is sent to OSD. Approval and program directions will be included in the Secretary of Defense Program Decision Memorandum (PDM), vice Secretary of Defense Decision Memorandum (SDDM). The SDDM will document a joint program decision. A JMSNS will be required for any program (major or non-major) for which the DOD component estimates the costs (FY 80 dollars) will exceed $200 million in RDT&E funds, or $1 billion in procurement (production) funds, or both.

The new component-prepared abbreviated Milestone I document, the System Concept Paper (SCP) will be used in place of the Decision Coordinating Paper and Integrated Program Summary. These last two documents (in abbreviated formats) will remain as the service's documentation to support Milestones II and III. The PDM will document the Secretary of Defense decision and direction. The services will be required to prepare, and submit to the DSARC for approval, Test and Evaluation Master Plans prior to Milestones II and III.

The Milestone II decision-point timing will be flexible and it may occur at the traditional point (entry into full-scale development (FSD)), or after entry into FSD if there is a need to more fully define the system being developed. The point of decision will be included in the service's acquisition strategy. If a delayed Milestone II is anticipated, FSD contracts will have to include provisions for early program termination at minimum cost to the government.

The sea of paperwork associated with the acquisition process and the briefing burden on the program managers have to be reduced if we are to make the process more efficient than it is.

In October 1982, Dr. Richard D. DeLauer, the DAE, requested that the draft of a revision to DODI 5000.2 be used by program management offices preparing for a DSARC until formal coordination and promulgation of the revised instruction was completed. In a memorandum to DSARC members and others, he stated there was a general consensus that:

The sea of paperwork associated with the acquisition process and the briefing burden on the program managers have to be reduced if we are to make the process more efficient than it is. This draft of DODI 5000.2 reflects that philosophy. It is important that the same philosophy be followed in implementation by the DOD Components. This is especially important in view of our past experience which indicates extensive pre-briefs and sequential reviews within the Component in preparation for a DSARC review.

If our cooperative approach to decision-making is to come to fruition, we ought to be able to do in parallel a good deal of the preparation which we've done in series in the past. This means open lines of communication and shared access to relevant information required as a basis for a decision recommendation to SECDEF. . . . [15]

The revision of DODI 5000.2 was issued in March 1983 as an enclosure to a memorandum from the new Deputy Secretary of Defense, W. Paul Thayer.[16] Thayer reminded the defense systems acquisition management community that the basic purpose of the DSARC is to advise the Secretary of Defense/Deputy Secretary of Defense at key program milestones whether the program is ready to move into the next phase. He added that the DSARC may review other acquisition issues as determined by the DAE.

The revision to the instruction was intended to describe more clearly the defense systems acquisition process. One intent of the revision to the instruction was to ensure assembly and documentation of the information that is essential for decision-making. Thayer sees the need for "a continuous dialogue and personal interchange between the Office of the Secretary of Defense (OSD) and DOD component participants in the acquisition process. Thus, information flow can be tailored to the needs to individual programs and circumstances." The revised instruction makes the milestone planning meeting optional; it may be held any time before the draft documentation is submitted to the DOD components.

Origin and Evolution of the Defense Resources Board

Assertions of inefficiencies in the area of DOD resources management were the basis of a presidential initiative that resulted in the commissioning of a Defense Resources Management Study (DRMS) in November 1977. That study was intended to provide a "searching organizational review into several resources management issues." Among the areas addressed were the resources allocation decision process, the planning, programming and budgeting system, and the defense systems acquisition process.

The DRMS report suggested that a Defense Resources Board (DRB) be established.[17] Accordingly, the DRB was established by the Secretary of Defense in April 1979 to enable the DOD to better respond "to signals emanating from Congressional budget reviews and meet Presidential decision requirements."[18] Membership is vested in USDRE, ASD(C), ASD(MRA&L), and Director, PA&E, with the Deputy Secretary of Defense serving as the chairman. Ex officio membership has been given to the Chairman, Joint Chiefs of Staff. There are six associate members.

The DRB is an advisory body; its actions and recommendations have no authority until specifically approved by the Secretary of Defense, or the Deputy Secretary of Defense acting "independently of his role as DRB chairman." The DRB has performed this function, although the method of operation has been highly dependent on the chairman's management style. This style has varied from (a) members voting on alternatives to develop a consensus, to (b) open discussion with the chairman to develop a final recommendation.

The DRB usually does not concern itself with particular programs, but is more concerned with the overall task of effective resource allocation within the DOD. Of course, if a program has major problems, for whatever reason, it could become a subject for DRB action. Final DRB recommendations consider the political sensitivities associated with their implementation. The DRB principals usually attend the meetings and the Chairman (Deputy Secretary of

Defense) has not missed any meetings. Although not a member of the DRB, the Secretary of Defense has attended some of the DRB meetings.

The original role of the DRB was defined as being one of "supervising the OSD review of service POMs and the budget submission." However, in March 1981, then Deputy Secretary of Defense Carlucci revised the role to helping "the Secretary of Defense manage the entire revised planning, programming, and budgeting process."[19] The redirection of the DRB was designed "to assure that major acquisition systems are more closely aligned to the PPBS." The number of major issues to be raised before the DRB were to be limited. Lesser issues were to be resolved outside of the DRB forum, and presented only to the DRB when a consensus could not be obtained. Carlucci's memo directed that "DRB members must be more than advocates of their particular areas of responsibility; they must take a broader and deeper DOD view. . . ."

Carlucci increased the membership in 1981 to that shown in Figure 5. Clearly, the enhancement of the DRB

membership was for the purpose of strengthening the board, particularly with regard to the interactions between the PPBS and the DSARC reviews.

With this as a background, let's consider the issues and perceptions that have influenced the defense systems acquisition review process.

Perceptions

To obtain insight into the personalities and issues that have influenced the DSARC operation since its inception, interviews were conducted with 13 individuals in the Washington, D.C., area, who have played key roles in the review process (Figure 6). In addition to the interviews, telephonic and written comments were obtained from other persons who had an intimate knowledge of the review process, but who were not available for an interview (Figure 7). The perceptions of these individuals were extremely beneficial in identifying programs for review and issues of general interest. Also, these individuals gave the study team an appreciation of the relevant issues surrounding the process at the time they

Figure 5. Defense Resources Board (DRB)

Deputy Secretary of Defense, Chairman
Executive Assistant to the Deputy Secretary of Defense, executive secretary

Under Secretary of Defense (Research and Engineering)[1]
Under Secretary of Defense (Policy)
Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics)
Assistant Secretary of Defense (Comptroller)
Director (Program Analysis and Evaluation)
Chairman, Joint Chiefs of Staff
Secretary of the Army[2]
Secretary of the Navy[2]
Secretary of the Air Force[2]

Principal Deputy Under Secretary of Defense (Research and Engineering)
Director, Defense Advanced Research Projects Agency
Assistant Secretary of Defense (International Security Policy)
Assistant Secretary of Defense (International Security Affairs)
Assistant Secretary of Defense (Health Affairs)
Assistant Director, National Security and International Affairs, OMB

(1) Defense Acquisition Executive and Chairman of the DSARC
(2) At DSARC meetings, only member(s) from involved service(s) attends

(Note: The permanent members of the Defense Systems Acquisition Review Council are also members of the DRB.)

Figure 6. Executives Interviewed and Their Principal Systems Acquisition Management Experience

NAME	PRINCIPAL RELATED EXPERIENCE
James A. Abrahamson Lt Gen, USAF	Program Director Maverick & F-16; Dep Chief of Staff for Systems, HQ AFSC
Robert Bond Lt Gen, USAF	Commander, Armament Devel & Test Center; Vice Commander, AFSC
Dr. Alexander J. Flax	Asst Secty Air Force; President, IDA; Chairman, Acquisition Advisory Group
John R. Guthrie Gen, USA (Ret)	Deputy Commanding General, AMC; Commanding General, DARCOM
David R. Heebner	Asst Director, Sea Warfare Systems, OSD; Dep Director, Tactical Warfare Systems, OSD
Donald R. Keith Gen, USA	Dir, Weapons Systems Office, DCS/RDA; DCS/RDA, HQ Dept of Army; CG, DARCOM
Isaac Kidd, Jr. Adm, USN (Ret)	Chief of Naval Material
Rob Roy McGregor	OSD/RDA, HQ Dept of Army: Dir, Sys Anal & Review; Exec Director of ASARC
Raymond Mess Col, USAF (Ret)	F-15 Program Element Monitor; Asst for Prog Reviews, Office ASAF; AFSARC Secretariat
Eldie Nucci	DSARC Executive Secretary (1969-1976)
Russell R. Shorey	Director of Acq Planning, OASD(I&L); DSARC Adviser on Support, OASD(MRA&L)
Leonard Sullivan, Jr.	Principal Dep Director, DDR&E; ASD(PA&E)
George Sylvester Lt Gen, USAF	Dep for Systems, Vice Cmdr, and Commander ASD; Vice Commander, AFSC

were personally involved with it. The findings from these interviews and the correspondence aided in structuring the 16 program studies.

the appearance of such a board.
—DSARC principals do not always have time to complete their "homework" before a DSARC meeting because of other pressing demands for their time.
—Monitoring his area of concern on more than 35 to 40 major programs is not a manageable workload for any DSARC principal.
—The DAE management style changes with each new DAE and this impacts the process.
—The Secretary of Defense decisions are not taken to be binding budget decisions. For example, staff members who did not "carry the day" during the review process are able to open any aspect of a specific program for discussion during the PPBS cycle.
—The DOD component staffs seem to lack a cooperative spirit when the PM is striving to meet program objectives. The staffs appear to have "hidden" agendas.
—Over the years, the DOD components have sensed tighter control by OSD on major programs.
—DOD must demonstrate responsibility for acquisition management to the Congress. A great deal of DOD action is a reaction to congressional action, or threat of action.
—The changing DSARC procedures with successive administrations have made it difficult to efficiently manage

should be handled through normal daily operations within the OSD.
—The DSARC has not acted like a "Board of Directors," although it has

A distillation of the principal perceptions of 21 people who were contacted follows. The sequencing of the perceptions is random. No attempt has been made to prioritize them.
—There is a general feeling of acceptance of the defense systems acquisition review process.
—The formation of a DRB was a desirable thing to do and it was a timely action.
—The defense systems acquisition review process provides clear, programmatic milestones that place an element of discipline on program managers.
—The defense systems acquisition review process should not serve as a substitute for other DOD functional activities. For example, the DSARC principals should not conduct functional oversight responsibility during the review process. The activity

Figure 7. Executives with Knowledge of Review Process Who Submitted Telephonic or Written Comments

NAME		
Mr. Norman R. Augustine	Former Assistant Secretary of the Army; current Chairman, Defense Science Board	
Dr. Solomon J. Buchsbaum	Former chairman, Defense Science Board	
Brig Gen Aloysius G. Casey, USAF	Commander, Ballistic Missile Org; former Asst DCS (Systems), AFSC; original MX Program Manager	
Dr. Malcolm R. Currie	Former DSARC Chairman and DDR&E	
Mr. Charles A. Fowler	Former member of the Defense Science Board	
RADM Rowland G. Freeman III, USN (Ret)	Former Commandant, DSMC	
Mr. Robert A. Fuhrman	Member of the Defense Science Board	
Dr. William E. Perry	Former DSARC Chairman and DDR&E	

programs that span 7 or more years.

—The Secretary of Defense Decision Memorandum, now the SDDM, sometimes contains items not covered in the DSARC review, especially when issuance of the document is delayed.

—A "macro" analysis of the program affordability is missing from many reviews.

—Items that are not expected to receive DSARC approval are not presented for consideration/action.

—There is no common method for effectively closing out a program.

Observations from the Selected Programs

In analyzing the 16 selected programs, emphasis was placed on review of such documents as DCPs, SDDMs, Selected Acquisition Reports (SARs), and other program data relative to the program milestones and reviews. Data gathering was conducted at four levels; namely, OSD staff, service staff, material command, and program management office. Detailed information setting forth specific experience on the selected programs is presented in the appendices to the report prepared for DSMC by Information Spectrum, Inc.[20]

Figure 9. Summary of Attendance by DSARC Principals at Reviews on Selected Programs

DSARC Review	Total Number of Reviews				
Milestone I	5	5	2	2	1
Milestone I/II	2	2	1	1	2
Milestone II	11	7	6	4	4
Milestone III	10	6	9	7	4
Program Review	8	6	5	6	5
Total	36	26	23	20	16
Percent	100	72.2	63.9	55.5	44.4

The findings are summarized below. Unfortunately, it is difficult to judge the findings as either positive or negative because criteria to measure effectiveness have never been developed. What might be considered positive to one DAE may not be considered so by another DAE because of differences in management style. Consequently, the findings summarized below are given without judging them to be either positive or negative, although, in some cases, such a judgment may seem to be obvious.

1. Administrative control of the defense system acquisition review process has been inconsistent.

—There has been a wide variation in the timing of the Secretary of Defense decision after the DSARC review. Figure 8 displays the time for 46 decisions made on the 16 selected programs.

—The method of documenting DSARC recommendations and Secretary of Defense decisions has not always been in conformance with published instructions.

—Preparation and submission of the DCP is not always timely.

2. The DSARC has not ensured that:

—Program content and technical parameters are adequately defined before program initiation.

—Program changes are adequately controlled.

3. Monitoring of cost, schedule, and performance threshold compliance has not been consistent from program to program.

4. The greatest impact of the defense system acquisition review process usually occurs during preparation for the reviews rather than at the DSARC reviews.

Figure 8. DSARC Decision Time on Selected Programs

CALENDAR DAYS UNTIL DECISION

Low: 3
High: 162
Average: 45
Median: 47
OSD Objective: 15*

*15 workdays objective established in March 1980
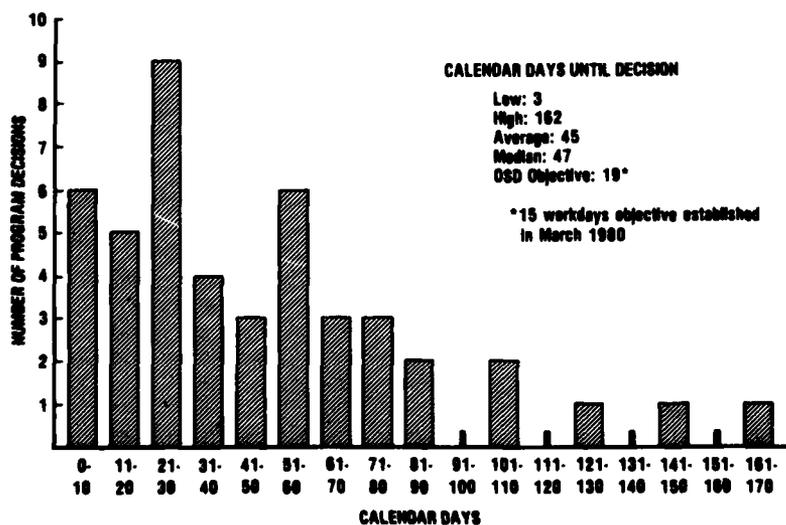
5. The actions of the OSD staff during preparation for a review appear to be unorchestrated. The milestone planning meeting, in its present form, is not effective in identifying key program issues.

6. The DSARC principals attend the DSARC reviews between 45 percent and 72 percent of the time; however, their functional areas appear to be adequately represented when they are absent (Figure 9). A heavy DSARC workload over a short time span tends to reduce the attendance of the DSARC principals. Also, reviews held during or just after changes in administration (after an election) increase the absences of DSARC principals.

7. The program management office workload increases during the period before and after a DSARC review. The large number of pre-briefs is a major factor in the increased workload before a review.

8. External forces (i.e., the Congress, international agreements) can impinge on a program and pre-empt or override the DSARC recommendations made to the Secretary of Defense.

9. It is difficult to establish contractual agreements and program schedules that are closely attuned to the DSARC decision-making process. This has been a continuing concern to program managers.

10. Multinational programs and joint programs have encountered procedural difficulties during the defense system acquisition review process.

Conclusions

The concept of a defense system acquisition review process for major defense systems programs is sound. Although the process has undergone maturation for 14 years, the basic concept has not changed appreciably. The transition of a major program from one program phase to the next is controlled according to instructions based on a clear and adequate OSD policy statement.

The defense systems acquisition review process has fostered decentralized management of the acquisition functions, an underlying philosophy of Packard. Further, the milestone reviews have instilled a sense of discipline into the manage-

ment of every major defense system program.

The defense system acquisition review process and procedures are effective, but not efficient. The failure of the process to provide early identification of critical issues is a weakness: On many programs, key issues are determined late in the coordination process—sometimes 1 or 2 weeks before a DSARC review.

The conduct of the defense systems acquisition review process on a specific program may not be in conformance with DOD directives/instructions. For example:
—A breach of threshold on one program may not be processed in the same manner as a breach on another program.

The defense system acquisition review process and procedures are effective, but not efficient. The failure of the process to provide early identification of critical issues is a weakness.

—Milestone review actions have not been consistent from one program to another.
—Previous Secretary of Defense decisions have been modified without benefit of the DSARC review process; i.e., sometimes the OSD staff has modified or revised the Secretary of Defense decisions set forth in the SDDM or PDM without the benefit of a DSARC review.

A major factor in program management office workload, and in the length of preparation time for milestone reviews, is the large number of pre-briefs requested by the services. The need for so many pre-briefs should be questioned by the service secretariats.

The substitution of other members of management for the DSARC principals at DSARC reviews detracts from Packard's concept of deliberation among senior members of management before a program milestone or major program decision.

There is a need for clearly defined program baselines. The DCP, as originally conceived, was the document that served as a "contract" between the Secretary of Defense and the service(s) for the acquisition of a specific defense system. The DCP was updated following each DSARC review. Also, yearly reviews of the "contract" ensured that changes caused by a PPBS action, the Congress, or other activities were documented in the DCP. The PDM used today has not satisfied this function.

Finally, the functional responsibilities of the DSARC and the DRB are sufficiently different to warrant the continuance of their organizational separation. The DSARC looks vertically at each program to ensure it is performing within the fiscal constraints of the Five Year Defense Plan, whereas the DRB looks across programs.

Recommendations

The recommendations set forth here are based on the precept that the preparation time for DSARC reviews can be reduced and less burden placed on the program manager if the following actions take place:
—There is senior management commitment to the process.
—The strategic planning for each program is focused.
—All participants in the program planning and review process have a moderate degree of currency with specific details of the program under consideration.

Specifically, the following actions are recommended:
1. Continue the defense system acquisition review process as currently designed.
2. Improve the efficiency of the process by implementing the following procedures:
—Provide short, routine status reports on designated programs to the Secretary of Defense/Deputy Secre-

Management Implications of an Unconstrained Look at the

Likely World of 2002

G. Dana Brabson, Colonel, USAF (Ret.)

Perhaps the most important insight that long-range planners can provide is that the future cannot be predicted with certainty. The future is not a world that lies before us quietly awaiting our arrival, but rather a world that we are creating by our daily decisions." With these words, General James P. Mullins, USAF, Commander, Air Force Logistics Command, began his foreword to a remarkable Logistics Command document entitled *Destination 1999—A Global Forecast of the Future and Its Impact on Military Logistics.*[1] This document takes an "unconstrained look at the likely world of 1999" and examines the logistics implications of that future world. It is to this document that I am indebted for the title I have selected for this paper; I commend *Destination 1999* to you for study.

A look at the likely world of 2002 is doubly important. In the first place, it is important that we prepare ourselves for the future; with adequate preparation, we will avoid surprises and the resultant resource-sapping corrective measures. In the second place, if we examine the consequences of current trends carried to their logical conclusions, we may discover that there are future consequences that are undesirable and current trends that we may want to reverse.

I shall begin this paper with a brief examination of the key elements in the environment that will most likely influence that management environment over the next two decades. I shall then discuss the implications of these environmental factors for the managers of the future. I shall close with a set of conclusions and some unresolved issues that I feel will require intense work during the next few years.

The methodology used in this article is suggested by Figure 1. At the outset. I recognize that the vector that represents any behavior pattern is influenced by environmental factors. For example. the application of multi-year procurement will be stimulated

". . . . the internal stakes associated with committing our troops abroad are quite high; one needs only to study the recent discussion about extending the stay of U.S. Marines in Lebanon."

■Colonel Brabson is an Assistant Professor of Chemistry at Indiana University Prior to his retirement from the Air Force in 1983 he was Dean Department of Research and Information at DSMC
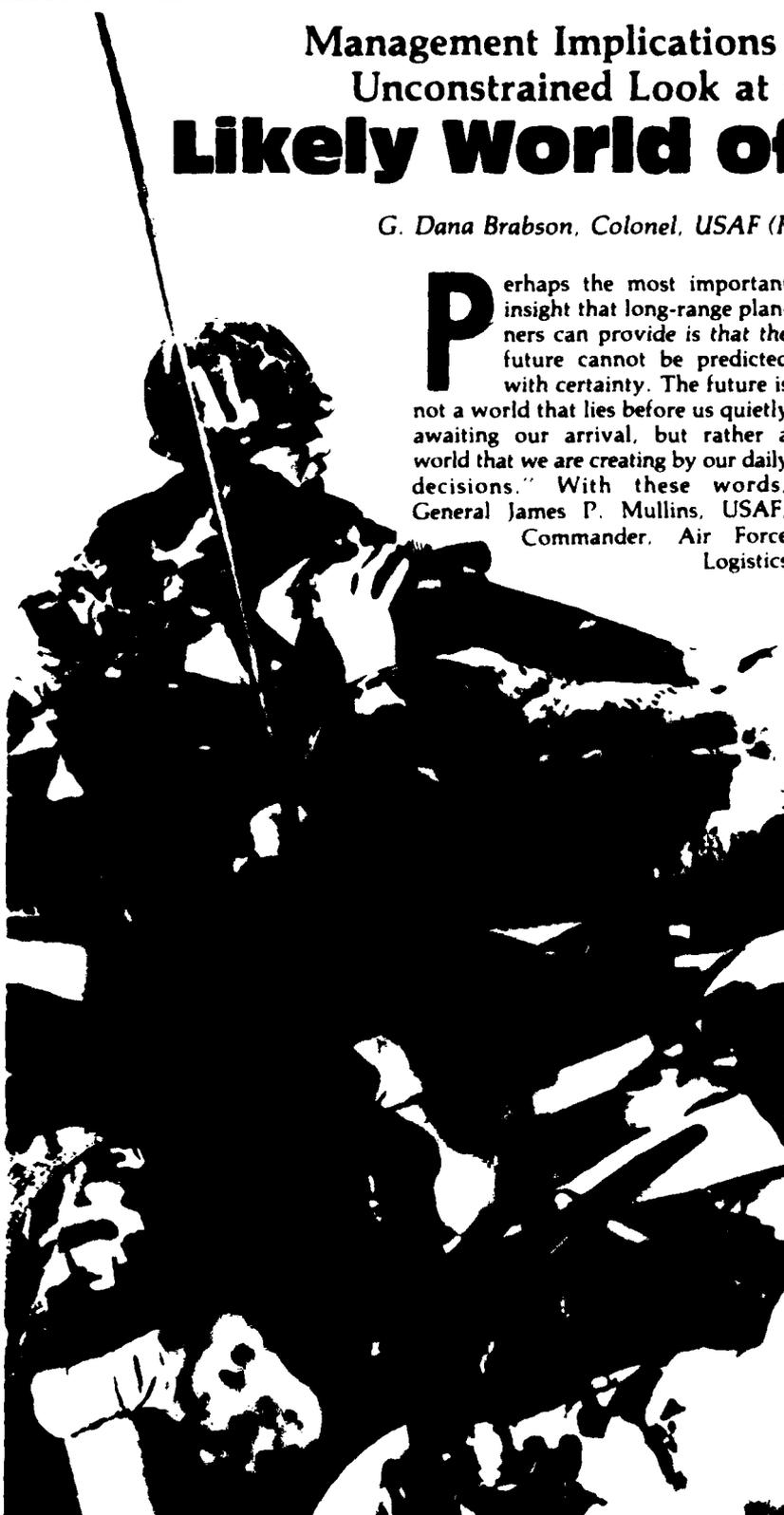
by environmental factors such as the desire to achieve cost savings and a stable industrial environment; at the same time, it will be restrained by the desire to retain flexibility in allocation of funds and the unwillingness to make long-term commitments.

Four conditions can change the direction of a typical vector: (1) A catastrophic event, such as a war; (2) a natural boundary, such as a resource limitation that prevents the vector from pursuing the same direction indefinitely; (3) a newly introduced factor in the environment, such as the advent of microelectronics; and (4) a change in management philosophy. The last condition is, in essence, a realization that the vector has been progressing in the same direction for an excessive length of time. It is the characteristic of our environment that, lacking a catastrophic event, every vector will be characterized by sinusoidal (or at least periodic) behavior. In many cases, the period is so long that the change in direction is barely perceptible. It is important to realize that the vector will progress in its "natural" direction unless we take positive measures to divert it. In this paper, I shall attempt to identify the current direction of several vectors, describe the environmental factors that are acting on these vectors, predict the most likely future direction of these vectors, and identify the implications of allowing these vectors to pursue their "natural" courses.

The Environment

Geopolitical Environment

It is useful to begin with an examination of the geopolitical environment. Perhaps the most important parameter in the geopolitical environment is the distribution of natural resources. Energy resources come to mind first; our interest in the Middle East is dictated not only by our own reliance on Middle East oil, but also by the even heavier reliance of our European allies on the same resource. In the Far East, Japan is dependent upon imports for 99 percent of its petroleum requirements.

Strategic and critical materials also play a crucial role. For example, we have no operating mines producing four of the metals (chromium, cobalt,

Figure 1. The Influence of Environmental Factors on the Course of Events
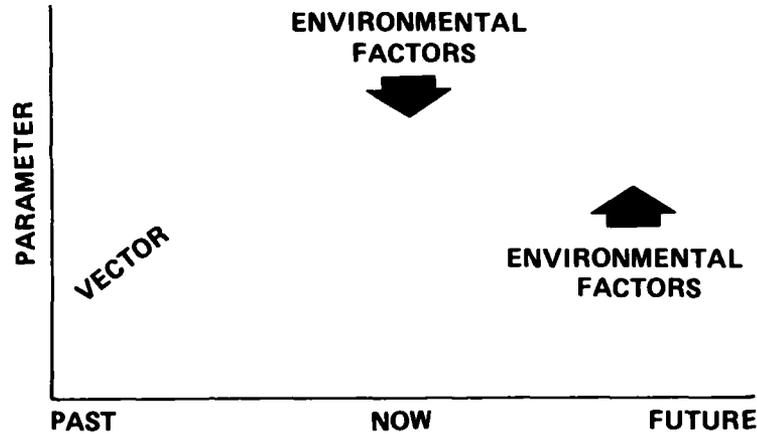
niobium, and tantalum) that are absolutely essential for production of turbine engines for military and civilian aircraft. On the other side of the ledger, our capability to produce excess agricultural products makes us, at times, a strange bedfellow with the Soviet Union.

The net result is increasing economic interdependence. At first glance, one would expect this to lead to increased political stability. The opposite appears to be true. The Third World countries, for the first time, are able to take advantage of their newly found economic and political leverage. There is, of course, a lesson here: As we deal with these countries, we must have respect both for their aspirations and for their newly won political and economic power. Strangely, the weight of opinion suggests that, in spite of the increased economic power of the Third World countries, the gap between the "haves" and the "have-nots" will widen, not narrow. As a result, we can anticipate continued tension and strife.

We can also anticipate that, as these Third World countries strive to achieve their expectations, alliances will shift and fragment. The net result will be a continued shift toward a multipolar world. Indeed, in the economic sphere, Japan and the Western European block have already emerged

as major influences. The "resource giants," especially Indonesia, Saudi Arabia, Nigeria, and Venezuela, are also making their influence felt on the international arena.[2] In the political sphere, the emergence of the People's Republic of China seems to presage even further divisions in the future. In essence, we can characterize the future world as one in which local constituencies will be gaining influence at the expense of long-standing alliances.

Military Environment

Much of the military activity we observe today may be characterized as proxy warfare, with a demonstrated unwillingness on the part of the major powers to introduce their own troops into the battle zone.[3] The use of Cuban forces in Angola appears to be a classic case in point. Certainly from the U.S. point of view, we have found that the internal stakes associated with committing our troops abroad are quite high; one needs only to study the recent discussion about extending the stay of U.S. Marines in Lebanon. It is projected that this military environment will continue into the foreseeable future. Moreover, with the aforementioned widening gap between the "haves" and "have-nots" and the increasing availability of sophisticated weapons, it is anticipated that the threats of terrorism will not abate. And the emergence of well-equipped subnational

(supranational) groups such as the Palestine Liberation Organization (PLO) adds yet another dimension to the military environment.[4]

The military environment is complicated by the increasing application of modern technology. Technological advances continue to shorten the warning times that we can expect, and to place our lines of communication (LOCs) at high risk. As James Forrestal commented in 1945, "We cannot expect again to be so fortunate as to have the time for preparation after war begins. Scientific advances have made our world smaller in both space and time. . . ."[5] This factor encourages us to pre-position materiel to an even greater degree than we do today. As Dr. Lawrence J. Korb, Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics), noted in an article in *Defense 82*, the pre-positioning of heavy equipment is one of two creative methods for improving support for our forces.[6] At the May 1978 Summit, the NATO heads of state and government agreed to "the pre-positioning of the heavy equipment for three additional United States divisions in the Central Region. . . ." Needless to say, the pre-positioning of materiel is a process with its own risks, particularly in an environment in which alliances are projected to be less secure.[7]

The military pressures on the LOCs and the decreased warning time combine with economic pressures to create an environment in which interdependent support arrangements will be sought. There is already movement in this direction. As Dr. Korb noted in *Defense 82*, the United States and the Federal Republic of Germany have signed a Host Nation Support Agreement by which Germany will organize reserve units in peacetime which, during crisis or wartime, would be dedicated to providing logistics support of U.S. Army and Air Force combat units in Germany.

Space is an entirely new dimension in the military environment. The Soviets have been testing "killer-satellite" anti-satellite (ASAT) systems since the mid-1970s. In the United States, we have been examining for many years those technologies that might be suitable for military operations in space. The most com-

The half-life of much of new technology is on the order of 10 years, although the half-life of computer technology is much shorter, probably no more than 2 or 3 years.

monly cited technologies in this arena are high-energy-laser technology and particle-beam technology. Earlier this year, the President renewed public interest in the potential of defensive systems placed in space.[8]

Technological Environment

The technological implications for the future are so pervasive that it is difficult to select those that will have the largest impact. At the outset, it is important to note that the half-life of much of new technology is of the order of 10 years, although the half-life of computer technology is much shorter, probably no more than 2 to 3 years. Indeed, most people focus on the impact that computer technology is expected to have.

Important insights into the technologies expected to be important in the next 20 years can be gained by studying the report of the 1981 Defense Science Board Summer Study Panel on the technology base.[9] This study evaluated both the opportunity and the risk associated with those technologies the Board felt would have an order-of-magnitude impact on the future. Of the eight top-ranked candidates, six dealt with computer technology or the electronics associated with computer technology. Computational speed is increasing dramatically, and the cost of hardware will continue to drop. In recent years, the cost of computing power has been dropping by 50 percent every 2½ years.[10] For example, fast semiconductor memory is one-tenth as expensive today as it was in 1975, and the

cost should fall by another factor of ten by 1995. It is forecast that by the close of the century, computer memory and processing power will no longer be the limiting factors in the cost of information handling.[11] At the same time, the cost of building and of maintaining software will continue to grow exponentially.

Of the eight top-ranked technologies described by the DSB Summer Panel, machine intelligence (or artificial intelligence) ranked third in terms of the opportunity to have an order-of-magnitude impact on our post-1990 military capabilities. Indeed, the application of artificial intelligence to the making of real-time battlefield decisions is currently being examined. Simultaneously, the application of artificial intelligence to the management sphere is just beginning to emerge and presages a major influence on management methodologies in the future. In the nearer term, computer technology is being applied both to manufacturing in contractor facilities and to remanufacturing in military depots. According to current schedule, the Integrated Computer-Aided Manufacturing (ICAM) Sheet Metal Center will come on line in 1985, and the Automated Blade Repair Center will be completed in the same year. These two installations foretell a major impact of computer-aided design and computer-aided manufacturing (CAD/CAM) on the defense industry.

Industrial robots are with us today; there are about 7,000 such robots on line in U.S. manufacturing facilities at the present time.[12] Projections into the future vary widely. The Robot Institute of America (RIA), for example, estimates there will be roughly 200,000 in U.S. factories by the end of the decade, and one million by the turn of the century.[13] The Illinois Institute of Technology (IIT) and Prudential-Bache paint a more conservative picture, projecting that there will be between 70,000 and 150,000 industrial robots on line by 1990.[14]

Manpower/Personnel Environment

By comparison with most analysts of the future, whose conjectures depend on their own insights and perceptions, demographers are on firmer

ground. Over the next decade, the most important trend will be the maturing of the work force. Although the work force will continue to grow, because of the declining birthrate (especially the "baby bust" of the 1970s) there will be a significant shift in its composition. In particular, there will be a dramatic increase in the number of workers in their prime working years (ages 25–54), and an important decrease in the pool of people (ages 18–24) from which the armed services draw their recruits.[15] By 1990, there will be four million fewer 18–24 year olds.[16] At the other end of the spectrum, the number of people more than 65 years of age will have increased by 20 percent by 1990.[17] A key result of this shift will be increased pressure on the work force to increase productivity and support the retired segment of our society. In the face of this increased pressure, and the smaller pool from which military recruits can be drawn, it will become increasingly difficult to acquire high-quality people for the armed services. There is conjecture that it may even be necessary to reinstate the peacetime draft.

The armed services are not experiencing difficulty in attracting quality people in today's environment of high unemployment. However, as recently as FY 1981, the Army accessions did not score as well on the Armed Forces Qualification Test (AFQT) as did the accessions of the other three services. The median score for Army accessions was 41, compared with 52 for the entire DOD and 51 for the comparison group of youth.[18] The net result could be lingering and recurring quality problems for the Army and perhaps for the other services as well.

In this context, each service has taken a hard look at the continued application of the All Volunteer Force concept. The study by the Strategic Studies Institute of the U.S. Army War College is particularly worthy of note. This study cites two findings as being the most significant: "(1) As currently constituted, the All Volunteer Force concept is unlikely to enable the Army to achieve the quality personnel end-strength levels envisioned in the Army's Personnel Long-Range Plan [PLRP]; but (2) numerous options

"Perhaps the most important parameter in the geopolitical environment is the distribution of natural resources."
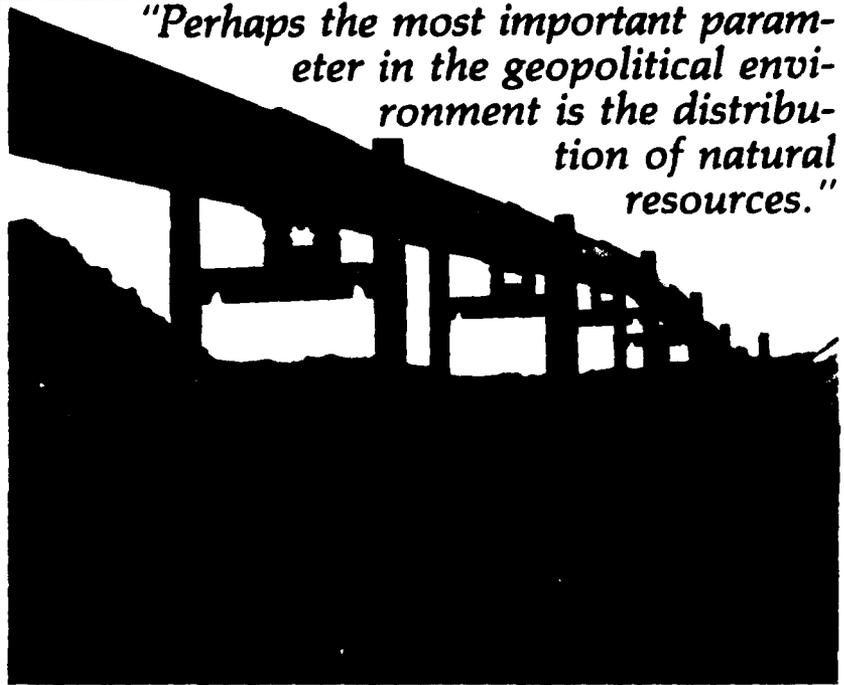
and modifications to current policies are available to Army planners and decision makers which could allow the Army to meet these PLRP quality manpower requirements during the 1990s."[19]

Management Environment

Two characteristics seem to typify the management environment: first is the aversion to taking risks, and second is the tendency to maximize short-term benefits at the expense of long-term opportunities. These are related in that long-term commitments necessarily entail risks. The expected result of these characteristics is turbulence. If we examine the historical data, we observe that we have come to expect a turbulent environment as a way of life. Consider, for example, the top-line total obligational authority (TOA) for the Department of Defense illustrated by Figure 2: During the past 30 years, it has oscillated with a period of about 5 years, and the longest period of sustained real growth (with the apparent exception of the current period) is 3 consecutive years.

There are many factors that contribute to our increasingly myopic view and our emphasis on short-term benefits. Some authors point to the ascendancy of financially oriented people to positions of leadership.

Other authors point to the management information systems we have instituted over the past half century and note that these systems focus primarily on the easily measured items such as inventories, labor hours, cash flow, etc. Moreover, the modern-day manager is inundated with such a flood of raw data that he/she has a natural tendency to focus on historical precedents and near-term probabilities instead of planning for the future.[20] Still other authors simply acknowledge the increased pace of communications and the sense of urgency that rapid communications seem to foster. Regardless of the underlying cause, the net result is the same: an increased emphasis on tactics and a decreased emphasis on strategy; or, if you will, an increased attention to short-term accommodation at the expense of far-sighted actions.

It would appear that we will be saddled indefinitely with annual budgets. Although there has been talk for many years of creating a budget spanning 2 years, there appears to be little enthusiasm for this concept in the Congress.

The fear of taking risks seems to stem from the perceived cost of making errors. We are under ever-increasing pressure to demonstrate that we are good stewards of the

Figure 2. Fluctuations on Total Obligational Authority (TOA)

Figure 2. Fluctuations on Total Obligational Authority (TOA)
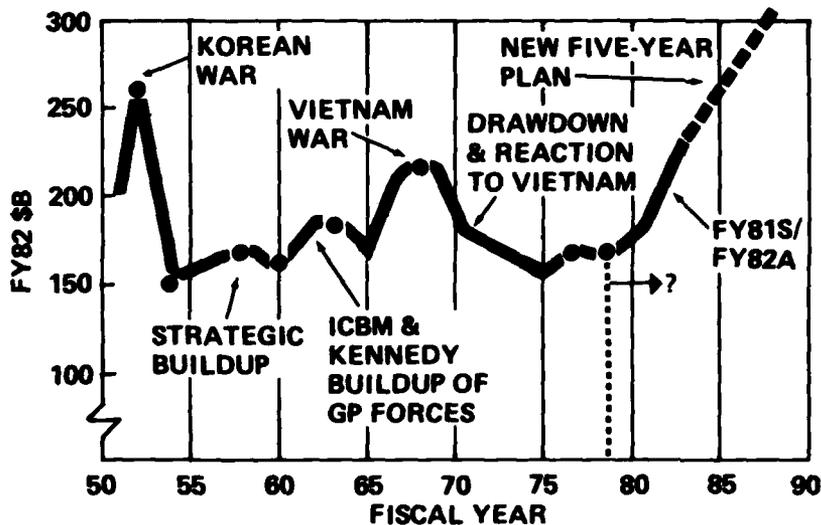
resources entrusted to us. At the same time, we are under increased scrutiny. The authority to make decisions has slowly but steadily accreted at higher and higher levels of management. The set of Defense Acquisition Improvement Program (DAIP) actions dealing with controlled decentralization is an attempt to reverse the trend toward increased centralization. The number of DSARC decisions has been reduced from four to two, and the threshold for identifying a program as a "major weapon system program" has been doubled. Yet, even in the environment of the DAIP, we are testing a new Defense Acquisition Executive's Summary (DAES), and the number of people assigned to the Office of the Secretary of Defense has grown substantially over the past 3 years.

There is yet a third characteristic that seems to typify the management environment: the dominance of local constituencies in the congressional decision-making process. In response to pressures applied by individual constituents, the Congress annually reshapes the DOD program by deleting some items from the DOD request so that funds can be provided for other items not requested by DOD. As Senator Barry Goldwater (R-Ariz.) put it: "Congress votes itself regional or local defense programs instead of a national defense structure."[21] This phenomenon is characteristic of our representative form of government and will persist, barring a catastrophic event that galvanizes the will of the nation.[22]

The Implications

Research and Development

I now turn to an examination of the implications of the trends described in previous paragraphs. In the case of research and development, I have chosen to list those few implications that likely will be of overriding importance from a development-strategy point of view. Preplanned product improvement (P³I) is one of the key thrusts of the Defense Acquisition Improvement Program, and has been widely accepted by the acquisition community. Its advocates note that the P³I strategy increases the assurance of meeting the initial operational capability (IOC) date within cost, and provides the opportunity for insertion of new technology after IOC to meet the evolving threat. The countervailing view holds that, because of the Soviet Union's numerical superiority, we are unwise to back away from forcing the most advanced technology into our new weapon systems. On balance, it appears that the view of the advocates of P³I will prevail because of the current emphasis on getting hardware into the field on cost and on schedule.

As suggested earlier, the dominant characteristic of the R&D environment is the impact of microelectronics and the computer. We are already seeing the broad introduction of automated test equipment (ATE) and of built-in test equipment (BITE). The result in many cases is an increased ability to stand alone, reduced logistics tail, shorter mean times to repair (MTTR), and simpler repair and maintenance procedures. We are also beginning to see the introduction of fault-tolerant systems, capable of degrading gracefully. Because of the tremendous processing power of present-day microprocessors, it is possible to build in redundancy, automatic fault-recognition circuitry, and self-switching to alternate modes in the event of a detected failure. Fault-tolerant systems are particularly appropriate for space assets, but will also become commonplace in more mundane applications. The net result will be an increased operational availability.

The application of advanced computer and electronics technologies will also facilitate the introduction of robotics on the battlefield. With the emphasis on taking over some of the most hazardous tasks, appropriate tasks include mine laying, mine clearing and, perhaps, ammunition handling.[23]

The current emphasis on improving reliability and supportability will drive the application of many new technologies. In this context, it is important to note that there is increased interest in supporting both logistics R&D and logistics IR&D. When these R&D programs are taken in their broadest perspectives, they include not only R&D on logistics systems, but also on those technologies that can increase the tooth-to-tail ratio.

Finally, it should be noted that there will be a continuing emphasis on reducing our dependence on imported metals and energy sources. The development of alternate materials will continue; composites and rapid solidification-rate powder metallurgy components come to mind immediately. There will be continued emphasis on energy efficiency, especially in aircraft turbine engines.

Decision-making in a Data-Rich Environment

Possibly the most troublesome trend we have observed in the past four decades of weapon system acquisition is the slow but steady increase in the time between program inception and program completion. The Air Force Affordable Acquisition Approach (A³) study, for example, reports that the average development time (for the programs surveyed) has grown to 11½ years.[24] In his recently published analysis of this phenomenon, Norman R. Augustine, Chairman of the Defense Science Board, chooses to divide the total development time into segments: *preparation* time ("time from concept formulation to start of full-scale development") and *execution* time ("time from start of full-scale development to initial operational capability"). Mr. Augustine notes that, while the "doing" time has remained nearly constant since the close of World War II, the "planning" time has grown dramatically. He is painfully close to the mark when he concludes that "what *has* changed is the decision/approval time it takes to get a new program started, together with the time it takes to get the end product fielded."[25]

There are many reasons for the increase in decision time. Among them are the elevated level of final decision authority, the increased number of "wickets" in the chain of command between the "doer" and the "decider," the increased scrutiny by management at all levels including Congress, the expanded number of staff elements at each echelon of responsibility, the fear of making mistakes, the greater prevalence of decisions by consensus, and the overwhelming abundance of data upon which to base decisions. The importance of making timely decisions is especially evident in view of the fact that, as noted earlier, the half-life of technology is very short. The Army Science Board, describing the rapid pace of development of computer and microelectronics technologies, put it this way: ". . . (1) a technological generation now spans about 4 years, and (2) a single weapon system development program now spans about 8–15 years, or 2–4 technological generations."[26]

We are beset with reams of data. Unfortunately, our ability to process data and make decisions has not kept pace with our ability to collect data.

Paradoxically, while computers, with their tremendous ability to generate data, are partially at the root of the problem, the application of computers may also contribute to the solution.

We are beset with reams of data made available by computer-based management information systems. Unfortunately, our ability to process data and make decisions has not kept pace with our ability to collect data.

In the near term, decision support system technology will be applied to the process of decision-making in a data-rich environment.

Decision support systems differ from conventional computer-based management information systems in that the latter focus principally on historical records of what has happened. By contrast, decision support systems are designed to help the decision-maker understand the most likely consequences of alternative decisions he/she can make within the context of the current situation. Thus, decision support systems will assist the decision-maker in capturing the essence of prior experience and using that information to assist him/her in arriving at timely decisions. In the long term, artificial intelligence will be applied to the sorting and interpretation of data, and will further assist the decision-maker in the decision process. Artificial intelligence will have numerous applications, including support of battlefield decision-making, target acquisition and identification, and support of integrated computer-aided manufacturing.[27]

Organizational Structure and Relationships

It would be a mistake to consider computers without considering the other systems with which they are being integrated. Particularly important are the telecommunications systems and the word-processing systems. It has been estimated that by 1990, 40 to 50 percent of all American workers will use electronic-terminal equipment daily.[28] As a result, communications will be greatly facilitated and conventional wisdom concerning organizational structure and functions will be placed under great stress. We are seeing the forerunners of distributed work centers. I am particularly fond of the phrase "electronic cottage" used by Alvin Toffler to describe the nature of a distributed work center.[29] It is now possible for certain workers to work in their homes using computer-based systems to transmit and process data.[30] It remains to be seen how managers will cope with this environment: On the one hand, the eyeball-to-eyeball interaction between the employee and the supervisor is largely lost; on the other hand, it is possible for the supervisor to measure (or have the computer measure) the output of the employee down to the last paragraph, word, and cipher.[31] It remains to be seen how workers in this type of situation will meet their apparent needs for socialization.[32]

Also challenging (and possibly threatening to the conventional management structure) is the proliferation of computer-based communications networks. The informal organization has long been recognized as an effective structure for getting work done. However, never before has the informal structure had such powerful tools at its command. There are two dimensions. In the vertical dimension, it is becoming increasingly possible for senior managers to call up data which, in conventional management structures, normally would be filtered by several intervening management layers before it would be exposed to top management. Similarly, it is becoming increasingly possible for organizations to transmit data horizontally across organizational boundaries without going through the conventional steps

of going up one chain of command and then going down the other.

As might be expected, there are many projections about the organization of the future. The following list is by no means an exhaustive catalog.

—Zuboff suggests that the traditional pyramid organization may be replaced by a diamond organization as the number of people engaged in clerical tasks decreases significantly and the number of "middle managers" increases.[33]

—Zuboff speculates about the nature of an organization in which face-to-face interactions are lost. She uses the phrase "abstract organization" to describe this situation and wonders whether the organization itself becomes an abstraction.[34]

—Fulker predicts that, because of the rapid pace in future organizations, it will be necessary to make greater use of temporary structures and systems.[35] It is interesting to speculate that this may presage the natural evolution of management structure beyond the matrix management organization.

—Cleveland notes that in organizations in which information is widely held, effective leadership often involves wide participation and collective thought; on this premise he concludes that a collegial structure, rather than a command structure, is the more natural basis for organization.[36]

Regardless of the specific design of future organizational structures and relationships, it is apparent that the forces currently at work have the potential for dramatic upheavals. As Toffler put it, "The third wave affects everyone. It challenges all the old power relationships, the privileges and prerogatives of the endangered elites of today."[37]

Logistic Support

The trends in the logistic support arena are driven in part by the increased complexity of weapon systems and the shortage of skilled people to repair and maintain them. Logistic support requirements into the foreseeable future will be further complicated by the necessity to continue to have a mix of high- and low-technology weapon systems, each with its own unique logistics "tail."[38]

" . . . our capability to produce excess agricultural products makes us, at times, a strange bedfellow with the Soviet Union."
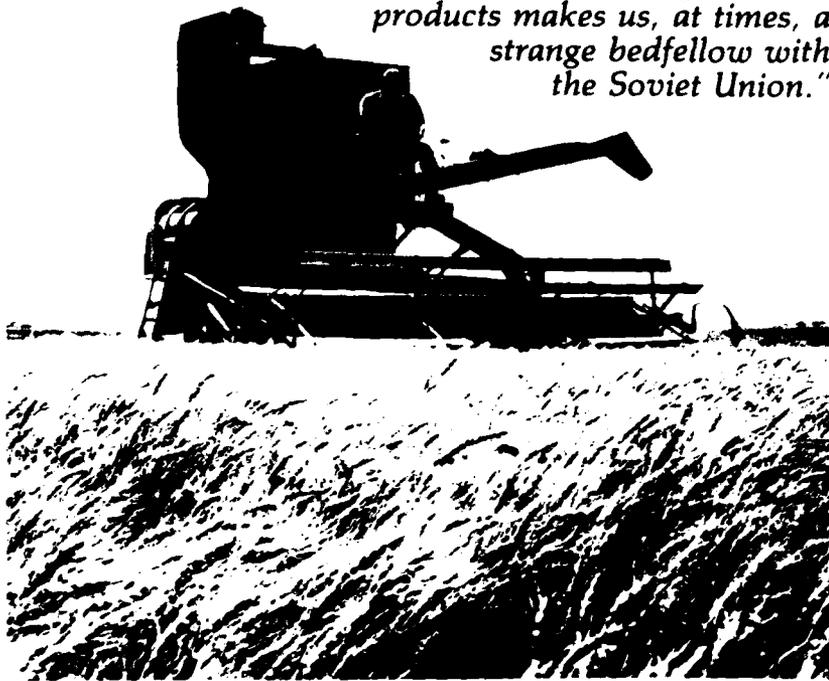
As a direct consequence of the increasing complexity of many line-replaceable units (LRUs), we can anticipate a shift toward a two-level maintenance concept. Complex LRUs will be serviced on a plug-in/plug-out basis at the operational unit and returned directly to a major depot (or contractor) for repair.

Computers are making their presence felt in the logistics depots. For example, the major depots in the three services either have, or soon will have, completely automated warehouses. The logistics community is moving with "deliberate speed" toward complete computer-aided integration of the logistics support function. One of the most exciting events on the horizon is the introduction of automated repair centers, which will capitalize on integrated computer-aided manufacturing technology to accomplish remanufacturing. The prototypical example is the automated turbine blade repair center, which is expected to come on line at the Oklahoma City Air Logistics Center in 1985. The blade repair center will include an automated welding cell and an automated grinding cell. In the same year, an automated blade inspection cell is expected to be brought on line at the San Antonio Air Logistics Center. Ultimately, an automated inspection system will probably be integrated into the automated blade repair center.

One other characteristic of the current environment that will carry into the future is the use of interim contractor support as a technique for providing adequate support while training is accomplished.

In the final analysis, it appears that the challenges in the logistics support arena have never been greater. In this context, the increasing emphasis on logistics R&D and on logistics IR&D could not be more timely or more appropriate.

Training

I have discussed most of the important elements in the training environment. Because of the anticipated decrease in the number of highly qualified maintenance personnel, it is all the more important to continue efforts to introduce automated test equipment. Fortunately, as the technology associated with automated test equipment technology matures, we can anticipate welcome relief in terms of decreased cost and increased reliability.

We can also anticipate greater emphasis on simulation. Simulation will play an increasingly important role not only in the training of combat-ready personnel, but in the training of maintenance and support personnel. For example, computer-simulated faults will challenge and sharpen the diagnostic skills of the maintenance and support personnel.

Contractual Relationships

In my judgment, the most reliable conjecture that can be made about contractual relationships is that they will continue to oscillate. Consider multiyear procurement (MYP). In the late 1960s, we (especially the Navy) embraced MYP with zest. Following the misfortunes in the early 1970s, we backed far away. Then, with the Defense Acquisition Improvement Program, enthusiasm for MYP once again peaked. Now, the momentum is again flagging. The reason is easy to understand; we are caught in the age-old struggle between two titanic forces—the desire for stability and the desire for flexibility. Thus, we can speculate about the near term only; for the foreseeable future, it can be anticipated that there will continue to be slight swing toward the search for stability, and multiyear procurement will continue to be used as a tool to achieve programmatic stability.

In the area of incentive contracts, a similar behavior has been observed, and here, also, we can only talk about the near term; thus, for the next few years, the swing toward the use of incentive contracts will be sustained. Perhaps the biggest challenge will be to determine how to use incentives effectively in an environment in which each of the "functional barons" wants to have an incentive for his/her particular area of interest. The weight of evidence suggests that there are far more items (cost, schedule, performance, productivity, maintainability, etc.) than can be effectively incentivized in a single contract. We have learned from history that, when one tries to incentivize more than two or three objectives, the impact of the incentive structure is largely lost.

" . . . it should be noted that there will be a continuing emphasis on reducing our dependence on imported metals and energy sources."
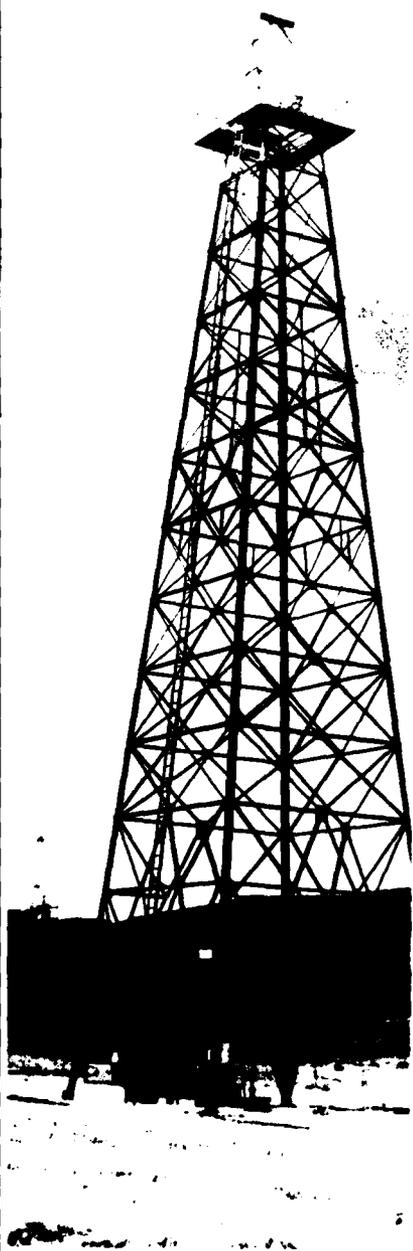
The use of innovative incentives may well spell the difference between success and failure. Perhaps the most noteworthy incentive arrangement of this type is the unique arrangement established for the F-16 technology modernization (TECH MOD) program. The services are also experimenting with warranties and guarantees, particularly in the maintainability arena. For example, nine of the line-replaceable units for the F-16 aircraft have reliability improvement warranties (RIWs), and two have mean-time-between-failure (MTBF) guarantees. These are special incentives and can be expected to be used more in the future in response to the significantly increased emphasis on maintainability and supportability.

One other characteristic of the contractual relationship environment deserves special mention: micromanagement. With, perhaps, a slight hiatus due to the DAIP, the relentless trend toward tighter control and increased oversight can be expected to remain unchanged.

International Programs

The area of international programs is the most complex of all because of the large number of environmental factors bearing on this vector. Among these factors, several stand out:

High cost of research, development, and acquisition. It is clear that, because of the high cost of development and production of weapon systems, it is in the national interest to share the responsibilities and resource commitments.

Loss of technological leadership. Because of the rapid (and welcome) rise of technological excellence in Western Europe, Japan, and elsewhere, we no longer have the overwhelming technological dominance we once enjoyed. The implication is clear; as the director of central intelligence noted recently, "an especially worrisome effect of these shifts in technological leadership is that they will render the United States increasingly dependent on other countries for state-of-the-art defense equipment."[30]

Fear of technology transfer. As we have watched our technological

supremacy slip away and that of the Soviet Union grow, we have sought to place the blame on "technology leaks" following technology-sharing agreements with our allies. These fears have stifled and will continue to stifle numerous technology-sharing arrangements that could be made.[40]

Importance of subnational objectives. It is apparent on the national and on the international scale that national objectives such as obtaining the greatest military effectiveness per unit dollar are in conflict with subnational objectives such as protecting domestic industries and local economic constituencies. An examination of decisions made with respect to international defense issues such as rationalization, standardization, and interoperability (RSI) shows the repeated ascendency of subnational objectives over national objectives.[41] The net result will be continued suboptimization with respect to the military capabilities that could be achieved.

Perceived need to maintain a warm production base. The case for a subnational objective is sometimes based (or at least rationalized) on the concern for a warm production base. Thus, coproduction presents problems in addition to the transfer of technology. To the extent that both nations insist on maintaining a warm production base, neither will be able to produce at a more nearly economic production rate.

In this context, the current administration seems to be significantly less interested in international programs than the previous administration. Nevertheless, the forces favoring increased cooperation remain strong and will lead to increased interest in international programs, probably in the next administration. It is important to recognize that, because of shifting alliances and emerging power centers, future arrangements should be more nearly arrangements between coequals.

With respect to rationalization, standardization, and interoperability, the desire to achieve standardization is beset by almost insurmountable obstacles. In a real sense, the desire to achieve standardization may be viewed as a national (or supranational) objective; and, as noted

above, our experience with achieving this high political objective is poor. As a result, it can be anticipated that the thrust into the future will be to achieve the lesser objective of interoperability.

The Issues

To this point, we have examined the environment, and explored some implications of the various environmental influences. In my opinion, there are three principal unresolved issues stemming from the current environment that deserve serious attention. The first is the relentless increase in the cost of major weapon systems. As Augustine has shown for aircraft systems, the rate at which the cost of aircraft has increased over the past 40 years is much greater than the rate at which the DOD budget has increased, and is greater than the rate of increase of the gross national product (GNP). If, as Augustine notes, one carries the current trend to its logical but irrational conclusion, one arrives at a condition in the year 2116 that Augustine calls "Calvin Coolidge's Revenge" at which point we must invest the entire GNP to acquire one single aircraft.[42] This conclusion is so *preposterous as to be ludicrous.* Yet,

We live in a risk-averse environment with numerous layers of oversight and review. We have many reasons for not taking chances, and few reasons for being bold. Indeed, this is the bottom line. There are few incentives for being creative and innovative.

there are no signs on the horizon that we are prepared (or able?) to break this trend.[43] We must be prepared to make a decision that some future weapon system will be of such high value and cost that we must rule it to be "unaffordable."

The next issue I would raise is what I would term the "Peace-War Paradox."[44] The paradox has its roots in the fact that warfighting is inherently inefficient, and many preparations for warfighting are likewise inefficient. Three examples will serve to illustrate this point. (1) To provide adequate surge capacity, we allow idle plant capacity in peacetime. (2) To anticipate airlift shortfalls during the early days of a crisis, we pre-position supplies and materiel, thus making them unavailable for peacetime training (except for the annual Reforger exercises). (3) To anticipate the unusually stressing environments to which equipment will be exposed in wartime, we apply rigid military specifications and standards.

As we examine these inefficiencies from the vantage point of a peacetime environment, we realize that economies can be realized if we are willing to place our wartime assets at risk. The forcing function is economics. The penalty is a *slow erosion of the infrastructure* capable of supporting a warfighting effort. With little difficulty, you can ask yourself some of the important questions that this paradox raises. For example, to what extent should we substitute contractor maintenance for indigenous maintenance? And, then, to what extent should we replace manual support systems with automated systems? And, to what extent should we substitute computer-based simulation for training with real hardware? The list of questions is long, and there are no easy answers, particularly since dollars saved in peacetime can be invested in new hardware. The only guideline I can offer is this: Made correctly, each decision will result in a *new increase in warfighting potential and* the avoidance of critical weaknesses.

The last issue I would raise is the need for incentives to stimulate the effective and efficient management of the acquisition of weapon systems. Disincentives are rife. Consider De-

fense Acquisition Improvement Program Action 3, Multiyear Procurement, for example. It is DOD policy that we will fully fund the cancellation liability up front; we are required to report to Congress on each program with a cancellation liability in excess of $20 million, and we must submit every major system candidate for MYP to Congress for approval.[45]

As suggested by the case of multiyear procurements, we live in a risk-averse environment with numerous layers of oversight and review. We have many reasons for not taking chances, and few reasons for being bold. Indeed, this is precisely the bottom line. The challenges are tremendous, and there are numerous opportunities. In spite of the fact that there are few incentives to be creative and innovative, these traits are precisely what are called for.

I have focused on a few of the more apparent characteristics of today's environment, and on their portent for the future. I hope these insights will be useful to you as you assume your role, wittingly or unwittingly, in building the future. For, as Edward Cornish wrote, "The primary goal of futuristics is not to predict the future accurately but rather to help people make better decisions so that they will create a better future."[46]■

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4. *Global Trends and U.S. National Security*, pp. 11-12.

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11. V. E. Giuliano, "The Mechanization of Office Work," *Scientific American, 247(3)*, September 1982, pp. 148-164.

12. "Ahead: Work Without Drudgery?" *U.S. News & World Report*, May 9, 1983, p. A26. C. Thomas, "Robots: Job-Takers or Job Makers?", *Pittsburgh Post-Gazette*, July 4, 1983, p. 1.

13. "Ahead: Work Without Drudgery?"

14. A. F. Ehrbar, "Grasping the New Unemployment: Jobs," *Fortune*, May 16, 1983, pp. 106-112.

15. In 1979, the labor force consisted of 102.9 million people, of whom 25.3 million were in the 16-24-year age group. It is estimated that in 1995, the labor force will have 127.5 million people, but only 21.9 million in the 16-24-year age group.

16. The total number of people in the 16-24-year age group was 35.5 million in 1977 and will fall to 30 million in 1990. ("The Speedup in Automation: Changing 45 Million Jobs," *Business Week*, August 3, 1981, pp. 62-67). We are already experiencing a decrease in the number of 18-year-olds; this trend began in 1979. (G. Still, "Korb Urges Greater Civilian Support," a report on Dr. Lawrence J. Korb's address to the Industrial College of the Armed Forces 1984 Class, *Pentagram*, 30(33), August 18, 1983, p. 1.)

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26. *Ad Hoc Subgroup Report on Artificial Intelligence and Robotics*, Army Science Board, September 1982.

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28. Giuliano.

29. A. Toffler, "Reflections on the Third Wave," *National Forum*, Summer 1981, pp. 3-5.

30. "Ahead: Work Without Drudgery?"

31. Zuboff (see note 20) notes that imposing traditional supervisory approaches on a computer-mediated work environment can create considerable dysfunction. The ability to more easily measure the productivity of individual workers not only puts more stress on the workers, but also creates new labor-management tensions. "The Speedup in Automation: Changing 45 Million Jobs."

32. Giuliano.

33. Zuboff.

34. *Ibid*.

35. E. N. Fulker, "Public Management in the 80's and 90's," *The Bureaucrat*, Fall 1982, pp. 26-30.

36. H. Cleveland, "Information as a Resource," *The Futurist*, December 1982, pp. 34-39.

37. Toffler.

38. Merryman.

39. Director of Central Intelligence, *National Strategies and the Global Economy*, NI 82-10001, March 26, 1982, p. viii.

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42. Augustine, pp. 47-53.

43. One wonders whether the vigorous debate over the MX and B-1 programs is the first sign of our struggle to break this trend.

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Balancing on the Technical Manager's Tightwire

The technical manager has a tough balance act to do—with cost schedule, and effectiveness.

Wilbur V. Arnold
Richard M. Stepler

Technical management as discussed herein is the logical and systematic conduct (includes planning, organizing, directing, and controlling) of the engineering effort required to transform a military requirement into an effective operational system.

The manager conducts technical activities aimed at maximizing cost effectiveness (Figure 1), which is generally accepted as the peacetime measure of a program. This effort requires the technical manager to do a balancing act between cost, schedule, and effectiveness. What is the proper phasing of major activities in the balancing act which will result in a cost-effective program?

The most significant system acquisition elements are shown in Figure 2. The manager must integrate these into the technical effort of a system acquisition from initiation to dis-posal. They are shown radiating from basic functional areas —systems (hardware and software), logistics, test and evaluation, production— with engineering at the core. The figure illustrates the broad base and complexity of technical management. Operation within the specific disciplines is even more difficult. Therefore, the faculty of the Defense Systems Management College Technical Management Department developed the Acquisition Life Cycle Technical Activities Chart (see fold-out at the end of this article) as a management tool. The chart represents a nor-mative approach to the broad-based activities in general time frames and should not be strictly interpreted.

Overview

The designation of technical management functional engineering areas as systems, logistics, test and evaluation, production, and cost sometimes parallels divisions of labor for application of specialties in the program office. There may be some argument that systems engineering encompasses all the technical functional areas and or that logistics is a broader discipline than indicated. However, it is not our intention to create or address such controversy here, but merely to use the terms in formation of a matrix that exposes more detailed activities.

Figure 1. Technical Activities that Maximize Cost Effectiveness


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                           COST
                       EFFECTIVENESS
                  ┌──────────┴──────────┐
              SYSTEM                   SYSTEM
           EFFECTIVENESS                COST
          ┌──────┴──────────┐      ┌────┼────┬────┬────┐
   PROBABILITY OF      READINESS TO   RDT&E PRODUCTION OPERATION DISPOSAL
   MISSION SUCCESS    CONDUCT MISSION              & SUPPORT
    ┌─────┴─────┐
PERFORMANCE  DEPENDABILITY
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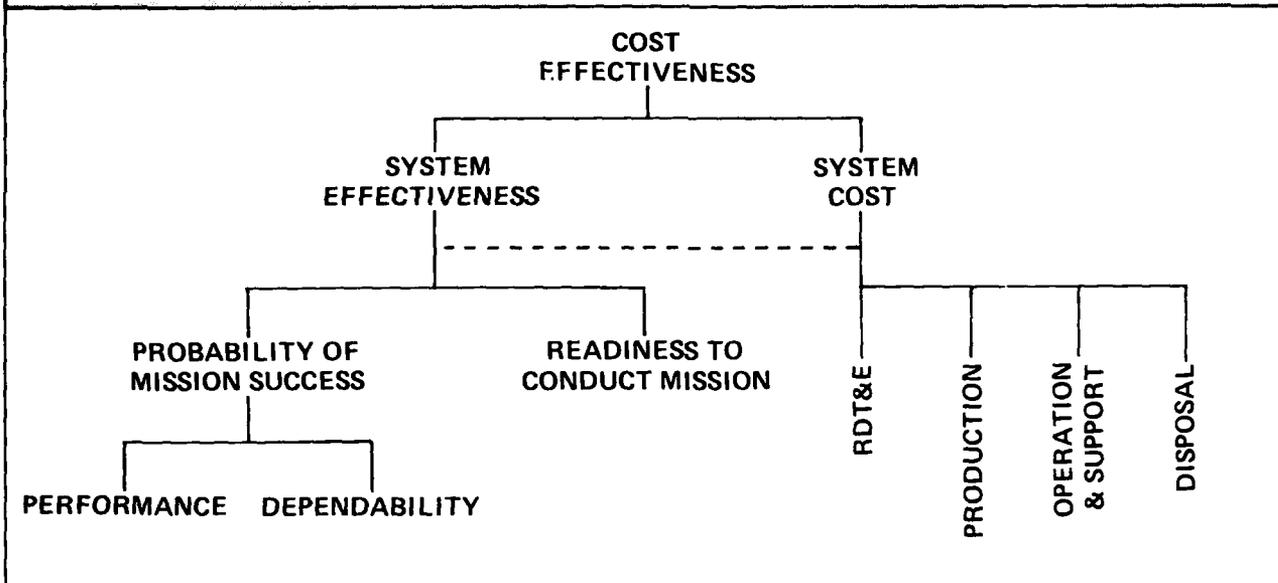
Figure 2. The Most Significant Acquisition Elements

1. HARDWARE
2. ENVIRONMENTAL COMPATABILITY
3. HUMAN FACTORS
4. SURVIVABILITY VULNERABILITY
5. RELIABILITY MAINTAINABILITY AVAILABILITY
6. SAFETY
7. TESTABILITY
8. TEST SUPPORTABILITY
9. PACKAGING, HANDLING, TRANSPORTATION, STORAGE
10. SUPPLY SUPPORT/ PROVISIONING
11. SUPPORT AND TEST EQUIPMENT
12. DEPLOYABILITY
13. COMPUTER RESOURCE SUPPORT
14. MANUALS, TECHNICAL DATA
15. FACILITIES
16. TRAINING
17. PERSONNEL
18. MAINTENANCE PLANNING
19. AFFORDABILITY
20. DESIGN TO COST
21. LIFE CYCLE COST
22. STANDARDIZATION COMMONALITY
23. PRODUCT ASSURANCE
24. PRODUCIBILITY
25. FIRMWARE
26. SOFTWARE

For our purposes, we use technical management as the broad discipline that encompasses all technical and functional areas.

The other variable of the matrix is program time. In this discussion, system acquisition phases—concept formulation, demonstration/validation, full-scale development, production and deployment—are convenient descriptors of time spans in which to group activities. In this way, technical management can be broken down to detailed activities by functional disciplines and program phase. The Acquisition Life-Cycle Technical Activities Chart provides a concise description of the activities.

There are important activities in all functional areas starting in the earliest phase of the acquisition life cycle and continuing through most of the program. The general thrust of technical management goes like this:

—*Define* what it takes to support, produce, and test the system utilizing analyses. Then see if we can afford it.
—*Influence the design* through producibility engineering, logistic analysis, testability design, and design to cost. Develop specifications and translate requirements to contract language.
—*Prepare to execute* by arranging for the test facilities, acquiring and setting up the production line, designing and acquiring the logistic support.
—*Execute* by testing, manufacturing, supporting.

The chart is a rigorous endeavor to show all the technical management activities in relative time phase. As such, it provides the manager a check list of activities that should be accomplished and integrated in the various program phases.

Delving into the details of the chart will soon confirm that hard work by management at the beginning will pay off later. Early technical decisions have a profound effect on total system cost and schedule, but there are continuing requirements for important technical activities and integration. The chart provides a guideline for accomplishing the technical management task. An explanation of functional discipline terminology is included at the end of this article.

Acquisition Life-Cycle Technical Activities

General

Technical activities are the genesis of a weapon system and continue through its life. The matrix in Figure 3 generally relates time to technical activities. The third dimension in managing this kind of effort is integration, that is, feedback and problem resolution between activities, and planning for the future. Any one management output must be based upon data and feedback developed during the generation of others. In other words, they must not only be consistent, but must also utilize the integrative power of functional consultation. The whole is greater than the sum of the parts.

There are some general integration flows that run through the chart:

—Specifications flow from systems (A) to development (B) to product (C), process (D), and material (E).
—These are reflected in the contract cycle: specification, statement of work (SOW), request for proposal (RFP) converted through the selection process to contractor effort.
—Product baseline is developed.
—*The review process, i.e., system requirements review (SRR), system design review (SDR), preliminary design review (PDR), and critical design review (CDR), focuses integration/definition of the product.*
—Test results provide feedback for analysis of performance progress.
—The overall technical management holds the activity together in the balancing act between cost, schedule, and effectiveness.

The following brief narrative addresses technical management activities and integration. We have tried to avoid getting lost depicting a maze of feedback loops, or attempting to articulate *rigorous discussion of policy, rules, or differences between types of programs*.

■ *Mr. Arnold is a Professor of Engineering Management in the Technical Management Department, School of Systems Acquisition Education. Mr. Stepler was a Professor of Systems Acquisition Management in that department before recently transferring to Headquarters, Lexington Bluegrass Army Depot, in Kentucky.*

Concept Exploration

Document outputs of the concept exploration phase include:

—System specification (A)
  —Hardware
  —Software
—System requirement review (SRR)
  —Hardware
  —Software
—System engineering management plan (SEMP)
—Integrated logistics support master plan (ILSMP)
—Test and evaluation management plan (TEMP)
—Acquisition/manufacturing strategy
  —"Design to" goals
  —Total quantity
  —Production rate

The key effort during concept exploration is generation of the system (A) specification and establishment of the functional baseline. Supporting this activity and projecting the system engineering effort are the system requirements review and the system engineering master plan. These activities must require and consider realistic inputs from technical functions:

(1) The dynamic policy and technology of software;
(2) Logistics support implications (cost, schedule, performance) and requirements;
(3) Feasibility of testing and feasibility testing; and
(4) Producibility.

Demonstration/Validation (DEM/VAL)

Document outputs of the DEM/VAL phase include:

—Development specification (B)
  —Hardware
  —Software
—System design review (SDR)
  —Hardware
  —Software
—Integrated logistics support plan (ILSP)
—Logistic support analysis (see also concept exploration)
—Prototype test results
—Test and evaluation master plan update
—Resolution of production risk(s)
—Preliminary manufacturing plan

As the development specification is generated and the allocated baseline established, the functional specialists

continue to expand knowledge of the system, generate input for system design, and define the remaining program tasks.

Software. A system software synthesis is conducted and system requirements established. The basis for monitoring quality is established and the effort commences. An independent verification and validation approach is selected (or not) and the procedure starts.

Logistics. The logistics support system concept is developed. Logistics support analysis is conducted/ continued to determine (current) alternatives and system design drivers.

Test and Evaluation. Prototype testing is conducted and reported. The test and evaluation master plan is updated for the current technology and system design. Better techniques may be available to accomplish T&E; the design may change and require a different T&E approach.

Production. Producibility paper studies are turned into technical modification/manufacturing technology programs, preliminary production engineering, and preliminary manufacturing plans. Preplanned product improvement feedback is provided.

Full-Scale Development (FSD)

Document outputs of the FSD phase include:

—Product specification (C)
　—Hardware
　—Software
—Process specification (D)
—Material specification (E)
—Logistics support definition
—Engineering development test report(s)
—T&E master plan update
—Manufacturing plan
—Production readiness review report
—Design documentation
　—Rate production
　—Complete support
—Quality assurance plan

As the final details of the system design are committed to specification:

—Software is designed, coded, tested, and product specification finalized;
—Logistics support is defined and acquisition started;
—Development test results are re-

ported and the T&E master plan updated for current technology and design change;
—Development test and evaluation flows into initial operational test and evaluation; and
—Production engineering is a driver for the final manufacturing plan, but earlier work should make this an optimization activity—low-rate initial production may be included—the evaluation/quality assurance plans are finalized—all in support of a demonstration of readiness for production.

Production and Deployment

Document outputs during Production and Deployment include:

—Functional quality review report
—Production configuration audit report
—Logistic documentation deliverables
—T&E reports for final operational and product assurance testing
—Product disclosure package
—Contractor(s) surveillance reports
—Implementation of manufacturing strategy
　—GFP support
　—Value engineering
　—Second source
　—Breakout

Detailed reviews are conducted to be sure that the design disclosure package is suitable for its intended use—system production to meet user requirements. Logistic deliverables—manuals, spares, fielding support training, maintenance—are acquired. The manufacturing plan is executed, including appropriate value engineering and tactical activities such as establishing a second source(s), component breakout, and preplanned product improvement (P³I). The total effort eventually becomes post-production support (hardware and software) wherein most if not all of the system effort is conducted within the using military service.

Summary

Criticism of weapon system acquisition costs has focused a great deal of attention on the procurement process. Initiatives to improve the process are being implemented. The chart is intended to advance the thought that the best way to improve the acquisi-

tion process is to do it the way it is supposed to be done. Most problems can be traced to ignoring essential activities (such as life-cycle analysis, logistic support analysis, producibility engineering) or taking "short cuts" that require extensive effort to "back fill" later. Timely technical activities should develop appropriate specifications, develop producible designs, provide meaningful evaluation, encourage productive facilities, provide effective support, budget and contract for effective production, and maintain system readiness.

This is the first publication of the chart. It is intended for use in program management offices and by others concerned with understanding the technical aspects of the system acquisition process. The content is oriented toward a large system procurement, but the flow of activity should be generally applicable to weapon systems. Comment is encouraged and should be directed to the authors at the publication address. Reproductions of the chart are available by writing Technical Management Chart, Defense Systems Management College, ATTN: SE-T, Fort Belvoir, Va. 22060.

FUNCTIONAL TERMINOLOGY AND USAGE

Production Definition

Requirements scrub. Review of user/government comments received in response to announcement of an operational requirement. The scrub is used to validate and prioritize suggested/requested system functions/capabilities before release to industry.

System requirements review (SRR). To ensure that system requirements have been completely and properly identified and that there is a mutual understanding between the government and contractor.

Type A, B, C, D, E specifications. See functional, allocated, and product baselines.

Baselines

Functional baseline. The technical portion of the program requirements (type A spec); provides the basis for contracting and controlling the system design.

Allocated baseline. Development specification (type B spec) defines the performance requirements for each

configuration item of the system

Product baseline (type C spec). Established by the detail design documentation for each configuration item. Normally includes:
—*Process baseline* (type D spec) and
—*Material baseline* (type E spec).

Request for proposal (RFP), statement of work (SOW), contract data requirements list (CDRL). The documents used in letting contracts for each phase of work. The RFP sets forth the needs; the SOW is the formal statement of these needs as requirements for contractual effort; and the CDRL defines the data deliverables.

reflect current DOD policies. Additional information is in AR 1001-1 (Army), Mil-S-1679 (Navy), and AFR 800-14 Vols. I and II (USAF).

Computer program development plan (CPDP). A management plan usually generated by the developer that presents the software effort.

Computer resources integrated support plan (CRISP) (USAF), computer resources management plan (CRMP) (Army), computer resources life-cycle management plan (CRLCMP) (Navy). Life-cycle software management plans developed by program managers and their management team.

Independent verification and validation (IV&V). An independent review of the software product for functional effectiveness and technical sufficiency.

System Engineering (Hardware)

System engineering management plan (SEMP). Includes plans for verification, risk alleviation, analyses, and simulation of the system requirements.

System requirement documents (SRD). Refine the mission requirements through analysis that evolves a system design concept and interfaces.

System design review (SDR). Reviews the conceptual design of the system and establishes its capability to satisfy requirements.

Preliminary design review (PDR). Follows preliminary design efforts and results in approval to begin detailed design.

Critical design review (CDR). Reviews the completeness of the design and interfaces.

Functional configuration audit (FCA). Verifies that the actual item that represents the production configuration complies with the development specification.

Formal qualification review (FQR). A systems-level configuration audit conducted after system testing is completed (to ensure performance requirements of the system specification have been met).

Physical configuration audit (PCA). A means of establishing the product baseline as reflected in an early production configuration item.

Systems Engineering (Software)

Policy/technology assessment. DOD Directives 5000.29 and 5000.31
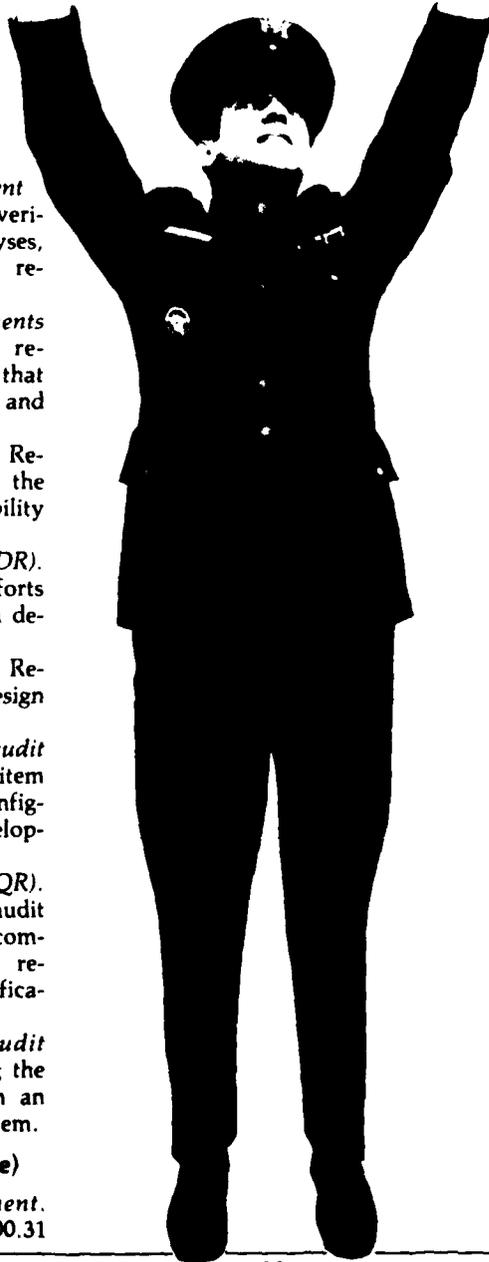
Quality assurance (QA). The process of assuring that a software product is produced that performs properly, has minimum support requirements, and facilitates maintenance as specified.

Software system synthesis. The analysis of user/buyer requirements to produce functional requirements for software at the A-specification level.

Software requirements generation. The decomposition of the A-specification requirements into functional requirements that are allocated to software.

Software design. The designing of the software systems to meet the functional requirements allocated in the B-specification.

Software programming. The coding of the software in accordance with the software design.

Software testing. The testing of the software to the functional requirements presented in the B-specification.

System engineering (hardware) activities for SRR, SDR, PDR, CDR, FCA/PCA, A Spec, B Spec, C Spec also apply to software.

Integrated Logistics Support (ILS)

ILS strategy development. Logistics acquisition strategy is developed setting forth objectives, resources, management assumptions, extent of competition, proposed contractual vehicles, program structure, but with emphasis on maintenance approach, operational support patterns, constraints, significant items, contractor role, GFE, including life-cycle support, transition, warranties, and post-production support.

ILS alternatives/trade-offs assessment. Largely a data-gathering and model exercise. Data comes from "lessons learned" files, comparative analysis, technological opportunities,

use studies, field visits, standardization requirements, functional and military requirements, constraints, maintenance, and operational approaches. Analyses and assessments are made on the cost and effectiveness of supporting the identified alternatives.

Integrated logistics support management plan (ILSMP). The early logistics plan dealing with organizational authorities and responsibilities and containing broad logistics strategy, goals/thresholds, and maintenance concepts.

Integrated logistics support plan (ILSP). The formal planning document for logistics support. It is kept current through the program life. It sets forth the plan for operational support, provides a detailed ILS program to fit with the overall program, provides decision-making bodies with necessary ILS information to make sound decisions in system development and production, and provides the basis for ILS procurement packages-specifications RFPs, SOWs, source-selection evaluation, terms and conditions, CDRLs.

Logistics support analysis (LSA). A formal tool under MIL-STD-1388 that helps identify and trade off qualitative and quantitative logistics support requirements. It is a logical, documented basis from which to influence design and force a degree of requirements integration. It also provides a yardstick from which to assess logistics objective achievement.

Logistics support analysis record (LSAR). The formal notation of design results in stylized format using forms for operations and maintenance requirements, RAM, task analyses, S and TE, facilities, skill evaluation, supply support, ATE and TPS, and transportability. LSAR is the basis for training, personnel, supply provisioning and allowances construction, S and TE acquisition, facilities construction and preparation, and for maintenance—preventive and corrective. Reference MIL-STD-1388.

Material Fielding and Training. The action of checking out equipment functions and operator and maintenance personnel training after production and before turnover to users.

Post production support (PPS). The planning for and provision of logistics support to the system after the end item production line has closed down (often a 10-20 year period). Requires tailored support activity usually documented in a PPS ILSP.

Test and Evaluation (T&E)

Three types of T&E—development test and evaluation (DT&E), operational test and evaluation (OT&E), and production acceptance test and evaluation (PAT&E) occur during the acquisition cycle. DT&E is conducted to assist the engineering design and development process and to verify attainment of technical performance specifications and objectives. OT&E is conducted to estimate a system's operational effectiveness and suitability, identify needed modifications, and provide information on tactics, doctrine, organization, and personnel requirements. PAT&E is conducted on production items to demonstrate that those items meet the requirements and specifications of the procuring contracts or agreements. OT&E is further subdivided into two phases—initial operational test and evaluation (IOT&E) and follow-on operational test and evaluation (FOT&E). IOT&E must be conducted before the production decision (Milestone III) to provide a credible estimate of operational effectiveness and suitability. Therefore, IOT&E must be conducted on a system as close to a production configuration as possible, in an operationally realistic environment, by typical user personnel. FOT&E is conducted on the deployed system to determine if operational effectiveness and suitability is, in fact, being attained.

Test and evaluation master plan (TEMP). The test and evaluation master plan is the top-level test management document. The TEMP is prepared at the PMO level and includes inputs from all participating agencies, with special emphasis on the test requirements of the independent operational test agency. There is a 30-page limit imposed by DODD 5000.3; however, the TEMP must include a system and mission description, T&E management and schedules, the status and plans for development, operational, and production acceptance testing, critical T&E issues, and test resource requirements. Prior to Milestone I, the TEMP is submitted to the Director of Defense Test and Evaluation (DDT&E) for review and approval. This approval establishes a "contract" between the service and OSD for testing throughout the life cycle of the system, since the TEMP covers all phases of testing. Subsequent to its initial issue, the TEMP is updated at each major milestone. In-process updates can also be accomplished at any time there is a significant change to the test program specified in the approved TEMP.

Test results/reports. The conduct of testing, and the associated collection, reduction, and analysis of test data, is a continuous process throughout the acquisition life cycle. The issuance of formal development and operational test reports is typically aligned with the major milestones to provide the essential risk reduction information and to support the program decisions. The issuance of independent OT&E reports by the independent operation test agency is considered critical to the support of the DSARC decision process.

Information from testing is forwarded to OSD and Congress by both informal and formal means (including the dissemination of the aforementioned test reports). Formal T&E briefings are made to DDT&E and others in the OSD staff approximately 3 weeks before each DSARC for the system. Information on test results is transmitted to Congress on a recurring basis as part of the selected acquisition reports (SARs) and congressional data sheets (CDS).

Production

Evaluate production feasibility. Assess the likelihood that a system design concept can be produced using existing manufacturing technology.

Assess production risks. Estimate probabilities of success or failure in manufacturing.

Identify manufacturing technology needs. Discriminate manufacturing capabilities vs. requirements to define new facilities and equipment needs.

Estimate manufacturing cost. Develop estimates of the resources required for various systems alternatives.

Design to goals. Requirement- or policy-driven constraints on design parameters for the system.

Acquisition/manufacturing strategy. The approach to obtaining the total quantity of a system at some rate for some cost.

Resolve production risk. Demonstrate required advances beyond the current capability.

Complete manufacturing technology development. Manufacturing technology is developed through a phased approach from definition to demonstration. This represents the final demonstration of the integrated manufacturing scheme.

Preliminary manufacturing plan. A method of employing the facilities, tooling, and personnel resources to produce the design.

Preliminary producibility, engineering and planning (PEP). Initial application of design and analysis techniques to reduce the potential manufacturing burden.

Industrial base issues. Critical resources, skills, and long-lead materials and processes required by the system design.

Finalize manufacturing plan. Refine and formalize initial manufacturing plan.

Execute PEP. Incorporate the producibility analysis into the mainstream design effort.

QA plan. Initiate a quality assurance plan to include quality of design and quality of conformance.

Low rate initial production (LRIP). Low rate of output used to prove manufacturing technology and facilities at the beginning of production.

Production readiness review (PRR). Formal examination of a program to determine if the design of the product and process are ready for the production phase.

Contractor surveillance. Execution of production contracts incorporating appropriate quality assurance documentation and observation. Surveillance may be conducted by on-site government representatives, authorized specialists, the program office, or a combination.

Post-production support (manufacturing). Arrange for purchase of spare parts or a portion of normal production runs.

Value engineering (VE). A program to allow for the sharing of cost savings derived from improvements in the manufacturing processes.

Second source. Execution of established acquisition strategy to establish two producers for the part or system.

Breakout. Execution of established acquisition strategy to convert some parts or systems from contractor-furnished to government-furnished.

GFP support. Execution of contracts and management of items provided as government-furnished property to the contractor.

Life-cycle cost (LCC). The net expenditure (usually an estimate) for acquiring and using an item.■

System Engineering Management
Guide Now Available

The complexity of a modern major weapon system requires conscious application of system engineering (SE) principles and concepts to ensure producible, operable, and supportable systems that satisfy mission requirements. For the first time, a *System Engineering Management Guide* is available to help acquisition management personnel understand and effectively apply SE management principles. The guide, which was produced under a DSMC-directed contract by Lockheed Missiles and Space Company, is available in limited numbers to members of the defense acquisition community.

A number of tools and processes have been developed over the years to assist the system engineer in defining requirements, configuring and sizing the system, managing its development, and verifying the capability of the design. These tools and processes, while usually described in various papers, seminars, and working documents, are sometimes held only in the minds of their practitioners. This guide compiles many of these into an overall description of system engineering and system engineering management techniques for use by program management personnel.

The guide is based on the tasks defined in MIL-STD-499A (USAF), "Engineering Management," augmented in areas that have come into prominence since that document was issued. The guide is intended primarily for use in the courses at the Defense Systems Management College, and secondarily as a desk reference guide for program and project management personnel. The guide is written for current and potential Department of Defense program managers, and some familiarity with the basic terms and definitions employed in program offices is assumed. It presents a discussion of the processes required without becoming involved in detailed mathematics. It relates the diverse elements of system engineering to one another and to the overall objective of delivering and supporting an optimized system.

The guide covers the development of a system from inception to operational deployment and use. It is divided into five modules:

I System Engineering Management
II System Definition

III Configuration Definition and Management
IV Technical Performance Achievement
V Operational Feasibility

Within each module, individual chapters concern specialized areas of the system engineering process. Each chapter generally follows the format below:

Introduction. Purpose of the activity being described.

Approach. Definition of terms employed, nature and time phasing of effort, related government documents.

Methodology. Description of tools and processes involved, examples of results.

Documentation. Description, format, and use of documentation produced as a result of the activity.

To obtain a copy of the *System Engineering Management Guide*, write SEM Guide, Defense Systems Management College, ATTN: DRI-P, Fort Belvoir, Va. 22060. Your request must be in writing—phone requests cannot be accepted.■

THE COMMON THREAD IS PRODUCT DEFINITION	REQUIRE-MENTS FORM-ULATION	OPERATIONAL REQUIREMENT	REQUIREMENTS SCRUB	SRR	REQUIREMENT REVALIDATED		REQUIREMENT REVALIDATED	
						TYPE A SYSTEM SPECIFICATION		
							TYPE B	
			GAIN THOROUGH FAMILIARITY WITH THREAT AND OP RQMTS		REASSESS THREAT			

BASELINES		FUNCTIONAL		ALLOCATED	
		RFP SOW CDRL → CONTRACT		RFP SOW CDRL → CONTRACT	

SYSTEM ENGINEERING HARDWARE	SEMP	SRD		SDR	PDR	CDR

CLE TECHNICAL ACTIVITIES

(3-6)	(3-5)	(15-40)

TATIVE CISION PRODUCE DEPLOY	FULL SCALE DEVELOPMENT	FINAL DECISION TO PRODUCE AND DEPLOY	PRODUCTION	DEPLOYMENT/ INITIAL OPERATING CAPABILITY	OPERATION AND SUPPORT	DISPOSAL

DESIGN AND TEST OF THE SELECTED SYSTEM ALTERNATIVE
- DESIGN TRADEOFFS

RATE PRODUCTION OF SYSTEM

USER SUPPORT
MODIFICATIONS/PRODUCT IMPROVEMENTS

MS II ▲ ▲
SARC

MS III ▲
(D)SARC

REMENT LIDATED

STEM SPECIFICATION ➤

●----● TYPE B   DEVELOPMENT SPECIFICATION ➤

●---------● TYPE C, D, E   PRODUCT/PROCESS/MATERIAL SPECIFICATION ➤

LOCATED   PRODUCT

CONTRACT | RFP SOW CDRL | → CONTRACT

| DESIGN DOCUMENTATION NECESSARY FOR PRODUCTION COMPLETE |

PDR   CDR   FQR   DESIGN OF MODS/PIP

FCA   PCA

REPRODUCED

ISSUE

SOFTWARE

POST DEPLOYMENT SOFTWARE SUPPORT (SOFTWARE MAINTENANCE)

- SOFTWARE DESIGN - SOFTWARE CODING - SOFTWARE TESTING

LSAR ➤   LSAR ➤ IMPLEMENT PLANS   LSAR ➤

ILSP FOR SELECTED ➤ UPDATED ➤ SYSTEM ALTERNATIVE   ILSP   UPDATED ➤ MFP ➤ ILSP

- DESIGN COMPLETE LOGISTIC SUPPORT SYSTEM
- ENSURE ILS IS INTERNAL PART OF DESIGN TRADEOFFS
- DESIGN ANY ITEMS OF SUPPORT

- ACQUIRE (RATE PRODUCTION) ALL NECESSARY SUPPORT ITEMS

CONCURRENT DELIVERY OF SYSTEM AND ALL REQUISITE ITEMS OF SUPPORT

MATERIAL FIELDING AND TRAINING

POST PRODUCTION SUPPORT

TEMP ➤ UPDATE

PRODUCTION TESTING

MODIFICATION TESTING

PRODUCTION MANAGEMENT	EVALUATE PRODUCTION FEASIBILITY
	ASSESS PRODUCT RISK ──────────►
	EVALUATE MANTECH NEEDS ◄──────
	ESTIMATE MANUFACTURING COSTS
	DESIGN TO GOALS
	
	ACQUISITION/MANUFACTURING ──────
	STRATEGY
	  •TOTAL QUANTITIES
	  •RATE GOALS
		RESOLVE PRODUCTION RISK
		COMPLETE MANTECH DEVELOP
		
		►PRELIMINARY MANFG PLAN ────────
		PRELIMINARY PEP ◄───────────
		INDUSTRIAL BASE ISSUES
		P²I
			►FINAL MANUFACTURING PLAN ◄
			►EXECUTE PEP
			QA PLAN
			  LOW RATE INITIAL PRODUCTI
			
			◄• • • PR

COST	AFFORDABILITY BOUNDS AND CEILING IDENTIFIED	•DEVELOP LCC ESTIMATES OF ALTERNATIVE SOLUTIONS •COMPARE WITH AFFORDABILITY LIMITS •DETERMINE LCC IMPLICATIONS OF MAJOR SYSTEM REQUIREMENTS	LCC ESTIMATE	•IDENTIFICATION OF MAJOR REQUIREMENTS IN LIGHT OF LCC IMPACTS •DEFINE LCC ESTIMATES OF ALTERNATIVES •AGAIN COMPARE WITH AFFORDABILITY LIMITS	LCC ESTIMATE	•TRADE-OFF PROCESS WITH THE SELECTED ALTERNATIV •CONTINUOUS REFINEMENT/ UPDATE OF LCC ESTIMATE •DESIGN TO COST

PDR	CDR	**PRODUCTION COMPLETE**	PQR	DESIGN OF MODS/PIP
	FCA		PCA	

				REPRODUCED	POST DEPLOYMENT SOFTWARE SUPPORT (SOFTWARE MAINTENANCE)
ITS	• SOFTWARE DESIGN	• SOFTWARE CODING	• SOFTWARE TESTING	ISSUE	
				SOFTWARE	

LSAR ━━━━━━━━ LSAR ━━━━━━ IMPLEMENT PLANS ━━━━━ LSAR ━━━━━━━━▶

ILSP FOR SELECTED ━━━ UPDATED ━━━ UPDATED ━━━ MFP ━━━━━━━━▶
SYSTEM ALTERNATIVE   ILSP   ILSP

CS	• DESIGN COMPLETE LOGISTIC SUPPORT SYSTEM	• ACQUIRE (RATE PRODUCTION) ALL NECESSARY SUPPORT ITEMS	CONCURRENT DELIVERY OF SYSTEM AND ALL REQUISITE ITEMS OF SUPPORT	MATERIAL FIELDING AND TRAINING
SYSTEM	• ENSURE ILS IS INTERNAL PART OF DESIGN TRADEOFFS			POST PRODUCTION SUPPORT
SYSTEM	• DESIGN ANY ITEMS OF SUPPORT			

TEMP ━━━━━━━━━━━▶
UPDATE

NG	ENGINEERING DEVELOPMENT TESTING DT&E/IOTE	PRODUCTION TESTING FOT&E/PAT&E	MODIFICATION TESTING
TEST RESULTS/ REPORTS		**TEST RESULTS/ REPORTS**	

			PRODUCTION OF SPARE PARTS PRODUCTION OF PIP/MODS
▶ FINAL MANUFACTURING PLAN ━━━		▶ IMPLEMENT MFG PLAN	
▶ EXECUTE PEP		CONTRACTOR SURVEILLANCE	
QA PLAN		INCORPORATE GFP/GFE	
LOW RATE INITIAL PRODUCTION • • • • • •		VE	
◀ • • • PRR		2ND SOURCE/BREAKOUT DECISIONS	

LCC	LCC ESTIMATE	• TRADE-OFF PROCESS WITHIN THE SELECTED ALTERNATIVE	LCC ESTIMATE	• EVALUATE ECP'S AND PRODUCT IMPROVEMENTS IN LIGHT OF LCC IMPACT
		• CONTINUOUS REFINEMENT/ UPDATE OF LCC ESTIMATE	• DESIGN TO COST	
		• DESIGN TO COST		

Successful Programs:

Can We Learn from Their Experience?

Why have some programs succeeded where others have failed?
A recent study came up with some surprising answers.

J. Stanley Baumgartner, Calvin Brown, and Patricia A. Kelley

What have we been doing *right* in defense systems acquisition that we want to repeat? That's the thrust of a study we made recently on successful weapon systems acquisition management. We wanted to find out what makes for success in systems acquisition management.

We learned that success is not just avoiding pitfalls where other programs have been less than successful. It is something different—in practices, purposes, and in the eyes of the program managers (PMs) themselves. One difference is that most PMs don't see cost, schedule, and performance goals as being their main objective. Their primary yardstick is "does it work in the field?"

Many commonly held beliefs are valid, such as stability, the need for good people, and wide-open communications between the defense pro-

gram office and its industry counterpart. Other beliefs don't hold up, such as "stay within the state-of-the-art" and "the PM should remain at least 3 years on his program." One program manager said, "We pushed hell out of the state-of-the-art." Continuity is essential, but not necessarily on the part of the program manager. His key staffers can provide the needed continuity.

What do successful PMs do differently? Sometimes it's a matter of *what* they do. In other cases it's more a matter of *degree*, such as their openness in communicating.

The first Aegis cruiser, the USS Ticonderoga (CG-47) on transfer cars, ready to be moved to the launch platform.
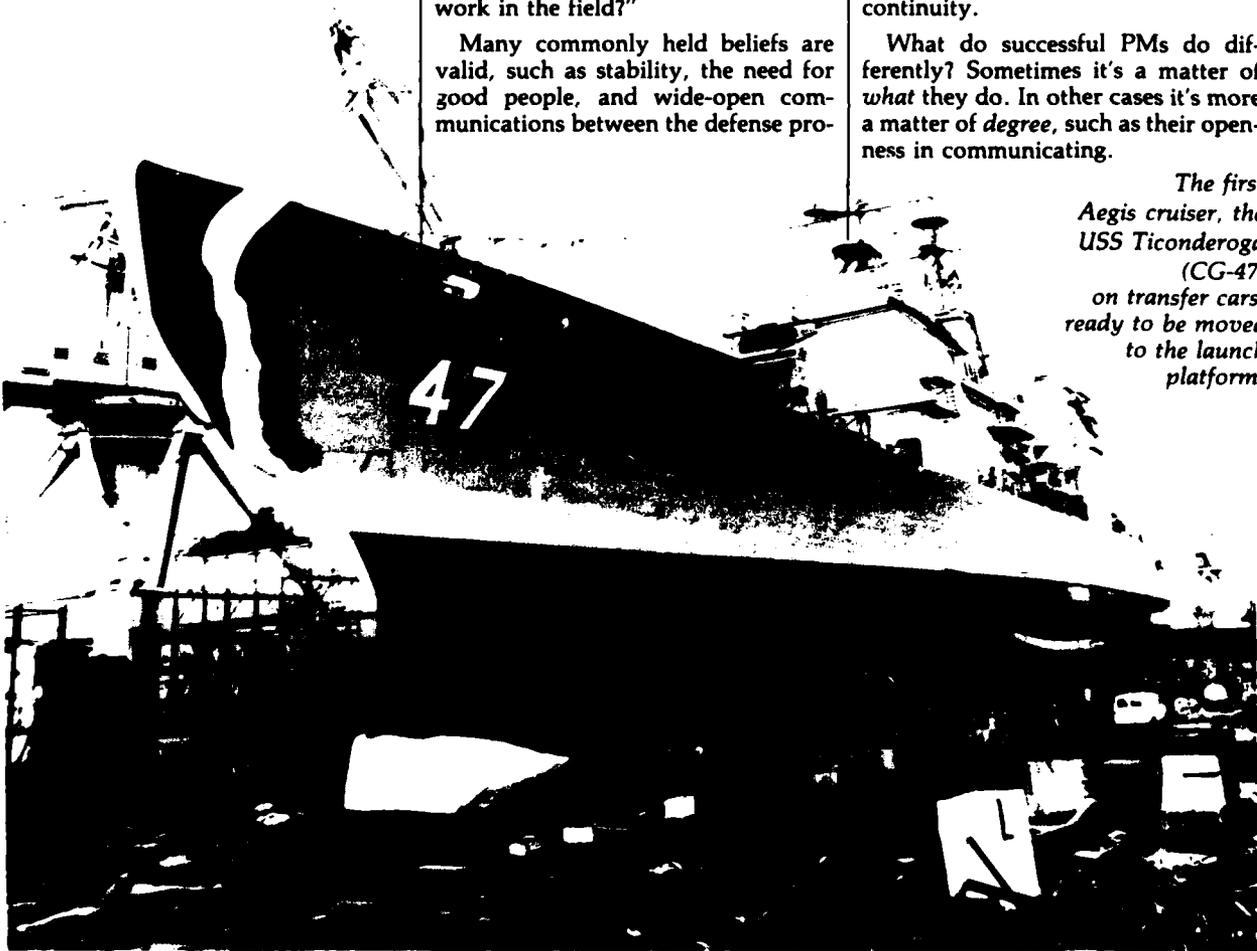
The Success Study

Our first requirement was to determine what constitutes success: Is it success in both development and production? Success in one phase but perhaps not in another? Success on the current program only? Success in whose eyes?

We asked the Joint Logistics Commanders to nominate some successful programs, leaving the criteria for success up to them. They recommended a combined total of 52. We selected 12, based on trying to obtain a mix in types of system, size, purpose, time frame, and acquiring service. Most are reported in Selected Acquisition Reports (SARs). The selection of these programs as successes does not mean that they had no cost growth. A review of the SARs for seven of the successful programs shows growth, but the primary causes must be recognized: escalation, changes in quantities, and unrealistic initial estimates. Hellfire, CG-47, F-16, and the E-3A have substantial quantity increases; the FFG-7 quantity requirements have changed from 50 to 74 to 50 ships so far. The OSD escalation indices used for budgeting purposes were very low compared to the actual escalation experienced. On one program the initial, highly optimistic estimate given by the chief of the service to Congress is still used for then and now comparisons. The responsibility for the programs finally selected is ours. We are well aware that in this way we have eliminated others that are also successful.

The programs we selected are as follows:

- FFG-7 Frigate
- CG-47 Aegis Cruiser
- Polaris Missile
- F-16 Fighter Aircraft
- C-141 Cargo Aircraft
- Ballistic Missile Early Warning System (BMEWS)
- Atlas Ballistic Missile
- E-3A Airborne Warning and Control System (AWACS)
- Multiple Launch Rocket System (MLRS)
- Hellfire Missile
- CH-47 Helicopter Modernization
- Firefinder Radars

We identified present and previous program managers and their industry counterparts, then set about interviewing 47 of them using a 22-point questionnaire for defense program managers and two 10-point subsets for their deputies and industry managers. We sought answers to the basic question posed above: What have we been doing right in DOD that we want to repeat? We believe the lessons learned will be valuable in the Defense Systems Management College curriculum and in the acquisition community at large.

One of the questions we asked was how PMs would rank the following as indicators of program success:
- Works well when fielded
- Meets cost objectives
- Meets initial operational capability (IOC) date
- Meets technical performance objectives
- Meets logistics supportability objectives

Their answer came back loud and clear. Sixty-eight percent ranked "works well when fielded" as most important. The least important, ranked last by 58 percent, is the IOC date, which is perceived as an artificial date whose main purpose is to aid in planning and scheduling for training and logistics support. Meeting technical objectives was second in importance, closely followed by cost objectives.

Reasons for Success

The factors that make or made for success differ, but there are recurring themes. Reasons for success cited most often are good office and technical staffs, good program managers on both sides, realistic and stable requirements, a good contractor, and factors related to stability—personnel stability, funding stability, and product stability. Here are the main factors for success.

People

Good people are an absolute must. So how did they get good people? Industry gets these people primarily by growing their own: selection, attendance at company and other acquisition-related courses, and development by giving them a chance to show what they can do. "But," one

manager said, "it takes time to develop them." The service PMs try to request people by name after careful, deliberate evaluation of their capabilities and background. The FFG-7 program hired young engineers-in-training at the beginning of the project and has been able to retain them throughout the life of the project by promoting them from within. Both service and industry PMs said they fire those who are not performing.

Stability

This is a theme that permeates the reasons for success. Product stability depends upon realistic requirements (realistic for the funds available) and keeping changes to an absolute minimum. An Army PM notes, "Systems that have problems are those with lots of changes, especially with the user pushing for them." Stability in funding is also essential. Vice Admiral Levering Smith of the Polaris program is admired for his frankness in advising congressional committees on what it would cost to achieve a particular level of performance. When he was pressed to lower this figure, he explained how this would buy less performance. Over the nearly 30 years of the program this straightforwardness has stood the test of time.

Interestingly, time pressures often are a factor in stability and success. The reason—a clear national need. As a result, outsiders who might be inclined to dabble in the management of a project are less likely to do so. Some multinational programs enjoy similar benefits of "hands-off" treatment because of their management complexity. Since multinational programs often receive high-level attention, intermediate levels tend to leave those programs alone.

Ability of the PM

This is a vital element that reflects operational background, leadership ability, and education for the position of program manager. Sub-items are ability to gain the confidence of higher levels (including not asking for additional dollars each year), ability to motivate a team, tenacity in driving toward program goals, and, usually, maintaining good relations with higher authority. A trait common to

almost every PM is an ability to communicate well with all types of audiences.

In every case, it was clear who ran the show—the PM. Sometimes this was stated in some form of directive. More often, though, the PM took the authority he thought he needed to do his job. This didn't always make him popular, of course. In one service the question arose whether dedication to program objectives may be a hindrance to career objectives.

Continuity

The continuity of key individuals is necessary, but not necessarily the continuity of the PM. One program has had five PMs in a little over 7 years. On the other hand, Polaris had only three PMs during its first 21 years. Rear Admiral Wayne E. Meyer had been the first and only PM on the Aegis cruiser since 1970. The key factor again is *stability*, with continuity being one important aspect.

Acquisition Strategy

Contractors give credit to acquisition strategy as a reason for program success. On the Hellfire program, the service PM established second sourcing as a principle of acquisition strategy. This tended to sharpen the competition and keep a discipline on costs, schedule, and technical performance.

The MLRS program employed competition with source selection based on "ammunition cost effectiveness," which forced the con-

(Above) Components of the Army's Firefinder mortar- and artillery- locating system. (Below) The Army's Multiple Launch Rocket System (MLRS).

tractors to optimize technical performance within a cost envelope. MLRS also used design to unit production cost (DTUPC) as a primary criterion in evaluating proposed changes. The acquisition strategy for MLRS included the evaluation of the relative cost effectiveness of multi-year procurement vs. second sourcing. The FFG-7 acquisition strategy employed ship system design support that provided for design support by prospective shipbuilders during the early stages of ship design; lead-ship/follow-ship concept, with a schedule interval of 2 years between their construction in order to implement lessons learned from the lead ship; government validation of drawings and other technical data; utilization of land-based test sites for integrating ship subsystems; and the use of grooming sites for repairing, testing, and delivering government-furnished equipment.

Resources

It would be easy, and understandable, for observers to conclude these programs are successful because they had everything going for them, including high-level backing, connection to a national need, choice of personnel, and funding.

In analyzing and discussing the question of success because of resources, or resources because of success, we came to two conclusions: (1) None of these successful programs would have "flown" if they had been unsuccessful in technical performance or had costs that soared above budget; (2) after a need has been established and a project is under way, there is a period of a year or so during which the PM has an opportunity to demonstrate that higher

levels' confidence is justified. Then, the resources, attention, and other advantages seen in hindsight become available.

Of the programs we studied, all had to prove or demonstrate their probability of success, their ability to do what they were being developed to do. Polaris and Atlas, classics in systems management, emerged after indecision and delays that might have killed other programs. A high official said of early Navy efforts to establish a long-range missile capability, "The Navy was really in danger of being read out of its ballistic missile altogether. There just wasn't enough money in the defense budget." Success looks easy in retrospect.

Multinational and coproduction programs usually receive adequate funding. At least three of the successful programs

that were part of this research project have received congressional support and funding partly because of their NATO and foreign military sales aspects.

State-of-the-Art

Seventy-eight percent of the managers contacted reported their programs pushed state-of-the-art technology, and felt this had a positive, motivating effect on their programs' successes. On the other hand, those whose programs did not push the state-of-the-art also felt this had a positive effect on the successes of their programs. Polaris pushed the state-of-the-art in five or six different areas simultaneously. This in fact had a lot to do with acceptance of the program. An industry manager made this perceptive comment regarding the state-of-the-art: "I don't believe this [advancing the degree of state-of-the-art] is critical to the program suc-

The USS Robert E. Lee (SSBN-601) at sea.

Polaris missile launching.

cess, as long as you don't have incompatibilities between state-of-the-art, program goals, and program commitments."

From this, we conclude that program success is not determined by the technological state-of-the-art, but by associated risks, and these risks must be adequately funded to avoid cost overruns. These results seem to refute the belief that successful programs depend on proven technology.

The Contractor

One of the questions asked of government managers was whether they had an integrating contractor. Ninety percent of the service PMs did have an integrating contractor, usually the prime. This contributed to the program's success. We also asked them about the technical expertise and management ability of their contractors. With few exceptions, all of the PMs responding to this question characterized their contractors as being very good or excellent.

A strong common theme, one that recurred often throughout the interviews, was openness and frankness on the part of both the PM and his industry counterpart. There is no substitute for the confidence and team spirit that develop from this straightforwardness.

It is interesting to note that two of the particularly successful contractors had been involved in other less-than-successful programs. The difference seems to be the working relationship between the program office and the contractor.

DOD and Outside Agencies

We asked the government program managers whether the successes of their programs was helped or hindered by outside government influences such as the user, supporting agencies, higher-command headquarters, service headquarters, DOD, Congress, and the General Accounting Office (GAO). Slightly over half of the responses to this question said

that overall outside influences were a help rather than a hindrance. One PM listed six separate outside influences that had hindered his program, but he then said that in the long run, the hindrances had helped. The problems and stumbling blocks encountered helped his office sharpen their skills, knowledge, and abilities.

In general, if the other levels agreed with a program's objectives, if the PM kept them informed and got them working together and gave them the feeling that the program was theirs also, the PMO was helped rather than hindered. Vice Admiral William F. Raborn, Jr., brought even the GAO and the Secretary of the Treasury onto his team of supporters.

The hindrance or adverse "outsider" effect mentioned most often concerned staff personnel at the service or DOD level. One PM stated "There are a lot of people in the Pentagon who can say no—and cause you a lot of delays and other problems—but do not have the authority to say yes." Another common complaint from both government and industry managers involved the numerous time-consuming audits performed by DOD and GAO inspectors. In most instances, new inspectors had to be taught the program before they could perform the audit.

Outsiders tend to leave a program alone if it is going well. PMs varied in their reactions of how to cope there are problems. One PM said that when someone outside his office tried
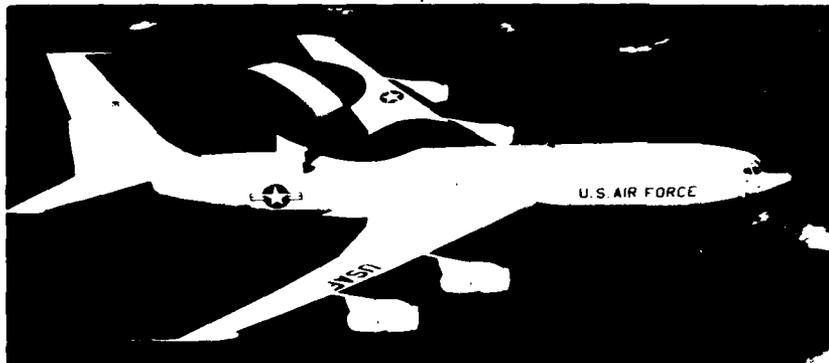
(Above) An Air Force Airborne Warning and Control System (AWACS) aircraft.
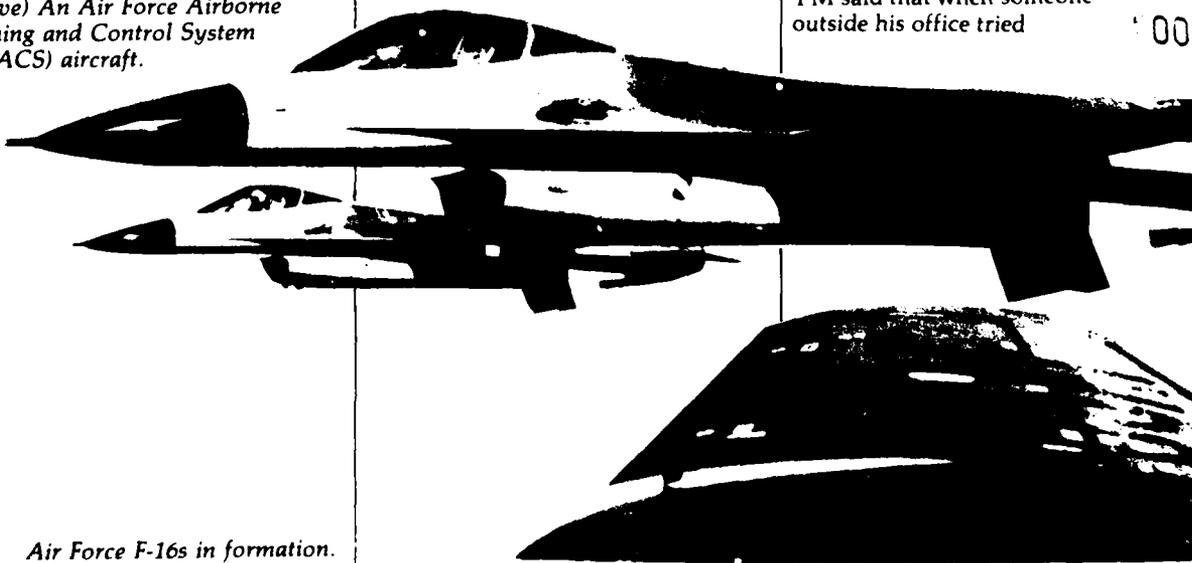
Air Force F-16s in formation.

to force him to do something, he explained what the repercussions would be. If the person persisted, the PM said he would tie the person's name to the required change and its related cost and schedule changes so that everyone throughout the briefing cycle would know who was pushing for that change. Usually, the person backed off.

The PMs gave Congress credit for, on balance, being a help rather than a hindrance. One PM suggests: "Brief them; talk to the staffers, the representatives, and the senators; answer them truthfully; be credible; don't try to con them; explain the national defense need that the program is filling."

We asked the program managers how they dealt with micromanagement. The approach generally followed was to be open, and to keep outside agencies informed on what was happening on the program. Some, however, said they didn't volunteer information, although they answered all questions without elaboration. "Being truthful is different from being candid, though," one PM stated.

DOD Directives and Regulations

We asked both government and industry program managers which regulations or directives caused problems and contributed to program costs. Their answers surprised us. Most of the responses indicated that regulations and directives *didn't* cause any significant problems. Two even said that specifications and standards are written for good reasons, are important and useful, and are not a waste of time.

No single regulation or directive was cited as a culprit. Most program offices tailor directives to what makes sense to them, or they ask for waivers. The PM himself generally doesn't get involved in the administration of directives and regulations.

We asked for observations regarding DOD Instruction 7000.2 on cost performance measurement. The response, with a couple of qualifications, was generally favorable. One Army PM said that he looked into reducing the cost of various reports, including the cost performance report. The reports' total

cost was $4 million, but the PM found that his contractor would use the reports for his own management purposes anyway; the most the PM could save was 10 percent.

The ease with which current PMs relate to levels of approval and administrative requirements is remarkable. The PM on one of the early programs said of the current environment, "We spend more trying to avoid mistakes, than if we made mistakes. Time is money." On the various requirements, justifications and bureaucratic red tape the PM must live with, he said, "Now we have echelons on echelons. . . The Soviets couldn't have imposed a more restricting system!" Defense and congressional staffs have grown tremendously over the past decade or two, and life for the PM has grown more complex but the current PMs are well-equipped, by temperament, experience, and education, for coping with their jobs. They like what they are doing.

Industry and Service Observations

As an illustration of how well industry and the services work together, no significant differences in practices, goals, methods or other factors surfaced during our study.

We asked managers in both industry and government to rank eight factors for successful program management. In slightly abbreviated form the factors are as follows:
—Establish a teamwork relationship of mutual trust between government and contractor program management;
—Understand the program objectives;
—Have good, visible program plans;
—Get accurate and timely information on actual progress;
—Note deviations between planned and actuals;
—Take corrective actions;
—Make friends for the program; and
—Establish total program definition at the start of the program.

The overwhelming majority rated teamwork and mutual trust as the most important. The next most important was ensuring that everyone really understand program objectives. The two tasks rated lowest require some explanation. One of these

is "make friends." The reason for this ranking is that if the item produced works as it should, making friends is incidental to the system's objectives. As expressed by one PM, "If a program is managed correctly, it is bound to make some enemies because some people will not get what they want individually."

Also ranked low is "establishing total program definition at the initiation of a program." Most PMs felt the initiation of a program is much too early to establish total program definition. Their rationale is clear when one recalls that most of these programs pushed the state-of-the-art in technology.

All individuals cited open communications as a basic practice. An industry spokesman refined this somewhat: "We had many informal channels, but we and the Navy require very careful control of the formal channels." Most of these programs involved high-risk technological advances and used cost-type contracts. Several industry executives said this contractual arrangement tended to promote communications. On lower-risk programs, we see no reason why fixed-price contracts should inhibit communications.

Industry's view of what makes a successful PM is similar to DOD's: bright, flexible, intent on results, able to make right but timely decisions (right 75 percent of the time), good health, and business acumen. On a high-technology program, he should also have some type of technical background.

Time Perspective

One factor in selecting the dozen programs we looked at was to find whether there are significant differences in program management now from what it was earlier. Most of the programs are fairly recent. The C-141 and BMEWS programs go back to the '60s. Going back even further, there's Polaris, famous for both management and technical breakthroughs, and Atlas, an outstanding program and the forerunner of modern project management dating from 1954.

As might be expected, there are differences between program manage-

ment as practiced earlier and as it is today. But an observer is struck more by the similarities than the differences, quite a compliment to the pioneers who blazed the trail.

Similarities, Then and Now

Although the degree of authority of the PM has changed—generally less now than formerly—one critical aspect has remained constant: *The PM has used his authority.* Successful program managers have taken authority where it is not specifically granted. One PM has said, "Any PM has as much authority as he is willing to step up and take."

The need for strong leadership remains constant, regardless of a program's era—dedication and determination to get the job done well, ability to attract good people, ability to communicate well.

Other similarities pertain to requirements. Typically, a successful program's requirements have been established early, and are realistic for the resources available. Plans are definitized early, and requirements stay virtually intact throughout a particular phase of a program. The type of contract is appropriate to the risk and complexity of the particular phase.

Army CH-47 helicopter undergoing modification.

Differences, Then and Now

There are far more directives, regulations and "help" now than during the early programs. But today's PMs do not view this as a major problem, perhaps because they have learned to survive in the present environment.

A more obvious difference relates to the climate of the times. In the time of Atlas, Polaris, C-141, and BMEWS, the need for each system was clear and these programs received strong, high-level support. There was greater urgency and team spirit then and the PMs strove diligently and successfully to develop this spirit.

The needs today are generally not as clear; the urgency is not so apparent; and perhaps the support is not so strong. One PM on an early program says, "[these higher levels] were 95 percent helpful. We made friends; they didn't try to manage for us."

The PM in earlier days was freer to make mistakes. This may have been part of pushing the state-of-the-art. Vice Admiral Smith, the technical director and subsequently the PM on

the Polaris, says, "When making new things, you have to expect surprises."

PMs' Recommendations to PMs

The final question in our discussion with PMs was "Do you have any other recommendations that might benefit program managers on other defense programs?" Some responses follow: "Tell a new PM that it is important to baseline his program—not just cost, but technically also so he really understands what's there. . . ." "Have your program planned out in as much detail as possible, as early as possible, so that there is a comprehensive baseline from which to evaluate changes."

A senior PM said: "Be in charge—100 percent. Keep people off your programs; take charge; don't give your program away. Limit outside influences on your program to those which you request." One program office has a sign that reads "Do not participate in our decision-making unless you share the consequences."

An area noted by several individuals was the importance of getting and developing the best people possible and then giving them authority and responsibility. One PM commented, "The biggest problem a PM faces is saturation. If the PM insists on making all the decisions, he gets into overload. Let your people make the decisions they can make and save the big problems for the PM. Successful program management means you get the broadest participation throughout the organization. Real success is measured by how few decisions the PM has to make. Ultimate success means the PM makes no decisions, just sets the program objectives."

Others commented: "Create a program office team atmosphere and everyone must aggressively manage—not just the PM. Delegate authority within the office and hold people accountable. Let people have latitude to make this happen and feel that they are responsible."

■*Mr. Baumgartner, Mr. Brown, and Ms. Kelley are Professors of Systems Acquisition Management in DSMC's Department of Research and Information.*

"Establish open communications with the contractor and maintain mutual respect for all decision making. Seldom are decisions popular to both sides. The contractor must understand why you are making the decision and respect it."

"Understand the contractor. It takes a team of the contractor and the PM to build a supportable system. They must agree it is the best they can do. Have a good interface with the contractor. There is no need for an adversarial relationship."

"Do not keep problems to yourself; surface them and work them. Determine who—government or contrac-tor, by name—is responsible for solving the problem. You have plenty of good experience available within the program office—use it."

They also emphasized the need to be cost conscious. Regarding funding, the consensus was: "Know how to protect your money and don't let anyone take it away from you. Let those who try know what the repercussions will be if they succeed."

"Don't ask for permission to act in Washington. Don't be reluctant to act when you know what you are doing." "Make timely decisions, don't procrastinate; make them as naturally as possible. Don't agonize over deci-sions; make the best one you can, as soon as you can, and get on with it."

Conclusion

The basic question asked of PMs was the reason for successes on their programs. The reason most often given was good people, followed by good program management, good relationships between the contractor and the PMO, good contractors, firm requirements, and stability. The differences in what makes for success are minimal, regardless of service affiliation, size or type of program, and time period. ■

Defense Systems Acquisition Review Process

tary of Defense, DAE, and other selected senior OSD staff officials.
—Have the DAE exercise administrative control over, and focus on, the DSARC preparation activities of the OSD staff.
—Have the DAE issue a policy statement on attendance of DSARC principals.
—Have the SDDM serve as a "contract" between the Secretary of Defense and the service secretary during the acquisition of a major defense system.

It is clear that better decisions have been made on defense systems programs because the people who have knowledge and expertise of each program have contributed recommendations along the pathway to each decision. However, it is acknowledged that conflicts as to approach have occurred at times because of the diverse interests of the members of the reviewing body—the DSARC. Normally, the DSARC chairman has en-sured that each recommendation submitted to the Secretary of Defense has been a product of the deliberations of the DSARC members. In the end, the Secretary of Defense has made the major program decisions. After such decisions have been made, everyone concerned with the program has been expected to abide by them. This has to be judged as an effective process.

Copies of the report prepared by Information Spectrum, Inc., for the Defense Systems Management College are available from the Defense Technical Information Center (DTIC) under accession number ADA 129795 for Volume I; ADA 129796 for Volume II, Part 1; and ADA 129797 for Volume II, Part 2. ■

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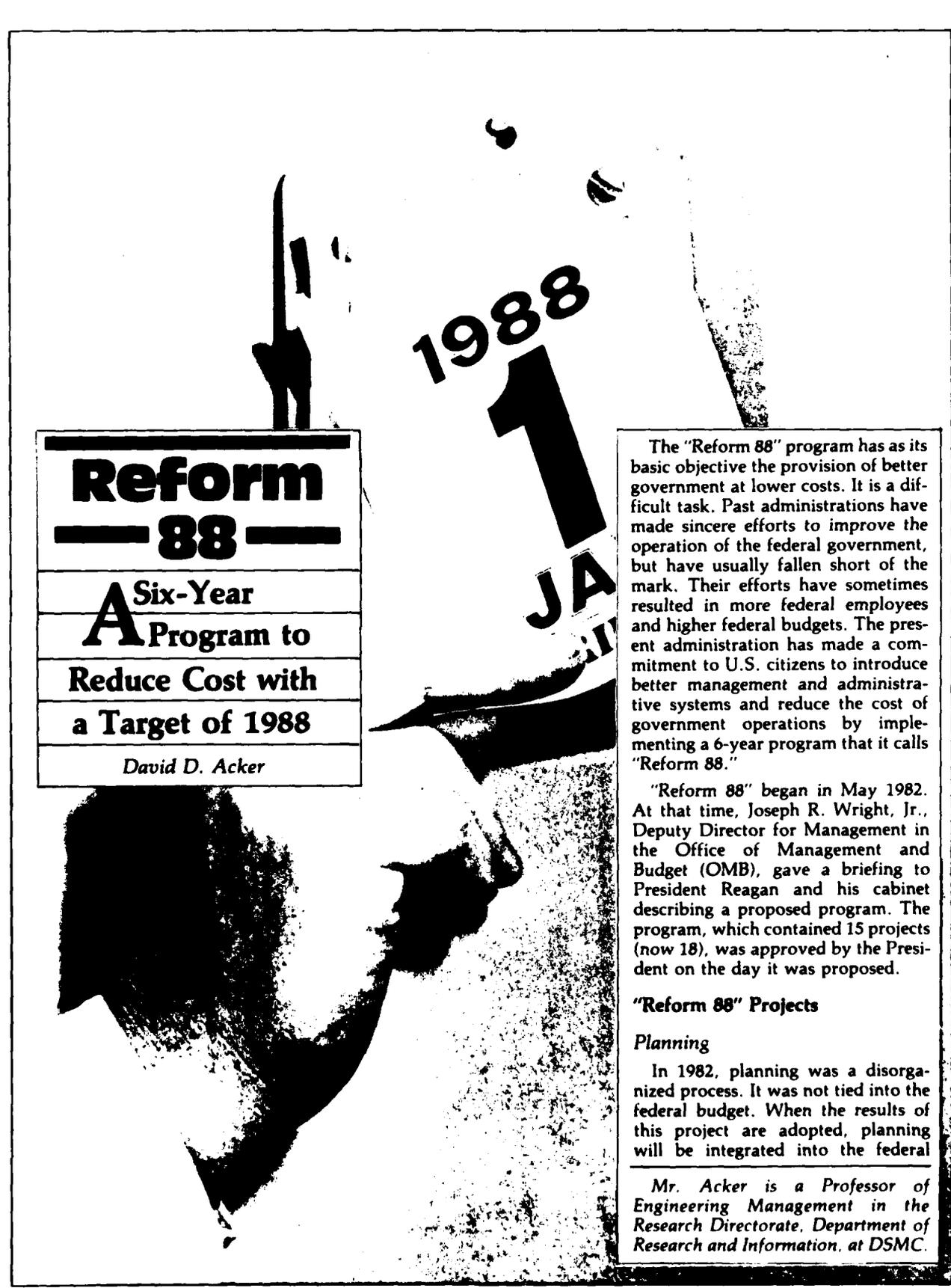
Reform
—88—

A Six-Year Program to Reduce Cost with a Target of 1988

David D. Acker

The "Reform 88" program has as its basic objective the provision of better government at lower costs. It is a difficult task. Past administrations have made sincere efforts to improve the operation of the federal government, but have usually fallen short of the mark. Their efforts have sometimes resulted in more federal employees and higher federal budgets. The present administration has made a commitment to U.S. citizens to introduce better management and administrative systems and reduce the cost of government operations by implementing a 6-year program that it calls "Reform 88."

"Reform 88" began in May 1982. At that time, Joseph R. Wright, Jr., Deputy Director for Management in the Office of Management and Budget (OMB), gave a briefing to President Reagan and his cabinet describing a proposed program. The program, which contained 15 projects (now 18), was approved by the President on the day it was proposed.

"Reform 88" Projects

Planning

In 1982, planning was a disorganized process. It was not tied into the federal budget. When the results of this project are adopted, planning will be integrated into the federal

Mr. Acker is a Professor of Engineering Management in the Research Directorate, Department of Research and Information, at DSMC.

budget process and tracked quarterly by the Office of Cabinet Affairs (OCA).

Budget Upgrade

Budgeting has been a manual, paper-intensive annual exercise. In the near future, major department/agency submissions will be sent to OMB electronically or on computer tape.

Financial/Accounting Systems

Of the 332 different and incompatible accounting systems used by the departments/agencies, only 63 meet the standards of the General Accounting Office (GAO). When adopted, a new government-wide system will replace the many systems now in use.

Cash Management

Improved controls over the federal cash flow—now $1.7 trillion annually and increasing to $2.1 trillion by the end of 1984—are being installed. The new controls will include electronic funds transfer and automated lock-boxes.

Credit Management

In the future, computer-driven collection systems will be used to correct debt-collection problems the federal government has been experiencing. Also, as part of the reform program, private collection firms will be employed, along with several new management approaches. To date, $3.5 billion in delinquent debts has been collected.

Electronic Mail Communications Systems

An Executive Office data link is being installed. This link will tie the top management of the 13 cabinet-level departments and nine additional major agencies to the White House complex, and to each other, in real time.

ADP/Telecommunications

Today, the government owns about 18,000 computers located at approximately 4,500 sites. These computers use over 100 management information systems (MISs), and researchers believe that no two of these systems are able to work together.

The basic objective of this project is to develop a policy and associated procedures that will ensure the White House receives a single answer to any question it raises.

Pay/Personnel

The objective of this project is to standardize and consolidate the 200-plus pay/personnel systems, presently used in 1,700 government offices, into a single computer-driven system.

Waste, Fraud, and Abuse

The first project under the broad subject of waste, fraud, and abuse is "Prevention through Computer Matching and Screening of Recipients," and the second project is "Internal Controls." The basic objective of these projects, which are under way, is to improve the present waste, fraud, and abuse program. According to the President's Council on Integrity and Efficiency, more than $22.3 billion has been saved or put to better use through "business as usual" since the beginning of these two projects.

Procurement Reform

The object of this reform is to replace the three federal procurement systems (Defense, NASA, and GSA) with a single system. On April 1,

The Commission presented more than 5,000 recommendations on potential cost reductions and management improvements.

1984, a new Federal Acquisition Regulation (FAR) will become effective. This regulation will consolidate and simplify the procurement regulations of the aforementioned agencies in a single document. Registered as Title 48 of the Code of Federal Regulations, it will cut the number of separate agency regulations by more than 60 percent.

Facility Utilization

The goal of this project is to reduce the volume of records that have to be stored, and to increase utilization of federal office space.

Travel

The intent of this effort is to save on travel costs by obtaining travel discounts, cutting back on travel, and using teleconferencing to save travel to meetings. To date, there has been a 16 percent reduction in travel costs.

Publications

Action has already been taken on this project. To date, 2,300 publications have been eliminated, and many others have been consolidated.

Administrative Payment Centers and Processing Operations

To meet the objectives of this project, standardized payment systems are being developed, payment centers are being consolidated, and uniform productivity standards are being established for various types of payments and personnel actions.

Recently, three additional projects were added to the "Reform 88" list. The objectives of these projects are (1) to consolidate the federal field-office structure and improve delivery of services to qualified citizens while lowering costs; (2) to make personnel management a single, businesslike function; and (3) to implement the recommendations resulting from the President's Private Sector Survey on Cost Control—informally called the Grace Commission after Peter J. Grace, Chief Executive Officer of W. R. Grace and Company. The Commission presented more than 5,000 recommendations on potential cost reductions and management improvements. The recommendations, resulting from discussions with 1,500 private sector executives, could save the U.S. government tens of billions

of dollars in operating costs if they are acted upon.

Private Sector Survey on Cost Control

The Task Force Report on Financial Asset Management, presented by the Grace Commission in the spring of 1983, contained 87 recommendations for cost savings through more efficient and sound business practices in the federal government. These recommendations were divided into six principal areas, namely:

—Cash management;
—Direct government lending;
—Guaranteed government lending;
—Debt collection;
—Government securities; and
—Policies, procedures, and practices.

The Grace Commission reported that the federal government is far behind private business in computer techniques, accounting systems, and management information systems. Action should be taken to modernize government operations. Fortunately, about half of the Commission's recommendations can be implemented directly by the government departments/agencies. Eighty percent of the projected savings resulting from implementation of the recommendations can be realized without any action by the Congress.

Actions to be Completed in 1984

One of the primary targets of the "Reform 88" program is modernization of the federal government's financial management practices; i.e., the budgeting and accounting systems, and other financial systems. These systems need to be modernized and integrated. The reform program calls for specific goals to be met in the following five areas by September 1984: planning, budgeting, department/agency financial systems, cash management, and debt collection. Let's briefly examine each of these areas.

—Government planning is frequently conducted on an *ad hoc* basis. It occurs at varying intervals and is not tied firmly to realistic spending levels. After the proposed reform is implemented, a budget update will take place every 6 months. The update will show the approved out-year budget totals.
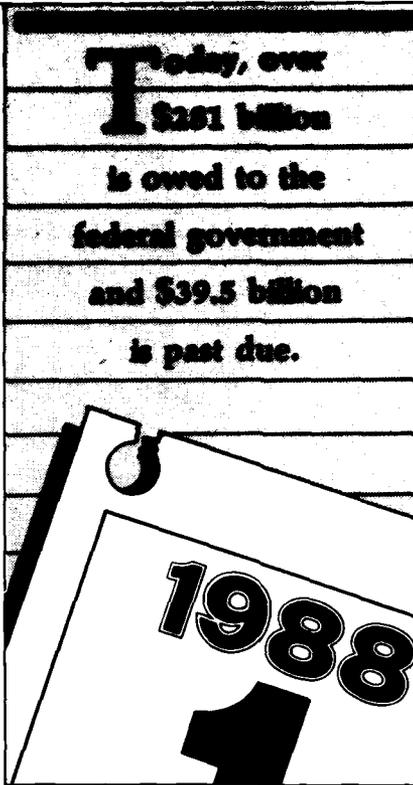
—The preparation, submission, and tracking of the budget through the Congress will be more automated after the reform. Twenty-two major departments/agencies of the federal government have fully automated the systems used in transmitting numeric data to the OMB in time for their fiscal 1985 budget submissions. By the end of 1984, it is expected that the remaining 79 agencies will be tied in.
—By September 1984 an integrated, government-wide financial system will be available to replace the 332 accounting systems being used by the government today. This means that up-to-date standards for accounting systems will have to be issued by the General Accounting Office very soon. Also, OMB will have to develop implementation guidelines and approve department/agency system-upgrade plans.
—Modern technology for making timely and prompt payments and deposits will be in place by the fall of 1984. About 90 percent of the federal deposits will then be made electronically, or through lockboxes. Control of disbursements will be tightened.
—Most of the debt collections will be corrected by an improved system. Today, over $281 billion is owed to

the federal government and $39.5 billion is past due. These amounts must be reduced.

The President does not view these improvements as a political exercise. However, what has been accomplished and what will be accomplished would not happen without his support. How did he get "Reform 88" off to a good start?

The Cabinet Council and the Congress

In September 1982, following a decision to support the program proposed by Joseph R. Wright, Jr., the President established a new Cabinet Council on Management and Administration (CCMA). This Council, chaired by President Reagan, and with Edwin Meese III serving as Chairman *pro tempore*, is composed of a select group of departmental cabinet officers.

The CCMA, after studying the "Reform 88" program, recognized that many of the reforms can be achieved through administrative improvements. These improvements have either been made, or are still in work. However, there are some needed changes that can only take place if the laws are changed. Thus, the Senate Committee on Governmental Affairs and the House Committee on Government Operations also have major roles to play. These committees of the Congress are working closely with OMB so "Reform 88" will become a reality.

Conclusion

If the "Reform 88" program succeeds, we will have a more cost-effective federal government because the government will be performing in a more businesslike manner. It will meet Wright's objective that we have ". . . a government that provides essential public services of high quality [and operating] as efficiently as possible." This is a worthy objective, one that every person in the federal government can support. Attainment of this objective will depend on people like you and me.■

Writing in the late nineteenth century, Andrew Carnegie observed, "While the law of competition may be sometimes hard for the individual, it is best for the race. . . . "[1] In that comment, the famous industrialist and philanthropist had in mind the benefits of competitive business to society at large. Mr. Carnegie's analysis, of course, lends itself to a similar conclusion on the benefit to the public arising from competition in government purchasing. The long-standing policy favoring competition in procurement has fostered laws, decisions, and interpretations seeking to assure that, to the maximum extent possible, the forces of competition are mustered to benefit the public when purchases are made for the government.

Recently, however, cases presented to the General Accounting Office (GAO) and the federal courts, seeking enforcement of the law of competition in government procurement, have raised new issues which merit examination. These issues have to do principally with the contracting officer's responsibility to secure competition in the context of a total program, rather than focusing only on the most current contract award. The resolution of those issues has expanded the responsibility of the contracting officer while, at the same time, raising the critical level of administrative and judicial review of the manner in which that responsibility is discharged.

The Fundamental Statutory Policy

The familiar, oft-quoted, and much litigated federal law on the subject of competition in military procurement reads:

> In all negotiated procurements in excess of $25,000 in which rates or prices are not fixed by law or regulation and in which time of delivery will permit proposals, including price, shall be solicited from the maximum number of qualified sources consistent with the nature and

requirements of the supplies or services to be procured. . . . [2]

Although there is no similar statutory directive in the federal procurement statute applicable to the civilian agencies, the omission is corrected, it seems, by regulation.[3] The Federal Procurement Regulation (FPR), Defense Acquisition Regulation (DAR), and NASA Procurement Regulation (PR) all contain the following statement of fundamental policy:

> All procurements ("purchases and contracts" in the FPR), whether by formal advertising or by negotiation, shall be made on a competitive basis to the maximum practicable extent.[4]

The Standard of Reasonableness

Notwithstanding the fundamental statutory policy on competition in federal procurement, we know that many contracts are awarded on a sole-source basis. Evidence of this, if any is needed, is contained in the numerous protests concerning sole-source procurements which recurringly come before the GAO. In reviewing sole-source justifications, and in ruling on the propriety of such procurement actions, the GAO applies a standard of reasonableness.[5]

The leading GAO decision on the reasonableness standard is *Pioneer Parachute.*[6] Later GAO decisions frequently cite that opinion for the following proposition:

> Generally, in determining the propriety of a sole-source procurement, the standard to be applied is one of reasonableness, unless it is shown by the protestor that the contracting agency acted without a reasonable basis, (the GAO) will not question the procurement.[7]

Two corollary principles are found in the GAO opinions discussing the standard of reasonableness applied to sole-source justifications: (1) contracting agencies are usually accorded a reasonable range of discretion when making sole-source determinations,[8] and (2) the burden is on the protestor to show that the agency's determination lacked a reasonable basis.[9]

The Responsibility of the Contracting Officer

As in most statutory and regulatory directives pertaining to the federal procurement process, the responsibility for implementing those pertaining to competition falls upon the contracting officer's shoulders.

The traditional method of securing competition, and certainly the one most frequently used in procurements accomplished through formal advertising, is synopsizing in the *Commerce Business Daily.* The responsibility assigned to the contracting officer is stated in the directives on synopsizing, which make it abundantly clear that the primary reason for the requirement is to enhance the competitive climate in which the procurement is to be made.[10]

The GAO has considered the contracting officer's failure to adhere to synopsizing directives in a number of protests.[11] Contracting officers are, of course, always vulnerable to criticism for not following the directives. But they are not always subject to GAO-recommended corrective action. The GAO has stated that a sufficient basis for invalidating a procurement occurs where the protestor can show a failure to synopsize properly resulted in an absence of adequate competition, an unreasonably high price, or a deliberate effort to exclude the protestor.

The contracting officer's responsibility to assure competitive procurement is also contained in the regulations implementing the statutory directive on competition in negotiated procurement. The regulations go further than merely restating the directive. They offer guidance on what to do when competition is not practicable in order to assure that future negotiated purchases of the same item or services can be made competitively.

■*Chester D. Taylor, Jr., is a partner in the Washington, D.C., law firm of Hogan & Hartson and head of its government contracts practice group. Prior to April 1, 1981, he was the Staff Judge Advocate of Air Force Systems Command, retiring on that date in the grade of brigadier general.*

Negotiated procurements shall be on a competitive basis to the maximum practical extent. When a proposed procurement appears to be necessarily noncompetitive, the contracting officer is responsible not only for assuring that competitive procurement is not feasible, but also for acting whenever possible to avoid the need for subsequent noncompetitive procurements. This action should include both examination of the reasons for the procurement being noncompetitive and steps to foster competitive conditions for subsequent procurements, particularly as to the availability of complete and accurate data, reasonableness of delivery requirements, and possible break-out of components for competitive procurement. . . .[12]

The Responsibility for Competitive Follow-On Procedures

The fundamental policy favoring competition and the guidance to contracting officers on how to eliminate or reduce the extent of future noncompetitive procurements have been interpreted and applied in two significant cases recently decided by GAO and a federal court.[13] In both cases, the procuring agency sought to justify its noncompetitive procurement approach on the absence of sufficiently complete and accurate data for competition. In both cases the reviewing forum, while sustaining the noncompetitive approach, looked to the prospect of follow-on procurements and directed that steps be taken to develop a data package that would enable subsequent competitive contract awards.

The GAO, in the protest of *International Harvester Company*, reviewed the Army's proposed noncompetitive procurement of an initial production quantity of armored combat earthmovers (ACEs). The ACE is a complex, state-of-the-art combat vehicle which has undergone an extended development phase through performance of a series of contracts with three heavy-construction-equipment manufacturers. When the Army announced its intent to purchase 25 ACEs from the most recent

developer, it was confronted with a protest filed by one of the others. The protest asserted a violation of the statutory directive and regulatory policy on competitive procurement.

Recognizing the requirement that procurement actions be conducted to maximize competition, the GAO restated, as it frequently has in such protests, that it will closely scrutinize sole-source procurements. Addressing the reasonableness standard, however, it added that it will uphold such procurements if there is a reasonable or rational basis for them.[14]

In the *Harvester* protest, the GAO correctly recognized that a sole-source award of an initial production contract to the developer of a technologically complex item may be justified. Such justification can be found, it said, in the developer's unique ability to complete the production engineering and the assembly and validation of the technical data package necessary to the transition of an acquisition program from the noncompetitive development phase to a competitive full-scale production phase.[15] The GAO also recognized that a shortened lead time to an ade-

quate data package could be obtained only through the most recent developer. Persuaded by a sense of urgency and a concern for national defense interests, the GAO upheld the sole-source award to the most recent developer.

Nevertheless, the GAO was not satisfied that the purchase of an initial production quantity of 25 units was necessary for production engineering and data preparation. It found that the Army had established a need for only six units. Carrying its scrutiny of procurement competition an additional and unprecedented step in *Harvester*, the GAO questioned not only a noncompetitive procurement approach, but also questioned the procuring agency's technical decision on the quantity of units to be thus purchased. It emphasized that the initial production contract award to the developer should be "for the absolute minimum number of vehicles required to support production engineering and to validate the data package." Although the GAO declined to sustain the protest in *Harvester*, it recommended that several steps be taken "so that this noncompetitive procurement will not be extended."

An underlying factual assumption materially aided the contracting agency in its defense against the protest in *Harvester*. That assumption was that the sole-source procurement action was not to be followed by another noncompetitive follow-on award in the same program. In that context, the GAO observed:

What is justifiable initially (in the way of sole-source procurement) may soon cease to be justifiable, particularly in light of the obvious advantages to be gained from competitive pricing and the wisdom, from a managerial point of view, of developing more than one source.

In tendering that comment, the GAO cited the case of *Aero Corp. v. Department of the Navy*, then active in the United States District Court for the District of Columbia.[16] *Aero* represents nearly a 4-year saga, involving five reviews by the court and three opinions by the GAO, the final chapter of which may not yet be written.

The plaintiff in that case, a contractor experienced in maintenance and overhaul of C-130 aircraft, sought in October 1979 to enjoin the Navy from making a sole-source award to the aircraft manufacturer of a contract for service-life extension of C-130s. The district court agreed with the GAO, whose opinion the court had requested, that the contracting officer had adequately justified such a sole-source award. The court pointed out, however, that upholding one sole-source award cannot be construed as approval of that approach to follow-on contract awards within the same program. Therefore, the court directed that steps be taken to secure competition in the follow-on (successive-year) contracts.

When in the succeeding year the contracting agency asserted a 3-year lead time to secure competition and stated its intent to extend the sole-source award by input of an additional quantity of C-130s, Aero went back into court. In this second review, the court found the continuation of the noncompetitive approach "had no rational support in the record" and issued an order directing that steps be taken "to foster competitive conditions for subsequent procurements."[17] However, impressed by the military urgency of the service-life-extension program, the court declined to issue an injunction, interrupting the scheduled input of aircraft.

Later, when the plaintiff again charged that the judicial order to secure competition was not being followed, the court agreed. Again, in view of its finding of military urgency and due to the limited number of aircraft remaining for work, the court declined Aero's request that it enjoin further sole-source awards in the remaining life of the program. The court did, however, issue a declaratory judgment that the contracting agency had violated its duty to pursue competition to the maximum possible extent. The court, finding evidence of bad faith, ordered payment of attorney's fees and litigation costs to Aero for its "legally successful but practically frustrated pursuit of relief from its elusive adversary."

At one point in the series of decisions issued in this case, the court observed that the statutory policy favoring competition in awarding contracts is a legal mandate that must be observed, not merely a regulatory statement of preference that can be ignored.

A New Dimension to the Standard of Reasonableness

In the *Harvester* and *Aero* cases, both the GAO and the court included in their assessment of the reasonableness of a sole-source procurement a heightened consideration of the contracting officer's responsibility to avoid a noncompetitive approach in succeeding stages of the same program. Moreover, in those cases, an examination of the current sole-source procurement was also undertaken to discern whether or not the contracting officer had managed to minimize the scope of the noncompetitive purchase. In so doing, the GAO and the court sought assurance that the competitive opportunity in succeeding program stages would be maximized. These aspects of the review of the sole-source justification in *Harvester* and *Aero* have introduced a new dimension to the application of the standard of reasonableness.

This new dimension, seen in the enhanced scrutiny given in those cases to the prospects of future competition, has added to the contracting officer's responsibility. This is particularly the case in requiring contracting officers to minimize the scope of a current noncompetitive procurement as part of the effort to maximize competition in future contract awards.

An additional aspect of the *Aero* case warrants attention when considering this increased measure of contracting officer responsibility. In *Aero*, the court rejected an argument that the statutory policy favoring competition is a mere preference. The court, in so doing, referenced legislative history of the statute intending "that the competitive mechanism will not be used in part but in the fullest [so] that the American public and the taxpayer himself will ultimately benefit by this method of operation."[18] The court also cited legislative history affirming that the statute provided "both direction and mandate with respect to ne-gotiated procurement and the method by which it shall be conducted."[19]

The new dimension to the reasonableness standard, when coupled with a renewed emphasis on competition as a legal imperative, has broadened the responsibility of the contracting officer and should serve to sharpen future GAO and judicial reviews of noncompetitive procurement actions.■

Cited References

1. Andrew Carnegie, "Wealth," *North American Review*, June 1889.
2. 10 U.S.C. 2304(g).
3. Federal and Administrative Services Act of 1949, 40 U.S.C. 471 *et seq.*
4. FPR 1-1.301-1, DAR 1-300.1, NASA PR 3.102(c).
5. Although neither the FPR nor the DAR offer guidance on justifying a sole-source procurement, detailed instructions on that subject are contained in NASA PR 3.802-3(c) and (d), DOE PR 9-3.805-51, HEW PR 3-3.802-50, and DOI PR 14-3.150.
6. *Pioneer Parachute*, 78-1, CPD 431.
7. *Diesel Parts of Columbus*, 81-2 CPD 50. See, also, *R&E Cablevision*, 81-1 CPD 110, and *McDonnell Douglas*, 81-2 CPD 154.
8. The courts also state that deference is owed to the contracting officer whose sole-source decision is under review. See, e.g., *M. Steinthal & Co. v. Seamans*, 455 F.2d 1289, 1301 (1971).
9. The plaintiff in the federal courts who challenges a discretionary decision of the contracting officer "bears the heavy burden" of demonstrating that the decision had no national violation of applicable statutes or regulations. *Kentron Hawaii v. Warner*, 480 F.2d 1166, 1169 (1973).
10. FPR 1-1.1003, DAR 1-1003, NASA PR 1.1003.
11. See, e.g., *Culligan, Inc.*, 77-2 CPD 242; *U.S. Tool Co.*, 78-2 CPD 307; and *Checkmate Industries*, 79-1 CPD 413.
12. FPR 1-3.101(d), DAR 3-101(d), NASA PR 3.102(c).
13. *International Harvester Company*, 82-1 CPD 459, *Aero Corporation v. Department of the Navy*, 493 F. Supp. 558 (1981); 540 F. Supp. 180 (1982); 549 F. Supp. 39 (1982); 558 F. Supp. 404 (1983); No. 79-2944, *sup. op.* (D.D.C.) June 10, 1983.
14. Citing *Precision Dynamics Corporation*, 75-1 CPD 402.
15. In so stating, the GAO reviewed its earlier opinions in *The Willard Company, Inc.*, 81-1 CPD 102; *Applied Devices Corporation*, 77-1 CPD 362; *Vega Precision Laboratories*, 78-1 CPD 467; *Engineered Systems, Inc.*, 79-2 CPD 408; and others.
16. *Aero Corporation v. Department of the Navy*, Note 14, *supra*.
17. The court cited the satutory requirement for competition, Note 1, *supra*, and the implementation regulation, DAR 3-101(d), Note 11, *supra*.
18. 108 Cong. Rec. 1970 (June 7, 1962).
19. H. Rep. No. 1638, 87th Cong., 2d Sess. 2, 3.

The Facts About "MAM"

Army Approves a New Career Program "Materiel Acquisition Management"

Lieutenant Colonel John G. Miscik, USA

The Department of Army has approved the new Materiel Acquisition Management (MAM) career program for commissioned Army officers. Although the Army Material Development and Readiness Command (DARCOM) has been assigned the responsibilities as proponent, MAM is an Army program to benefit all organizations and officers performing acquisition functions. As the program fulfills its potential, it will provide better and more efficient career management for officers in acquisition management, and will give the Army a well-defined pool of talent from which to fill slots in project offices.

A Complex Business

The development and acquisition of Army materiel is a highly complex business that includes all of the components of a commercial business. The major difference between a commercial business and materiel acquisition management is that commercial business is profit-oriented and materiel acquisition management is oriented to equipment operational and cost effectiveness.

Some of the key functions of MAM are listed in Figure 1. The materiel acquisition manager must be knowledgeable in each of these complex functions and be able to fit them together in a cost-effective and efficient manner to ensure that operationally effective systems or equipment are placed into the hands of the user.

In addition to the complex MAM functions, today's equipment and systems technology has burgeoned so rapidly, and has become so complex, that it adds significantly to the overall complexity of acquisition management.

It is obvious that MAM is a multi-disciplined field requiring managerial expertise across a broad range of functions. What is not so obvious are the interrelationships between the functions themselves and between an officer's specialties and the MAM functions. (See Figure 2.) The challenge is to tie these interrelationships together into a meaningful program that will provide the Army with proficient and successful materiel acquisition managers.

When you consider the overall number of commissioned officers in the Army, only a small portion work in the acquisition field. And yet, a significant portion of the Army budget is for materiel acquisition. The bottom line is that a small portion of the officer corps manages a significant part of the Army budget, involving 100 percent of the technologically and managerially complex acquisition business.

MAM SELECTION CRITERIA

DO YOU HAVE WHAT IT TAKES?

IN A BRANCH UNDER OPMS

YOUR OBC&OAC COMPLETE

CAPTAIN OR HIGHER

AT LEAST 5½ YEARS OF AFCS
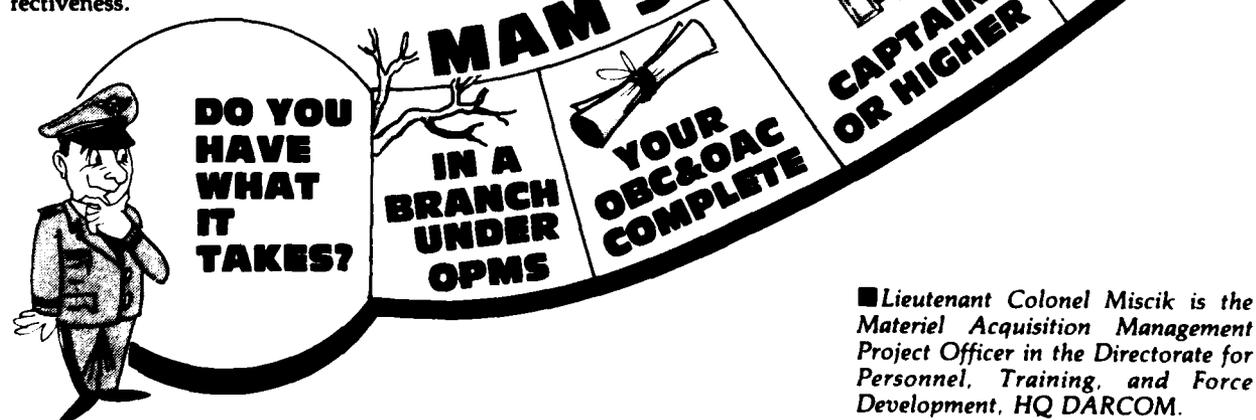
■ *Lieutenant Colonel Miscik is the Materiel Acquisition Management Project Officer in the Directorate for Personnel, Training, and Force Development, HQ DARCOM.*

(See Figure 3.) This makes it essential that the Army develop successful managers throughout the entire acquisition arena. The MAM program, through intensive training and broad-based assignments, is intended to do just that. Note the program objectives shown in Figure 4.

The program pulls together all of the functions and specialties involved in materiel acquisition into one program for the first time in the history of the Army. Thus, the Army will be able to develop and assign the right officers, with the right abilities, to the right jobs in materiel acquisition.

MAM Career Specialties

There are two types of specialties involved in MAM: acquisition specialties and hardware/alignment specialties. Acquisition specialties (see Figure 5) consist of functions that are

Figure 1. Key MAM Functions

MISSION AREA ANALYSIS

REQUIREMENTS DOCUMENTATION

DOCTRINE DEVELOPMENT

CONCEPT FORMULATION

TRAINING REQUIREMENTS
  IDENTIFICATION

COST AND OPERATIONAL
  EFFECTIVENESS ANALYSIS

RESEARCH

DEVELOPMENT

MANNED/SYSTEM INTEGRATION

INTEGRATED LOGISTICS SUPPORT

SYSTEMS ENGINEERING

CONFIGURATION
  MANAGEMENT

TESTING

EVALUATION

PROCUREMENT

PRODUCTION

QUALITY ASSURANCE

DISTRIBUTION

FINANCIAL MANAGEMENT

PERSONNEL MANAGEMENT

DATA MANAGEMENT

SECURITY ASSISTANCE

COMPANY-GRADE PROFICIENCY/ FIELD GRADE POTENTIAL

MAM-RELATED B.A. OR HIGHER

POTENTIAL AND DESIRE TO BE IN PROGRAM

HAVE "6 YEARS PLUS" TO RETIRE

HAVE AN ACQUISITION SPECIALTY MAM NEEDS

The user/support development phase, which begins when an officer enters active duty, lasts about 6 years. During this phase, branch specialization and company-grade professional development occurs; also, officers develop an important user/ support base of knowledge and experience. Because acquisition personnel exist to satisfy a user's need, it is upon the user/support base of experience
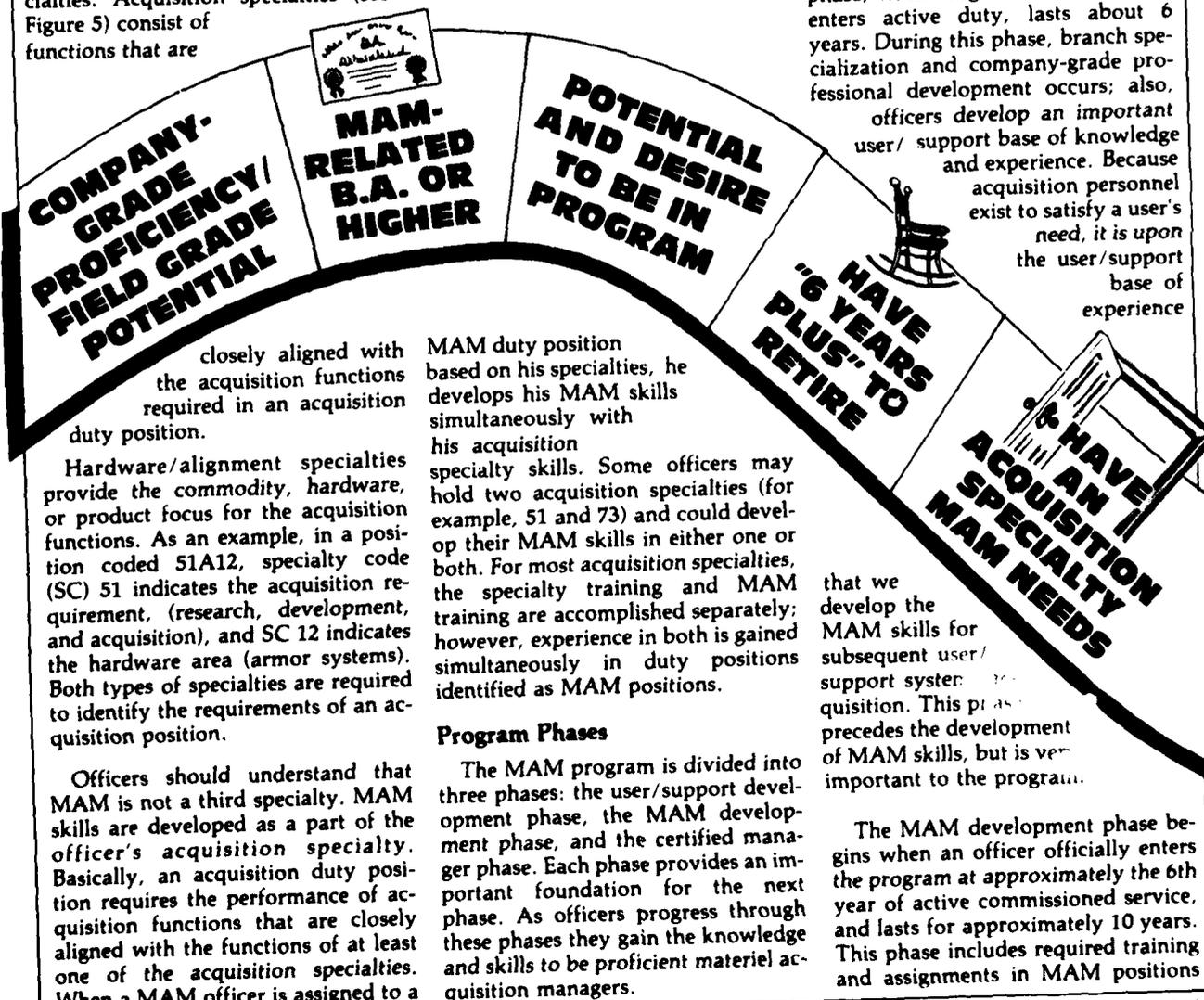
closely aligned with the acquisition functions required in an acquisition duty position.

Hardware/alignment specialties provide the commodity, hardware, or product focus for the acquisition functions. As an example, in a position coded 51A12, specialty code (SC) 51 indicates the acquisition requirement, (research, development, and acquisition), and SC 12 indicates the hardware area (armor systems). Both types of specialties are required to identify the requirements of an acquisition position.

Officers should understand that MAM is not a third specialty. MAM skills are developed as a part of the officer's acquisition specialty. Basically, an acquisition duty position requires the performance of acquisition functions that are closely aligned with the functions of at least one of the acquisition specialties. When a MAM officer is assigned to a

MAM duty position based on his specialties, he develops his MAM skills simultaneously with his acquisition specialty skills. Some officers may hold two acquisition specialties (for example, 51 and 73) and could develop their MAM skills in either one or both. For most acquisition specialties, the specialty training and MAM training are accomplished separately; however, experience in both is gained simultaneously in duty positions identified as MAM positions.

Program Phases

The MAM program is divided into three phases: the user/support development phase, the MAM development phase, and the certified manager phase. Each phase provides an important foundation for the next phase. As officers progress through these phases they gain the knowledge and skills to be proficient materiel acquisition managers.

that we develop the MAM skills for subsequent user/ support system or acquisition. This phase precedes the development of MAM skills, but is very important to the program.

The MAM development phase begins when an officer officially enters the program at approximately the 6th year of active commissioned service, and lasts for approximately 10 years. This phase includes required training and assignments in MAM positions

Figure 2. MAM is Also interdisciplined

BETWEEN FUNCTIONS

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FUNCTION A  ◄──────►  FUNCTION B
    ▲   ╲          ╱    │
    │    ╲        ╱      ▼
FUNCTION C  ◄──────►  FUNCTION N
```

BETWEEN SPECIALTIES/FUNCTIONS

```
SPECIALTY  ◄──────►  SPECIALTY
        ╲            ╱
          ╲        ╱
        MAM FUNCTIONS
```

OFFICERS NEED A BROAD EXPERTISE

MAM CERTIFICATION CRITERIA

OBC/ OAC/ MEL 4 (CGSC)

MAM- RELATED B.A. OR HIGHER DEGREE

(MAM) ALMC AND PMC (DSMC) COURSES

AL MC
DS MC

TWO MAM ASSIGNMENTS

05 LEVEL POTENTIAL

Figure 3. Materiel Acquisition Management

RESPONSIBILITY GRAPH

OFFICER STRENGTH — 100% ... 6%

ARMY BUDGET — 100% ... 37% ... FULLY MANAGEABLE

EQUIPMENT COMPLEXITY — 100% ... TECHNOLOGICAL

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for officers in the grades of captain and major.

The certified manager phase starts at approximately the 16th year of active commissioned service and lasts throughout the remainder of an officer's career. Upon their selection to lieutenant colonel, all program officers will be evaluated by a central selection board for certification as materiel acquisition managers and for retention in the program. Those who meet the certification criteria (see Figure 6) and are certified by the board will receive a certificate attesting to their achievement and, more importantly, will be assigned to lieutenant colonel and above MAM positions. These will be high-level, responsible managerial assignments requiring MAM skills. Continued refinement of MAM managerial skills occurs throughout this career phase.

The Way It Works

The MAM concept is depicted in Figure 7. Active duty officers, male or female, who have a desire to become materiel acquisition managers may, upon completion of 5½ years of active commissioned service, apply for the program.

They must submit a letter of application, through their immediate supervisor for endorsement, to their appropriate assignment branch at MILPERCEN. Applications should include details about any relevant training or experience.

All applicants who meet the selection criteria (Figure 8) will be considered for the program. Final selection is made by a board based on qualification, specialty, and grade re-

quirements, and not all those who apply will be accepted. Those who are selected will be awarded the Additional Skill Identifier (ASI) 6T. This is the code that was used by the Project Manager Development Program (PMDP), which the MAM program has replaced. With the award of ASI 6T, the selected officers will enter the MAM development phase.
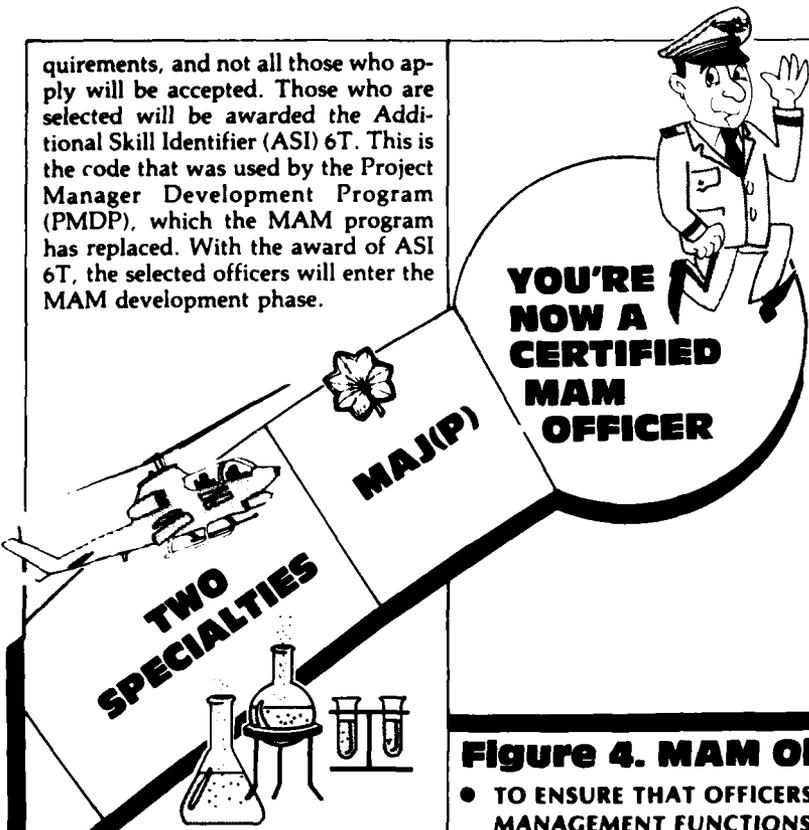
YOU'RE NOW A CERTIFIED MAM OFFICER

TWO SPECIALTIES

MAJ(P)

Officers who hold any non-acquisition specialty during the user/support development phase may also apply for the program after having an acquisition specialty designated as their additional specialty. In general, selected applicants will normally enter the program at approximately the 6th year of active commissioned service in the grade of captain.

When appropriate, MILPERCEN will assign the selectees to their first MAM assignment with TDY en route to the 9-week MAM course at the Army Logistics Management Center, Fort Lee, Va. This assignment is normally followed by a return to each officer's branch or initial specialty for further user/support development. At about the mid-point of their service in the grade of major, MAM program officers will receive their second MAM assignment with TDY en route to the 20-week Program Management Course at the Defense Systems Management College, Fort Belvoir, Va. The goal is to have received two MAM assignments by approximately the 15th year of active commissioned service.

Only those managers who have been certified, as noted earlier, will be assigned to lieutenant colonel and above MAM (6T) positions. Officers who do not meet certification will have the 6T code removed from their records and will be withdrawn from the program. These officers will still receive assignments in their specialties, but not the MAM (6T) positions. All acquisition specialties have both 6T and non-6T positions.

Continuing Education

The 9-week MAM Course (entry-level) at the Army Logistics Management Center and the 20-week Program Management Course at the Defense Systems Management College are both required courses for MAM officers. In addition, MAM officers selected for a senior service college will normally be programmed to attend the Industrial College of the

Figure 4. MAM Objectives

● TO ENSURE THAT OFFICERS PERFORMING MATERIEL ACQUISITION MANAGEMENT FUNCTIONS OBTAIN SPECIALIZED AND INTENSIVE TRAINING, EDUCATION, AND DEVELOPMENTAL ASSIGNMENTS.

● TO PRODUCE MATERIEL ACQUISITION MANAGERS WITH A BROAD PERSPECTIVE ACROSS THE ENTIRE FIELD OF MATERIEL ACQUISITION MANAGEMENT.

● TO MAXIMIZE SUCCESSFUL MATERIEL ACQUISITION MANAGEMENT THROUGH CONTROLLED ASSIGNMENTS OF PROPERLY TRAINED, DEVELOPED, AND CERTIFIED MAM OFFICERS.

● TO ENSURE THAT MAM OFFICERS HAVE OPPORTUNITIES FOR ADVANCEMENT AND CAREER SATISFACTION.

Figure 5. Acquisition Specialties

27 COMMUNICATIONS-ELECTRONICS ENGINEERING

45 COMPTROLLER

49 OPERATIONS RESEARCH/SYSTEMS ANALYSIS

51 RESEARCH, DEVELOPMENT, AND ACQUISITION

52 NUCLEAR WEAPONS

53 AUTOMATED DATA SYSTEMS MANAGEMENT

71 AVIATION LOGISTICS

72 COMMUNICATIONS-ELECTRONICS MATERIEL

73 MISSILE MATERIEL MANAGEMENT

74 CHEMICAL

75 MUNITIONS MATERIEL MANAGEMENT

91 MAINTENANCE MANAGEMENT

92 MATERIEL/SERVICES MANAGEMENT

97 PROCUREMENT AND PRODUCTION

Armed Forces (ICAF), although some MAM officers can expect to attend other senior service colleges. Graduate civilian schooling is also available for officers to obtain a master's degree in MAM or a related discipline. Related disciplines include management, business, engineering, and hard sciences. Two master-level degrees singled out as particularly relevant to the program are systems management offered at the University of Southern California, and materiel acquisition management being developed by the Florida Institute of Technology. Both of these degrees cover the disciplines of acquisition management.

There are a number of duty positions in MAM that call for an incumbent who has received training with industry (TWI). Under the Army's TWI program, selected officers are sent for 1 year to an industrial organization to gain experience on how industry performs acquisition functions. Upon completion of the training year, these officers receive a utilization tour in a TWI-designated duty postion. These are frequently positions that require an interface with industry personnel. *Most TWI occurs at the grade of captain,* with some senior TWI at the grade of lieutenant colonel. Once trained, officers can receive reutilization assignments in higher-grade positions as they attain those grades.

There are also positions in MAM that call for graduate-level training in MAM-related disciplines in order for the incumbent to perform successfully in the position. Another program, known as the Army Educational Requirements Board (AERB) program, provides an opportunity for selected officers to attend an accredited college or university on a fully funded basis in order to attain a graduate degree. Once the degree is attained, officers will receive a utilization tour in an AERB-designated duty position. As with TWI, most of the AERB training occurs at the grade of captain. Reutilization of trained officers can occur at any grade.

Position Identification

Accurate identification of position requirements is essential to build the proper inventory of MAM officers to meet the requirements. The number

Figure 6. MAM Certification Criteria

- MILITARY SCHOOLING — OBC/OAC/MEL 4 (CGSC)
- CIVILIAN SCHOOLING — BACCALAUREATE OR HIGHER IN MAM-RELATED DISCIPLINE
- MAM SCHOOLING — MAM (ALMC) AND PMC (DSMC)
- TWO MAM ASSIGNMENTS
- HAVE DEMONSTRATED POTENTIAL TO SUCCESSFULLY SERVE AT THE 05 LEVEL IN MAM
- QUALIFIED IN BOTH SPECIALTIES[1]
- SELECTED FOR PROMOTION TO LTC

1. PROGRAM DOES PERMIT SOME OFFICERS TO SINGLE TRACK

Figure 7. MAM Concept
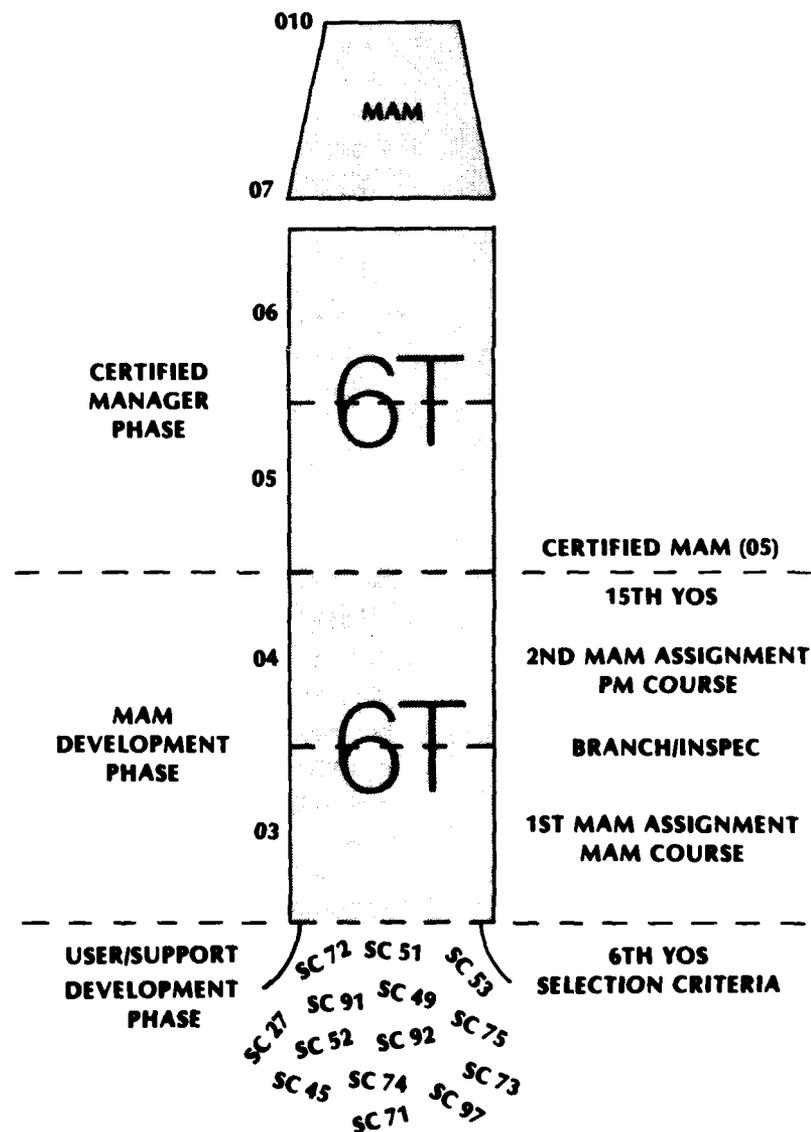
of officers accessed into the program will be based on the requirements by specialty and grade. Since MAM positions are multiskilled (requiring two specialties) it is imperative to access officers who hold both specialties. Once the proper inventory exists, the goal is to make MAM assignments based on both of the specialties called for in the 6T duty position.

Positions requiring officers with MAM skills are predominantly found in DOD, Department of Army, the Training and Doctrine Command, and DARCOM. These organizations play a vital role in the acquisition process. Slightly more than 2,000 positions within these organizations have been identified so far for the MAM program.

A Transition Phase

Obviously, it will take time to develop materiel acquisition managers from new captains in the program. In the meantime, there will be a shortage of majors and lieutenant colonels. To fill this shortage, majors and lieutenant colonels who have had some related training or experience will need to be selected into MAM.

A transition phase providing for a slight relaxation of criteria will be in effect to facilitate building the inventory assets needed. Those officers that were a part of the old PMDP will be screened, and if they meet the criteria will be automatically transitioned into MAM. Other officers, majors and above, must apply, and if they meet the transition criteria they will be selected into the program. Their training and development needs will be assessed and intensive management will be provided to ensure that the most reasonable "get-up-to-speed" training and experience is provided. The transition phase should not last for more than 3 years.

Making the Program Work

Intensive management of program members is the key to program success. MILPERCEN will perform this function and has developed a personnel management plan (PMP) to accomplish the personnel requirements. The PMP, also approved by DA, provides for a MAM controller/career manager who will function as the focal point for MAM assignments. Requisitions to fill MAM duty posi-

Figure 8. MAM Selection Criteria

- BE IN A BRANCH MANAGED BY OPMS
- COMPLETED OBC & OAC
- BE IN THE GRADE OF CAPTAIN OR HIGHER
- COMPLETED AT LEAST 5½ YEARS OF AFCS
- EXPRESS A DESIRE TO PARTICIPATE IN THE PROGRAM
- HAVE DEMONSTRATED COMPANY-GRADE PROFICIENCY AND POTENTIAL FOR FIELD-GRADE DUTY
- HOLD A MAM-RELATED BACCALAUREATE OR HIGHER DEGREE
- HAVE DEMONSTRATED A HIGH LEVEL OF POTENTIAL FOR DEVELOPMENT AS A MAM OFFICER
- HAVE AT LEAST 6 YEARS OF SERVICE REMAINING
- HOLD AN ACQUISITION SPECIALTY REQUIRING MAM OFFICERS

tions will be provided to the MAM controller, who will match the appropriate officer with the job requirements. Having selected an officer for a MAM job, the MAM controller will forward the proper documents to the appropriate assignment branch to complete the administrative details of the assignment. Another important function of the controller is to build an inventory by specialty to meet MAM position requirements. MILPERCEN has stressed how critical it is in building the proper inventory to have accurately identified and reasonably stabilized position specialty requirements.

Details of the MAM program will be included in the next update to Chapter 101, DA PAM 600-3, due out in the second quarter of FY 1984. It will be a comprehensive chapter and all officers should read it—particularly MAM officers.

MAM is a complete, comprehensive, competitive, and challenging program. It is also an exciting program with its own checks, balances, and rewards whereby successful officers can reach the highest levels of the Army. ■

The Civilian Side

450 Attend Williamsburg Meeting

Symposium Emphasizes Teamwork

About 450 acquisition executives, managers, and professionals from government, industry, and academe attended the 12th Federal Acquisition Research Symposium held at Williamsburg, Virginia, in December.

General Lawrence A. Skantze, Air Force Vice Chief of Staff, set the tone for the 3-day forum by noting in his welcoming letter the unparalleled challenges facing the acquisition community. Referring to the increasing complexity of new systems and the immensity of the dollars entrusted to the acquisition community, General Skantze charged that research must provide new tools for improved management. To that end, he characterized the symposium as "a bridge between the theoretical world of ideas and the practical world in which we acquire the government's needs."

The Air Force served as host for the 1983 symposium. Colonel Ronald Deep, Director of the Air Force Business Research Management Center, was symposium chairman. Brigadier General Bernard Weiss, Director of Contracting and Manufacturing Policy at USAF headquarters, opened the meeting by calling attention to the symposium theme: "Government, Industry,

Academe—Synergism for Acquisition Improvement."

Among the senior officials who shared their views on acquisition issues during the opening session were the symposium co-sponsors, Ms. Mary Ann Gilleece, Deputy Under Secretary of Defense (Acquisition Management); and the Honorable Donald Sowle, Administrator of the Office of Federal Procurement Policy (OFPP). Each subsequently served as moderator of an executive panel before the general audience. These panels, which were devoted to "perspectives on acquisition management," consisted of debate on a number of issues including competition, spare parts procurement, the role of internal audits, warranties, and congressional involvement in the acquisition process. Divergent viewpoints were heard from Derek Vander Schaaf, DOD Deputy Inspector General; Ms. Colleen Preston, congressional staffer, House of Representatives; Dr. Jack Borsting, Dean of the Graduate School of Business Administration, University of Miami, and former OSD Comptroller; Major General David Stallings, Director of Procurement and Production, U.S. Army Materiel

Development and Readiness Command; Rear Admiral Joseph Sansone, Deputy Chief of Naval Material for Contracts and Business Management, Naval Material Command; and Brigadier General Bernard Weiss, HQ USAF.

Responding to the challenge presented by General Skantze, the authors of more than 90 papers presented ideas in program management, the acquisition process, contracting, cost growth, capital investment incentives, product assurance, integrated logistics support, estimating and pricing, industrial preparedness, and the acquisition workforce. Their presentations are contained in the "Proceedings of the 1983 Federal Acquisition Research Symposium," which is available through the Defense Technical Information Center.

Thomas Pownall, Chief Executive Officer of the Martin Marietta Corporation, and Thomas Murrin, President of the Energy & Advanced Technology Group at Westinghouse Corporation, were featured luncheon speakers. Hugh Witt, Vice President for Government Liaison at United Technologies Corporation, was the banquet speaker.

These symposia began with a 1972 Department of Defense (DOD) sponsored conference in Dayton, Ohio. In recent years, they have been co-sponsored by DOD and the Office of Federal Procurement Policy with the Army, Navy, Air Force, and the Defense Systems Management College (DSMC) alternating as host.

DSMC will be host at the next symposium, which is tentatively scheduled for the fall of 1985. A call for papers will announce dates, location, and theme. Questions or suggestions should be directed to the Symposium Chairman, Lieutenant Colonel Francis A'Hearn, Director of Research, Defense Systems Management College, Fort Belvoir, Virginia 22060, or to David D. Acker, Symposium Executive Director, at the same address. Telephone: Commercial (703) 664-5783; or Autovon 354-5783.

Hugh Witt, Vice President, Government Liaison, United Technologies Corp., gives the banquet address at the 12th Federal Acquisition Research Symposium. At the front table are, left to right, Brigadier General Bernard Weiss, USAF, Director of Contracting and Manufacturing Policy, HQ USAF (Air Force host), Colleen Preston, Counsel, House Armed Services Committee, and Brigadier General Raymond Preston, Jr., USAF, Director of Program Integration, HQ USAF.

OFPP Reauthorized

Four More Years and a
Higher Small Purchase Ceiling.

Editor's Note: Dr. William N. Hunter, former Director of the Federal Acquisition Institute, has joined the Defense Systems Management College as the first occupant of the Office of Federal Procurement Policy Chair in DSMC's Executive Institute. During his 1-year tour at the College, Dr. Hunter will use this space to keep Program Manager *readers informed about the latest in federal acquisition policy. The first installment in this series, prepared by OFPP Administrator Donald E. Sowle, is presented here.*

President Reagan signed Public Law 98-191 on December 1, 1983, reauthorizing the Office of Federal Procurement Policy (OFPP) for an additional 4 years.

Legislation to reauthorize the OFPP was introduced in the House of Representatives as H.R. 2293 last March by Representatives Jack Brooks (D-Texas) and Frank Horton (R-N.Y.), and in the Senate as S. 1001 in April by Senator William S. Cohen (R-Me.). The Senate substituted the text of S. 1001 for H.R. 2293 and passed it unanimously on November 15. The House passed H.R. 2293, also unanimously, 2 days later. In addition to authorizing OFPP for an additional 4 years, the bill raises the small-purchase ceiling for the civil agencies from $10,000 to $25,000 to correspond with the Department of Defense ceiling.

The bill provides the OFPP administrator with:

—Overall direction of government-wide procurement policy, which must be implemented and followed by the executive agencies;
—Authority to prescribe regulations, procedures, and forms when the administrator determines that the regulatory agencies (DOD, GSA, and NASA) are unable to agree on, or fail to issue, government-wide regulations, procedures, and forms in a timely manner; and
—Authority to test innovative procurement methods and procedures.

The Director of the Office of Management and Budget (OMB) has the authority to deny the promulgation of or rescind any government-wide regulation or final rule or regulation that is inconsistent with OFPP policies, regulations, or procedures.

New Requirements

Public Law 98-191 requires the administrator to perform studies on the following topics during the next 6 months:

—Spending practices of DOD at the end of the fiscal year;
—The extent of competition in the award of subcontracts by federal prime contractors; and
—Weapon systems spare parts procurement by DOD.

Formal reports to the Congress are required on February 1, April 15, and June 1, 1984, respectively.

Policy Letter on Competition

By memorandum to the heads of departments and agencies on August 11, 1983, President Reagan emphasized the importance of competition in federal procurement. He directed the administrator of OFPP to issue a policy directive establishing government-wide restrictions on the use of noncompetitive procurement. A proposed policy letter, published in the *Federal Register* on August 17, 1983, establishes eight circumstances under which all noncompetitive procurements must be justified, and also requires that agency procurement executives establish systems for the review and approval of noncompetitive procurements, and for controlling inappropriate noncompetitive awards. More than 50 comment letters have been received. The comments are highly supportive of a policy letter on this subject. Such a policy letter is being reviewed in light of these comments and will be issued soon.

Donald E. Sowle
Administrator

FRAUD, WASTE AND ABUSE HOTLINES

Department of Defense	800-424-9098
	202-693-5080 In the National Capitol area
	AUTOVON 223-5080
Army	800-446-9000
	800-752-9000 in Virginia
Navy	800-522-3451
	AUTOVON 288-6743
Air Force	202-697-1061
	AUTOVON 227-1061
Marine Corps	Use local hotlines at bases and installations.
AAFES	800-527-6789
	800-442-6345 in Texas
Navy Exchange System	800-221-6330
	800-522-5144 in New York

Windy Sprints

Colonel William J. Weafer, USA

A common misconception exists that running outdoors in the cold is dangerous. Actually, cold weather is more suitable for running than hot weather. It is ironic that many of the winter indoor runners are not concerned about running in the heat during the summer.

In *Running With the Elements,* a booklet by World Publications, the point is made that dangers and discomforts of cold are greatly exaggerated, but that the threats of heat are very real. The booklet explains that the body is geared to adapt itself to a cold situation by means of built-in mechanisms. These include:

—Constriction of blood vessels on the surface of the skin.
—Contraction of involuntary muscles (shivering) to increase heat production.

■*Colonel Weafer is the Special Assistant for Physical Fitness, 1st Infantry Division, Fort Riley, Kansas.*

■*(This article originally appeared in* Soldier Support Journal, *published by the U.S. Army Soldier Support Center, Fort Benjamin Harrison, Ind.)*

—Redirection of blood from surface vessels to deeper vessels. Because of these mechanisms, a runner warms up quickly in cold weather. In warm weather, however, the body cools slowly, if at all, when overheated.

In addition, nature takes care of us by turning up our appetites a few notches in cold weather. In this respect, humans are much like birds. As long as birds can find food in winter, they survive. Unknowingly, we eat about 15 more calories each day for every one-degree drop in temperature. At 92 degrees in the tropics, the average person would unconsciously select a diet totaling about 3,000 calories per day. On the other hand, at 25 degrees below zero, that same person would eat around 5,000 calories each day. Extra calories allow us to generate more heat in our internal furnace.

In spite of the efficiency of our furnace, there is a tendency to overdress for exercise. Dr. Alan C. Burton of the Canadian Research Council reports that the clothing necessary to keep us warm when sitting quietly at 70 degrees will also keep us warm at 40 degrees if we are walking briskly. If we run, still in the same clothes, we will remain comfortable down to 5 degrees below.

Each winter the question seems to come up of the possibility of the lungs being frostbitten while running in cold weather. The same booklet quotes Dr. Merritt Stiles, an authority on medical questions related to skiing.

> Because of the warming effect of the upper air passages, I can conceive of no possibility of air cold enough to damage the lungs ever reaching them, no matter how strenuous the exertion. And I have never heard of cold air damaging the upper respiratory passages, for that matter, even though superficial frostbite of the skin is not uncommon in fast skiing in cold weather.

The only real concern when running during very cold weather is possible frostbite to the peripheral areas—the face, the ears, and the hands. This is most likely to happen not during exertion, but after a person stops running and perhaps remains outdoors too long to cool off. If the danger of frostbite exists, the run should be continuous and the cooling off period should be brief.

A brisk winter wind, however, may warrant special consideration.

Regardless of the temperature, it's the wind that determines how cold the day feels. In the winter, the speed of the wind affects the comfort level as humidity does in the summer.

Running With the Elements contains some very pertinent information concerning wind-chill readings and the associated pitfalls. For example, a temperature of 20 degrees above zero may actually feel as cold as a temperature of -20 degrees, depending on the speed of the wind. Thus, an actual 20-below day can range from relatively safe to extremely hazardous. Seldom, however, will the combination of temperature and wind speed actually subject a runner to "great danger." Such a threat would require a severe combination, such as a -15 degree temperature and a wind of 35 miles per hour.

The booklet also stresses the importance of wind direction and, for the runner, considers it as important as wind speed:

> Anyone who has run in the cold knows the feeling. You're running along nicely, enjoying yourself, even working up a sweat, and you say "There's nothing to this. It's 10 below and I don't even notice it." Then you turn back toward home and an icy blast takes your breath away. It freezes the sweat and turns the return trip into a numbing grind.

In order to prevent such a freeze-up on an out-and-back course, always run into the wind at first and with the wind to return.

In cold weather, it is more common for runners to overdress than to underdress. On most days, light sweat pants, a turtleneck, and a nylon windbreaker may be enough. If necessary, include gloves or mittens and a stocking cap.■

A Look at
# How Some 'Winners' Get That Way

In Search of Excellence
by Thomas J. Peters and Robert H. Waterman, Jr.
New York: Harper and Row 1982, 360 pages, $19.95.

Peters and Waterman's best seller is a breath of fresh air after the decade's blizzard of books on how to meet foreign competition, the benefits of quantification, and other facets of management. Here is a book that looks at business management on a broad scale, one that confirms to students and practitioners of business that the basics they believe in are not only still valid, but are of fundamental importance. *In Search of Excellence* has the ring of truth and authority.

The authors stumbled onto the excellence theme almost by accident in the course of their roles as consultants with McKinsey and Company. They observed that certain companies, in spite of vast diversities in products, have striking similarities. These successful companies are highly responsive to change; they have fundamental values of beliefs that serve as beacons; and their employees are motivated with an entrepreneurial fervor.

After several iterations, the authors arrived at eight reasons for excellence common in large degree to the 62 companies they analyzed, companies as diverse as IBM, 3M, Caterpillar Tractor, and McDonald's. These eight factors are as follows:

1. A bias for action, for getting on with it: "do it, fix it, try it."
2. Closeness to the customer. They listen, intently and regularly, to their customers.
3. Autonomy and entrepreneurship. The innovative companies encourage practical risk taking and support good tries; they expect and encourage a reasonable number of mistakes.
4. Productivity through people.
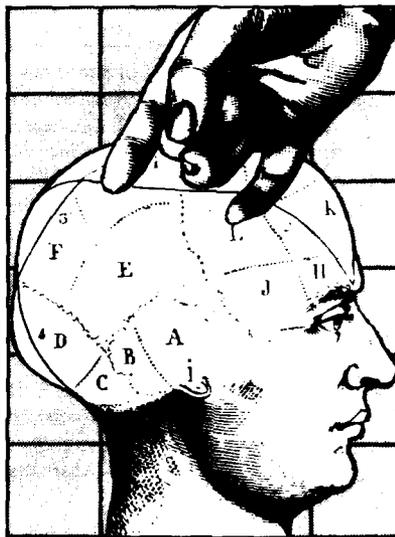
They treat their employees as the root source of quality and productivity gain.

5. A "hands-on, value-drive" approach. Values, such as McDonald's QSC&V—quality, service, cleanliness, and value—are fundamental to successful companies' philosophies. At the same time, top managers "walk the floors"; they get out to see for themselves, and to be seen.
6. Sticking to what they know best. These companies stick to the business they know, rather than reaching beyond their expertise.
7. Simple form, lean staff. The authors found that it is not uncommon to find a corporate staff of fewer than 100 people running multi-billion-dollar companies.
8. Simultaneous loose-tight properties. Autonomy is pushed down to the shop floor or product development team; but "they are fanatic centralists around the few core values they hold dear. 3M is marked by

barely organized chaos surrounding its product champions."

These eight principles are "conspicuously absent in most large companies today. . . . Far too many managers have lost sight of the basics, in our opinion: quick action, service to customers, practical innovation, and the fact that you can't get any of these without virtually everyone's commitment."

(Many of these factors were prominent among program managers three of us interviewed recently in the DSMC project, "Managing for Success in Defense Systems Acquisition": closeness to the customer, concern for products that work, concern for people, autonomy and entrepreneurship, a "hands-on" approach, and outstanding communications.)

Peppered throughout the book are specific examples and answers to "why do things work so well, with seeming lack of effort, in these companies?" Peters and Waterman are able to discern and reveal broad values or principles, on a macro level, and day-to-day operations through which these principles are expressed, on a micro level. The companies studied are brilliant on the basics at both levels. The result is a book you'll find hard to put down.

Criticisms of the book are very minor: occasional repetition in the use of specific examples, a few type glitches, and an ambivalence about the merits of "matrix management." But compared to the scope, penetration, and importance of the book, these are small points indeed.

Try *Excellence.* You'll like it.■

Stan Baumgartner

The On-Line Management Simulation

Sizing Yourself Up With Expert Program Managers

Dr. Maurice Bisheff
David Boals

Program managers charged with the responsibility of overseeing the acquisition of major weapon systems are coming under increased public scrutiny. In addition to possessing the essential management skills, program managers must be adept at performance auditing and negotiation if they are to achieve success and to attain the financial, military, and political objectives of their program in this high-risk environment. As the complexity and expense of weapon systems increase, the need for greater expertise in these areas becomes even more critical.

Recognizing this need, the Defense Systems Management College is producing an innnovative curriculum for newly appointed program managers in its Program Managers Workshop. [See "The Program Managers Workshop," November-December 1983.] A key aspect of this workshop is a unique management training process known as "On-Line Simulation."

The On-Line Simulation

The On-Line Simulation (OLS) is a form of living case study in which participants share in and evaluate opportunities and pitfalls actually encountered by an expert program manager as he works through an important segment of an actual program. Similar in concept to a "flight simulator," these living case studies compel participants to occupy the position of the manager, and to experience the responsibility and uncertainty involved in making decisions as various contingencies evolve in near real time.

The OLS process used in the workshop was originally developed for the U.S. Office of Personnel Management by the Center for Multidisciplinary Educational Exercises (COMEX), which is associated with the University of Southern California's School of Public Administration. The simulation has been successfully presented at a number of federal management training centers, including the Federal Executive Institute at Charlottesville, Va. Recognizing the potential of this process, DSMC decided to develop a series of on-line simulation exercises designed specifically for training senior program managers.

Advantages of the OLS

As a training method, the OLS provides a challenging, engaging, and realistic experience that generates a great deal of participant involvement. Specific benefits which accrue to the trainee include:

—Improved skills in assessing and responding to predictable and unpredictable aspects of the program manager's job;
—Enhanced awareness of how to get good performance from other players in the system;
—Direct experience in the protocols (do's and don'ts) of the program manager's environment;
—Appreciation for values, cultures, and operating methods of different weapon acquisition environments; and
—A repertoire of approaches for understanding how expert program managers undertake and act on problems and contingencies.

Structure and Operations of the OLS

An on-line simulation exercise is composed of a number of cycles that correspond to particular points at which the decision-maker is assessing the progress and possibilities of his program, and is planning for the future.

This approach differs from that typically used in case-study methodologies. Case studies examine the content of a situation in retrospect. In this sense, they are historical documents, giving insight by examining the totality of a situation. In contrast, the on-line simulation seeks to put the participant within the flow of action and events as they actually occur for the decision-maker. Thus, data for the simulation is collected from the expert decision-maker as his situation evolves, and is presented to the participant only in the perspective that the program manager had at that time.

The OLS begins with a short background scenario of the program and an assessment of its current status. Participants are then required to commit, on an individual basis, to their view of the appropriate objectives, strategies, tactics, and probabilities in the situation as if they were in the manager's position. After a group discussion of their estimates, the estimates provided by the actual manager at that particular point in his program are revealed and further discussion takes place. The next cycle then commences with an update of what transpired in the projected time frame, and the estimation process

Figure 1. The OLS Training Process
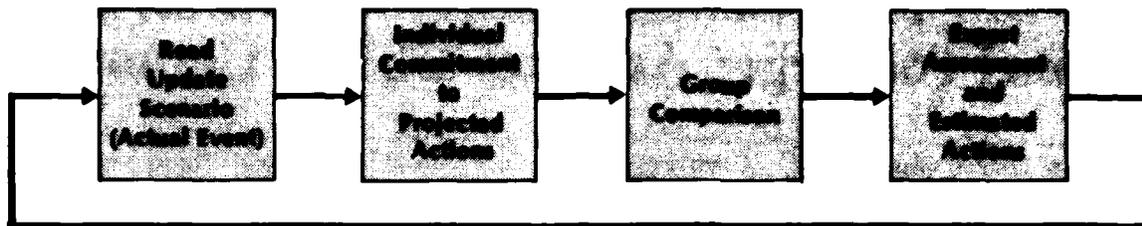
begins again (see Figure 1). An average OLS will run from three to six cycles of play, depending upon the manager's situation and the time allotted for the simulation.

It should be noted that the approach the expert decision-maker takes is not automatically assumed to be the correct, or only, one. The thrust of the simulation is to aid the participant in discovering and developing, for himself, perspectives and principles that may be employed in formulating effective actions. In this sense, the expert decision-maker serves as a role model, and a mirror of action, rather than as an oracle of truth.

Deployment

The OLS may be tailored to simulate the specific level of management or scope of program desired. It can be used as a self-contained learning module or as part of a larger curriculum. It may be conducted within a 3-to 5-hour time block with a group of 15 to 30 participants.

Participant Reactions

While program management training usually emphasizes the important prescribed management procedures and principles, the OLS focuses on the dynamic interplay between the prescribed and discretionary aspects of the job. This is reflected in participant reactions such as: "Challenges us to think"; "Gives a realistic view of the real interactions necessary to make it work"; "You get the feel of what the job is about"; and "I see how the pro's operate."

■ Dr. Bisheff is an Associate Director, Center for Multidisciplinary Educational Exercises, and Instructor for the School of Public Administration, University of Southern California. Mr. Boals is a Program Specialist at the Center for Multidisciplinary Educational Exercises, University of Southern California.

Defense Industry Produces for PMC 83-2

The Industry Program at the Defense Systems Management College provides future government managers the opportunity to better understand industry's role in the relationship and the interface between industry and government. During the Program Management Course, each of the six sections of the PMC class visits a defense manufacturing plant. The volunteer companies open their offices and factories to the approximately 30 members of one section. Before the plant visit, the section reviews program documentation, raises questions, and discusses the program background and status with the industry and DOD program managers.

During the 2½ days at the facility, the class sees, first-hand, the people, plant, and equipment required to design and manufacture weapon systems, and observes the management effort necessary to get it "out the door." Detailed discussions with factory managers, coupled with the time on the factory floor, provide an experience from which the class can gain insight into industry's role in the relationship. The insight complements the technical and business management curriculum of the PMC.

Our ability to conduct a meaningful program depends entirely on the full and open participation of both government and industry program management organizations. The programs and companies listed in Figure 1 supported PMC Class 83-2, and we at the College wish to publicly express our appreciation.■

Figure 1. PMC 83-2 Industry Program

Corporation	Program
Hughes, Los Angeles, Calif.	US ROLAND
Boeing, Seattle, Wash.	
Martin Marietta,	Low Altitude Navigation and Targeting
Orlando, Fla.	Infra-Red Night System
McDonnell-Douglas,	HARPOON
St. Louis Mo.	
FMC, San Jose, Calif.	Bradley Fighting Vehicle System
Vought, Camden, Ark.	Multiple Launch Rocket System
Rockwell International,	
Seal Beach, Calif.	NAVSTAR Global Positioning System

Brigadier General Pellegrini Retires; Colonel Forburger Assumes DSMC Command

Brigadier General Benjamin J. Pellegrini, USA, DSMC Commandant since January 8, 1982, retired from the U.S. Army on January 31 after more than 25 years of active duty. He was the sixth Commandant of the College.

Colonel Thomas V. Forburger, USA, formerly Deputy Commandant, replaced General Pellegrini as Commandant. The Honorable Richard D. DeLauer, Under Secretary of Defense (Research and Engineering) and Chairman of the DSMC Policy Guidance Council, passed the colors from General Pellegrini to Colonel Forburger during the change-of-command ceremonies.

Colonel Forburger served as Dean of Administration and Support from July 1982 until June 1983 when he was named Deputy Commandant. Before coming to DSMC he was Executive Officer, Office of the Deputy Chief of Staff for Research, Development and Acquisition.

General Pellegrini came to DSMC from the U.S. Army Missile Command, Redstone Arsenal, Ala., where he was Deputy Commanding General for Research and Development. Before that, he was project Manager, Hellfire/Ground Laser Designators, also at Redstone Arsenal.

Other assignments include tours in the Pentagon as Department of the Army System Coordinator for High Energy Lasers, Office of the Deputy Chief of Staff for Research, Development and Acquisition, and as Military Assistant to the Secretary of the Army. He was a physicist and project manager at Headquarters, Defense Nuclear Agency, before serving a tour of duty in Korea as a battalion commander in the Second Infantry Division.

General Pellegrini was awarded the Distinguished Service Medal and the Defense Superior Service Medal during the change-of-command ceremony. His other awards include the Legion of Merit, the Bronze Star, and the Army Commendation Medal.

General Pellegrini, a native of Milwaukee, Wis., received a B.S. degree in engineering from the U.S. Military Academy in 1958, an M.S. degree in nuclear physics from Tulane University in 1965, and a Ph.D. degree in nuclear physics, also from Tulane, in 1970.

General and Mrs. Pellegrini will reside in the Philadelphia area where he has accepted a position with Day and Zimmerman, Inc.■

(Left) Colonel Forburger, Dr. DeLauer and General Pellegrini arrive at the DSMC auditorium for the change of command ceremony.
(Center) Dr. DeLauer passes the flag to Colonel Forburger, effecting the formal change of command.
(Above) Accompanied by his wife, Mary, General Pellegrini gives his farewell address to members and friends of the College.

Gains

Agresto   Alberts   Ballou   Bergman   Botts   Cahill

Mary Agresto is a Management Analyst in the Navy Office for Acquisition Research, which is colocated with DSMC. Her last assignment was with the Chief of Naval Material as a Management Analyst and where she handled DSMC quotas for the Navy.

Henry C. Alberts is a Professor of Engineering Management, Technical Management Department, School of Systems Acquisition Education. He had been associated with MRJ, Inc., Fairfax, Va. Mr. Alberts holds a B.S. degree in physics and mathematics from Queens College, and an M.S. degree in the same disciplines from the University of Delaware.

Paul O. Ballou, Jr., taught Contracts and Finance and was the Director of the Multinational Program Management Course, Acquisition Management Laboratory, at DSMC from April 1978 to December 1980. Since then he has been with the General Services Administration as Director of Stockpile Acquisition for the National Defense Stockpile.

Mr. Ballou returned to DSMC in January 1984 to be a Professor of Financial Management, Business Management Department, School of Systems Acquisition Education. He received a B.S. degree in industrial management from the University of Kentucky, and an M.P.A. degree in organization and management from Golden Gate University. He is a D.P.A. candidate at Nova University.

Dr. Clarence Bergman holds the Air Force Chair, Executive Institute, Office of the Commandant. He came to DSMC from the Netherlands, where he was the Deputy Director of the SHAPE Technical Center in The Hague. Doctor Bergman holds a B.S. degree in electrical engineering from the University of Oklahoma, and M.S.E.E. and Ph.D degrees in electrical engineering from the University of Illinois. He also holds an M.B.A. degree in general management from the University of Southern California.

Lieutenant Colonel Mason S. Botts, USAF, is an Instructor of Systems Acquisition Education. His last duty was at Headquarters USAF, where he was C-20 Aircraft Program Element Monitor. Lieutenant Colonel Botts holds a B.S. degree from the U.S. Air Force Academy, and a master's degree in systems management from the University of Southern California. He has completed the Industrial College of the Armed Forces program.

Allen L. Cahill, who retired from the U.S. Navy in 1983 as a Commander after serving for more than 3 years as an Instructor in the Business Management Department, School of Systems Acquisition Education, has returned to the College as a Professor of Financial Management in the same department. After leaving the Navy, he was a Management Consultant with E. M. Kaitz Associates. Mr. Cahill holds a B.S. degree in accounting from the University of Dayton, and an M.S. degree in finance and business management from the Naval Postgraduate School.

Losses

Brigadier General Benjamin J. Pellegrini, USA, sixth DSMC Commandant, has retired from the U.S. Army after more than 25 years of active duty. He is associated with Day and Zimmerman Inc., Philadelphia, Pa.

Dr. Jay C. Billings, Professor of Industrial Management, Business Management Department, transferred to Redstone Arsenal, Ala., to be Director of the DSMC Southern Region, School of Systems Acquisition Education.

Gloria J. Eakin, Editor, Publications Directorate, Department of Research and Information, to the Publications Directorate, Editorial Division, of the U.S. Army Adjutant General Center, Alexandria, Va.

Staff Sergeant Dennis L. Griffey, USAF, Military Personnel Division, Department of Administration and Support, separated from the U.S. Air Force after 5 years of service. He plans to attend the Delaware State Police Academy, Aviation Division, Dover, Del.

John R. Mathias, Professor of Policy and Organization Management, School of Systems Education, has accepted a position in private industry with M and T Co., CDI Corp., Arlington, Va.

Captain (P) Robert J. Walsh, USA, Comptroller, Plans and Resource Management Directorate, Department of Administration and Support, has been reassigned to Turkey, where he will be Commander of the 27th U.S. Army Field Artillery Detachment.

Fradenburg

Frye

Kristensen

Merchant

Sauntry

Major Ronald L. Fradenburg, USAF, is an Instructor of Systems Engineering, Technical Management Department, School of Systems Acquisition Education. His last assignment was in the Pentagon as a Program Element Monitor for the Precision Location Strike System, Avionics and Armament Directorate of the Development and Production Division, Deputy Chief of Staff for Research and Development. Major Fradenburg received a B.S. degree in electrical engineering from Purdue University, and an M.S. degree in electrical engineering from the University of Tennessee.

Thomas W. Frye is a Professor of Engineering Management, Technical Management Department, School of Systems Acquisition Education. His previous assignment was at the Naval Training and Equipment Center where he was Head of Sea Trainers, ILS Branch. Mr. Frye received a B.S. degree in management from Rollins College, and an M.S. degree in logistics management from the Florida Institute of Technology.

Gail A. Kristensen, who retired as a U.S. Navy Commander in July 1982 after teaching for 18 months in the Acquisition Management Laboratory, School of Systems Acquisition Education, has returned to DSMC and to the Laboratory as a Professor of Systems Acquisition Management. For the past 18 months he was associated with Anadac Inc., Washington, D.C. Mr. Kristensen holds a B.S. degree in naval science from the U.S. Naval Academy, and an M.S. degree in financial management from the Naval Postgraduate School.

Major George S. Merchant, USAF, is an Instructor of Systems Acquisition Management, Technical Management Department, School of Systems Acquisition Education. Previously, he was Deputy Manager for Logistics, Joint Navy/USAF Program Office for Advanced Tactical Aircraft Protection Systems. Major Merchant holds a B.S. degree in aerospace engineering from Oklahoma State University, and an M.S.I.A. degree from Purdue University. He is a graduate of PMC 83-2.

Commander Thomas Sauntry, USN, is an Instructor of Systems Acquisition Management, Technical Management Department, School of Systems Acquisition Education. His last tour was with Patrol Squadron 5, Jacksonville, Fla. Commander Sauntry holds a B.S. degree from the U.S. Naval Academy, and an M.S. degree in aeronautical engineering from the Naval Postgraduate School.

Other Staff Additions

Staff Sergeant Eduard Boyd, USA, has returned to the Graphic Arts Division, Academic Support Directorate, as an Illustrator after a 23-month recruiting tour in Sylacauga, Ala.

Seaman Apprentice Denise Chase, USN, Camera Operator, Academic Support Directorate, Audio Visual Division, from the Recruit Training Command, Orlando, Fla.

Judith DeLoach, Secretary. Executive Institute.

Marjorie Orr, Secretary-Steno, Acquisition Management Laboratory, School of Systems Acquisition Education.

Promotions

Lieutenant Colonel Elliott Dworin, USA, was promoted to his present rank on February 1, 1984. He is an Instructor in the Business Management Department, School of Systems Acquisition Education.

Joyce Stapleton has been promoted to be Secretary to the Dean, School of Systems Acquisition Education. She had been Secretary to the Associate Dean for Executive Programs and IRM Systems.

Owen C. Gadeken, formerly Professor of Acquisition Management in the Policy and Organization Management Department, School of Systems Acquisition Education, has been named as leader of the newly established Educational Research Team within the Department of Research and Information.

Corrections

In our November-December issue, the figure referenced in Lieutenant Colonel Brown's article actually appeared on page 6.

On page 43 an incorrect phone number was given for the Defense Logistics Studies Information Exchange. The correct numbers are (804) 734-4255/-4546 or AV 687-4255/-4546.

PMC Graduate Update

PMC 83-1

Capt Ian B. Littlejohn, USAF, has been assigned as the Program Manager for the Integrated Electronic Warfare System (INEWS) Program within the Deputy of Reconnaissance, Strike, and Electronic Warfare Passive Systems Division, Aeronautical Systems Division, Wright-Patterson AFB, Ohio. He was assigned to the position after having served for 2 months as the Have Charcoal Test Manager.

PMC graduates Send your input for PMC Graduate Update to Inside DSMC Publications Directorate Defense Systems Management College Fort Belvoir Va 22060 Be sure to include your PMC class number

DATE
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