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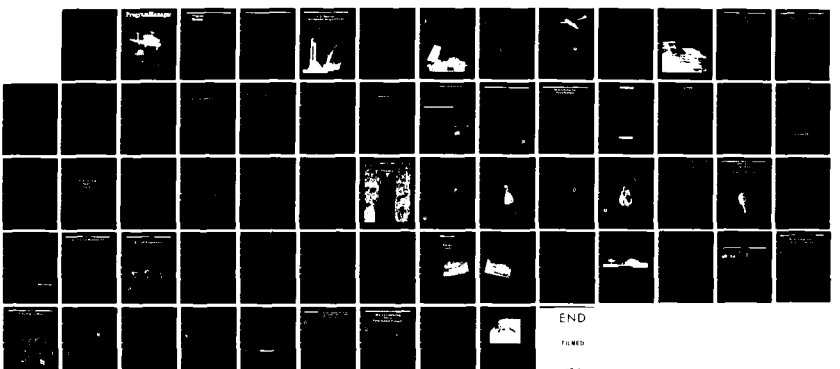

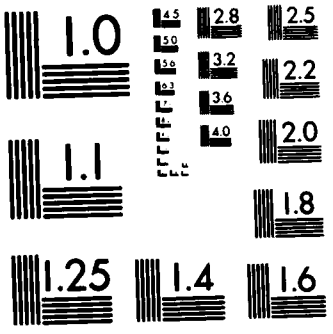

ProgramManager

July-August 1984

The Journal of the Defense Systems Management College

US/Soviet Weapons Acquisition Comparative Readiness

The Nuts and Bolts of Procuring Spare Parts

Searching for Excellence in the Program Office

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Vol. XIII, No. 4
DSMC 61
July-August
1984

Cover: The Army Black Hawk in our cover photograph moves troops, equipment, and supplies into combat and performs aeromedical evacuations and other missions. The Navy Sea Hawk and the Air Force Night Hawk use the same basic airframe and engine, but have different primary missions.

Program Manager (ISSN 0199-7114) is published bimonthly by the Defense Systems Management College, Fort Belvoir, Va. 22060, and is intended to be a vehicle for the transmission of information on policies, trends, events, and current thinking affecting program management and defense systems acquisition.

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U.S./Soviet Weapons Acquisition

Two Different Worlds

Raymond W. Shymansky and William Holder

The Soviet Union has achieved parity with the United States in weapon systems. In some circles, the opinion is that the Soviet Union has achieved world supremacy. How have the Soviets achieved such a degree of comparative military preparedness? What are their weapon system acquisition practices? What are the motivating factors behind those practices? How is the Soviet system different from that of the United States?

Soviet Decision-Making

Before addressing the issue of Soviet acquisition, the Soviet process of decision-making should first be understood.

The initial concepts, formal requirements, research, design, development, testing, and production of all military weapon systems in the Soviet Union are carried out by a highly integrated bureaucratic structure whose outline can be easily identified, but whose inner workings are extremely difficult to interpret. The system includes four primary elements: policy-maker, requirement generator, national management, and the RDTE&P performers.

The Communist Party of the Soviet Union

There is no doubt that the Communist Party of the Soviet Union (CPSU) is the policy-maker. The CPSU pervades Soviet society, and its presence is embedded within every weapon-related institution, from the highest government level down to the working-level organizations. The CPSU has a command/oversight structure reaching down to the scientist in the lab, the designer in his bureau, and the worker in the production shop. At the highest level, the CPSU establishes the national policy to be followed, oversees the execution of policies, dictates the substance and imparts the direction to military doc-

■ *Mr. Shymansky is an intelligence research specialist and Mr. Holder is an intelligence analysis engineer, both in the Directorate of Technology and Threat at Wright-Patterson AFB, Ohio.*

Soviet Soyuz spacecraft atop launch vehicle.

trine, and arbitrates any interagency dispute unresolvable at the governmental levels.

According to Soviet literature, power in the CPSU resides in the Communist Party Congress, which meets every 5 years. The Congress normally meets to approve Party-drafted guidelines to an ensuing Five Year Plan. It also elects (in actuality, it approves) the Central Committee of the CPSU. This body is charged with conducting Party affairs between Congresses. The Central Committee meets semiannually. Its composition includes the elite of the Soviet political, governmental, military, scientific, and cultural societies. This body further delegates its responsibilities to the Politburo.

The Politburo

In reality, the Politburo is at the apex of the Party structure. Policy and decision-making of both civilian and military R&D in the Soviet Union lie with this select body. The body is almost certainly the most influential decision-maker on all Soviet national policy matters, including weapon systems acquisition.

The Politburo's power, which is enormous, comes from its individual members, all of whom have other Party/government responsibilities and therefore exert an interlocking web of influence throughout the vast network of Soviet Party and economic organizations. This cross-membership assures that the various decision-making bodies implement consistent policies of the Party. A good example of this is the present Minister of Defense, who is located at all the critical decision-making points, within Party and government, having to do with military issues.

Most of the decision-makers involved in weapon system acquisition in both Soviet political and governmental national-level structures have enjoyed considerable longevity in office. This probably accounts for the conservatism exhibited by Soviet decision-making. That conservatism has been translated into the stability and program continuity that have historically characterized the Soviet military R&D management system. The average tenure for these senior officials, along with those for a number of the weapon system chief designers, approaches three decades.

The Defense Council

Basically serving as an advisory body to the Politburo, the Defense Council is a unique forum for the Soviet military sector to receive directions from, and have access to, the Soviet leadership. The body is composed of the nation's most important political, government, and military leaders on military matters. It basically approves doctrinal and strategic formulations, reviews overall budgets to the military, reviews final plans, and approves the major programs.

The Secretary for Defense Industry

Also serving in a staff oversight capacity, the Secretary for Defense Industry is a formal member of the Central Committee Secretariat. This position is charged by the Party to monitor all matters relating to the research, development, and production of military-related hardware through its extensive political Party network. Assisting the Secretary for Defense Industry is a party staff office

Stages of Scientific Research Work

STAGES OF NIR	PHASES OF WORK
Development of the Technical Task (Tekhnicheskoye Zadaniye) to conduct NIR	Analysis of initial information sources, development of the Technical Task for research, coordination and approval of the research Technical Task.
Development of the Technical Proposal (Tekhnicheskoye Predlozheniye)	Collection and analysis of the sources of S&T information. Development of the Technical Proposal according to the results of analysis of the Technical Task and sources of S&T information. Coordination and approval of the Technical Proposal for research.
Conduct of Theoretical and Experimental Research	Development of initial methodological documentation for conducting research. Development of the experimental model or test article. Planning, designing, and preparation of the experimental models, test articles, and equipment research. Conduct of experimental research. Correction of technical documentation according to results of theoretical and experimental research.
Formulation of the Results of NIR	Development of summary scientific and technical documentation. Review of the summary S&T documentation by the Scientific Technical Council or its sections and approval.
Acceptance of the NIR	Review and acceptance of the NIR. Transfer of documentation to interested organizations or enterprises for use or assimilation.

called the Defense Industry Department, which basically monitors the overall functioning of the weapon system acquisition process.

The National Structure

The Supreme Soviet

At the top of the government structure is the Supreme Soviet. Much like the Party Congress, the Supreme Soviet delegates its power to the Council of Ministers, which delegates the day-to-day operation of the large governmental bureaucracy to its Presidium. The Council of Ministers' Presidium decision-making authority is embodied primarily in the Council Chairman and his deputies, similar to the Party in the political sphere. This important body has the overall responsibility for implementation of national policy through centralized economic planning and resource allocation. In scientific and technological matters, subordinate government organizations are charged with the planning and management of R&D performance.

The Military Industrial Commission

The Military Industrial Commission, known as the VPK, serves as an important advisory body to the Council of Ministers. Together with its sister political counterpart, the VPK's purpose is to provide a national-level framework for overall coordination and oversight of all Soviet military product development and production activities. In this capacity it serves as a supraministerial body with implementation oversight authority over all aspects of defense development and production. As such, it acts as the official link between the Minister of Defense as the customer, and nine industrial ministries as the system developers/producers. As might be expected, the VPK also has responsibilities to the Party Secretary for the Defense Industry.

The Minister of Defense

In the role as the ultimate customer of the weapon systems, the Minister of Defense defines and approves new weapon system requirements and monitors the military product research and development carried out by industrial and scientific contractors.

The State Planning Committee

As an agent of the Council of Ministers, the State Planning Committee (GOSPLAN) participates in the acquisition process by allocating and monitoring the use of those resources approved by the Council of Ministers and the Politburo for the research, development, and production phases.

Defense Industrial Ministries

The defense industrial ministries are the primary working elements in the Soviet R&D system. There are believed to be nine military-associated ministries in the Soviet economy. Each of these ministries has a separate responsibility for performing the RDT&E and production of a particular type of weapon system and, in some cases, also for its subsystems and components. The four prime system design integration ministries are (1) the Ministry of General Machine Building (MOM), (2) the Ministry of the Aviation Industry (MAP), (3) the Ministry of the Defense Industry (MOP), and (4) the Ministry of the Shipbuilding Industry (MSP).

Soviet Design Practices

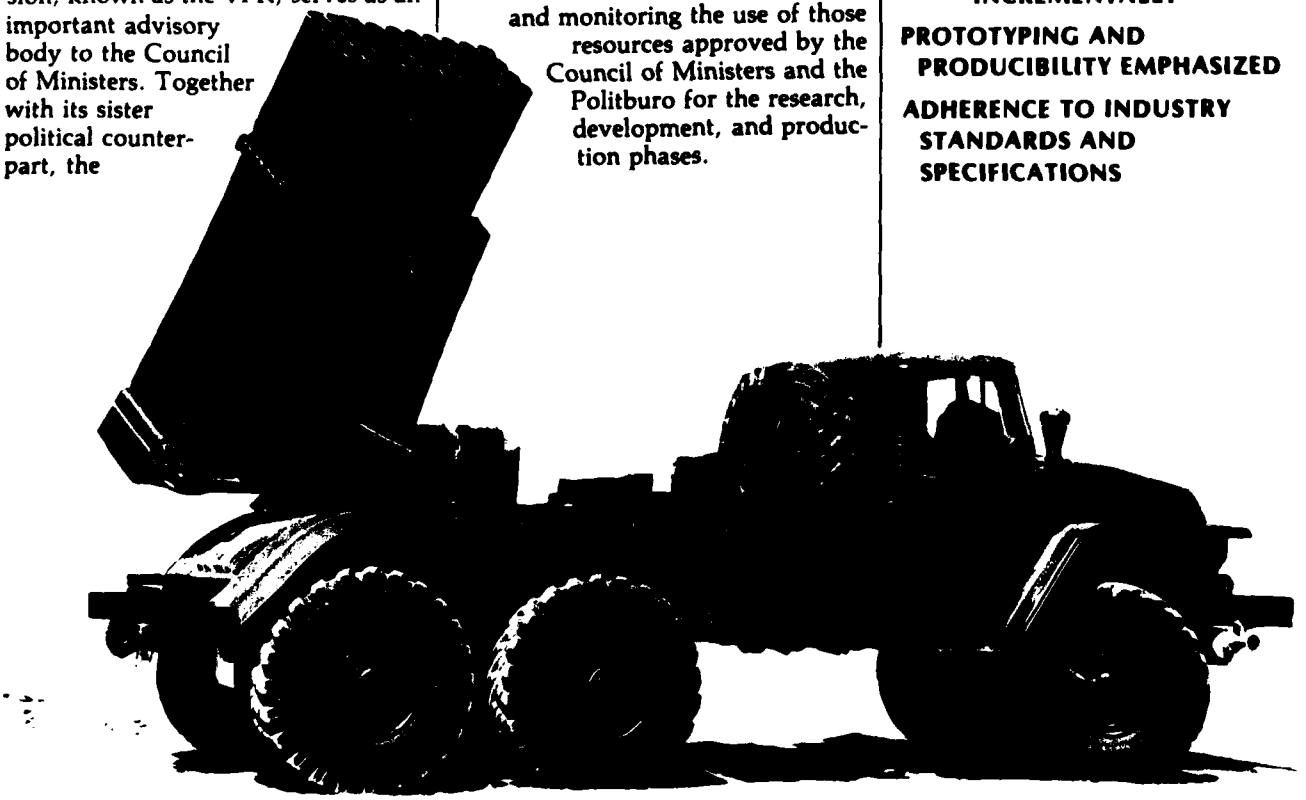
MEETING DEVELOPMENT SCHEDULES IMPERATIVE

RISK MINIMIZATION

- **EXTEND EXISTING TECHNOLOGY**
- **IMPROVE SYSTEMS INCREMENTALLY**

PROTOTYPING AND PRODUCIBILITY EMPHASIZED

ADHERENCE TO INDUSTRY STANDARDS AND SPECIFICATIONS



Soviet BM-21 artillery rockets on URAL 375 truck.

The Soviet Development Performers

There are four basic types of facility elements involved in the Soviet weapon system R&D process: scientific research institutes (NIIs), design bureaus (KBs), R&D test facilities, and series production plants, all of whom are subordinate to particular industrial ministries.

The industrial scientific research institutes primarily perform applied research on technologies and components that will eventually be incorporated into a weapon system. Basic research is primarily performed, in addition to that accomplished by the NIIs, by Academy of Sciences facilities and higher education institutes. The research institutes are directly involved before, during, and after a weapon system development program. The participation includes the development of technologies and components, preparation of design handbooks, assistance in the testing of prototypes, and finally, the actual R&D flight testing.

The system design focal point, however, for all design and development activities within each industrial ministry lies within the design bureau. This elite organization serves as the industrial program manager. As such, it is supported by both the production plants and the research institutes. In many cases, the design bureaus are headed by prominent, highly visible chief designers, and are supported by subsystem and component design bureaus. The design bureau has sole responsibility for the system through the R&D cycle.

Scientific Research

Research work is generally identified in Soviet literature as fundamental, exploratory, and applied research. The work is grouped together under the title of Scientific Research Work (NIR). An explanation of each research category follows:

Fundamental research (fundamentalnyye issledovaniya) is the formulation of principally new theoretical problems, laws, and theories. Its performance is dictated, as a rule, by the general requirements of the national economy or requirements for acceleration of scientific and technical progress. Fundamental research determines the development of knowledge, makes discoveries, and establishes conformities, which become the source of new technical concepts.

Exploratory research (poiskovyye issledovaniya) is defined as the use of fundamental research results to resolve theoretical problems within a technical discipline and to develop new forms of technology.

Applied research (prikladnyye issledovaniya) occurs when the design bureau and series production plant apply the results of exploratory research to design or production requirements.

Scientific research work can be performed under the centralized planning procedure (Five-Year Plan) or under contract where the scientist serves as the initiator in response to national directives. Scientific research in the Soviet Union is normally planned and funded through the state budget in formulation of Soviet Five-Year Plans. The initial step is the drafting of a comprehensive 20-year science and technology forecast. The draft identifies the main direction of science and technology and is used by GOSPLAN, in concert with party-directed economic goals, for preparing the draft of the Five-Year Plan. Therefore, NIR is primarily planned over an extended period with small allowance for flexibility.

Experimental Design

Experimental design work (opytno-konstruktorskaya rabota) (OKR) is that activity of incorporating results of the research and existing technology into finished and tested technical design/production drawings and specifications which serve as the medium for production of modified or new weapon systems. The primary purpose of OKR is to aid in the development of design documentation to be used in series weapon production.

The OKR starts with design and development initiation and continues through series production. The process continues as feedback is received from the customer and modifications are made to the series production model.

The Soviet Acquisition Process—At the Working Level

The Soviet acquisition of a military system follows a strict sequencing of procedural steps that can be basically outlined as follows:

Requirement Generation. This step occurs when a specific armed service generates a weapon system requirement by preparing and issuing a document known as the Tactical Technical Requirement (TTT).

Preliminary Design. This portion of the cycle involves the particular defense industrial ministry selecting the appropriate design bureau, or design bureaus, to prepare a Preliminary Design document that follows a procedure in which need (customer) and capability (KB) are negotiated and accepted by both parties.

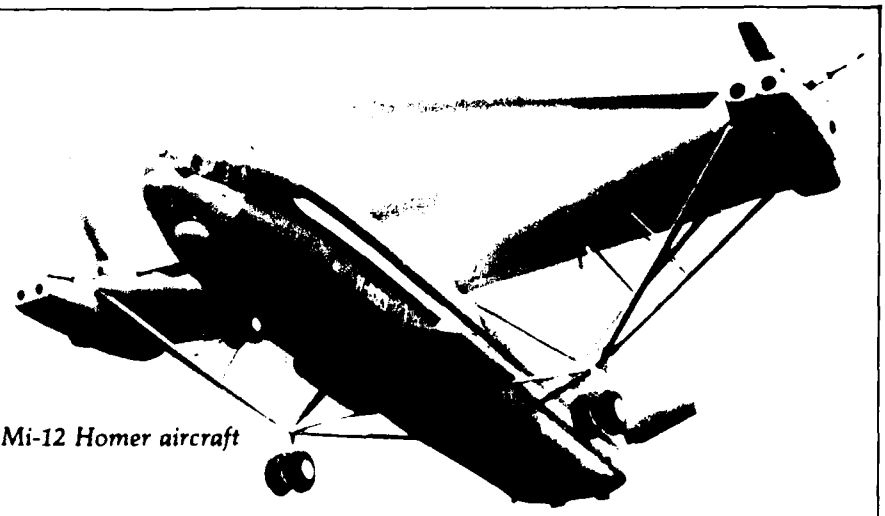
Party/Government Approval. The approval process by the VPK of the Preliminary Design then follows. This important milestone authorizes the design and development through

Differences

US	USSR
EARLIER FLIGHT HARDWARE	EARLIER DESIGN/TECHNOLOGY FREEZE
PROGRAMS TIED TO ANNUAL CONGRESSIONAL FUNDING	MULTIYEAR FUNDING
LATEST TECHNOLOGY BUILT INTO SYSTEMS	EVOLUTIONARY TECHNOLOGY ADVANCES
COSTS IMPERATIVE	SCHEDULES IMPERATIVE
DOMESTIC TECHNOLOGY	TECHNOLOGY TRANSFER PLAYS KEY ROLE

pilot lot production, names the primary participants, and allocates the necessary resources. The resources allocated are multiyear for the entire design and development phase, to include R&D testing.

Design and Development/ Prototype Production Phase. This portion of the acquisition process sees the design organization within the industrial ministry performing the necessary technical calculations and analyzing the possible configurations. The completion of these steps culminates with the fabrication of the initial system prototypes. These prototypes are fabricated by an experimental production plant, which produces the initial lot (called the "pilot lot").



Mi-12 Homer aircraft

The sequence of events indicated under the Soviet design and development/ prototype production phase is conducted as outlined in a set of Soviet state standards known as the Unified System of Design Documentation (YeSKD). These standards were incorporated in 1970, and form the framework by which all Soviet design bureaus engaged in weapon system design and development must comply. The system provides for various well-defined functions to be performed under the general classifications of "technical assignment," "technical proposal," "draft design," "technical design," "pilot model production," and "pilot lot production."

Inherent in the design and development phase is an early design freeze with flight hardware not being fabricated until the "pilot model production" phase. In comparison, the U.S. system normally demonstrates much earlier flight hardware with design changes being incorporated till late in the design phase.

Party Government/Approval. During the design and development phase, the system development program is reviewed, and necessary approval for preparation for series production is made by the appropriate decision-making authorities. This is necessary in order to allow sufficient lead time for construction and/or retooling of the participating series production plant. This procedure is thought to provide resources and authorize manning of series production plants, production preparation, and procurement of long lead-time equipment and tooling.

R&D and State Qualification Tests. These are a series of tests, the first of which are performed by the responsible design organization, with subsequent suitability testing being performed by the military customer. The testing is performed, depending on the weapon system type, at flight test centers, ordnance proving grounds, artillery test ranges, naval test facilities, etc.

Party/Government Approval. The documentation requesting series production is reviewed and approved by the appropriate decision-making authorities. This decision authorizes the actual series production, endorses deployment plans, and specifies the number of weapon systems to be deployed.

Series Production. Finally, the series production plant is allocated resources for quantity production of the weapon system. Quality control and final acceptance of the series-produced systems are accomplished by the military customer's plant representatives.

Differences from the U.S. System

Comparing the U.S. and Soviet systems reveals obvious differences. Under the U.S. system, weapon systems acquisition is initiated when the Secretary of Defense approves a go-ahead for concept exploration. Subsequent major U.S. weapon system acquisition decisions are called the demonstration and validation phase, full-scale development phase, and the production phase. Subsequent key decisions are also made by the Secretary of Defense with the issuance of a Decision Coordinating Paper. It should be noted, however, that U.S. Secretary of Defense milestone decisions do *not* authorize commitment of funding. Appropriate authorization must be taken to reflect the milestone decisions in the planning, programming, and budgeting system (PPBS) documentation for actual budget approval and funding.

Major differences in the two systems also occur early in the process. In the Soviet system the initial approval, which occurs following the early weapon system design phase, authorizes program go-ahead for the entire design/ development/test/phase along with multiyear funding. Most U.S. programs continue to be tied to annual congressional funding.

The document that initiates the Soviet weapon systems acquisition process, the aforementioned Technical Tactical Requirement (TTT), is submitted to a responsible defense industrial ministry design bureau. Under the U.S. process, the request for proposal (RFP) would conceivably be submitted to qualified firms and the academic community. Federal laboratories, federally funded research/ development centers, and other not-for-profit organizations are also considered as sources for U.S. system design concepts.

The Soviet TTT contains not only the overall mission need, but also outlines the general requirements for the weapon systems required to accomplish the mission. The U.S. program initiation paperwork, on the other hand (which contains the data that will eventually initiate the conceptual phase), is primarily concerned with describing the *mission* need, threat, existing DOD capability, impact of not acquiring the capability, and program plan. It is *not* intended to specify the specific weapon system required to accomplish the mission.

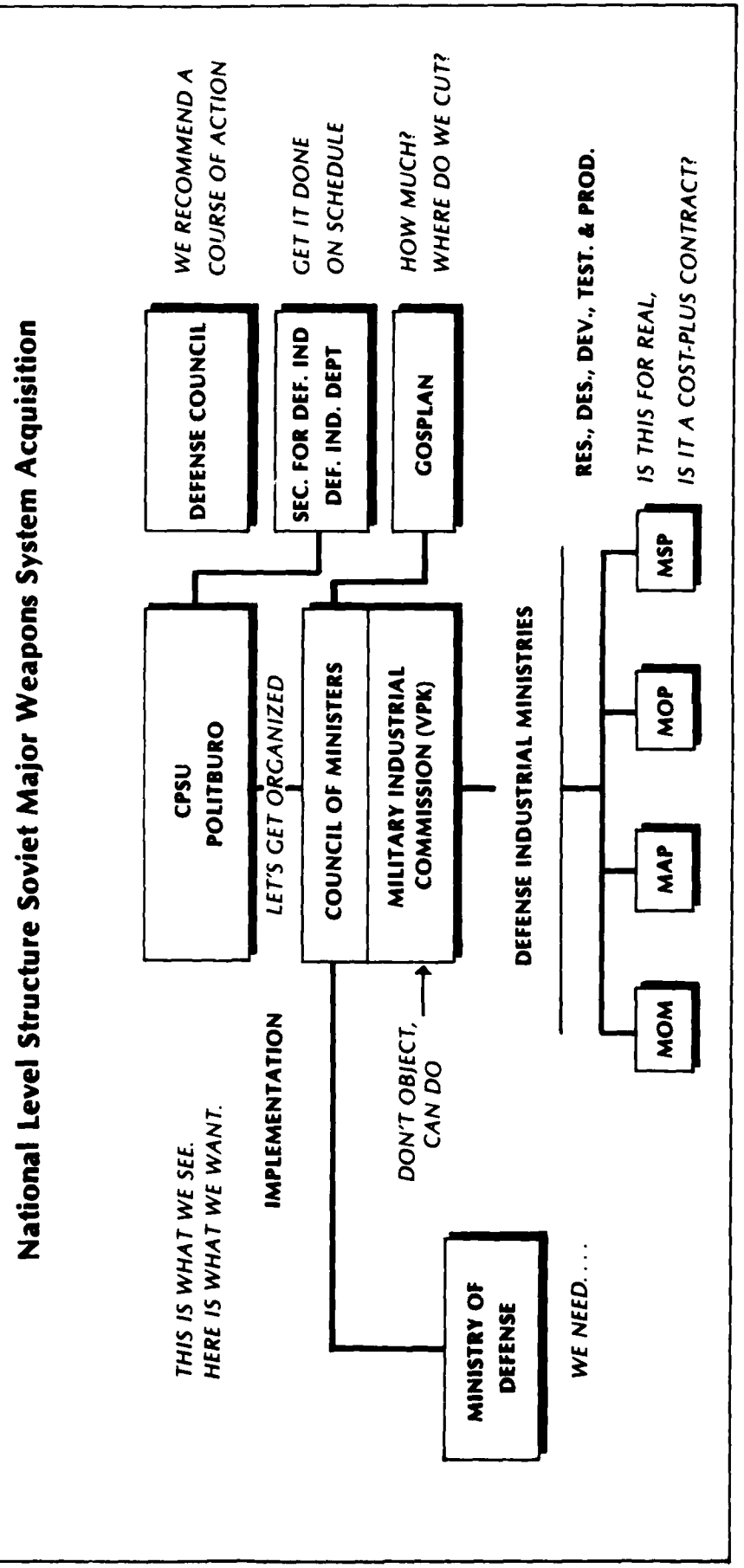
During the Soviet weapon system definition phase, the design bureau will prepare the "preliminary engineering design," which defines the performance characteristics and may also include schedules, cost data, subcontractors, and test requirements.

The U.S. process requires the completion of two phases, i.e., the concept exploration phase and the demonstration and validation phase, prior to the start of full-scale development.

The production phases of the major weapon system acquisition processes are very similar for both the U.S. and the Soviet Union. Both systems strive for production of weapon systems in sufficient quantities to support deployment requirements.

Differences in the two processes, though, occur in the Soviet system where the design bureaus and series production plants operate under separate management, and also possess different qualities of tooling, equipment, and labor skills. The two facilities could be geographically separated by thousands of miles, or co-located in the same complex. During the series production phase, the Soviets produce a small quantity of the system as a trial production lot. This quantity will then be tested to ensure that the items produced at the series production plant meet the same specifications as the prototypes produced at the design bureau.

When a Soviet Chief Designer at a design bureau undertakes the design of a new weapon system, he is ultimately governed by deeply rooted practices that are strictly enforced. These include (1) meeting the schedules agreed to with the customer, (2) minimizing developmental risks,



(3) testing prototypes prior to making production decisions, (4) ensuring ease of production, and (5) conforming to existing industrial standards and specifications.

The meeting of development schedule deadlines is considered imperative in the Soviet way of thinking, and is a prime consideration during the Soviet weapon system development process. Once development milestones are incorporated in monthly, annual, and Five-Year Plans, chief designers and their staffs are rewarded with bonuses and honorariums when schedules are successfully met. There also are penalties assessed when schedules are delayed.

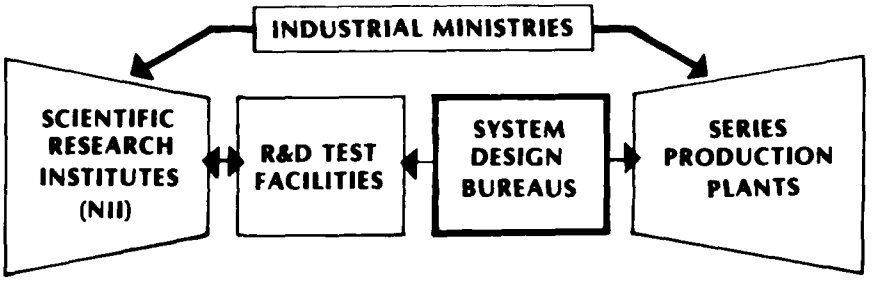
A basic Soviet design criterion is the minimization of program risk. Whereas in the United States it is almost a given that a new system will use the latest available technology, in most instances in the Soviet Union existing or proven technology, components, and subsystems are utilized to the maximum extent possible. If however, technology advancements *are* to be incorporated into a Soviet weapon system design, they are usually applied by taking small steps rather than by quantum jumps. In this context, weapon system follow-on modification is provided for in the original tasking. The use of available Western technology also tends to aid the design process much of the time.

The fabrication and testing of prototypes during the development phase are a routine practice at Soviet design bureaus prior to making the series production decision. This includes the manufacturing and testing of both sub-scale and full-scale prototypes. Also, the producibility aspects of a Soviet weapon system are a prime consideration during its design phase, which in many cases places design restrictions on the developer.

All industrial ministry and state standards and specifications are closely adhered to during the design phases of a weapon system by the design bureau. This results in reducing problems that might arise during the introduction of new innovations, and further limits the freedom of design choices that might be introduced by a designer.

Soviet development practices and adherence to their system acquisition process have undoubtedly resulted in greater military R&D effectiveness, along with a seemingly endless stream of increasingly complex weapon systems for all the Soviet armed forces.■

Soviet Weapon System Elements Involved in R&D



Soviet TU-134 transport aircraft in production.

Establishing Competitive Production Sources

A Handbook for Program Managers

Patricia A. Kelley

Emphasis from various organizations, especially the Congress, is increasing on several acquisition issues, particularly warranties, spare parts, and competition.

Now there is help available for the program manager trying to cope with one of these issues—competition. The Defense Systems Management College, under contract to Anadac with International Planning and Analysis Center, has issued a handbook to aid program managers and other acquisition officials in planning for, developing, and implementing a second-source strategy or production competition. The handbook provides a framework for deciding which technique for transferring production technology would be more advantageous based on the specific program characteristics.

The purpose of this production competition handbook is to provide the program manager with a single reference to use in assessing, implementing, and executing production competition. It combines the lessons learned from prior programs with the key results of recent research to form a guide to the production competition issue.

The handbook is in four parts. The first part briefly discusses the importance of the production competition decision, describes various techniques to effect technology transfer, and presents the critical variables associated with production competition. A framework for a rough-cut analysis of whether or not to pursue competition is provided. (See Commander Benjamin R. Sellers, SC, USN, "Second-Sourcing: A Way to Enhance Production Competition," *Program Manager*, May-June 1983.)

The second part presents detailed economic, technical, and program analyses that must be undertaken by the program manager in development of a production competition strategy. A model helps the program manager perform a cost-benefit analysis when contemplating the use of production competition.

The purpose of this production competition handbook is to provide the program manager with a single reference to use in assessing, implementing, and executing production competition.

The third part discusses program management actions that can be undertaken to effectively implement a production competition program. Implementation problems encountered on prior programs are discussed, along with alternative solutions to those problems. Examples of programs that have used the variety of technology transfer techniques available are included.

The last part presents ways in which the program manager can take advantage of production competition to secure greater contractor cooperation. Issues discussed include production award methodologies, logistic support, product improvement and capital investment.

The handbook suggests that the program manager note the following:

—There is a growing momentum within Congress and the DOD for increased competition, especially competition during production.
—This momentum is fueled by the numerous benefits that have been attributed to competition; however, the costs of competition also must be recognized.
—Production competition is a complex undertaking that requires careful planning and analysis.
—Design competition and production competition are distinct but complementary concepts.
—Empirical research has yielded diverse results concerning competition, indicating a need for analyses that reflect program characteristics.
—A framework has been developed to assist the program manager in that analysis.

The handbook was written to aid in the development of a production competition strategy and its implementation. Once you have received a copy and used it, please let us know if it helped you and if you have any suggestions for improvement of the handbook.

Copies of the handbook are available by writing (telephone requests cannot be honored):

Production Competition Handbook
Defense Systems Management College
ATTN: DRI-P
Fort Belvoir, VA 22060 ■

■ *Ms. Kelley is a Professor of Systems Acquisition Management in the Research Directorate, Department of Research and Information, at DSMC.*

The Personality Factor

Software Technology and the "Thinking Styles" of Program Managers

Colonel Kenneth E. Nidiffer, USAF

There is no question that computers and software are critical components to the accomplishment of the military mission. Almost every military system in the current and planned military force structure uses computer subsystems, and these subsystems are, in essence, a function of their software.

In the earliest application of digital computers to military systems, software served essentially as the instruction book necessary for the computer to perform its functions. As the world of information-handling electronics became more digital, computer software costs increased as a substantial fraction, and frequently a dominant fraction, of military system acquisition cost.

Program managers are often confronted with a very subtle systems-engineering problem. Over the last 20 years, there has been a fundamental reversal in the roles of the computer software and hardware. For example, software embedded in the electronic weapon system has moved from the role of the servant to that of the master, and computer hardware distributed throughout a system can often be best understood as the hardware tools necessary to enable the software instructions to be carried out. This notion has not been lost on the military managers. For example, the World Wide Military Command and Control System (WWMCCS) Information System (WIS) Joint Program Management Office (WIS JPMO) has decided on a software-first *vis-a-vis* a hardware-first acquisition strategy.

Unfortunately, software-intensive systems are traditionally beset with management and technical problems, among which are

—System failures due to software errors;
—System schedule slips due to software delays;
—System cost overruns due to soaring cost of software development and support;
—System development problems due to the inability to reuse and transport applications and support software;
—System support problems due to difficulties in maintaining and upgrading software.[1]

The challenges of technology transition involve the moving of methods and state-of-the-art technology into practice in software organizations.

Several high-level committees have studied what has been called "the software problem." These studies recommended that DOD undertake a significant effort to improve software engineering.

In 1975 DOD began an effort to reduce the rapidly increasing expense of military systems. This effort has now evolved into one of software engineering's most exciting and far-reaching developments—the Ada[2] programming language and the associated Ada programming support environments.

The Ada compiler and the associated programming support environments are being designed to help software developers reduce the cost and improve the quality of software products by facilitating the application of modern software engineering practices. For example, the most popular languages, FORTRAN and COBOL, were created in the 1950s, before the problems associated with large military systems developments were understood. As a result, such languages do not reflect modern design methodologies. The challenges of technology transition involve the moving of methods and state-of-the-art technology into practice in software organizations. Although advances have been made in developing good software development techniques in both the technical and management sense, there are those who feel there has been minimal progress in moving this information from research environments into practice on real systems. Part of the problem centers on how technology is usually transitioned within DOD.

Basic research is currently conducted by various agencies both in and outside DOD. The results of basic research efforts often find their way into the DOD laboratories, which investigate the practical aspects. When sufficiently matured,

■ *Colonel Nidiffer is Director of Computer Resources, Deputy Chief of Staff for Acquisition Logistics, Air Force Systems Command.*

the technology is transitioned to DOD contractors on specific systems and into policies and standards. As a result, insertion of new technology into DOD weapon systems occurs relatively slowly.

Other impediments to rapid technology transition are numerous and varied. A partial list is provided below.

—Many non-DOD industries are reluctant to share new technology with DOD for fear of losing proprietary rights.
—Technical expertise capable of realistically assessing the applicabilty of many new technologies is scarce and frequently unavailable to program offices.
—New technologies concerned with the production process itself (software engineering technology is an example) are contractually difficult to specify and enforce in use.
—Often processing technologies, such as the contractor's software factory, are considered entirely within the province of the contractor to develop as long as the delivered product apparently conforms to specification.

In addition to these impediments, another problem exists that must be adequately addressed if rapid technology transition is to occur. Stated simply, DOD program managers feel they cannot afford the added cost or schedule risk often associated with first-time applications of new technology. It is easy to accept this problem at face value based on the following argument.

The government program manager and his industry counterpart are usually under very tight schedule, cost, and performance constraints. They are legally joined together via a contract. A change to the contract to insert new technology usually means a negative impact to one of the constraints, which in turn increases the risk of unfavorable upper management attention and oversight. Therefore, unless the new technology demonstrates the potential to either save cost, schedule, or improve performance (which is difficult to do), both government and industry program managers are reluctant to take on the risks inherent in introducing new tools. Although it is difficult to find fault with this argument, it fails to adequately address the behavior and attitude of the program manager when dealing with risk. It is clear that any attempt to inject new technology, such as the Ada language, into a program must be done with some consideration given to the way program managers think. As we shall see, this may be the key to effecting better technology infusion into a program.

Stated simply, DOD program managers feel they cannot afford the added cost or schedule risk often associated with first-time applications of new technology.

Quantification of Personality of Program Managers

The manager of a major defense system program does not spend much of his time solving problems that are well structured and require little management insight. Rather, he is usually confronted with the task of choosing a course of action among a number of possible actions. Usually, a set of consequences and uncertainties is attached to each available course of action. Based on his view of the technical, economic, schedule, and political implications, the program manager must choose one of the alternatives. The question is this: How does a program manager perform the function of decision-making effectively?

To begin, it is important to recognize that the decision-making process is substantially influenced by the behavior and attitude of the decision-maker. Carl G. Jung developed a theory that each of us has the same multitude of instincts that drive us from within, but that each of us has a preference as to how he will "function."[3] Our preference for a specific "function" is an individual characteristic, and we can be "typed" by our preference.

Isabel Myers-Briggs, who is credited with bringing Jung's theory to life, addressed this subject in a recent book.[4] She believes that much of what appears to be a random variation in our behavior is really quite orderly and consistent.

According to Myers-Briggs, there are four pairs of preferences: extraversion/introversion, sensing/intuitive, thinking/feeling, and perceptive/judging. People are not completely one or the other in each of these four pairs, but one will generally tend to be more extraverted than introverted, or more sensing than intuitive, and so on. Psychologists do not know whether these preferences are inborn or whether they develop as we mature. Regardless of their origin, Jung believed our preferences tend to develop and become stronger through use. To provide an understanding of the eight preferences, a short explanation of each follows.

First, a person who chooses *people* as a source of energy is recognized as an extravert (E), and a person who prefers *solitude* to recover energy is considered an introvert (I). Second, a person who has a natural tendency for sensing (S) is considered to be *practical*, whereas a person who tends to be intuitive (N) is *innovative*, relies on hunches or unverbalized cues, and is impatient with routine details. Third, a person who makes a choice on an *impersonal* basis is considered to be a thinker (T), whereas a person who makes a choice on a *personal* basis is considered to be a feeling (F) type. Fourth, a person who chooses closure over open options is likely to be a judging (J) type, whereas a person who prefers to keep things open and fluid is likely to be a perceiving (P) type. Keirsey and Bates have tabulated the differences within the pairs of preferences by words and phrases.[5] These are shown in Table I. These preferences are found in everyone; therefore, no decision-maker can be described as having only one type of preference.

Building on the theory we have just examined, 16 types of personality emerge. At this point, it is interesting to note that, according to Myers-Briggs, whatever a person's particular combination of preferences may be, other persons with the same combina-

Table I. The Differences within the Four Pairs of Preferences

E (75% of population)	vs. I (25% of population)
Sociability	Territoriality
Interaction	Concentration
External	Internal
Breadth	Depth
Extensive	Intensive
Multiplicity of relationships	Limited relationships
Expenditure of energies	Conservation of energies
Interest in external events	Interest in internal reaction

S (75% of population)	vs. N (25% of population)
Experience	Hunches
Past	Future
Realistic	Speculative
Perspiration	Inspiration
Actual	Possible
Down-to-earth	Head-in-clouds
Utility	Fantasy
Fact	Fiction
Practicality	Ingenuity
Sensible	Imaginative

T (50% percent of population)	vs. F (50% of population)
Objective	Subjective
Principles	Values
Policy	Social values
Laws	Extenuating circumstances
Criterion	Intimacy
Firmness	Persuasion
Impersonal	Personal
Justice	Humane
Categories	Harmony
Standards	Good or bad
Critique	Appreciate
Analysis	Sympathy
Allocation	Devotion

J (50% of population)	vs. P (50% of population)
Settled	Pending
Decided	Gather more data
Fixed	Flexible
Plan ahead	Adapt as you go
Run one's life	Let life happen
Closure	Open options
Decision-making	Treasure hunting
Planned	Open ended
Completed	Emergent
Decisive	Tentative
Wrap it up	Something will turn up
Urgency	There's plenty of time
Deadline!	What deadline?
Get show on the road	Let's wait and see

Legend

E - An extravert	T - A thinking type of person
I - An introvert	F - A feeling type of person
S - A sensing type of person	J - A judging type of person
N - An intuitive type of person	P - A perceiving type of person

tion of preferences are usually the easiest for the first person to understand and like. The Myers-Briggs Test, which a person can self-administer, identifies one's preferences and, thereby, his personality. The Myers-Briggs Type Indicator (MBTI), shown in Table II, displays the 16 types of personality that have emerged from this research.[6] Each personality type shown in Table II has its own unique connotation of the four preferences. Each type also shares preferences in common with other types.

A knowledge of the personality types can be useful if one develops an understanding of the temperamental base of each type. According to Myers-Briggs, temperament explains behavior; therefore, at least in theory, a person's temperament has the effect of placing his signature on each action.

The four basic temperaments are sensitive perceivers (SP), sensitive judgers (SJ), intuitive thinkers (NT), and intuitive feelers (NF). The SPs, who according to MBTI make up about 38 percent of the total population, are impulsive. They are compelled to be free and independent. The SJs, who make up another 38 percent of the total population, want to belong. They are compelled to be bound or obligated. The NTs represent about 12 percent of the population. They like to do things well under any set of circumstances; NTs have a need to be competent. An NF has a desire for self-actualization, to become oneself. Although the NFs represent only 12 percent of the total population, their influence on the minds of the population in general tends to be substantial because many of them are writers.

The ideas presented as a result of the psychological research led David Acker and me to wonder whether the preferences of effective defense system program managers tend to follow a pattern.[7] Because defense systems are highly technical in nature, and because so many acquisition managers have backgrounds in the hard sciences, we were particularly interested in the results of recent tests taken by engineering students. The results were given with respect to the four-letter convention shown in Table II. One examination of overlapping per-

sonality types for engineering students revealed that ENTJ, INTJ, and INTP types tend to predominate. Two other types also appeared, but less frequently: INFJ and INFP. It may be inferred from this finding that most engineers are intuitive thinkers.

This finding is supported by tests conducted by the ASEE-MBTI Engineering Consortium on more than 3,700 students from eight engineering schools. The results of these tests, conducted in 1980 and 1981, indicated that "engineering students markedly prefer thinking [over feeling] (74 percent) and judging [over perceiving] (61 percent)."[8] The study concluded that engineers are usually logical, tough-minded, and decisive. Tough-minded persons—TJs—prefer a thinking and judging attitude. The consortium data also reveal that the four TJ types account for almost half the sample. Although a TJ type is not one of the basic temperaments, the TJ type is a significant type with respect to program managers, as we shall see later.

To assess program managers, data was collected from Myers-Briggs tests given at the Industrial College of the Armed Forces (Class of 1981) and the Program Management Course of the Defense Systems Management College (classes 82-2, 83-2, and 84-1). The raw data are shown in Tables III, IV, V, and VI. In addition, the data in the tables have been converted into a form that would provide meaningful information from which to make a judgment.

Summary and Conclusions

The data collected in the MBTI tests demonstrated in every case that the students in these particular schools and courses were more introverted, thinking, and judging than expected. For example, of the 803 students surveyed, 38 percent had extravert preferences, and 63 percent were more introverted. Based on the data given in Table I, the nominal percentage values for the extravert and introvert preferences of the population as a whole are 75 percent and 25 percent respectively—a very sharp contrast to the data collected. Another significant deviation from nominal is the preference for thinking. It was expected that the preference for thinking would be 50 percent; however, the value turned out to be 85 percent.

Using the T preference as a base, the next logical extention to the two-letter preference proved to be a TJ type. The preference for this type is presented in Tables III through VI. Of the students surveyed, 63.4 percent were TJ types, compared to an expected result of 25 percent.

Table II. Contribution Made by Each Preference to Each Type

WITH THINKING	WITH FEELING	WITH FEELING	WITH THINKING
ISTJ	**ISFJ**	**INFJ**	**INTJ**
I Depth of concentration	I Depth of concentration	I Depth of concentration	I Depth of concentration
S Reliance on facts	S Reliance on facts	N Grasp of possibilities	N Grasp of possibilities
T Logic and analysis	F Warmth and sympathy	F Warmth and sympathy	T Logic and analysis
J Organization	J Organization	J Organization	J Organization
ISTP	**ISFP**	**INFP**	**INTP**
I Depth of concentration	I Depth of concentration	I Depth of concentration	I Depth of concentration
S Reliance on facts	S Reliance on facts	N Grasp of possibilities	N Grasp of possibilities
T Logic and analysis	F Warmth and sympathy	F Warmth and sympathy	T Logic and analysis
P Adaptability	P Adaptability	P Adaptability	P Adaptability
ESTP	**ESFP**	**ENFP**	**ENTP**
E Breadth of interests	E Breadth of interests	E Breadth of interests	E Breadth of interests
S Reliance on facts	S Reliance on facts	N Grasp of possibilities	N Grasp of possibilities
T Logic and analysis	F Warmth and sympathy	F Warmth and sympathy	T Logic and analysis
P Adaptability	P Adaptability	P Adaptability	P Adaptability
ESTJ	**ESFJ**	**ENFJ**	**ENTJ**
E Breadth of interests	E Breadth of interests	E Breadth of interests	E Breadth of interests
S Reliance on facts	S Reliance on facts	N Grasp of possibilities	N Grasp of possibilities
T Logic and analysis	F Warmth and sympathy	F Warmth and sympathy	T Logic and analysis
J Organization	J Organization	J Organization	J Organization

Table VII was developed in an effort to see if a four-letter preference type could be identified. The TJ type was used as a base. The most significant deviation from the nominal was the ISTJ type. In general, the student data were seven times higher for this type than for the nominal data. In addition, based on the data collected, the ISTJ personality type was significantly predominant.

We are now in position to make some observations about how an agency can effect the rapid transition of the Ada language by understanding the personality of the program manager. The fact that future program managers have certain personality types as indicated by the BMTI tests leads one to infer that our current program managers probably have similar preferences, since the road to becoming a program manager is a structured one. If this assumption is correct, program managers are usually strong TJ types. In essence, the program manager is a tough-minded technical and business person who approaches problems in a similar way to a systems engineer.

Table III. Results of Myers-Briggs Test on the Class of 1981 at Industrial College of the Armed Forces

	SENSING TYPES		INTUITIVE TYPES				
	WITH THINKING	WITH FEELING	WITH FEELING	WITH THINKING		NUMBER	PERCENT
INTROVERTS JUDGING	ISTJ N = 80 % = 38.5	ISFJ N = 5 % = 2.4	INFJ N = 6 % = 2.9	INTJ N = 16 % = 7.7	E I S N T F	79 129 142 66 184 24	37.98 62.02 68.27 31.73 88.46 11.54
INTROVERTS PERCEPTIVE	ISTP N = 8 % = 3.8	ISFP N = 1 % = 0.5	INFP N = 3 % = 1.4	INTP N = 10 % = 4.8	J P IJ IP EP EJ	168 40 107 22 18 61	80.77 19.23 51.44 10.58 8.65 29.33
EXTRAVERTS PERCEPTIVE	ESTP N = 6 % = 2.9	ESFP N = 1 % = 0.5	ENFP N = 3 % = 1.4	ENTP N = 8 % = 3.8	ST SF NF NT SJ SP NP NJ	131 11 13 53 126 16 24 42	62.98 5.29 6.25 25.48 60.58 7.69 11.54 20.19
EXTRAVERTS JUDGING	ESTJ N = 37 % = 17.8	ESFJ N = 4 % = 1.9	ENFJ N = 1 % = 0.5	ENTJ N = 19 % = 9.1	TJ TP FP FJ IN EN IS ES	152 32 8 16 35 31 94 48	73.08 15.38 3.85 7.69 16.83 14.90 45.19 23.08

Number of students = 208

The data appear to indicate that an agency would have a hard time selling the Ada language to a program manager on the argument that the Ada language is technically better than other languages. This, in itself, is not enough to prompt the TJ program manager to achieve effective technology transfer. There must be a conscious recognition on the part of those seeking rapid transition that the choice on use of the Ada language will most likely be made with respect to cost, schedule, and technical performance trade-offs for the overall weapon system.

One last significant point is the need for strong advocacy. The data indicate that the majority of program managers have introvert preferences. This would imply that an agency that is advocating the Ada language must seek out opportunities to approach program managers rather than

Table IV. Results of Myers-Briggs Test on Program Management Course (Class 82-2) Students at DSMC

	SENSING TYPES		INTUITIVE TYPES				
	WITH THINKING	WITH FEELING	WITH FEELING	WITH THINKING		NUMBER	PERCENT
INTROVERTS JUDGING	ISTJ N = 50 % = 26.2	ISFJ N = 6 % = 3.1	INFJ N = 3 % = 1.6	INTJ N = 25 % = 13.1	E I	81 110	42.41 57.59
					S N	106 85	55.49 44.50
INTROVERTS PERCEPTIVE	ISTP N = 6 % = 3.1	ISFP N = 2 % = 1.0	INFP N = 3 % = 1.6	INTP N = 15 % = 7.9	T F	162 29	84.82 15.18
					J P	146 45	76.44 23.56
					IJ IP EP EJ	84 26 19 62	43.97 13.61 9.95 32.46
EXTRAVERTS PERCEPTIVE	ESTP N = 4 % = 2.1	ESFP N = 1 % = 0.5	ENFP N = 3 % = 1.6	ENTP N = 11 % = 5.7	ST SF NF NT	89 17 12 73	46.60 8.90 6.28 38.22
					SJ SP NP NJ	93 13 32 53	48.69 6.81 16.75 27.75
EXTRAVERTS JUDGING	ESTJ N = 29 % = 15.2	ESFJ N = 8 % = 4.2	ENFJ N = 3 % = 1.6	ENTJ N = 22 % = 11.5	TJ TP FP FJ	126 36 9 20	65.97 18.85 4.71 10.47
					IN EN IS ES	46 39 64 42	24.08 20.42 33.51 21.99
					Number of students = 191		

Table V. Results of Myers-Briggs Test on Program Management Course (Class 84-1) Students at DSMC

	SENSING TYPES		INTUITIVE TYPES				
	WITH THINKING	WITH FEELING	WITH FEELING	WITH THINKING		NUMBER	PERCENT
INTROVERTS JUDGING	ISTJ N = 62 % = 29.1	ISFJ N = 7 % = 3.3	INFJ N = 3 % = 1.4	INTJ N = 20 % = 9.4	E I S N T F	74 139 136 77 177 36	34.74 65.26 63.85 36.15 83.10 16.90
INTROVERTS PERCEPTIVE	ISTP N = 15 % = 7.0	ISFP N = 4 % = 1.9	INFP N = 8 % = 3.8	INTP N = 20 % = 9.4	J P IJ IP EP EJ	140 73 92 47 26 48	65.73 34.27 43.19 22.07 12.21 22.54
EXTRAVERTS PERCEPTIVE	ESTP N = 12 % = 5.6	ESFP N = 3 % = 1.4	ENFP N = 2 % = 0.9	ENTP N = 9 % = 4.2	ST SF NF NT SJ SP NP NJ	116 20 16 61 102 34 39 38	54.46 9.39 7.51 28.64 47.89 15.96 18.31 17.84
EXTRAVERTS JUDGING	ESTJ N = 27 % = 12.7	ESFJ N = 6 % = 2.8	ENFJ N = 3 % = 1.4	ENTJ N = 12 % = 5.6	TJ TP FP FJ IN EN IS ES	121 56 17 19 51 88 26 48	56.81 26.29 7.98 8.92 23.94 41.31 12.21 22.53

Number of students = 213

expecting program managers to seek them out.

A few notes of caution are provided in conclusion. First, as discussed earlier, the program manager often adjusts his personality to fit the situation and, therefore, one should not jump to a quick decision on the personality type of a particular program manager. Second, although the data indicate that approximately 30 percent of the students surveyed are ISTJ types, one should not assume that this is the most preferred type for a program manager. The literature is silent with respect to quantifiable data on what constitutes the optimum personality type for effective program managers. Third, the MBTI is gaining a lot of acceptance; however, follow-on effort is needed to fully validate the tool.■

Notes

1. Report of the DOD Joint Service Task Force on Software Problems, Deputy Under Secretary of Defense, Research and Advanced Development, July 30, 1982.
2. "Ada" is a registered trademark of the U.S. Department of Defense.

Table VI. Results of Myers-Briggs Test on Program Management Course (Class 83-2) Students at DSMC

		SENSING TYPES		INTUITIVE TYPES				
		WITH THINKING	WITH FEELING	WITH FEELING	WITH THINKING		NUMBER	PERCENT
INTROVERTS	JUDGING	ISTJ N = 50 % = 26.2	ISFJ N = 10 % = 5.2	INFJ N = 2 % = 1.0	INTJ N = 21 % = 11.0	E I S N T F	68 123 110 81 159 32	35.60 64.40 57.59 42.41 83.25 16.75
INTROVERTS	PERCEPTIVE	ISTP N = 14 % = 7.3	ISFP N = 2 % = 1.0	INFP N = 6 % = 3.1	INTP N = 18 % = 9.4	J P IJ IP EP EJ	127 64 83 40 24 44	66.49 33.51 43.46 20.94 12.57 23.04
EXTRAVERTS	PERCEPTIVE	ESTP N = 7 % = 3.7	ESFP N = 0 % = 0	ENFP N = 7 % = 3.7	ENTP N = 10 % = 5.2	ST SF NF NT SJ SP NP NJ	94 16 16 65 87 23 41 40	49.21 8.38 8.38 34.03 45.55 12.04 21.47 20.94
EXTRAVERTS	JUDGING	ESTJ N = 23 % = 12.0	ESFJ N = 4 % = 2.1	ENFJ N = 1 % = 0.5	ENTJ N = 16 % = 8.4	TJ TP FP FJ IN EN IS ES	110 49 15 17 47 76 34 34	57.59 25.65 7.85 8.90 24.61 39.79 17.80 17.80
							Number of students = 191	

3. Carl G. Jung, "Psychological Types," *The Collected Works of C. G. Jung*, ed. R.F.C. Hall, Volume 6 (Princeton, N.J.: Princeton University Press, 1971).

4. Isabel Briggs with P. B. Myers, *Gifts Differing*, (Palo Alto, Calif.: Consulting Psychologists Press, 1980) pp. 1-9.

5. David Keirsey and Marilyn Bates, *Please Understand Me*, (Del Mar, Calif.: Prometheus Nemesis Books, 1978) p. 25.

6. Isabel Briggs Myers, *The Myers-Briggs Type Indicator*, (Palo Alto, Calif.: Consulting Psychologists Press, 1962).

7. Kenneth E. Nidiffer and David D. Acker, "Program Managers Support System: Serving the Manager in Decision-Making," publication pending, Defense Systems Management College.

8. Mary H. McCaulley *et al.*, "Applications of Psychological Type in Engineering Education," *Engineering Education*, February 1983.

Table VII. Contribution Made by Each Preference to Each Type

		CLASS (% PREFERENCE)			
TYPES	NOMINAL %	ICAF	82-2	83-2	84-1
ISTJ	4.7	38.5	26.2	26.2	29.1
INTJ	1.6	7.7	13.1	11.0	9.4
ESTJ	14.1	17.8	15.2	12.0	12.7
ENTJ	4.7	9.1	11.5	8.0	5.6
ISFP	4.7	0.5	1.0	1.1	1.9
INFP	1.6	1.4	1.6	3.1	3.8
ESFP	14.1	0.5	0.5	0.0	1.4
ENFP	4.7	1.4	1.6	3.7	1.0

National Science Center to be Built at Fort Gordon, Georgia

Secretary of the Army John O. Marsh, Jr., and Mr. Harry J. Gray, Chairman of the Board, National Science Center for Communications and Electronics Foundation, Inc., have formalized an agreement between the U.S. Army and the Foundation for the construction of a national center dedicated to enhancing communications and electronics technology, education and educational research into interactive learning. The center has been conceived as a highly participative educational tool, with a national outreach, to serve the needs of both the public and private sectors, adapting its various programs to reflect current progress in science and technology.

The formal agreement states the Foundation will build the center in Augusta, Georgia, on Fort Gordon and, upon completion, donate it to the U.S. Army to operate. Fort Gordon was selected jointly by the Department of the Army and the Foundation, because it is the home of the largest communications and electronics training complex in the free world. The agreement was signed July 19, 1984 at a Pentagon ceremony. In addition to Mr. Gray, who is the Chairman and Chief Executive Officer of United Technologies Corporation, the Foundation was represented by their President and Chief Executive Officer, Mr. Thomas A. Pyle and Secretary, Mr. Albert Schwartz.

The Foundation, a non-profit private organization, is dedicated to establishing this national focal point for the primary purpose of promoting science and technology across the United States. Their efforts are directed at supporting Concurrent Resolution 130, passed by the United States Congress on 13 December 1982 which, "encourages the establishment within the United States of a center dedicated to communications and electronics." Although the Foundation will donate the center to the U.S. Army to operate, they plan to remain as principal advisors on the programs and curriculum developed at the center to ensure the national needs are being met. The Foundation, composed of distinguished leaders from industry, academia and government, has its offices in Burke, Virginia.

The center, a multimillion dollar facility, will include: a Main Exhibit Hall, featuring nine interactive participative exhibit galleries covering the communications and electronics fields; and Learning and Information Network Center (LINC), a national distribution system, using a fully interactive computer controlled telecommunications network, for the production/acquisition, delivery and management of improved communications and electronics training and educational materials; a large screen theater used to show films relating to the communciations and electronics fields; and a Research Program consisting of ongoing studies in the areas of interactive learning.

The center will provide the general public the opportunity to learn about science and tehnology and the importance of both to the economy and national security of the United States. The center will help maintain the United States' position as a world leader in science and technology. ■

In Memoriam

Commander William E. James, U.S. Navy October 1937 - July 1984

PMC 84-1 graduate and Section Leader for students of Section "C" died Sunday, July 1, 1984, in Washington, D.C., as the result of a heart attack. Commander James returned to the Naval Electronics Systems Command for duty as Deputy Director for Systems Engineering. Grave site services were held July 5 at Arlington National Cemetery. Commander James is survived by his wife Carole, son William, and daughter Christina. They reside in Burke, Va.

ALUMNI

DSMC Alumni Association Well into First Year; Seeks to Expand Membership

The Defense Systems Management College Alumni Association was founded October 20, 1983, at Fort Belvoir, Virginia, by more than 60 graduates representing virtually every Program Management Course (PMC) class. Membership has since grown to more than 500 members from throughout the defense acquisition community.

The Association provides a forum for developing the professional growth of the defense acquisition community, and will also provide a resource of experienced acquisition management professionals available to contribute to the growth and effectiveness of DSMC.

Activities include a quarterly newsletter and annual Program Manager's Symposium.

All those eligible are invited to apply for membership in the appropriate category below.

Regular Member:
PMC graduate, or DSMC faculty/staff at least 2 years.

Associate Member:
Short course graduate, or DSMC faculty/staff less than 2 years, or others holding key defense acquisition program management positions.

Dues Structure

(Membership year: 1 Oct thru 30 Sep)

Month of Application	Dues	Membership Period Covered
Oct-Dec	$5.00	Through 30 Sep of following year
Jan-Jun*	$5.00	Through 30 Sep of current year
Jul-Sep	$7.50	Through 30 Sep of following year
*PMC ____-1 graduates	$7.50	Through 30 Sep of following year

"Only Regular Members shall be entitled to vote, hold elected office or be appointed to chair a standing committee of the Association. Associate Members may nominate candidates for office, and serve as committee members, but may not vote, except that Associate Members shall from their group elect a representative to serve on the Board of Directors." (Constitution, Article IV. C.)

Please Take a Few Moments and Fill out this Application

7/84

Name (last, first, m.i.)_____ Rank _____

Service/Agency/Company _____

PMC Class _____

Faculty/Staff Position and Years_____

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Current Title/Position _____

Preferred Mailing Address _____

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Telephone (Home)_____(Office) _____

Mail with check to DSMC Alumni Association, Ft. Belvoir, VA 22060

☐ Regular Member ☐ Associate Member

Committees you are interested in:

☐ Membership ☐ Symposium ☐ As Needed
☐ Constitution Operating Procedures ☐ Publications ☐ Nominations/Elections
☐ Publicity/PR

☐ Other _____

_____

Searching for Excellence

in the Program Office

A look at the way successful program managers manage—and an analysis of the attributes they share.

Patricia A. Kelley

Late last year, a DSMC research team made up of J. Stanley Baumgartner, Calvin Brown, and myself completed a study of a selected number of successful defense acquisition programs. Our purpose was to determine if there were any particular management characteristics common to these programs. In other words, we wanted to know why these programs were more successful than others. We were looking for "keys to success" for major acquisition programs. The results of that study are summarized in the January-February issue of *Program Manager* ("Successful Programs: Can We Learn from Their Experience?").

My purpose here is to look more closely at (1) the management styles and techniques that tend to characterize successful programs, and (2) the attributes successful program managers said they would look for in selecting a new PM.

MANAGEMENT STYLE

In their book, *In Search of Excellence*, Thomas J. Peters and Robert H. Waterman, Jr., developed eight attributes of successful companies. Many of the eight attributes are applicable to the 12 successful defense acquisition programs we studied.

The eight attributes from *In Search of Excellence* are as follows:

1. *A Bias for Action*: "management by walking about" (MBWA); informed exchanges; positive reinforcements; chunking (*ad hoc* task forces); project teams and project centers; experimentation; making decisions.

2. *Close to the Customer*: service; measurement and feedback systems; programs for people (incentives, training, hoopla); quality obsession; "nichemanship"; listening to the users.

3. *Autonomy and Entrepreneurship*: entrepreneurial spirit encouraged; autonomy far down the line; intense communication; toleration of failure; focus on keeping bureaucracy limited.

4. *Productivity Through People*: treating people as adults, partners, with dignity and respect; people programs; MBWA; open door policy of supervisors; extended family; informality; information provided to the ranks; positive reinforcement; less layering; smallness.

5. *Hands-On, Value-Driven*: attention to values; clearness of position; values stated in qualitative rather than quantitative terms; efforts to inspire people at the very bottom of the organization; expectation of excellence; highly visible and accessible leaders who listen and keep people informed; senior managers who set the tone; regular meetings; leaders unleashing excitement.

6. *Stick to the Knitting*: staying close to central skill when diversifying; internal growth; tiny acquisitions.

7. *Simple Form, Lean Staff*: matrix not used (except for Boeing); flexible; able to reorganize frequently and fluidly; authority pushed far down the line; few people at corporate level; functions decentralized; few career "staffers"; habit-breaking structural techniques.

8. *Simultaneous Loose-Tight Properties*: rigidly controlled yet allowing autonomy, entrepreneurship and innovation; stern disciplinarians; small, quality, excitement, autonomy, and efficiency; "rules" have a positive cast—focus on building, expanding; simultaneously internally and externally focused.

Even though Peters and Waterman concentrated mainly on private industry and their commercial efforts, we found examples in our DOD programs to support each of their attributes of excellence.

A Bias for Action

Several of our managers mentioned the importance of making a timely decision. They said it is impossible to wait for perfect knowledge. It is better to make a timely decision rather than the "right" decision. If the PM waits to make a decision, it will be made for him and that decision may be one that is difficult to live with.

In terms of "management by walking about," it takes time; it takes the ability to either clear one's calendar or set aside specific time periods to walk around the office or plant to visit the people who work for you. This idea was exemplified by the manager of one of the earliest programs we studied. He would visit the contractor's plant, visit the floor, talk with the workers and their families, talk to community leaders; he would have open houses for his staff and meet with their families. The open houses helped the families to under-

■ *Ms. Kelley is a Professor of Systems Acquisition Management in the Research Directorate, Department of Research and Information, at DSMC.*

stand the importance of the job of their spouse or parent.

Close to the Customer

The PMs we interviewed recognized that the user will determine product acceptance and product success. Sixty-eight percent of the PMs said that "works well when fielded" is the most important factor as a measure of program success. The users are the ones who determine if the system works well. The PM responds to the needs of the user and listens to him; but there are times when the PM must explain to the user why it is not possible, given limited resources and time, to do all that he asks. In those cases, it is important for the PM to be sensitive to the needs of the user and provide him with alternatives that may satisfy the requirements.

In addition to the user being the customer of the acquisition command, the service is the customer of the contractor. The contractor PMs interviewed stressed the importance of maintaining a good relationship with their customer and being responsive to his needs. Several mentioned that a good relationship was so important that if someone on their team could not get along with the customer, that person would be transferred off the program.

Autonomy and Entrepreneurship

Every PM we talked to stressed the importance of good, open communications with their staff and their contractor. They know how important open communication is to get a job done well; almost all said that communication with their contractor was very good. Many of the PMs delegated the authority and responsibility of the everyday running of the organization to their subordinates, while providing overall guidance to their staff. Subordinates were given the opportunity and encouraged to make decisions. In one case, a PM even had lieutenants signing out letters to the contractors. With this delegation comes the possibility of mistakes. The PMs allowed their subordinates to make mistakes, but let it be known that the same mistake made again wouldn't be ignored.

Quotable PM Quotes

"The Golden Rule: He who has the gold, rules."

Productivity Through People

The No. 1 reason for program success is people. One of the most important jobs of the manager is people—getting good people to come to the program; making sure the job is interesting and challenging; providing responsibility and authority; helping people to move on to something better so the program, through its reputation for taking care of its own, can attract more good people; passing out smiling faces or attaboys; recognizing achievements through assembly of the program office staff; and allowing them to make decisions. One PM, when hiring someone new, would let the prospective employee know that he didn't want any "front porch rockers," but he would fully support the ones who worked in the "heat of the kitchen." The PMs provided their people with positive reinforcements, with strokes; they let them know that they were important to the success of the program; they promoted them or found them good jobs when their rotation came up.

Many PMs stressed their open-door policies. They gave their people responsibility and authority and expected them to use it; but if they ever needed help, the PM's door was open. They were encouraged to come in and talk.

Quotable PM Quotes

"Get rid of your 'not invented here' mindset."

Hands-On, Value-Driven

We didn't find any stories or myths related to these programs as you do for some companies, but we did find the PM inspiring people at the lowest level of the organization. As one PM said, "every worker counts." Taking time to talk to the secretaries and the plant workers and showing an interest in what they are doing is very important in building loyalty and *esprit de corps*. The more valued these people feel, the harder they will work, and the prouder they will feel about what they are doing.

Stick to the Knitting

DOD system program offices do this very well. They are usually organized to design, develop, and acquire a specific weapon system. Their duties may expand, such as having a group who handles P^3I, or new subsystems to be added, but this is still related to their primary purpose or function—acquire a weapon system.

Simple Form, Lean Staff

Even though most of the programs had a matrix organization, the PMs were able to reorganize to meet changing needs. Looking at just the program office itself, functions were decentralized and there were few people in the PM's office. There were few career staffers in the PMO. They were functional experts. Of course, this ignores the tremendous bureaucracy surrounding the program office.

Simultaneous Loose-Tight Properties

The PMs expected their people to come up with innovative solutions to problems, allowed them autonomy. Several PMs said that it was important for the PM to instill enthusiasm in his staff and get them excited about the task. Another PM said a PM should have the ability to recognize when to disregard directives and rules for the best interest of the program. The PMs are adept at being simultaneously internally and externally focused. They have so many eyes on them that much time is spent educating others about the program and collecting supporters and a constituency—from headquarters, services, OSD, Congress, and communities involved—that sometimes the PM is known as "Mr. Outside" and the deputy is known as "Mr. Inside."

As you can see, those qualities evident in successful companies are also evident in successful DOD programs.

The management styles of our PMs can also be compared with the results a government study conducted in 1981.

Other Successful Organizations

In 1981 Kenneth A. Gold prepared a study for the Office of Personnel Management entitled *A Comparative Analysis of Successful Organizations.* He examined some public and private organizations that were considered successful and developed a number of management "proverbs" based on what he found there. Many of these are basic management philosophies. Most of them were mentioned by our successful managers as being something they themselves follow or try to do as managers. Table I shows which of Gold's "proverbs" were specifically mentioned by the PMs involved in our DSMC study.

Quotable PM Quotes

"The enemy of good is better."

PROGRAM MANAGER ATTRIBUTES

The program manager's personal attributes are very important to the success of the program. The program's organizational climate takes on the attitude of the program manager. If he or she is enthusiastic, hard-charging, and success-oriented, the rest of the PMO staff also becomes that way. Success breeds success. "The program is the PM."

Richard C. Smith, in his article "Appraising the Successful Program Manager," [*Program Manager*, July-August 1982] lists the attributes of a successful PM as resourceful, observant, people-oriented, understanding of human behavior, receptive, dedicated, self-starting, healthfully skeptical, intuitive, energetic, an actor, logical, a good communicator, intelligent, creative, and professional, with good judgment and character.

Table I. Proverb

	YES	NO
Delegation of Authority and Responsibility		
—Delegate authority and responsibility to the lowest possible level.	X	
—The worker performing the actual job has the most knowledge about that job.		X
—Get the best people you can find; get agreement on objectives; then turn them loose to do their job.	X	
—Have confidence in your own people, and have the courage to stand back and let them make mistakes.	X	
Decision-making		
—Spread decision-making around. Give people the chance, and they will figure out ways to do things better.	X	
—Organizations should be designed to force decision-making as far down as possible.	X	
—If you dictate to people they will lose their initiative, and will become accustomed to waiting around for you to tell them what to do.		X
Participation and Involvement		
—Allow subordinates the chance to participate. People need to feel that they are a part of things.	X	
—Give people a job to do, but don't bury them with details.	X	
—Encourage people to ask questions.	X	
—Establish overall goals, but give people a chance to make mistakes. People must be able to see their successes and failures.	X	
—Involve people by keeping them informed.	X	
—Learn to communicate, and especially listen. Recognize that ultimately you have to get the work done through people.	X	
Trust and Integrity		
—Trust your own people.	X	
—Treat people with respect and dignity, the way you yourself would like to be treated.		X
—Be extremely honest with employees.	X	
—Demonstrate a sense of awareness and concern for others.	X	
—Demonstrate a commitment on the part of management to the highest ethical and moral standards.		X
—Be consistent, and set an example in everything you do.	X	

Quotable PM Quotes

"Good enough is good enough."

We asked both government and industry program managers what attributes or capabilities they would look for in selecting a PM. The 38 people who answered this question gave us 82 different answers. Those attributes mentioned by at least three people are the following:

Experience (12)
Technical background (12)
Leadership ability (10)
Ability to put a team together (6)
Honesty and integrity (9)
Intelligence (7)
Energy/drive (7)
Decisive (6)
Ability to get along with people (6)
Willingness and ability to communicate (6)
Good manager (6)
Willingness to accept responsibility and execute authority (5)
People skills (5)
Good business manager (4)
Operations experience (4)
Flexibility (4)
Tech background not necessary (3)
Mature and experienced judgment (3)
Generalist (3)
Problem-solving oriented (3)
Strong internal discipline (3)
Articulate (3)
Delegator (3)
Willingness to take risks (3)

Experience

As one PM said, being scarred is important to future success. Having experience and a background in acquisition is essential. Decisions are based on judgment gained through experience. Experience and background include knowledge gained through actual on-the-job acquisition work and schooling. Understanding organizations and interrelationships, knowing how outside organizations and personnel systems operate, having a working knowledge and understanding of how the acquisition system really works, having Pentagon

Kenneth A. Gold, "A Comparative Analysis of Successful Organizations," Office of Personnel Management, July 1981, pp. 31-33.

	Yes	No
Objectives and Mission		
—Organizational objectives should be realistic, clearly understood by everyone, and should reflect the organization's basic character and personality.		X
—Employees must feel that their organization has a mission, and that they are helping to accomplish that mission.	X	
—Help people understand what their objectives are, and make sure that they have the tools, guidance, and *freedom* to do their job.		X
—Make individual goals high but attainable.		X
Challenge and Enthusiasm		
—Operate with a lean staff. People need to be challenged with plenty of work.		X
—Offer people new challenges and experiences whenever possible.	X	
—Ensure that their jobs are as interesting as possible within the task.	X	
—Generate enthusiasm at all levels. Managers should not only be enthusiastic themselves, but must also foster enthusiasm in others.	X	
—Inspire people.	X	
—Be willing to take risks.	X	
Employee Development		
—Make a commitment to train and develop people.	X	
—Help people recognize their own capabilities.	X	
—Promote from within whenever possible.	X	
Performance		
—Be hard-nosed with poor performers.	X	
—Raise poor performance issues immediately.	X	
—Don't beat around the bush—be direct.	X	
—Don't concentrate your efforts on the 8% of employees who are weak.		X
Openness and Informality		
—Keep things informal and open, and be accessible. Pomp and ceremony only serve to get in the way.	X	
—Status symbols, dress codes, and formality are things that encumber an organization, and are artificial and extraneous to what the organization really does.		X
—Have fun.	X	

experience and knowing the key operators in the system, knowing how to do things in Washington and knowing whom to trust—these are all part of experience gained during years of performing jobs within the acquisition system. This experience comes from jobs in program offices, at headquarters, and at the Pentagon. Knowledge obtained in each assignment helps the future program manager in the job of managing the acquisition of a weapon system.

Technical Background

Twelve people said that being an engineer or having a technical background was important to a program manager. But three people said that a technical background was not necessary, including a two-star program manager who has been the PM of several programs. He said you can get a good PM from any background, not just technical. It is more attitudinal than anything else. Another said that acquisition is business; the PM is a business manager and he or she does not have to be an engineer. A retired three-star general who was in charge of program managers before his retirement said that a PM does not have to be an engineer. The answers from those who said a technical background was good ranged from "must be an engineer" to "have a technical background" and "be technically qualified." Almost all the PMs we spoke with had been engineers.

Leadership

Leadership is an important intangible that has to be there. "There is a world of difference between those with leadership ability and those without." If you lead properly, you can get results from the unlikeliest people. "Inspiration comes from above—not below." A leader instills loyalty; a leader motivates the people to do what he wants done without having to resort to coercion or force. Most of the PMs differentiated between leadership and management. Some mentioned both leadership and management ability; some only mentioned one or the other. Note also that 12 said leadership ability is important, six said being a good manager is important, and four said being a good buisness manager is important.

Quotable PM Quotes

"If you make the decision on my program, then you accept the consequences."

Ability to Put a Team Together

I think this attribute is closely aligned with both leadership and management. Everyone recognized that the program office should be a team. Management skills are important in recognizing what needs to be done, which capabilities are necessary, who can handle which job, and which resources are to be used. Leadership plays an important role in the motivation of the team, team playing, and getting the job done.

Honesty and Integrity

Integrity means "soundness of moral character; honesty." Honesty means "truthfulness, sincerity, integrity." The words are synonymous. The PMs mentioned such things as being honest with oneself; being straightforward; dealing with superiors honestly and candidly; and being sincere. Honesty and integrity tie in with one PM's management style of not sweeping things under the rug, but bringing them out into the open and solving them. Also, several PMs mentioned keeping their staff informed of not only the bad things but also the good things. Share your success and failures with your people. It makes them feel that they are important and are truly a part of the program.

Quotable PM Quotes

"Rule: Don't sweep anything under the rug."

Intelligence

Naturally. The job of program manager requires the ability to "keep track of" and "stay on top of" many things at a time. As one PM put it, the PM and staff often get caught up in the "35-balls-in-the-air syndrome." There is so much going on at any one time, it is often difficult to pay attention to all of them. A smart PM has foresight to understand problems and weigh consequences; can look downstream for the effect of decisions made; is resourceful; able to absorb and integrate the many facets of the program into a cohesive acquisition strategy; is able to see the big picture or total program objectives and see how trade-offs will work.

Energy and Drive

The PM must put in long hours and long weekends, and must be totally dedicated to the program: One has to *want* to be a PM. He must understand what is needed, must be willing to do more than just get the job done, and be one who won't accept a mediocre product. The good PM works the problem to a satisfactory conclusion. The PM must be willing to concentrate and expend mental effort and discipline to get into things in order to make decisions; must have the desire to get the job done; must have the capacity for dealing with a lot of detail.

Decisive

This attribute was mentioned by six PMs. They said: "be reasonably decisive," "handle emergencies decisively," "be able to make decisions on diverse subjects," "be a quick and good decision-maker." Not much else can be said for this attribute. The PM must make decisions, every day, some of which won't be popular. The PM must be strong enough to make those decisions, even unpopular decisions, and make them in a timely manner, often with insufficient data.

Ability to Get Along with People and Willingness and Ability to Communicate

These are self-explanatory. The contractor PMs emphasized that the PM must get along with the "customer"—the government program office. We all know the importance of communication—speaking and listening. Most of the government PMs said openness with the contractor was a reason for the success of their program, and almost all of them said that communications with their contractors were excellent. One stressed that the government and industry PMs on a program must communicate often, especially when there are problems. The greater the communication, the simpler becomes the resolution of the problems. Several PMs mentioned as attributes the ability of the PM to communicate in lay terms, and to communicate effectively with diverse functional groups.

Willingness to Accept Responsibility and Execute Authority

Sometimes one hears the comment that PMs don't have the authority they need. One PM of an aircraft program told a young PM, who later became the PM of another aircraft program, "Don't let anybody kid you. Any PM has as much authority as he is willing to step up and take." Another PM of a Navy missile program demonstrated that fact during his tenure as a PM. His comment was, "When delegated authority, take it and use it." The PM is in charge of the program even though there are many others who have their hands on it too. But the one person everyone points to as being responsible is the PM. The PM often must take risks for the good of the program and not worry about his career.

The remaining attributes of our list are fairly self explanatory—people skills, operations experience (better able to understand the system), flexibility (ability to roll with the punches), mature judgments (based on experience), generalist, problem-solving oriented, strong internal discipline, articulate, delegator, and willingness to take risks.

But this list is too cumbersome to remember or try to apply. Try these:

- Acquisition background
- Leadership qualities
- Managerial ability
- Integrity
- Communication skills
- People skills

All of these six attributes must be worked at, but they are achievable. If you are young and are just starting out in the acquisition "business," start developing them. If slightly older, assess your strengths and weaknesses and build on the strengths and modify the weaknesses.

In many cases in this article, I have given you the actual words used by the managers in answering the interview questions. In every case, they enjoyed their jobs and the challenges they afforded. They wanted to be PMs; they were enthusiastic about their programs; they were patriotic; and they were men trying to do a good job for their service and their country. ■

Table II. PM Interviews

Government PMs Interviewed

Lieutenant General James Abrahamson, USAF	F-16
Rear Admiral John D. Beecher, USN	FFG-7
Lieutenant General John Buck, USAF	E-3A
Colonel Stanley Cass, USA	Hellfire
Colonel August Cianciolo, USA	MLRS
Colonel John Chesbro, USA	Firefinder
Colonel Max Hammond, USAF	C-141
Colonel Monte Hatchett, USA	MLRS
Brigadier General J. M. Hesson, USA	CH-47
Colonel D. T. Irby, USA	CH-47
Rear Admiral Wayne E. Myer, USN	CG-47
Major General George Monahan, USAF	F-16
Rear Admiral Ed Otth, USN	FFG-7
Lieutenant Colonel Norbert Patla, USA	CH-47
Admiral W. F. Raborn, USN	Polaris
Captain David Stembel, USN	FFG-7
Vice Admiral Levering Smith, USN	Polaris
Colonel E. B. Stringer, USAF	C-141
Major General William E. Thurman, USAF	F-16
Colonel Walter H. Williamson, USAF	BMEWS

Deputy PMs Interviewed

Mr. John Clark	CH-47
Mr. James Collie	FFG-7
Mr. Anthony Ditrapani	FFG-7
Mr. John Herrity	Hellfire
Colonel Donald Koretz, USAF	E-3A
Mr. Larry Seggel	MLRS

Contractor PMs Interviewed

Mr. Frank Berger	Ingalls Shipbuilding	CG-47
Mr. J. R. Dempsey	Boeing	Atlas
Mr. William Haggett	Bath Iron Works	FFG-7
Mr. D. B. Holmes	Raytheon	BMEWS
Mr. William T. Odlum	Hughes	Firefinder
Mr. E. K. Ossorio	Martin Marietta	Hellfire
Mr. John Songster	Rockwell International	Hellfire
Mr. Ward E. Squires	Todd Seattle	FFG-7
Dr. Derald Stuart	Lockheed Missile	Polaris
Mr. Lynn Thorell	Todd L.A.	FFG-7
Mr. Charles Wagner	Lockheed	C-141
Mr. Gordon Urquhart	Boeing	E-3A
Mr. Al Yee	Vought	MLRS

The Nuts and Bolts of Procuring Spare Parts

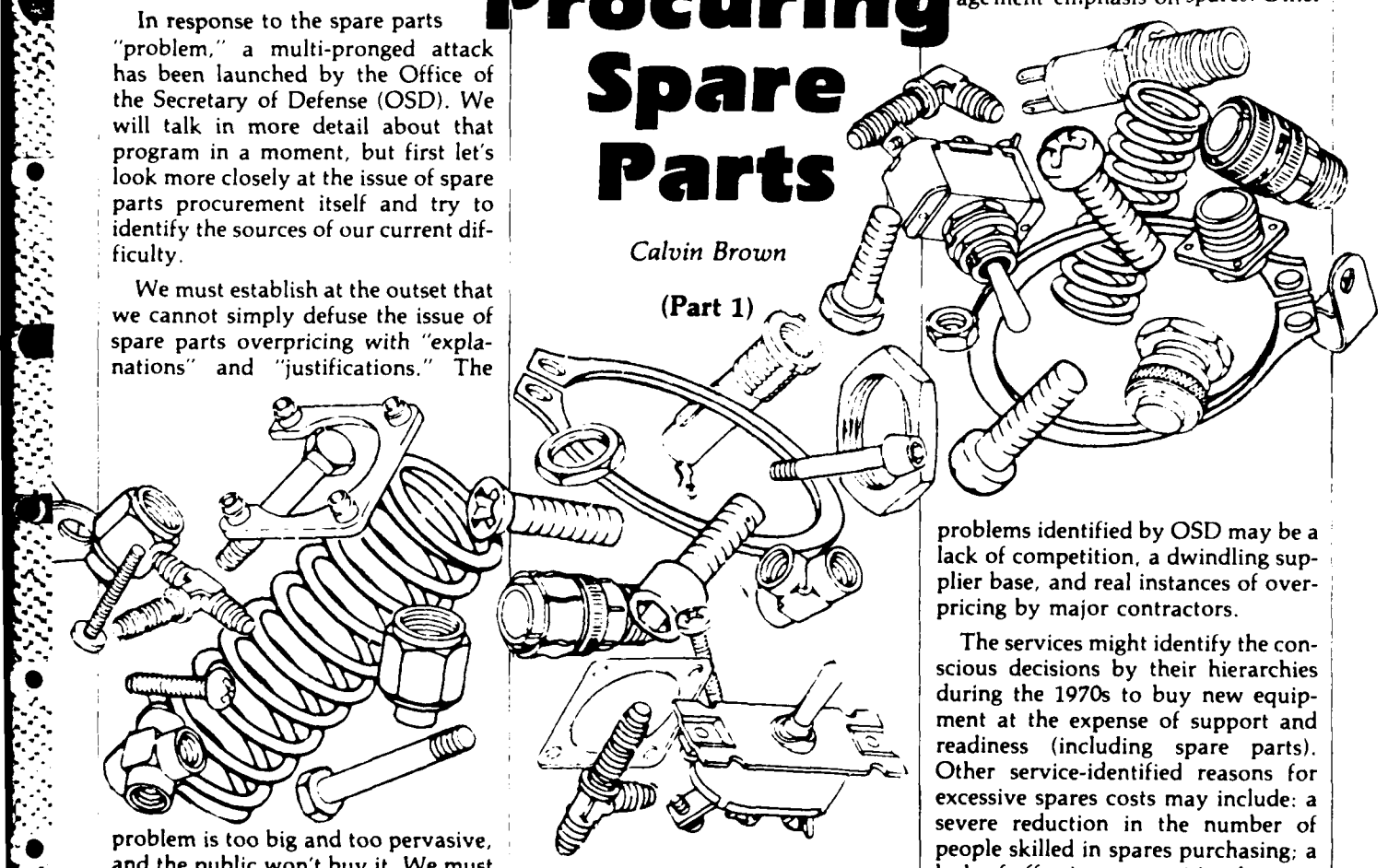
Calvin Brown

(Part 1)

One of the recurring defense-related news items of the past year and a half has been the pricing of spare parts. Bills of $1,100 for a plastic cap for the leg of a stool, $425 for a hammer, $110 for a diode, $9,600 for an Allen wrench, $337 for a nut, and $37 for a screw are sure to get the public's attention and to prompt questions about DOD's ability to manage its business. And rightly so. The public may not be able to grasp the reality of a $22 billion budget for spares, but it does recognize a reasonable price for common household items. The public also appreciates the value of comparison shopping, which it perceives DOD to generally avoid.

In response to the spare parts "problem," a multi-pronged attack has been launched by the Office of the Secretary of Defense (OSD). We will talk in more detail about that program in a moment, but first let's look more closely at the issue of spare parts procurement itself and try to identify the sources of our current difficulty.

We must establish at the outset that we cannot simply defuse the issue of spare parts overpricing with "explanations" and "justifications." The problem is too big and too pervasive, and the public won't buy it. We must face the fact that there are thousands, or perhaps even hundreds of thousands, of parts for which the government may very well be paying too much. There are many more cases of "apparent" overpricing on items that are, in fact, reasonably priced, but this should not blind us to the very real problems we face in this arena. I will focus in this article on some cases of, and reasons for, this "apparent" overpricing, but I do so in an effort to shed light on often overlooked aspects of the spares procurement process rather than in an attempt to dismiss media criticism as unwarranted. After all, we have to recognize the existence of a problem before we can begin to solve it. With that as a prologue, we may now examine the spares procurement process in more detail.



One of the reasons for real problems in buying spares is the sheer magnitude of the effort. DOD must maintain an inventory of more than 3.4 million different types of parts, and it issues some 13 million separate contract actions for spares each year. The Department will spend about $22 billion for spares in FY 84 and about $25 billion in FY 85. The Air Force alone manages some 835,000 spare parts with an inventory value of more than $38 billion. It would be remarkable indeed if there were not occasional foul-ups and "dumb" mistakes made in an effort this large.

Other reasons for the spare parts problem can be identified, but they vary depending on whom you talk with. At OSD level, for example, you may be told that the problem is with the services in their lack of high-level management emphasis on the entire spare parts procurement process, and in their misuse of basic ordering agreements (BOAs). You may also hear the major defense contractors criticised for their lack of management emphasis on spares. Other problems identified by OSD may be a lack of competition, a dwindling supplier base, and real instances of overpricing by major contractors.

The services might identify the conscious decisions by their hierarchies during the 1970s to buy new equipment at the expense of support and readiness (including spare parts). Other service-identified reasons for excessive spares costs may include: a severe reduction in the number of people skilled in spares purchasing; a lack of effective competition because of restrictive data rights; a constricted industrial supplier base; poor requirements forecasting and pricing capability owing to obsolete automatic

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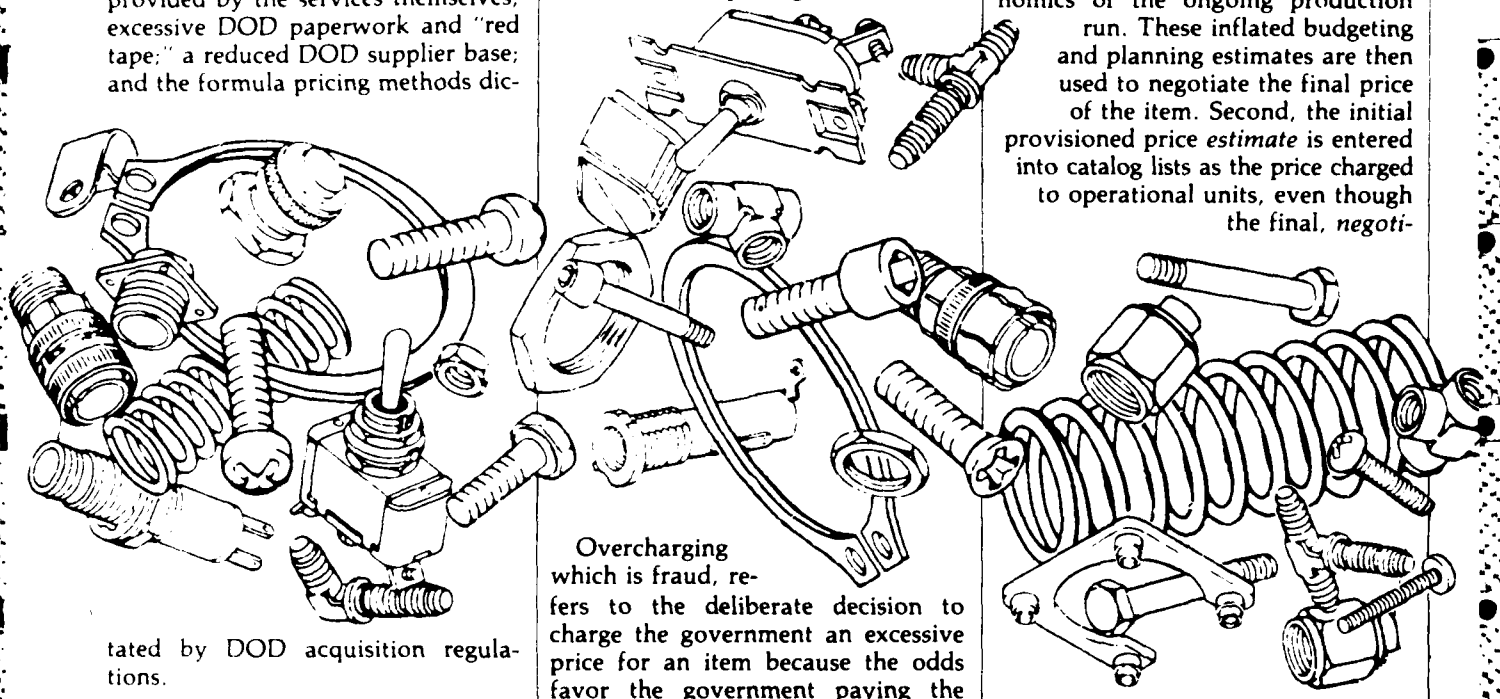
data processing (ADP) equipment; the need for highly reliable and safety-critical parts, meaning stringent specifications and reliance on certain suppliers; and the loss of unit price integrity for spare parts because of cost allocation methods.

If you ask a defense contractor for his opinion of the spares situation, he will likely say that the problem is micromanagement by the Congress and DOD; failure of DOD to buy in economic order quantities; a lack of skilled procurement personnel in DOD, requiring the contractor to perform many functions (at additional overhead) normally expected to be provided by the services themselves; excessive DOD paperwork and "red tape;" a reduced DOD supplier base; and the formula pricing methods dictated by DOD acquisition regulations.

A member of the small business community might complain that there is a lack of opportunity to compete for spare parts business caused by "greed" on the part of "big business"; a lack of adequate data and data rights on the part of the services, and the myriad "red tape," including prequalification requirements, associated with all government procurements.

Overpricing vs. Overcharging

Before we begin this section, it may be worthwhile to distinguish between what I call "overpricing" (apparent and real) and "overcharging." Overpricing results primarily from a contractor's cost-allocation method whereby he evenly distributes his total overhead costs over all items, both expensive and inexpensive. This distorts the prices charged for individual items, especially low-value items. The results—loss of unit price integrity—is the cause of most of the spectacular headlines and recent attention from the press. This phenomenon is *apparent* overpricing, and we will consider it in detail later. Overpricing also occurs when prime contractors simply act as "middlemen" between vendors or subcontractors and the government buyers. The prime contractors charge overhead and profit, but they add no value to the purchased items. This phenomenon is *real* overpricing.



Overcharging which is fraud, refers to the deliberate decision to charge the government an excessive price for an item because the odds favor the government paying the price rather than questioning or auditing it. It is important to note that few of the "horror stories" reported by the press involve overcharging.

The Reality and the Perception

There can be little doubt that all of the causes listed above for excessive spares cost contribute, in varying degrees, to the problems. As noted at the outset, one of the purposes of this article is to explain why some of the spare parts prices quoted in news stories are not as excessive as they may seem, if at all. There are actually several reasons for this phenomenon. To do this, it will be necessary to briefly look at the way the services buy parts.

Provisioning

When a new weapon system enters the inventory, an initial buy of spare parts is made through a process that is shown, in a simplified way, in Figure 1. The provisioned item orders (PIOs), which are the contractual instruments used to order initial spares from the prime contractor, are based on *estimated* prices. The contractor is allowed to proceed with production before establishing a firm price. This process provides the potential for two types of price distortion. First, contractors are instructed to provide PIO estimates without regard to minimum-buy quantities or the economics of the ongoing production run. These inflated budgeting and planning estimates are then used to negotiate the final price of the item. Second, the initial provisioned price *estimate* is entered into catalog lists as the price charged to operational units, even though the final, *negotiated* price may be far lower. Because of antiquated automated data processing equipment within the services, there is often a significant time lag in updating the catalog price.

Replenishment

Organizations called inventory control points (ICPs) are responsible for logistically supporting operational weapon systems. ICPs acquire replenishment spares by either using a contract type that establishes definite delivery requirements, or by using more flexible instruments under which separate orders can be placed as firm requirements are identified. The main types of flexible instruments are as follows: blanket purchase agreements (BPAs), which are

similar to a charge account, and under which orders can be placed orally or in writing; identified-delivery-type contracts in which firm prices are established and orders are placed as the quantity or delivery requirements become known; and basic ordering agreements (BOAs), which cover terms, conditions, and pricing arrangements under which the individual contracts (orders) are to be made.

Pricing Methodology

Acquiring spare parts for a major system from the prime contractor may involve hundreds or thousands of parts. Pricing on other than an individual-item basis is often necessary because of the immense workload. A systematic basis for pricing the parts is sometimes used, such as military price lists, standard costs, or formula pricing.

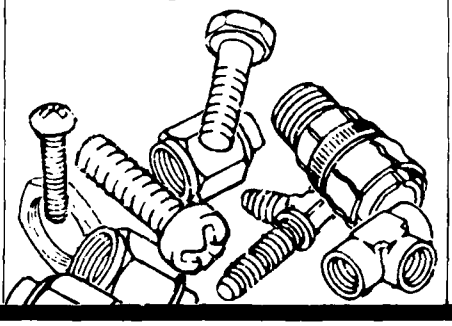
Military Price Lists

Military price lists of noncommercial items are normally established through negotiation of a representative sample selected at random from the price list. Sample prices are audited to establish the government negotiation position for the entire price list. For example, if after negotiations, a 15 percent reduction of the sample is agreed to, all list prices are reduced by 15 percent.

Standard Costs

Standard costs are developed on the basis of work-measurement studies for the production of selected parts, which, in turn, results in the initial price. Actual costs for producing these parts are collected during the accounting period and compared to agreed-upon standard costs. Any difference between actual and standard costs is known as a variance. Variance from the standard cost is generally validated and considered in the negotiations for the next pricing period.

We must face the fact that there may be thousands of parts for which the government is paying too much.



Formula Pricing

Formula pricing distributes costs systematically over all items. Factors such as labor rates, overhead rates, scrap rates, and profit are negotiated with the contractor. These rates are then applied to the number of labor hours agreed upon and to the cost of materials. In this method of cost allocation, an item may be assessed a share of the costs not specifically allocated to it. Thus, the item may appear to be overpriced. Conversely, an item may not be assessed its full share of the overall costs. That item would appear to be underpriced. The overall result is, while the total price of the contract may be fair and reasonable, some items will appear overpriced and some will appear underpriced. An example of the effect on unit price when this allocation method is used, is shown in Table I—the case of how a 4-cent diode costs $110. In this case, two diodes and six power supplies were bought on the same purchase order.

Figure 1. Simplified View of the Provisioning Process

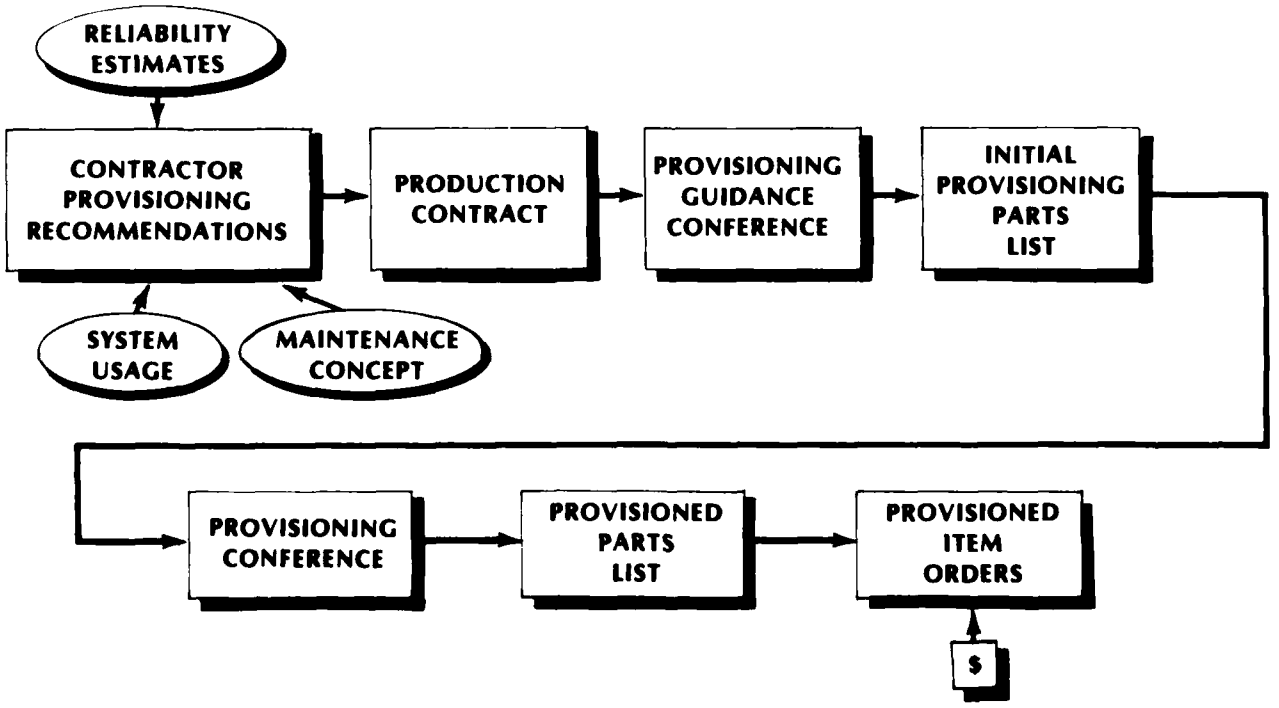


Table I. How a Four-Cent Diode Costs $110

Example A
Material Handling Labor Hours
Prorated on Basis of Total Purchased Parts Cost

	Diode		Power Supply
Purchased Parts 2 @ $.04	$ .08	6 @ $100	$ 600.00
Direct Labor Negotiated 4.5 hours @ $18.00	81.00		81.00
Overhead @ 94%	76.14		76.14
Total Mfg Cost	$157.22		$ 757.14
G&A @ 21%	33.02		159.00
Subtotal	$190.24		$ 916.14
Profit @ 16%	30.44		146.58
Total Prices $	$220.68		$1,062.72
Unit Price	$110.34		$ 177.12

Example B
Material Handling Labor Hours
Prorated on Basis of Total Purchased Parts Cost

	Diode		Power Supply
Purchased Parts 2 @ $.04	$ .08	6 @ $100	$ 600.00
Direct Labor	.20		161.98
Overhead @ 94%	.02		152.26
Total Mfg Cost	$ .12		$ 914.24
G&A @ 16%	.03		191.99
Subtotal	$ .15		$1,106.23
Profit @ 16%	.03		176.99
Total Prices	$ .18		$1,283.22
Unit Price	$ .09		$ 213.87

TOTAL PRICE COMPARISON

	Diode	Power Supply	Total
Example A	$220.68	$1,062.72	$1,283.40
Example B	$ .18	$1,283,22	$1,283.40

NOTE: Under either method of allocating material handling labor hours, the total price is the same.

Apparent overpricing also arises when spare parts are bought in small quantities, particularly when those parts haven't been procured for several years and equipment set-up costs are incurred. Another instance of apparent overpricing occurs when we order parts through a prime contractor, who then performs several services for the government such as receiving inspection, quality assurance, configuration management, packaging, and shipping. Although the prime contractor may charge a fair price for his services, the final price to the government often appears higher than the intrinsic worth of the parts.

What is Being Done?

After looking at the spare parts procurement problem, and various perceptions of its causes, it is appropriate for us to look at what those involved—Congress, OSD, the services, and industry—are doing to solve it.

Congressional Initiatives

During 1983 and 1984, Congress conducted numerous hearings directed at the spare-parts procurement problem. Many witnesses from the Government Accounting Office, DOD, and industry were heard.

As a result of the 1983 hearings, the media attention, and other data available to Congress, the FY 84 Defense Authorization Bill, Public Law (PL) 98-94, mandated the following actions:

—By December 1, 1983, the Secretary of Defense was to submit an interim report on DOD actions to improve the acquisition and management of spare parts;
—By January 22, 1984, the Secretary of Defense was to issue regulations prohibiting the purchase of spare parts that had a price increased over some "to be determined" amount;
—By June 1, 1984, the Secretary of Defense was to submit a final report on DOD management of initial and replenishment spares.

Public Law 98-191, re-establishing the Office of Federal Procurement Policy (OFPP), directed OFPP to review the DOD's spare parts procurement process and submit a report to Congress by June 1, 1984.

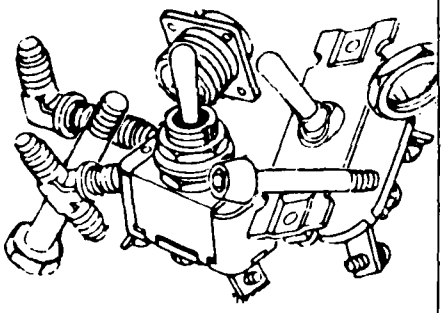
The FY 84 Defense Appropriation Bill (PL 98-212) provided $15 million and 700 additional manyears, allocated equally to the services, for managing spare-parts acquisition. In recent months, numerous bills have been introduced in both Houses of Congress that sought to improve DOD's spare-parts procurement process by increasing competition, restricting industry's data rights, and increasing small-business participation.

OSD Initiatives

The Secretary of Defense (SECDEF) issued Defense Acquisition Regulation (DAR), Supplement Number 6, "DOD Replenishment Parts Breakout Program," dated June 1, 1983. The purpose of this program is to "breakout" spare parts from the prime contractor so those parts may either be competed on future buys, or bought directly from the original equipment supplier. Two major OSD spare-parts policy initiatives are contained in the memoranda issued by

Defense Secretary Weinberger on July 25 and August 29, 1983. The July 25 memorandum, "Spare Parts Procurement," directed a 10-point program intended to prevent price abuses in spare-parts purchases. The August 29 memorandum, "Spare Parts Acquisition," mandated 25 actions for improving acquisition management for spare parts and a DOD-wide test of a program to motivate system contractors to facilitate breakout. The Deputy Secretary of Defense was tasked with monitoring progress of the various actions and the test program.

Each service has initiated programs to solve its particular perception of the spares problem.



Service Initiatives

Each service has initiated programs to solve its particular perception of the problem and to respond to the Secretary of Defense memoranda. Each service has assigned "competition advocates" and breakout managers at their buying commands, assigned additional resources to perform value engineering, directed contractors to change cost-allocation practices that result in price distortions, sought refunds from contractors, and placed increased emphasis on reviewing reprocurement data packages for accuracy and data rights. The Army has its Spare Parts Review Initiatives (SPRINT) with objectives, actions, milestones, etc., to accomplish the initiatives in the

(Continued on page 39)

SECDEF Weinberger's 10-Point Program to Fight Price Abuse

1. Offer incentives to increase competitive biddings and reward employees who pursue cost savings.
2. Take stern disciplinary action, including reprimand, demotion and dismissal, against employees who are negligent in implementing Defense Department procedures.
3. Alert defense contractors to the seriousness of the problem and ask them to take disciplinary action when necessary and reward employees when appropriate.
4. Competition Advocates already in place in the services must challenge orders that are not made competitively or appear to be excessively priced. Procurement officers must heed the advice of the Competition Advocates.
5. DOD will refuse to pay unjustified price increases. The Defense Contract Audit Agency will work with contract administration offices to strengthen spare parts pricing procedures and assist in negotiations of major spare parts purchases.
6. Reform of basic contract procedures must be accelerated.
7. Take steps to obtain refunds in instances where we have been overcharged.
8. If alternative sources of supply are available, DOD should cease doing business with those contractors who are guilty of unjustified and excessive pricing and who refuse to refund any improper overcharges. If such sources are not available, they must be developed rapidly. Suspension or debarment should be accomplished within 30 days of indictment or conviction of a contractor.
9. Audits and investigations of spare parts will continue.
10. The many corporations not involved in spare parts overcharging should not be maligned because of the failures of a few. ■

Highlights of SECDEF Weinberger's 25-Point Program to Improve Spare Parts Acquisition.

—Optimize use of standard military parts or commercially available parts in development of new systems.

—Give acquisition of spare parts the necessary attention.

—Use value engineering to investigate parts where cost exceeds intrinsic value.

—Ensure that prices paid for parts are fair and reasonable.

—Acquire reprocurement technical data unencumbered by needless or improper proprietary restrictions.

—Automate data repositories to improve the acquisition, storage, and retrieval of technical data.

—Eliminate disincentives on industry to facilitate breakout and competition of spare parts. ■

PHILOSOPHY

Taking Issue with Theory "Y"

Frank Marutollo

In 1960, Douglas McGregor introduced us to the familiar management theories of "X" and "Y."[1] He postulated that, traditionally, management practices had been based on certain assumptions about human nature and human behavior. He identified those assumptions and classified them as "Theory X."

He then put forth his own perceptions of human nature, which differed from those of Theory X, and which he used in the development of his Theory Y. It was this theory that he proposed as the one most likely to lead to optimum productivity and a better or more "excellent" product. We will look at the assumptions that formed McGregor's theories in some detail in just a moment.

First, since we will be talking of McGregor's postulates in terms of scientific theory, we should look at what we mean by "scientific theory."

Scientific theory consists of a set of postulates and derived theorems "constructed" from a body of empirical data, which explains all known experimental data and can predict future experimental data or events.[2] In one sense a scientific theory is never verified or disproven, since the experimental data doesn't necessarily relate to the postulates and theorems directly. A theory whose validity is weakened by no longer being able to explain all known experimental data or predict

■ *Mr. Marutollo is a Budget Analyst at Headquarters, U.S. Marine Corps.*

new events will eventually be abandoned and replaced by a more fertile set of explanatory rules, but it is very rarely expressly "disproven." So the chief features of a scientific theory are its explanatory power over known data and its prediction function.

Generally, in applying *management* theory to this standard we see that it fails on both counts: It can't explain all known data, and its prediction function is low. Specifically, in applying McGregor's Theory Y to this standard, we see that while he doesn't necessarily need direct experimental data to build his initial hypotheses, those hypotheses must explain all known data and have fertile predictability or else fail. For example, McGregor claims, "Only if Theory Y, then excellent products." However, Leavitt[3] will show from presumably experimental evidence, "If non-Theory Y, then excellent products," and, likewise, Morse and Lorsch[4] will show, "If Theory Y, then excellent products, and if Theory X, then excellent products." The result is that McGregor's Theory Y can't explain all the available data. Additionally, these critics will argue that, "If Theory Y, then bad products," showing that the prediction function of Theory Y is also weak.

McGregor's Thesis

McGregor argues that traditional management practice, Theory X, was characterized by the following elements, and provides the evidence for each as follows:

1. The average human being has an inherent dislike of work and will avoid it if he can.

2. Because of this human characteristic of dislike of work, most people must be coerced, controlled, directed, threatened with punishment to get them to put forth adequate effort toward the achievement of organizational objectives.

3. The average human being prefers to be directed, wishes to avoid responsibility, has relatively little ambition, wants security above all.

McGregor also notes that "The principles of organization which comprise the bulk of the literature of management could only have been derived from assumptions such as those of Theory X. Other beliefs about human nature would have led inevitably to quite different organizational principles."

The consequence of Theory X assumptions, he argues, is less than full utilization of human capacity in work, with the attendant loss of creative contributions that workers can make. In effect, the excellence of the product is less than it can be. To fully achieve this desirable end, McGregor offers the assumptions and grounds of Theory Y, as follows:

1. The expenditure of physical and mental effort in work is as natural as play or rest. The average human being does not inherently dislike work. Depending upon controllable conditions, work may be a source of satisfaction (and will be voluntarily performed) or a source of punishment (and will be avoided if possible).

2. External control and the threat of punishment are not the only means for bringing about effort toward organizational objectives. Man will exercise self-direction and self-control in the service of objectives to which he is committed.

3. Commitment to objectives is a function of the rewards associated with their achievement. The most significant of such rewards, e.g., the satisfaction of ego and self-actualization needs, can be direct products of effort directed toward organizational objectives.

4. The average human being learns, under proper conditions, not only to accept but to seek responsibility. Avoidance of responsibility, lack of ambition, and emphasis on security are generally consequences of experience, not inherent human characteristics.

5. The capacity to exercise a relatively high degree of imagination, ingenuity, and creativity in the solution of organizational problems is widely, not narrowly, distributed in the population.

6. Under the conditions of modern industrial life, the intellectual potentialities of the average human being are only partially utilized.

Essentially, his theory concludes that if Theory Y assumptions prevailed, the excellence of the product would be maximized.

On the merits, the following observations are offered on the assumptions of each theory and the legitimacy of McGregor's claims:

Premises of Theory X

Let's look at the legitimacy of McGregor's claims, beginning with Theory X. Proposition 1, which addresses man's inherent dislike of work, appears too comprehensively stated by McGregor. Most observations of man indicate that he has a need, perhaps biologically driven, to be active and mold the world, to engage in some kind of purposive enterprise. Therefore, in the sense that men will avoid effort *per se*, proposition 1 appears false. It really should be rephrased to state that he will avoid unpleasant effort, or directed effort, or non-internalized effort. Thus, Theory X is wrong when it asserts that people will avoid work, but right when it says that they will avoid non-internalized on non-valued work.

Proposition 2, regarding the threat of punishment as a necessary motivator, would appear to be valid if the work is non-valued. Unless this value is perceived by the worker, there will not be a spontaneous desire to engage in the effort to sustain that value; therefore, direction and coercion will be required to keep the worker at the effort. Thus McGregor is right on proposition 2 if the workers have not internalized the value of the work effort.

Proposition 3 speaks to the average person's lack of ambition and desire for security. This proposition is more factually determinable than the others, and we are all familiar with studies and cultures that seem to validate it. People do seem to seek security as a primary need (Maslow), and, in all probability, the great mass of us are mediocre at best and so seek direction and avoidance of the troubles of responsibility. In short, there is ample evidence for the truth of this proposition.

Thus, the premises of Theory X appear generally valid, subject to the caveats noted under each proposition. It can be said that McGregor's "Theory X is not a strawman [constructed] for purposes of demo-

lition . . . but in fact a theory whose premises might be generally true in most work contexts. Indeed, there may be good reason that it is a "theory which maternally influences managerial strategy in a wide sector of American business today. McGregor will have to go some to undercut the valid portions of Theory X.

Premises of Theory Y

Proposition 1 of Theory Y (work as a natural desire and possible source of satisfaction) is the analogue and obverse of proposition 1 of Theory X and valid under the value-internalization exception noted above. If the value of the work effort is internalized, men will probably consider work as a source of satisfaction.

Proposition 2 (self-direction and initiative in pursuit of valued objectives) is the analogue and obverse of proposition 2 of Theory X, and likewise is valid if the value internalization of proposition 1 has been accomplished.

Proposition 3 (commitment to objectives as a function of rewards), in its simplest terms, appears to be a low-level law that has been very well substantiated in animal experiments. But it has yet to be fully demonstrated that ego and self-actualization needs suffice as motivators, or, more compellingly, whether a person will ever in his lifetime under current societal conditions have the opportunity to feel the motivational drives of self-actualization in work. It may be true, but we may never know it. Indeed, if we follow McGregor, we may find out how true it is, but right now its assertion is more normative than factual.

Proposition 4 (acceptance of, even desire for, responsibility is *learned* behavior) is the analogue and obverse of proposition 3 of Theory X and can be subsumed under proposition 2 of Theory Y in the sense that acceptance of responsibility can be equated to the spontaneous "caring" action generated by an internalized value.

Proposition 5 (the wide distribution of creativity and originality in the human population) is another analogue of proposition 3 of Theory X, and is a question of fact not yet fully substantiated. Indeed, Drucker[5] will argue below that the obverse is more likely true, and we have stated above that the available evidence lies in favor of the opposite. This proposition is more posited than confirmed.

Proposition 6 (the under-utilization of human potential) seems true everywhere at any time.

It was this theory that he proposed as the one most likely to lead to optimum productivity and a better or more "excellent" product.

In summary, it can be seen, as noted in the introduction, that McGregor is basically building on personal experience and knowledge, and positing his propositions about people-in-work coupled with normative elements, such as "they are good propositions and ought to be assumed about men rather than the Theory X propositions." But the real potential value of this "theory," even if the postulates are unverifiable, will lie in its ability to explain all or most management and work data and to predict data about the excellence of the product. We will see that both Leavitt and Morse and Lorsch show that neither condition obtains.

Leavitt

Leavitt's article is basically a polemic and therefore does not in the end develop a counter thesis. The theme of his article is not "that human relations theory is incorrect or immoral." "My argument," he said, "is that it is simply insufficient. It is too narrow a perspective from which to analyze the management of organizations."

Leavitt focuses on the task itself as a basis for progressively pointing up McGregor's shortcomings. For example, McGregor asserts that continued participation and creative self control and responsibility in any task are prime factors in excellent performance. Leavitt counters by observing that "high interest, high challenge may be caused as much by the job at hand (is it already programmed or not?) as by 'participation.'" This statement comes from his analysis of a common game. This game consists of three people not in communication with each other who get feedback from an instructor with the goal of coming up with a designated number. Leavitt's point is that the task itself is what generates the intense application—not participation itself.

He argues further that these types of tasks may evaporate as interesting work tasks, since they may be based on the programability of people; that is, he states that in work "these dual findings—programming oneself out of challenging and novel situations and then losing interest—keep showing up." In this regard, he asks "Is it reasonable to think that we can, in the real world, maintain a continuously challenging 'unprogrammed' state for all members of an organization? . . . especially . . . while the demands made upon the organization call for routine tasks like making the same part tomorrow, tomorrow, and tomorrow that was made today?"

Therefore, it may be that only so much of the human elements of Theory Y are necessary to perform tasks excellently in certain work contexts. But there is no room in McGregor for selected application of Theory Y.

Leavitt concludes that excellent products are possible without the

human elements of Theory Y: The worker's

> job has been enlarged, for she now wires the whole circuit (50 or 60 hours' worth) instead of one small piece. But there is no human interaction here, no patient human teachers; no great involvement; not even very much learning. For the crutch of the teaching machine stays there always. She can lean on the diagrams next year if she should still want to, and she probably will.

Again, excellent products without Theory Y. Here Leavitt's analysis shows that Theory Y cannot explain all available data, which weakens its status as a scientific theory.

Another example presented by Leavitt is the communication experiments at MIT where five persons are set up in three networks. Network I consists of four persons independently connected to one central person; Network II consists of two groups of two persons connected to one central person; and Network III consists of all five persons in direct communication with each other. The conclusions are as follows:

> We can then measure the "efficiency" of each net by such factors as speed of problem solving, number of messages sent, number of errors made, clarity of organizational form, specificity of each job in the organization, and clarity of leadership. It turns out that on these simple tasks Network I is far more efficient than II, which in turn is more efficient than III. . . . However, if we now ask members of these three networks to indicate how happy they are in their jobs, we get the reverse effect.

Again focusing in on the task, Leavitt demonstrates that in some instances, Theory Y contexts don't always yield task excellence, and as a matter of fact yield the poorest results.

Leavitt finally derives with the following conclusion:

> So by certain industrial engineering-type criteria (speed, clarity of organization and job descriptions, parsimonious use of paper, and so on), the highly routinized, noninvolving, centralized Network I seems to work best. But if our criteria of effectiveness are more ephemeral, more general (like acceptance of creativity, flexibility in dealing with novel problems, generally high morale, and loyalty), then the more egalitarian or decentralized Network III seems to work better.

But he asks further, "Are we also to conclude that the criteria of creativity and flexibility and morale are somehow fundamentally more important than speed and clarity and orderliness?" Thus, it can be seen that Leavitt arrives at the following results in some contexts: "If Theory Y, then poor performance" and "If Theory X, then excellent performance." His overall conclusion is that in some instances Theory Y elements are irrelevant to task accomplishment.

Leavitt's sums up by stating: ". . . routinize and control what we can;. . .loosen up and make challenging what we cannot. In so doing we may end up being efficient, and at once human and unhuman, depending on where, within the large organization, we choose to focus."

In summary, then, it can be observed that Leavitt centers his attention on the object—the task and the excellence of its accomplishment—and shows that in a number of quite significant situations Theory Y assumptions are irrelevant. Leavitt also demonstrates that McGregor's overall thesis is merely a proposal, and in no way approaches a theory of man-in-work. He does this by showing that McGregor's theory cannot explain all known relevant management data and that it is a poor predictor. But Leavitt confirms McGregor in the fact that Theory Y elements do have applicability in some contexts. But, he warns, "Even if we grant that people carry out solutions to business problems more eagerly when they have participated in the decision, does this mean that the solution itself is 'better'?"

Drucker

Peter Drucker also has some interesting observations to make about McGregor's theory. Drucker argues that proposition 3 of Theory X—need for security—is so fundamental to man that "One has to replace the security of Theory X and the certainty it gives by another but different structure of security and certainty. There is need to provide by different means what commands and penalties do under Theory X. Theory Y, in other words, has to go far beyond Theory X. It cannot simply be substituted for it." This conclusion he derives from Maslow's book *Eupsychian Management*, where Maslow concluded that the Theory Y "demand for responsibility and achievement may well go far beyond what any but the strong and healthy can take. . . . Even the strong and healthy . . . need the security of order and direction; and the weak need protection against the burden of responsibility." These observations could well represent a large portion of people in the world; "Or at the very least there are different human natures which behave differently under different conditions."

Drucker proceeds, like Leavitt, to focus in on the task to be performed to weaken McGregor's theory by observing "that it is not human nature [Theory Y] but the structure of the job and work that, in effect, determines how people will act and what management they will require."

Drucker develops another argument that would, in effect, totally destroy any claim to scientific validity of McGregor's theory by arguing that Theory Y is in fact a new Theory X with much more demanding and non-human aspects:

> Most, if not all, of recent writers on industrial psychology profess allegiance to Theory Y. They use terms like "self-fulfillment," "creativity," and "the whole man." But what they talk and write about is control through psychological manipulation. They are led to this by their basic assumptions, which are precisely the Theory X assumptions: man is weak, sick, and incapable of looking after himself. He is full of fears, anxieties, neuroses, inhibitions. Essentially he does not want to achieve but wants to fail. He therefore wants to be con-

trolled. Indeed, for his own good he needs to be controlled—not by fear of hunger and incentive of materials rewards but through his fear of psychological alienation and the incentive of "psychological security."

Drucker finally concludes, like Leavitt, in a contingency approach: "The debate over the scientific validity of Theory X versus Theory Y is, therefore, largely a sham battle. The question the manager needs to ask is not 'Which theory of human nature is right?' The question is 'What is the reality of my situation and how can I discharge my task of managing worker and working in today's situation?' "

Morse and Lorsch

The gist of the Morse and Lorsch article may be summarized as follows:

> The concept of participative management, as symbolized by Douglas McGregor's Theory Y, was an important insight into improving organizational effectiveness. But, many managers assume that Theory Y is the only correct approach. In this article, the authors go "beyond Theory Y" to propose that the most productive organization is one that fits the needs of its task and people in any particular situation. In some cases, this may well mean a more directive approach. Even more significant, the proper "fit" among task, organization, and people seems to develop strong "competence motivation" individuals, regardless of the organization style.

Morse and Lorsch present the results of an empirical study relating to four organizations: two predictable manufacturing task organizations (Akron/Hartford Container Plants) and two research and development organizations (Stockton/Carmel Research Labs). They first determined which one of each pair was highly effective and which was less effective, each company being evaluated by that company's management. Akron and Stockton were the effective organizations.

The objective was to explore more fully how the fit between organization and task was related to successful performance. Morse and Lorsch also stressed the investigations of a "sense of competence." "We saw this sense of competence in performing a particular task as helpful in understanding how a fit between task and organization characteristics could motivate people toward successful performance."

The question is: "What is the reality of my situation and how can I discharge my task of managing worker and working in today's situation?"

Then, to determine fit of organization characteristics to the job to be done they developed two sets of factors: "formal" characteristics and "climate" characteristics. They measured the feelings of competence of the people in the organization so that they could link the appropriateness of the organizational attributes with a sense of competence.

The results of the study with regard to the formal characteristics are summarized in Table I. The results of the study with regard to the climate characteristics are shown in Table II.

Competence motivations were measured by first asking each participant to write creative and imaginative stories in response to six ambiguous pictures and, secondly, by asking him to write a creative and imaginative story about what he would be doing, thinking, and feeling "tomorrow" on his job. The results indicated that the individuals in Akron and Stockton showed significantly more feelings of competence than did their counterparts in the lower-fit Hartford and Carmel organization.

Using McGregor's thesis, Theory Y would be expected to predict "If Theory X, then poor performance," and "If Theory Y, then excellent performance." Morse and Lorsch show that both these propositions are false in certain circumstances.

> For example, the managers at Akron worked in a formalized organization setting with relatively little participation in decision making, and yet they were highly motivated. According to Theory X, people would work hard in such a setting only because they were coerced to do so. According to Theory Y, they should have been involved in decision making and been self-directed to feel so motivated. Nothing in our data indicates that either set of assumptions was valid at Akron.
>
> Conversely, the managers at Hartford, the low-performing plant, were in a less formalized organization with more participation in decision-making, and yet they were not as highly motivated as the Akron managers. The Theory Y assumptions would suggest that they should have been more motivated.

Thus, Morse and Lorsch experimentally show that the McGregor theory has low and inconsistent predictability, and, as a matter of fact, the assumptions of the opposite initial premise yield the same conclusion, that is, contradictory premises yield the same theorem. This is a signal that the initial premise is wrongly posited.

In summary, Morse and Lorsch have demonstrated that in no way is

Table I. Formal Characteristics

Characteristics	Akron	Stockton
Formal relationships	Highly structured	Low structure
Formal rules	Pervasive	Minimal
Time dimensions	Short term	Long term
Goal dimensions	Manufacturing	Scientific

McGregor's "Theory" to be considered a scientific theory, since the universality of its explanatory and predictive functions is refutable. Additionally, when serious investigation is centered on the work object, conclusions are developed about people's needs in work that vary considerably from McGregor's initial assumptions.

Conclusions

It can be seen that in reality McGregor initially did not enunciate a theory *per se*, but proposed a series of hypothetical propositions about people in work to the effect that, "If Theory Y assumptions, then excellent performance." Conceptually, and by inference in Leavitt and experimentally in Morse and Lorsch, this proposition has been validated only for certain contexts. However, the obverse has been shown to hold also in other contexts. McGregor's error lies in the generality of his proposals and in beginning his analysis with assumptions about human behavior rather than with the task to be performed. Leavitt and Morse and Lorsch have shown that we are not yet ready for a "general theory of management" and that we had better start with the object (task) before generalizations are made about it.

A final comment on Morse and Lorsch and contingency theory appears in order. Contingency theory seems to be the drive to develop empirically valid connections between work events such as "If a predictable manufacturing task, and task oriented, within the formal and climatic characteristics noted above, then effective performance." But this is not a theory. It is a program to apply scientifically validated hypothetical data to the right contexts. It is merely an urging to be systematic in data gathering and relating the resulting "laws" to various work contexts. It cannot be considered a proposal to be a general theory. Rather, it is the recommendation to use a fruitful methodology.■

Notes

1. Douglas McGregor, *The Human Side of Enterprise* (McGraw Hill, 1960).
2. Norman R. Campbell, "The Structure of Theories," reprinted in *Readings in the Philosophy of Science* (Appleton, Century, Crofts, 1953), pp. 288-308.
3. Harold J. Leavitt, "Unhuman Organizations," ***Harvard Business Review***, Vol. 40, No. 4, July-August 1962, pp. 90-98.
4. John J. Morse and Jay W. Lorsch, "Beyond Theory Y," reprinted in *On Management Harvard Business Review* (Harper and Row, 1975).
5. Peter Drucker, *Management – Tasks, Responsibilities, Practices* (Harper and Row, 1974).

Table II. Climate Characteristics

Characteristics	Akron	Stockton
Structural orientation	Tightly controlled	Low structure
Influence of worker	Low	High
Superior/subordinate relationships	Low freedom	High freedom
Colleague relationships	Similarities	Differences
Time orientation	Short term	Long term
Goal orientation	Manufacturing	Scientific
Top executive's "managerial style"	More concerned with task than people	More concerned with task than people

First National Conference on Producibility

The first National Conference on Producibility in the Defense Sector will be held September 24-26 1984, in Cambridge, Mass. "Managing the Transition from Development to Production" is the theme of this 2-day, unclassified meeting, sponsored by the Manufacturing Management and Research & Engineering Committees of the National Security Industrial Association, in coordination with the Department of Defense.

The conference will address the management of the transition disciplines from design to production, the new technology to bring process and product into alignment with each other, the implications of the integrated computer technology, the role of program managers and subcontractors in the achievement of producible weapons systems, and the new interest in the Office of the Secretary of Defense in ensuring producibility in weapons systems.

Dr. Richard DeLauer, Under Secretary of Defense for Research and Engineering, and Willis Willoughby, Jr., Deputy Chief of Naval Material (Reliability, Maintainability and Quality Assurance), are speakers along with Kenneth Olsen, Chairman, Digital Equipment Corporation, and many other senior government officials and top executives of industry.

Producibility has attracted national attention at a senior level of management throughout American industry in recent years. "Producibility" denotes the management task of bringing resources in line with commitments, and process technology in line with product technology, so that engineers and manufacturing managers can integrate their efforts to produce reliable, cost-effective products within lead times consistent with the changing requirements of the Department of Defense.

Persons interested in attending this conference should contact the National Security Industrial Association (NSIA), Dept. PC, Suite 901, 1015 15th Street, N.W., Washington, D.C. 20005. Telephone (202) 393-3620.■

VIEW FROM THE CONGRESS

Fighting the Tough Battle for an Adequate Defense

Representative Samuel S. Stratton

Representative Samuel S. Stratton (D-N.Y.) was the featured speaker at the Defense Preparedness Association's Honors and Awards Luncheon on March 29 of this year. The following is a transcript of his remarks.

As one of the few remaining unreconstructed hawks in the U.S. House of Representatives, I'll say at the outset that it is a distinct privilege to be asked to address an organization pledged to the principle embodied in your name, American Defense Preparedness.

Never was this principle more needed than today; and never has it been so neglected, ignored, and even ridiculed in recent years in the only nation with the capability—if not the *will*—to be the leader of the Free World.

Preparedness has been a major watchword of this nation from its earliest days. It was President Washington who reminded us that to be prepared for war is the surest way to keep the peace.

Admiral Rickover said that the more we sweat in peace, the less we'll bleed in war.

Most Americans express themselves in total agreement with these sentiments. Yet here in Washington, as we begin still another annual battle of the national budget, the overriding question is not "Where's the beef?" It's how much will we cut defense this year? $18 billion? $20 billion? $30 billion? Or even $120 billion, as three former federal defense officials last year recommended with a straight face?

Some of these assaults have been motivated by partisan politics. But this is not entirely a partisan problem. Authentic business groups, like the Business Council and the Grace Commission, have made their assaults, too, on alleged "excessive" defense spending—as though it were just one more social program that must expect to bear its *fair share* of any common fiscal misery.

Defense is *not* just *another social program.*

Representative Stratton

The Lesson of Norway

The late Senator Scoop Jackson, one of Congress' leading defense supporters for over 40 years, used to cite the story of his native Norway in 1941. Norway had a magnificant environment—clear air, clean water, and a successful economic order. Wages were good, and poverty had been virtually eliminated. Yet when Adolf Hitler decided to invade, Norwegian sovereignty evaporated overnight because Norway had no *adequate military force.*

Nobody wants to pay more for defense than what is needed. So how much is enough? It depends on the nature of the threat. This year before Secretary Weinberger and General Vessey sent up their $305 billion Defense Budget for FY 1985, they first sent to the Armed Services Committee the net assessment team—who showed us *with charts and graphic* overhead photography the precise comparison between U.S. military capability and that of the Soviets.

Even for those of us who have been on the committee for some years, the dramatic comparison between ourselves and the Soviets sent a shiver up our spines. Over 4 to 1 in tanks, 8 to 1 in submarines. Indeed with the exception of aircraft carriers, and some types of fighter aircraft, the Soviets outnumber us significantly in virtually every category of military capability—not only in numbers but also in performance. They are still building, and far beyond anything strictly needed for defensive purposes.

I only wish the American people could see those photographs and those comparative numbers. It would curl their hair, as many members of this distinguished audience are already well aware, and it might convince them that we aren't kidding.

The budget President Reagan sent up to Congress this year included a real growth, after inflation, of 13 per-

cent; and critics in Congress have already challenged that percentage. Does anybody honestly say that 13 percent real growth is *too much*? Compared to *what*? Can anybody make an informed judgment on how much we need without first seeing those charts and those pictures? Yet only a small percentage of the numbers of Congress so far have been bothered to look at them.

If this relentless Soviet military expansion doesn't seem to impact on a majority of members of Congress, it does impact in other areas. Our European allies, for example, with over 1,000 SS-20 warheads targeted against them, certainly understand what the Soviets are up to. Last year's unprecedented Soviet effort to scare our NATO allies into separating themselves from the U.S. did not succeed, and that was a distinct victory for us.

We're not out of the woods yet. West German Chancellor Kohl was a real pillar of strength in that showdown. As the Soviets drag out their boycott of the missile talks, even he has begun to urge the U.S. to sweeten the pot and make new preliminary concessions to get the talks restarted. Even though it was the Soviets who walked out, not ourselves!

Nearer to Threat

Since they are much closer to that enormous military might, the Germans realize that Soviet power has a very definite edge. Besides that, they read the papers and they see continued American disinterest in any significant move to restore the military balance between the superpowers.

Even Mrs. Thatcher, who stood firmly behind the GLCM deployment and won a brilliant battle for the Falklands, nevertheless felt it was the path of political wisdom last fall to criticize the United States for going into Grenada, remembering how many SS-20s are also targeted on the British Isles.

Yet as the House moves to draft its own 1985 Budget Resolution, the defense cutters are back at the same old stand—reduce the numbers—stretch out the program another few years. That doesn't really save money at all; it actually increases the cost in future years.

Secretary Weinberger presents an even more crucial argument against these stretch-out proposals. How much time do we really have? Can we count on the Soviets to wait for 1989? Or 1995?

In 1936, when Winston Churchill suggested a rapid expansion of the RAF, his House of Commons colleagues almost laughed him off the floor. It would increase the deficit, they said. Sound familiar? Had Churchill had *his* way, instead of Baldwin and Chamberlain, Hitler might never have moved against the Czechs or the Rhineland.

How can we possibly hope to offer any credible defense against the Soviet threat when the American Congress insists on enshrining U.S. inferiority instead of U.S. strength and resolve?

Yet, no matter how much we on the Armed Services Committee may complain, the House Budget Committee, following the Speaker's lead, will almost certainly approve a real growth figure for defense no larger than 3.5 percent. The Senate, following more closely the President's figure, is likely to come closer to 7.8 percent, which could then produce a conference agreement at 6 percent.

Even with 6 percent, the President's defense bill still has to be cut by $19.5 billion. And that's no easy matter, especially in the area of procurement, where we must cut more than *$8.7 billion*. A cut of this size means we cannot possibly do the job just by eliminating marginal programs; we'll have to cut out some very desirable ones too!

Preview of Budget Battle

Let me just give you a preview of what are likely to be the two biggest battles over this bill.

Rumors suggest that the prime target for the defense-cutters will be the second-year buy of the MX missile, a system finally approved last year after many years of controversy, and then only as part of an "arms control package," which included the new single-warhead MIDGETMAN missile, a cut in the MXs from 27 to 21, and an agreement to press the Soviets to agree to the so-called "build down" proposal.

In the meantime, of course, the Soviets walked out of both nuclear talks at Geneva, so there is no chance not to push any new "arms control package." Instead the MX opponents will try to cut the second-year buy of 40 MXs down to 21 and possibly even to zero.*

It was the Soviets who walked out of Geneva, not us. Yet in this Alice-in-Wonderland logic the United States is to be punished for the Soviet walkout, while the Soviets are to be rewarded, with the assurance they needn't worry about the original 100 MXs any time soon, just a scraggly 21.

Such a performance would seem to outdo even the British House of Commons in 1936 with Winston Churchill's call for more planes.

Remember that the Soviets have already had in operation for some

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*On May 24, the Senate Armed Services Committee reported out a defense authorization bill that would allow for an FY 85 increase, above inflation, in military spending, but halved the President's MX request. The Committee agreed to provide funds for 21 missiles instead of the 40 the administration had requested. The Senate bill allows for the release of MX funds at the beginning of FY 85, October 1, 1984.

The House voted, on May 31, to halt production of the MX at least until next April After that Congress would have to vote again to resume production of the missile. This vote reversed a decision by the House some 2 weeks earlier to allow production to begin in April if the Soviets had not returned to the arms-control talks, or had been deemed by the President not to be bargaining in good faith.

The vote does not affect missiles approved by Congress for this fiscal year.

At press time, the two houses were in conference attempting to reconcile their positions.

time *four* hard-target-capable ICBM's: the SS-16, the SS-17, the SS-18, and the SS-19. Years later we are still unable to agree on producing just *one* such system. How can we possibly hope to offer any credible defense against the Soviet threat when the American Congress insists on enshrining U.S. *inferiority*, instead of U.S. *strength and resolve*?

Or reflect on this second example. Once again this year the administration has asked Congress to modernize our grossly antiquated, dangerous, and deficient World War II chemical warfare capability so as to pose at least *some deterrent* to the overwhelming Soviet chemical capability.

For the past 2 years, however, Congress has refused to provide funds for this modernization on the curious ground that chemical warfare is just too *barbaric* even to think of. Instead, we have been urged by slim congressional majorities to continue to occupy this "moral high ground" by having nothing whatsoever to do with chemical weapons; and, presumably, in the process shaming the Soviets into destroying their chemical weapons too!! Fat chance!!

Actually, the principal purpose of a U.S. chemical capability, as with every other weapon, is to deter some enemy from attempting to use chemical warfare against us. That important feature, you may recall, saved many American lives in the Battle of the Bulge in World War II. Hitler wanted to use gas to wipe out the U.S. troops caught in the "pocket" of that bulge. However, the German High Command told the Fuhrer that our forces could retaliate with a gas attack on the Germans. So Hitler backed off, although the truth was that we actually had *no such* capability at that time.

How ironic that some people in the name of "humane" warfare should be willing to endanger the lives of American service personnel on the battlefield. For without an offensive American chemical capability, fully known and fully understood by the Soviets, American troops would be forced to operate on the battlefield in cumbersome, incapacitating chemical protective garb, which seriously degrades their ability to defend themselves.

Is *this* the kind of American preparedness we should advertise to the world in a year when the Soviets not only arrogantly refuse to negotiate on arms reduction but even to accept a letter from President Reagan to Party Secretary Chernenko?

Surely 1984 is not the year for us to *blink* in the face of Soviet intransigence, when President John F. Kennedy in 1961 stoutly refused to blink in an even more serious confrontation, the Cuban missile crisis.

Need for Bipartisan Support

The one thing that has most troubled all our efforts in creating an effective defense preparedness over the past 3½ years has been the conspicuous absence of a strong, understanding, realistic bipartisan support for American military strength both in the Congress and in the general public.

President Reagan has repeatedly stood up forcefully for defense. There has been no corresponding response from the other side of the political aisle, something that the late Senator Henry M. Jackson ably represented in both the House and the Senate.

If we cannot find enough such leaders prepared to speak out firmly and frankly in today's political miasma, it must be up to the American Defense Preparedness Association, and other patriotic groups like yours, to get the facts out to the American people so that we continue, in spite of the obstacles put in our way, to carry on our efforts to preserve peace in a troubled world.

I am sure many of you have noticed in the House Chamber, over the Speaker's chair, an inspiring quotation from Daniel Webster which most members have memorized as we listen to the long debates and have often thrown in at the conclusion of some of our speeches back home.

I would make this modest suggestion: that at least for a good part of 1984, as we deliberate the contents of the 1985 Defense Budget, we take down the Daniel Webster quote and replace it *temporarily* with one sentence from that very excellent article by Herbert Stein which appeared in the March 12, 1984, *Wall Street Journal*. "Somebody has to tell the American people there are costs to the survival of a free society on a small planet."■

Nuts and Bolts

(Continued from page 30)

SECDEF's July and August memorandums. The Navy has its Buy Our Spares Smart (BOSS) program that includes more than 100 initiatives to improve spare-parts procurement, and PRICE FIGHTER to ensure paying fair and reasonable prices for spare parts. The Air Force established its ZERO OVERPRICING initiative in 1979. In 1982, the Air Force performed a study, CORONA REQUIRE, to improve the spare parts requirements process. In 1983, the Air Force Management Analysis Group (AFMAG), was established. It studied the entire Air Force spare parts acquisition process and made 178 specific recommendations to improve the process. Project PACER PRICE was established at the logistics buying centers to ensure that fair and reasonable prices were paid for spare parts.

So far, we have looked at various perceptions of the spare-parts procurement problem. We have seen that the real overpricing problem is impairing the readiness and sustainability of our fielded weapon systems. We have seen that there is a decrease of confidence in our defense establishment caused by a perception that spare parts are overpriced. We have also seen how the services buy and price spare parts, and how "apparent" overpricing can occur. Finally, we have taken a brief look at what Congress, OSD, and the services are doing to solve the problem. In Part 2, scheduled for the next issue of *Program Manager*, we will take an even closer look at OSD and service initiatives, as well as examining some of industry's initiatives.■

INSIDE DSMC

PMC 79-1

Carl Amato of Grumman Aerospace has been promoted to Director of Program Management for the Integrated Logistics Support (ILS) Department. For the past 4 years he was Program Manager of the Air Force EF-111A for ILS at Grumman. Prior program management assignments include 11 years on the Navy/Marine A6/EA6B program and 4 years on the Army OV-1 program.■

ASSIGNMENTS

Air Force Names 32
for PM-Related Positions
12 Are DSMC Grads

The Air Force named one general officer and 31 colonels and colonel selectees for assignments to program management-related positions during the last quarter. Most will assume their new duties during the current quarter.

Twelve of the selectees have graduated from DSMC courses.

Names, assignments, and, when known, effective dates of assignment are shown below.

Brigadier General Donald L. Cromer (ERC 77-2) will become Deputy Director for Launch and Control Systems, Space Division.

Colonel Glenn R. Seeley (ERC 84-2) became Commander, Hughes Air Force Plant Representative Office (AFPRO), California, on July 31. AFPROs are elements of the Air Force Contract Management Division.

Colonel Thomas R. VanMeter moved from the Ballistic Missile Office to become Deputy for Strategic Systems, Aeronautical Systems Division, on July 31.

Colonel Robert M. Butchta (PMC 78-2) assumed duties as Deputy for Sensor Systems, Space Command, on July 31.

Colonel Alan J. Driscoll became Special Assistant to the Commander for Program Management, Hqs. AFSC, on July 31.

Colonel (Sel) Stephen P. Richard became Deputy Director for Launch Systems Support, SAF/AP, on July 31.

Colonel Leonard R. Vernamonti became Deputy for Comptroller in the Ballistic Missile Office, on July 31.

Colonel John W. Dettmer (ERC 83-4) has been named Director, Space Laser Program Office, Space Division, effective July 31.

Colonel George C. J. Jackson has been named Deputy Director for Satellite Operations, AFSCF, Space Division.

Colonel (Sel) Lawrence J. Sokolowski is to become Chief, Acquisition Systems Management Inspection Division, AFSC/IG, in late September.

Colonel William H. Crabtree became Deputy Commander for Space Systems, Space Division, in mid-May.

Colonel (Sel) Larry N. Looney (PMC 79-2) became Commander, Lockheed AFPRO, on July 31.

Colonel Howard E. Bethel (PMC 75-1) became Deputy for Propulsion, Aeronautical Systems Division, on June 1.

Colonel Frederick J. DeGroot (PMC 74-2, ERC 83-2, IFM 80-3) became Assistant Director, Advanced Tactical Bomber, on June 30.

Colonel James A. Fain became Chief, F-15 Project Test Division, on July 1.

Colonel Thomas R. Ferguson became Program Director for AMRAAM, on July 1.

Colonel Robert E. Riggs became Director of the Fighter Attack SPO, Aeronautical Systems Division, on July 1.

Colonel Guy A. Smith became Director of Electronic Systems, Space Division, on May 21.

Colonel Robert A. Zang will become Director of Test, Deputy for Strategic Systems, Aeronautical Systems Division, in late August.

Colonel Charles B. Harvin, Jr. (MSAPC 80-2) will become the AMRAAM Second Source Program Manager in late August.

Colonel David C. Luke became Director of TABMS, Electronics Systems Division, in mid-July.

Colonel Joseph C. Rutter is slated to become Deputy for Defense Satellite Communications, Space Division, on August 31.

Colonel Kenneth W. Brotnov will become Director B-1 CTF, AFFTC, at the end of August.

Colonel Benjamin D. Crane became Deputy for Strategic Systems, Aeronautical Systems Division, in mid-July.

Colonel James P. Havey, Jr., will become Director of Nuclear Technology, AFWL, Space Division, on August 31.

Colonel Herbert L. Bevelhymer became SPO Director of Cruise Missiles, Aeronautical Systems Division, on July 31.

Colonel Donald W. Dill (ERC 81-2) will become the Deputy General Manager, NATO Airborne Early Warning and Control Program Management Agency in Brussum, Netherlands, at the end of August.

Colonel Charles E. Franklin (PMC 78-1) will become Deputy for Tactical Systems, Electronic Systems Division, in September.

Colonel Harry I. Gillogly III became Director, JSTARS, Electronic Systems Division, on July 31.

Colonel Robert S. F. Jennings will become Director, Maverick SPO, Aeronautical Systems Division.

Colonel Thomas M. Sieminski will become Deputy Director, Missile Engineering, Ballistic Missile Office, at the end of September.

Colonel William S. Weisinger, Jr., (PMC 78-1) is slated to become Director, MILSTAR Space Segment, Space Division, at the end of August.

R³ * of Engineers

*Recruiting, Retention, Retirement

Dr. Franz A. P. Frisch

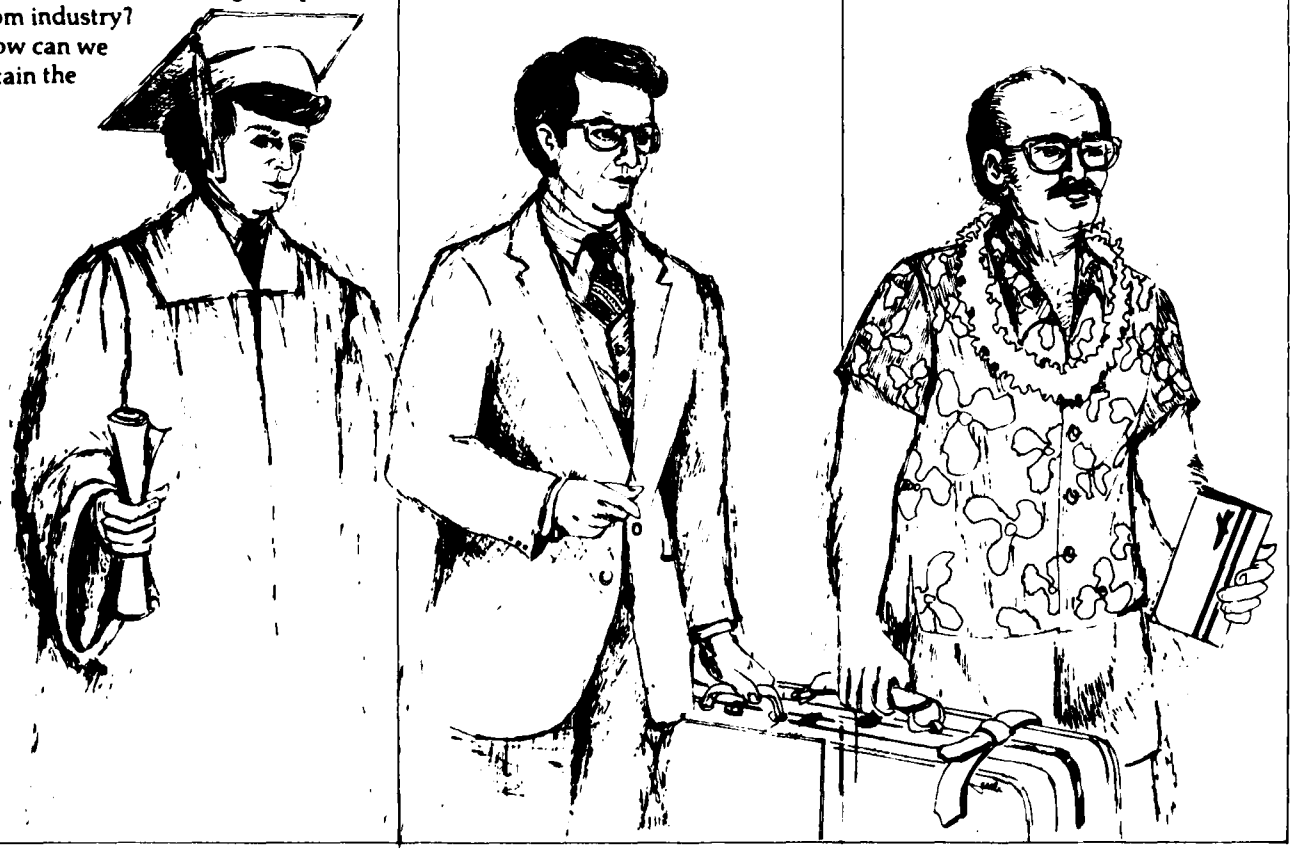
I was recently invited to teach and to participate in the pilot offering of the Technical Managers Advanced Workshop at the Defense Systems Management College. The participants in this workshop represented a cross section of all DOD acquisition activities and defense industry.

The last session of the workshop was unstructured, allowing the participants to focus on a topic of special interest to all. Immediately, personnel problems came up: How can we hire young engineers in the government in a time of strong competition from industry? How can we retain the best engineers in the face of high-salary offers from other companies? Although nothing was resolved, the common concern of all experienced managers with the R³ (recruiting, retention, and retirement) problem was revealed and reinforced. During the discussion, a few ideas occured to me about what we might do about this problem. Those thoughts form the basis for this paper.

Introduction and Caveat

This is *not* a professional article based on deep research and containing a wealth of statistics. It is only a trial balloon for three ideas, the implementation of which may help to (1) recruit young engineers into the government service; (2) retain them in the government; and (3) postpone the retirement of at least some of them. Taken together, the recommendations I will make could increase the productivity of government engineers and, in the process, save taxpayers' money.

The system I propose would consist of three basic elements:



—Adding an additional pay classification, GP (government professionals), to the current GS (general schedule) and GM (general manager) schedules;

—Institutionalizing continuous education for engineers to accommodate the knowledge explosion;

—Creating a flexible retirement system that would preserve the "corporate memory" while saving money.

The first two suggestions are just sketched here; the third is discussed in more depth.

Although the suggestions to follow are tailored to "engineers in the government service" and in particular to those in the Department of Defense, this does not mean that they are inappropriate for other professional groups such as lawyers or scientists, whether in or outside the government.

Assumptions

To make sense out of the R^3 discussion and to bound the subject, we have to accept two assumptions:

—We must assume that an "engineer" is a "professional" in rigid terms of education, experience, and licensing; and

—We must assume that we need *de facto* engineers in the government service in addition to *managers* of the acquisition of engineering products.

Rendezvous with Reality

There are innumerable reasons why young people choose specific jobs or careers. It may be because they are following a role-model; it might be because "Daddy told me so"; it might be a response to the attractiveness of a segment of the job market with high pay and security; or it may even be because of a genuine talent, inclination, or interest.

For whatever reason, many a young fellow or young lady struggles for his or her B.S., M.S., or even Ph.D., and enters his or her first real job with great expectations. But, sooner or later, even the most idealistic engineer recognizes that real, hands-on engineering is a dead-end job. Of course, a pretty picture is painted at the beginning with a relatively high starting salary, but the road thereafter leads nowhere. Hence, in order to "get ahead" he or she has to leave engineering behind as fast as possible and become a "manager"—whatever that may mean.

This is the young engineer's first encounter with reality. It is a reality we have ourselves created, but it is one that has no incentive for capable engineers; this holds, to different degrees, in both government and industry.

The Challenge: Meaningful Incentives

If we accept the assumption that we need real engineers to do real engineering in the government, and if we accept the young engineer's bleak rendezvous with reality, then the challenge is clear: We must find incentives for talented people to become and remain engineers.

When one mentions incentives, right away the universal panacea pops up—money. Unquestionably, money is one incentive—even a strong one—but it is not necessarily the strongest. It is definitely not the only one, and it does not work for all. There are numerous incentives other than money, some of which cost next to nothing. Consider, for example, title, status, recognition, job security, an office with a window, time and freedom to learn, and last but not least, the privilege to work on challenging projects. In short, to be effective, incentives must be compatible with the personality profile of the incentivised. From this plethora of possible incentives, I offer three for discussion.

Government Professionals (GP)

The first suggestion deals with the possibility of introducing, in addition to the existing GS and GM groupings, a new group of "government professionals," or GP, employees. This would definitely include, but not be limited to, engineers.

The requirements for acceptance into the GP ranks in a specific engineering discipline must be demanding. These might include an advanced degree, a professional license, at least 5 years' hands-on experience in manufacturing as well as design, and at least 2 years of research-related experience.

Such a person would likely be in his or her mid- to late 30s, and this kind of rare animal, with the above qualifications, is normally not looking for a job—he has one. Now, our first question is, "How do we get these people into the government?" Two ways exist: First, we can hire them from the outside with an acceptable and competitive salary, and offer, as a special incentive, to credit their previous years of experience and/or university time against their retirement benefits, either in part or in full. The second way, and this may be more preferable, is to groom the GP engineers "in house" by hiring young engineers with a bachelor's degree and offering them the opportunity to satisfy all requirements to gain GP status as part of a structured career pattern. Of course, we must also assign penalties for not "making it."

I can envision three groups of GP-engineers:

—GP engineering candidates;
—GP engineers; and
—GP senior engineers.

In terms of salary, the first group could fall into the GS-9 to GS-13 range, with a wide overlap for the second group from GS-11 through GS-16, and again with a wide overlap for the third group, senior engineers, from GS-13 through GS-18. This way, the title of "engineer" or "senior engineer" could be separated from a specific salary, allowing for a double-incentive—the title *and* the salary. The first proclaims status; the second provides competitiveness with the industry.

Restricting further considerations to DOD, all GP engineers should be part of a DOD or department-wide pool, which would operate in a way similar to a private consulting company. Engineers could be hired out for specific tasks, as consultants are, or they could work within the pool-

■ *Dr. Frisch is Professor Emeritus of the Defense Systems Management College, and a former Head of the Technical Management Department. He is currently an Operations Research Analyst for the Naval Electronics Systems Command. Dr. Frisch gives selected lectures on European economy, management, and cartel structures in several DSMC short and executive-level courses.*

structure on specific problems for clients.

Such an arrangement would benefit a major acquisition project, where specialists could be hired for a limited time, then returned to the pool. This would allow, for example, design engineers to be exchanged for manufacturing engineers during the transition from development to production. It would also benefit the engineers, because they would, first, be engaged full time in their area of competence, and, secondly, they would have the benefit of learning from different sources and, hence, be able to transfer knowledge among projects.

Through the pool arrangement, engineers could be alternately placed into design, production, or research-related work in order to gain, and to maintain, a balanced experience. Last, but not least, the temporarily assigned GP engineer could have a higher rating than the manager of the group of the assignment, without disturbing the necessary hierarchial order of management.

Institutionalized Continuous Education (ICE)

The institutionalization of continuing education for government professionals is the second suggestion. It may be the most important one, because it will allow us to reach a degree of excellence not otherwise achievable.

The institutionalized continuous education starts as soon as the GP engineering candidate has been accredited as GP engineer, and ends with the retirement of the GP senior engineer.

The purpose of the ICE is twofold: First, it will keep the engineer in the fore-front of competence and fully familiar with the newest developments in his field. Secondly, it will broaden the engineers' vision toward engineering-related disciplines like business, economics, administration, and law. The senior engineer in DOD should also have some knowledge about the military sciences and applied psychology; even some philosophy could do no harm. In short, I see the GP career as a permanent combination of producing and learning, not only specialized learning, but learning about the world.

As he is learning about his field, the GP engineer will be increasing his direct usefulness to his employer. As he learns about his environment, he will develop into the interpreter among disciplines, helping to bridge the existing communication gap between specialists of different fields. Besides, this was the original idea behind the founding of operations research and general systems theory.

The ICE can be accomplished in many ways and combinations thereof. Four of those ways are as follows:

—Mandatory active and passive participation in professional conferences and seminars;
—A planned exchange between work in the government and work in industry;
—Independent research in a quasi-sabbatical condition; and
—Mandatory passive and active participation in university curricula.

The participation in *conferences* could be passive as listener or active as a contributor or presenter of papers. Classified conferences and workshops could also serve knowledge dissimination within DOD.

The *exchange* of professionals among industry, government, and academia already has models that can be structured for GP engineers. It would help to create an understanding of different points of view and could ultimately lead to a new form of competition between industry and government in the search for excellence.

The *independent research* during a quasi-sabbatical would give the engineer an opportunity to research and to work toward development of some ideas he may have generated during his duties. This work could be performed at his work site, which is why I call it a "quasi-sabbatical." It may mean that, for a predetermined time, the engineer will devote either all or part of his time to a "personalized" project. One of his most valuable projects might be the write-up of his experiences in synthesized form. This, in turn, brings me to the fourth option for ICE.

Active curricula participation should be the most important aspect of institutionalized continuous education. In a single word, it means "teaching" (and I accept that I, as teacher, could be biased). Specifically, it means that the GP engineer or the GP senior engineer formulates his experiences into lectures. In my view, preparing a lecture is the most unique and the most advanced form of learning. The lecturer must organize his knowledge and gain clarity of his own (often intuitive) thinking and decision process as if he were writing an expert program for artificial intelligence. He is forced to structure his knowledge so that he may discover and fill the holes in it. Hence, teaching is learning, and teaching itself is the expression of learning. This in turn, means that teaching should be the summit of a person's career.

The teaching GP engineer or GP senior engineer would be able to teach, in a synthesized form, a "lesson of failures" across many projects instead of "lessons of success"—something that is almost never done. In most of our lectures and papers, we transmit and accentuate the positive. We tell how smart we are (30 percent), why we had success (50 percent), and what not to do (20 percent). The first 30 percent is a waste of time, because nobody cares; the last 20 percent is also a waste of time, because nobody ever follows negative advice (remember your teenaged children?). However, the middle 50 percent is an outright fraud, because we never know (and cannot know) why we were successful: Was it our superb intellect, or just plain and simple, old-fashioned luck? But we never talk about our failures, although we know exactly, as Monday-morning quarterbacks, what mistakes we made. We therefore let others repeat the same failures over and over again (because everybody has to learn by his own mistakes).

What time and effort could be saved if the GP engineer, as a part- or full-time teacher, had the freedom to teach about erroneous assumptions, wrong decisions or, in short, about failures. He could do it in a detached way without being a threat to anybody. It would be a new economy in teaching.

From a personal point of view, teaching could be, for many engineers, a smooth transition into retirement.

Gradual Retirement (GT)

The third suggestion deals with retirement. Retirement, as we know it today, is a product of recent history. It has its roots in the mass employment, in and out of government, as a consequence of industrial development. Various retirement modes exist around the world with regard to funding, age, compensation, and so forth. But we all know retirement schemes since Bismarck's time have one thing in common: All are predicated on an abrupt shift from a work-life to a non-work life. The almost universal monotony that results makes modern human retirement unique; it has a model neither in human pre-industrial history nor in nature.

Only on the American scene has this monotony been broken through (1) the economic possibility and social acceptance of part-time work, (2) the elimination of a mandatory retirement age, and (3) the introduction of the individual retirement account (IRA) concept. These refreshing developments point toward the search for a truly democratic solution to the retirement problem, where the freedom of personal choice can be combined with high efficiency. The gradual retirement plan I am suggesting is just another step in this direction. This proposal should appeal to the American marketplace, its demography, and its value system.

Gradual retirement can provide a "natural transition" from working to nonworking that would be tailored to the financial and intellectual needs of the worker as well as his or her, probably declining, physical capacities. Gradual retirement, if properly organized and, foremost, if offered as an individually selective option, could (1) maintain a person's dignity through work, even as he or she reaches advanced ages, (2) substantially reduce the burden on all retirement funds and, hence, to the "supporting generation," and (3) surprisingly enough, it could open more job opportunities for young people than are provided by the present system.

This "have your cake and eat it too" seems almost too good to be true. But I will show with a few simple calculations that it can be done. Of course, I am also aware that it may not be possible across-the-board for all employee categories. Panaceas exist only in fairy tales; however, the concept would be definitely possible for GP engineers.

In the distant future, gradual retirement might be the norm in the highest developed countries. New technologies, new types of jobs, and new tools for communication might permit the structuring of jobs for gradual retirement. Until then, we must start to introduce gradual retirement only in those types of work where the prerequisites for it already exist.

The prerequisite for gradual retirement is the absence of the need to be on the job permanently and full time. For example, managing a small, art-oriented graphics company could not be conducted on a part-time basis. The manager must be present during all operation to direct, to arbitrate, and to decide, and he also must carry the corporate memory. On the other hand, managing a fast-food franchise is a job that can easily be subdivided into many short-hour shifts. The artist-architect who sketches the layout of a new condominium can do the same work at home or in the office, at any time he desires. But the programmer must finish a well-structured part of his program, otherwise the entire program will disintegrate. For the independent medical practitioner, the consulting engineer, or the professor, it might be painless to reduce his workweek to 3 days or to one simple lecture. Along this line, common sense must determine those types of work where gradual retirement is possible. I do not think we need strict rules, although it appears that non-management-oriented jobs and individualistic jobs are more suitable to gradual retirement than other types.

I said earlier that the gradual retirement plan I propose could meet the needs of the individual and the government while saving taxpayers' money and creating more jobs for younger workers. This goal is not as idealistic or utopian as it may sound, as I hope to show.

I suggest that the gradual retirement of GP engineers could fall somewhere between three options (see accompanying table).

Option 1

Under Option 1, the GP engineer chooses to work only 4 days per week instead of 5. Accordingly, his salary drops by 1/5 from $50,000 down to $40,000 which is now his tax base. However, he opts for a full (or even increased) contribution to the retirement fund in order to increase his eventual retirement income. If three GP engineers in the $50,000 bracket select this option, (1) one GP engineer in training could be hired without any cost to the government, and (2) the retirement fund would receive contributions in full not only from all three GP engineers, but also from the junior GP engineer, meaning the entire game has only winners and no losers.

Options

OPTION #1:

— Full salary based on 2,000 hr/year	$50,000
— Reduced salary based on 1,600 hr/year	$40,000
— Tax base	$40,000
— Base for retirement fund	$50,000 or higher

OPTION #2

— Full salary based on 2,000 hr/year	$50,000
— Reduced salary based on 1,200 hr/year	$30,000
— Tax base	$30,000
— Base for retirement fund	$NONE; payment deferred

OPTION #3

— Full salary based on 2,000 hr/year	$50,000
— Reduced salary based on 800 hr/year	$20,000
— Three fifths of retirement income	$9,000
— Tax base	$29,000
— Base for retirement fund	negative

Option 2

Under Option 2, the GP engineer chooses to work only 3 days per week. Accordingly, his salary drops by 2/5, from $50,000 down to $30,000, which is now his tax base. Since (so we assume) he is already more or less satisfied with his prospective retirement income, he decides to make no further contribution to his retirement plan, but he also defers receipt of retirement payments. If three GP engineers in the $50,000 bracket select this option, (1) two new GP engineers in training can be hired without any cost to the government, and (2) the retirement fund receives full contributions from the two young GP engineers and is not burdened by retirement payments to the three GP engineers. Again, we have only winners and no losers.

Option 3

Under Option 3, the GP engineer chooses to work only 2 days per week. Accordingly, his salary drops by 3/5, from $50,000 down to $20,000, which may (so we assume) not be sufficient to cover his expenses. Hence, he decides to supplement his work salary of $20,000 with 3/5 of his already vested retirement income in the amount of $9,000, and his total tax base is now $29,000. If three GP engineers select this option, (1) three young GP engineers can be hired without cost to the government, and (2) three young people make a full contribution to the retirement fund, making the burden to the fund only 3/5 of what it would have been had the older engineer retired completely, as under our current system. Even in this case, there are all winners and no losers.

All three options demonstrate the separation of work income from retirement income in the best tradition of the private insurance business. It reduces the burden on the retirement fund (regardless of how this fund is provided) and, on a national basis, it reduces the needed contribution by the next generation because of the demographically changing worker-retiree ratio. From the business point of view, gradual retirement keeps at least some people in the group of reliable consumers much longer. It will open more jobs for young engineers, because far fewer of the old ones will be searching for after-retirement employment in industry.

The argument that the administration of the personalized retirement option might develop into a nightmare is invalid in an advanced computer age. Besides, few people would object to an administrative fee connected with each option.

On a much higher level, I think that with the experiment of gradual-retirement we could demonstrate (1) that the United States has the capability to be in the forefront with new ideas, (2) that freedom and capitalistic principles can even work within the government, and (3) that the American system has a human face undreamed of by any socialist society.

On the personal level, the GP engineer will be provided the realistic opportunity to design an individual retirement plan with a smooth transition—emotionally and financially—from working to nonworking.

From Concept to Reality: Research

It is easy to develop new ideas or concepts and frame them with flowery rhetoric. It might be much more difficult to implement them. Those difficulties, however, should be taken as a challenge for research rather than a barrier for action. Nevertheless, a series of open questions are begging for answers through research. Some of those research topics would be:

—The real desirability of a further subdivision of government workers beyond GS and GM to include a GP group.
—The exact definition of a GP engineer in the Department of Defense.
—An inventory of possible GP positions in each service.
—Actuary calculations of cost benefits for gradual retirement plans.
—A poll to determine possible interest of employees in participating in gradual retirement plans.
—An estimate of administrative cost to establish DOD or department-wide GP pools and to administer pools and the gradual retirement plan.
—The determination of possible amendments to the latest Civil Service Reform Act in order to implement new concepts.
—Options for the transition of the present system into the new system.
—The possible competitive impact of the new concepts *vis-a-vis* industrial employment benefits and/or post-retirement employment.
—Methods of motivating engineers (and other government professionals).
—The age at which optional retirement should start.

The above topics would constitute the first round of research activities, all of them designed to answer practical questions. Such research would be (in my opinion) less formidable than it may appear, and should not take longer than 1 year. The research should also help to surface difficulties not yet recognized. I also assume that this research will discover already existing models for some of the suggested concepts.

Epilogue

This all started so simply. All I wanted to do was sketch three simple ideas. However, once started, I could not resist the temptation to declare some of my personal philosophy (if you want to call it such) about teaching and about the need for American solutions to American problems—be it in solving economic problems, management problems, schooling problems, or human problems. Yes, Europe and Japan have fine solutions to some of those same problems. But Europe has European solutions, and Japan has Japanese solutions, and the United States is neither Europe nor Japan. Yes, we all can learn from each other as long as we do not forget that learning is not copying. This, in turn, is a part of what Bismarck called *realpolitik*, or the policy of reality. Besides, we have no need to copy as long as we are willing to use our own imagination, tailored to the way we perceive our reality—our own American reality.■

Editor's Note: Further discussion of this topic is encouraged. If you have comments on the proposals outlined by Dr. Frisch here, or if you have counter proposals, send them to this magazine at the address provided on the inside front cover. We will publish the most thought-provoking responses.

COMPETITION

The Great U.S.-German Swiss Tank Competition —And How We Lost

Christopher W. Nygren

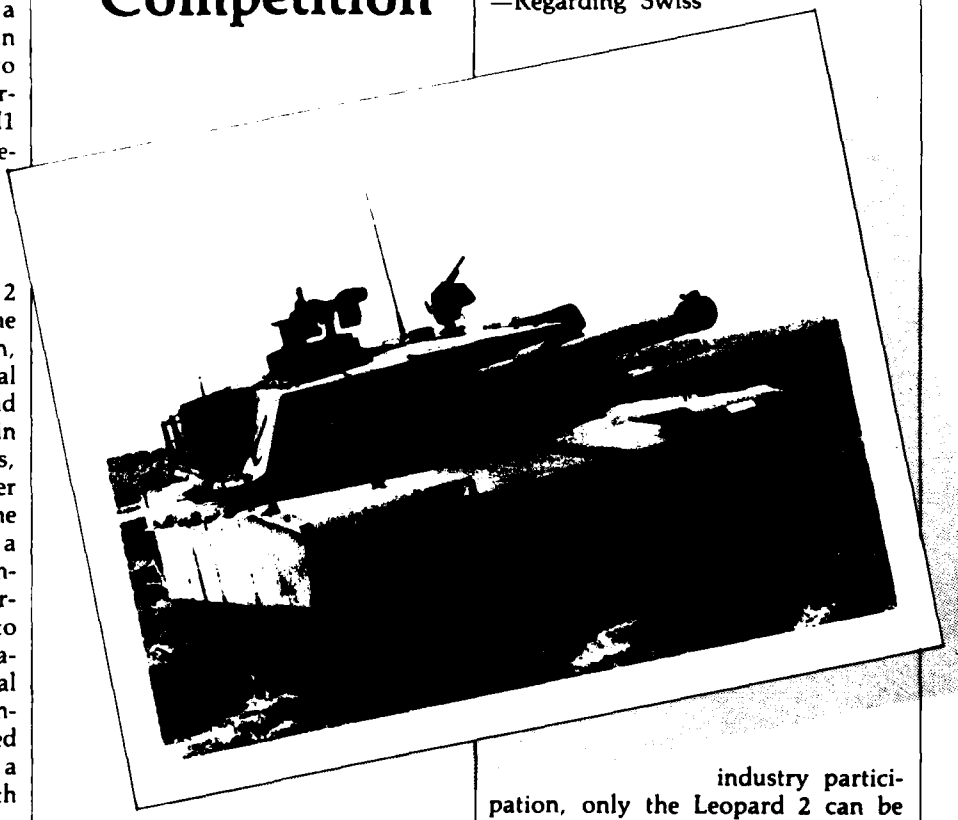
—And what we might do to keep from losing in the future

In 1978, a Swiss delegation visiting the program manager (PM) for the Army's XM-1 first indicated a serious interest in the new American tank, along with the West German Leopard 2 and a domestic Swiss tank that was in development. In 1979, the Swiss decided to discontinue their own tank development and concentrate on the evaluation of the M1 Abrams and the Leopard 2.

In November 1980, a group of Swiss users visited Fort Knox, Ky., to undergo familiarization training on the XM-1 tank in preparation for a detailed evaluation of the tank in Switzerland. In March 1981, two Leopard 2 tanks arrived in Switzerland, followed in July by two M1 Abrams tanks. Testing of the four vehicles began in August 1981 and continued through June 1982.

Both the Abrams and Leopard 2 tanks met the requirements of the Swiss militia. During the evaluation, the Swiss were also given additional test, quality assurance, logistics, and other information to assist them in their evaluation. General Dynamics, the M1 prime contractor, was under contract to assist the Swiss in the evaluation. The company offered a detailed coproduction package, including cost, offset, production sharing—all packaged in such a way as to give the Swiss a number of alternatives from which to choose. General Dynamics dealt directly with Contraves, Zurich, who had been charged by the Swiss government to conduct a cost and producibility study on both the Abrams and the Leopard 2.

On August 24, 1983, the Swiss Federal Council made its decision. It requested that the (Swiss) parliament grant a credit of 2.5 billion SFR as part of the 1984 Armaments Program (*Rustungsprogramm* 1984) to procure 210 Leopard 2 tanks beginning in 1987. A second lot of 210 tanks is to be procured in connection with a future armaments program. The first 35 tanks will be purchased in Germany, with licensed production commencing with the 36th tank. Since both the Leopard 2 and the M1 are quality products, why did the Swiss pick the Leopard 2 over the M1?



The Official Swiss Rationale

The reason for the decision to procure the Leopard 2 was stated by Chevallaz, the Swiss Defense Minister, as follows:

—The M1E1 (an improved version of the basic M1 incorporating several features the Swiss wanted) could have been considered only in the 1986 Armaments Program. It was decided not to wait that long.

—The M1E1 would be available in 2 years at the earliest, and would then have to be subjected to an additional test.

—Regarding Swiss industry participation, only the Leopard 2 can be manufactured in Switzerland with acceptable additional cost. Even in case of a coproduction, the M1E1 is significantly more expensive than the Leopard 2 produced under license.

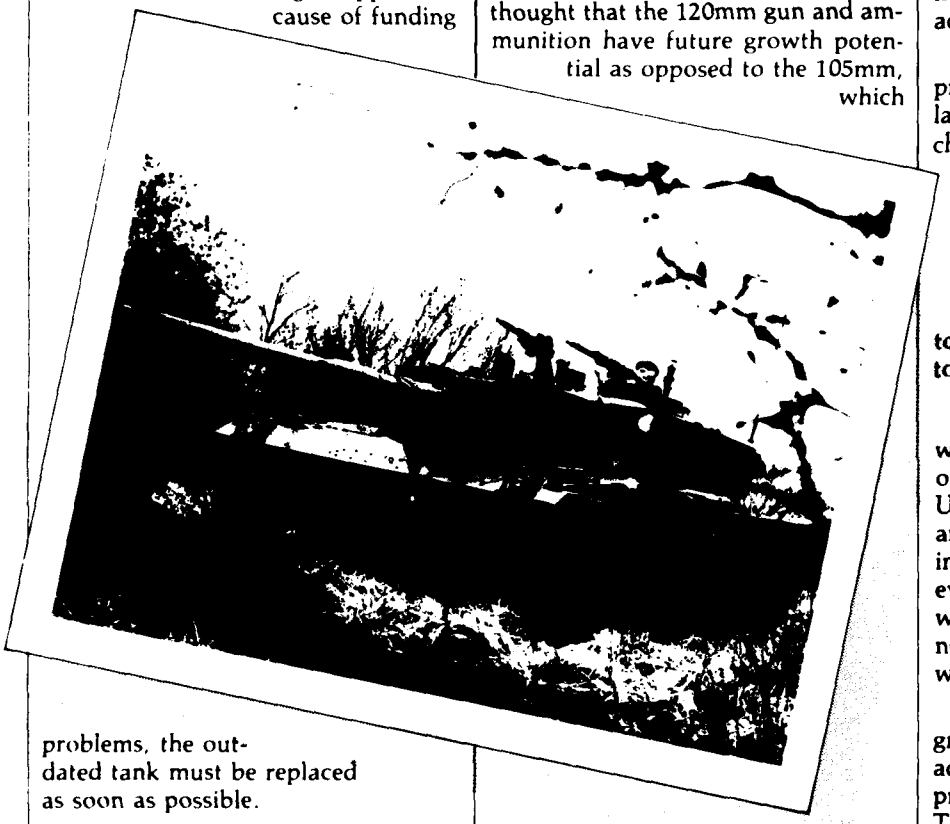
—The technological maturity of the Leopard 2 presents a solid basis for licensed production.

—Overall costs: If the two tanks were bought "off the rack," their price would be about the same; however, the total costs in relation to Swiss industry participation would be significantly higher with the M1E1 than with the Leopard 2. Krauss-Maffei, the German Leopard 2 manufacturer, waived the payment of non-recurring costs.

—The Leopard 2 is a mature system that conforms to the Swiss military characteristics. The M1 is still not equipped with the 120mm gun, and its current fire control equipment does not measure up to the Leopard 2.

—Official releases state that the license production of the Leopard 2 will guarantee 1,000 jobs each year for the next 15 years.

—The 420 new tanks are to replace 300, 30-year-old Centurion tanks and 150 PZ61 tanks now more than 20 years old; since the modernization of the Centurion is being dropped because of funding problems, the outdated tank must be replaced as soon as possible.



The Swiss View—Thirteen Points

In additional press information that followed the August 24 press release announcing selection of the Leopard 2, the Swiss Military Department stated:

> Decisive factors for the selection of the Leopard 2 are therefore the ordering date, the potential for a participation of the Swiss industry, the total costs, and the fact that the Leopard 2, today already, fully meets the Swiss requirements.

In September 1983, I visited the Swiss Embassy in Washington to further discuss this decision. Those discussions revealed the following information.

Point 1: At the beginning of the program, the Swiss military sent out a request to the various arms manufacturers for a follow-on tank for the Swiss militia. No U.S. contractor responded. This explains why the specifications drawn up by the Swiss militia reflect the heavy input of the Leopard 2 manufacturer, Krauss-Maffei.

Point 2: The 120mm gun was a key requirement of the Swiss, since it was thought that the 120mm gun and ammunition have future growth potential as opposed to the 105mm, which is considered to be a mature gun with mature ammunition.

Point 3: Another problem was a lack of public relations money spent in-country to sway the Swiss population, the military, and members of the Swiss parliament. Krauss-Maffei and top German government officials were instrumental in promoting the worth of the Leopard 2 tank. This is not to say that General Dynamics and the U.S. Army—and, eventually, the U.S. Ambassador to Switzerland—did not attempt to provide information to the Swiss to help them make a decision, it's just that there was no sincere, early-on, top-level corporate (at that time, Chrysler) and government interest in helping market the M1 tank to the Swiss.

Point 4: Another problem had to do with the price history. Originally, the M1 was priced better than the Leopard 2, even allowing for the differences in exchange rates. But, during the years of analysis by the Swiss, while the Leopard 2 price remained stable, the M1 price continued to climb because of inflation, fluctuations in exchange rates, and changes to the M1 basic tank as its design matured. Thus, the initial M1 price advantage was gradually eroded.

Point 5: Another problem in our pricing was the U.S. government's delay in waving R&D recoupment charges. Krauss-Maffei did it immediately, and easily, within their government. The United States however, had a very difficult time getting it removed from our pricing structure, although it was eventually done. This led the Swiss to question U.S. sincerity in wanting to market our M1 tank for their use.

Point 6: Criticism of the M1 tank within the United States did not help our case. The image of the M1 in the United States was generally negative and was based on General Accounting Office reports, the media, and even high-ranking military officers, who publicly said the M1 tank was not what the U.S. Army hoped it would be.

Point 7: Another factor was congressional vacillation on the issue of adopting the 120mm main gun (initial production models use the 105mm). This issue has since been resolved, and the Army's Watervliet Arsenal is producing, under license, the 120mm gun. During the source-selection process by the Swiss, however, they were not sure we would incorporate a 120mm gun in the improved M1, and this was something they wanted without question.

Point 8: There were some technical differences. The Leopard 2 had a pan-

■ *Mr. Nygren is a Professor of Systems Acquisition Management, Acquisition Management Laboratory, and Director of the Multinational Program Management Course, Defense Systems Management College.*

oramic commanders' sight, i.e., 360 degrees of vision, which enhances survivability. Eventually, the M1E1 will have a panoramic sight.

Point 9: Swiss industry has had more experience in dealing with Germany as a trading partner. Krauss-Maffei drawings were in European standards (DIN). The offsets, the co-production, and licensing options presented by General Dynamics were good, but Krauss-Maffei initially offered 100 percent compensation in form of license production and offset, as well as other support, which proved more attractive to Swiss industry.

Point 10: A key factor is that the Krauss-Maffei Leopard 2 tank is ready for production today. The M1E1 would not be ready until 1986. This was a major concern to an economy in difficulty. Swiss industry was pushing for a timely procurement.

Point 11: Another factor was restrictive U.S. legislation such as specialty metals and other buy-American restrictions. It appeared that the U.S. government and the Congress were not seriously pursuing a two-way street. Of the last five major defense systems procured by the Swiss, four were U.S. systems. Because of the political perception that the two-way street was not working, plus the Europeans' "Corporate Europe" philosophy to combat restrictive trade practices by the United States, it was considered time for a European model to be selected.

Point 12: Another factor was one with which those of us familiar with the U.S. defense budgeting process can readily identify. The Swiss militia feared that if it did not commit the funds that were then available, that those funds would not be available the next year for a decision. Even if the militia had wanted the M1E1 tank, it was not politically feasible for them to delay committing the money, because if they waited, other requirements, e.g., helicopters, fighter aircraft, missiles, may have received higher priorities.

Point 13: In addition to these problems, perhaps one other problem should be mentioned. There was no single DOD spokesman. There was no one voice that could speak consistently of U.S. government and U.S. Army policy. It is important to note that, as much as the Swiss would perhaps have liked to have bought the M1 tank, we in the United States made it difficult for them to do so by our poor communication of intent.

The M1 Program Office and General Dynamics View—Seven Points

In October 1983, I visited the M1 production facility in Lima, Ohio, and talked to the international project office for the M1 tank program. I also traveled to Warren, Mich., where I talked to representatives from General Dynamics. Their viewpoints are summarized as follows.

Point 1: The Swiss decision to buy the first 35 Leopard 2 tanks from Krauss-Maffei in 1987 raises the question why the Abrams tank could not have been selected. In 1987, the M1E1 tank will have been in production for more than 6 months, equipped with the 120mm armament that the Swiss Army feels it needs. The additional test that the Swiss Army should have to run could have been conducted as of August 1984 with a refurbished M1E1 prototype offered to the Swiss by the United States. The Swiss could also, at very little cost, have participated in the ongoing M1E1 test program, conducted with 14 pilots at various test sites. It is therefore difficult to understand the Swiss perception that they would have had to wait 2 years before being able to test an M1E1 tank.

Point 2: Both General Dynamics and government production experts find it difficult to explain why the Leopard 2 should be cheaper to produce than the M1E1. Their structures are similar, and both tanks can be manufactured using the fixtures available to Swiss industry. Whereas Contraves received from the United States a detailed drawing package (albeit no manufacturing drawings) allowing them to closely assess the M1 manufacturing costs, the Germans gave them relatively little information and forced the Swiss industry to hazard a guess or accept the manufacturing costs suggested by the Germans. Another factor was that both Swiss industry and government representatives consistently pointed to the automation at Lima Army Tank Plant (LATP). They argued that, if the United States manufactured its tanks "with robots," then building the M1 with conventional machinery would cost much more. This argument persisted, despite the fact that General Dynamics had based its cost estimate to the Swiss on building the M1E1 with conventional tools.

Point 3: It may be argued by the Swiss that the Leopard 2 is currently the more mature of the two tanks, more readily conforming to the Swiss military characteristics, than the M1 tank. This, however, is valid only for the present and immediate future. In the out years, i.e., the 1990s, the Leopard 2, as produced by the Swiss, unless it is improved significantly, will (as echoed by the *Neue Zurcher* newspaper) be a totally outdated "new" tank. Beginning in 1985 with the introduction of the M1E1 tank and, particularly with the incorporation of the Block 2 program, the Abrams tank will be by far the more modern tank.

Point 4: According to a Swiss consultant under contract to General Dynamics Land Systems Division, the Swiss claim that the production of the Leopard 2 would guarantee work for an additional 1,000 workers for the next 15 years. In view of the small production of three tanks per month, of which only 60 percent will be produced in Switzerland, which in turn will be again contracted out to a large number of subvendors, this claim of an additional 1,000 work spaces each year seems excessive unless this figure is based on an employment multiplier effect. The additional work will become available only in 1987, and the 15-year production run on the one hand, and the utilization of a large number of vendors on the other hand, will result in mini-contracts to the companies involved.

Point 5: The urgent need to replace the aging tank fleet of Centurions and PZ61s with the Leopard 2 is negated by the fact that, for one, urgency is not served by a 15-year production run of three tanks per month. Secondly, in the 1990s a thoroughly outdated tank will be replaced by a dated Leopard 2. The slow procurement of Leopard 2 battle tanks becomes a more serious concern since the partial modernization planned for the Centurion fleet has been dropped for lack of funds.

Point 6: The advantages of selecting the M1E1 based on the General Dynamics coproduction offer would have been as follows:

—The M1E1 represents a lower-cost solution in the long run than does licensed production of the Leopard 2.

—Creation of approximately 1,800 jobs in 1986, increasing to 2,200 jobs by 1991.

—M1E1 offer of coproduction to meet the needs of both Switzerland and the United States.

—Swiss assembly of the tank and all major subsystems maintains the tank-building capability in Switzerland thereby enhancing that nation's ability to become self-sufficient in times of national crisis.

—A greater technology transfer is possible under the U.S. program owing to the use of more advanced subsystems.

—Offset arrangements associated with coproduction offer the Swiss much greater opportunities than such arrangement with Germany. U.S. markets for Swiss products are virtually untapped when compared to German markets.

—The M1E1 program continues beyond the 1990s, offering the Swiss the safety of a parallel program.

—Product improvements which will evolve from ongoing R&D efforts funded under the U.S. program will also be available to Switzerland to keep their tank fleet current.

—Coproduction offers a continuation of working relationships with Swiss firms, which have existed since 1980, beyond the program life.

—The M1E1 coproduction approach has low risk, is conservative, and requires a minimum of expenditures initially.

—Switzerland could produce spare parts for U.S. Army needs in Europe.

Point 7: Various discussions conducted with Swiss officials, members of parliament, and industrialists by General Dynamics and program office representatives, and a thorough review of Swiss papers and periodicals make it apparent that the General Dynamics coproduction offer and its advantages were not widely known in Switzerland.

Lessons Learned: "To Meet the Competition"

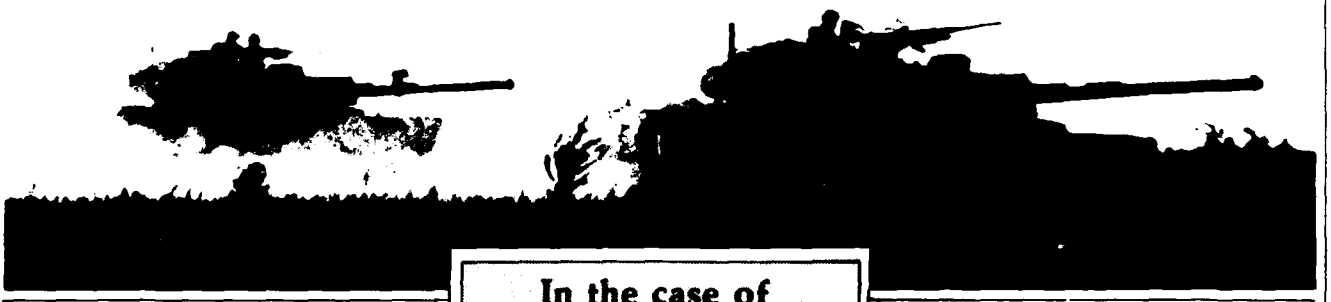
Although U.S. Army participation in the Swiss tank program was reasonably organized, the United States did not proceed on a foundation of unambiguous guidelines that would have permitted the Swiss to clearly understand our intention (or bottom line) in the sale of the Abrams tank.

You have to recognize that the Abrams tank has a formidable contender in the Leopard 2 tank, which not only was conceived out of the joint U.S./FRG MBT-70 program, but whose sale to foreign countries is supported by a powerful government/industry lobby. Stated simply, the U.S. tank production philosophy is centered foremost on the manufacture of a sufficient number of tanks for the U.S. Army. German tank production is considered in the light of the number of work spaces created and foreign sales to augment the limited production run of 1,800 tanks to the German armed forces. Therefore, the sale of 420 tanks to Switzerland becomes a powerful incentive to remove all obstacles that would stand in the way of making the Leopard 2 attractive to friendly foreign governments.

In the case of Switzerland, a "salesman" for the German Leopard 2 had a lot simpler task than his American colleague "selling" the Abrams tank. The Swiss military need document (MN) was closely fashioned after the Leopard 2 characteristics (120mm gun/diesel engine/panoramic sight); the Leopard 2 "speaks German" and was built to specifications well understood by the Swiss; it is a tidy tank at home in the crowded European environment, and the German salesman is able to do his marketing in his own back yard.

The German salesman also had to contend with fewer obstacles. The German government is not overly concerned with the problem of technology transfer. Questions of data proprietary in German industry are generally resolved by charging license fees, which are negotiable.

The German government is flexible when it comes to foreign military sales (FMS). Waivers of FMS charges are at the discretion of the Defense Ministry, mainly because the German parliament had not yet adopted the kind of micro-management practiced by the U.S. Congress. Again, keeping economics and job security foremost in their minds, costs are adjusted quickly and without a great deal of painful discussions.



In the case of Switzerland, a "salesman" for the German Leopard 2 had a lot simpler task than his American colleague "selling" the Abrams tank.

Contrary to the U.S. government, where the concept of offset, especially during the Carter administration, was taboo, the German government tends to open the bidding to any prospective foreign buyer with the promise for 100 percent offset. (How this offset is divided internally between industry and government is another matter.) It may be of interest to note that the promise of 100 percent offset by the German government is not always met when put to the test, but it makes good copy in the press and causes an assessment of the economic package in favor of the Leopard 2. Offset experts within General Dynamics, economic advisors attached to the U.S. embassy in Berne, and the Swiss consultant to General Dynamics have pointed out the trade between Switzerland and Germany is so saturated that finding opportunities for import of Swiss goods to Germany directly identifiable as offset for Leopard 2 is going to be a difficult matter, to say the least.

Lack of a firm price for the M1E1 was the most persistent complaint lodged with the United States by the Swiss. According to the Defense Technology and Procurement Group, Krauss-Maffei, manufacturer of Leopard 2, had submitted a firm price early-on, with a built-in escalation factor and a promise by the German government to waive all FMS costs.

This contrasted sharply with the U.S. practice of providing the Swiss with periodic price and availability data, which in their opinion was less than firm and therefore not wholly trustworthy. The prolonged U.S./Swiss haggling over the waiver of FMS charges added to the problem confronting the Swiss in comparing a firm German Leopard 2 price with a U.S. estimate of the cost of the M1E1.

The M1E1's chances in the Swiss competition were severely hurt by the lack of an effective public relations (PR) effort. General Dynamics stated that "Refraining from PR in Switzerland, a country that enters all decisions on a consensus basis, was a mistake." Until 1978, when the first Swiss delegation visited the M1 program office for a briefing on the XM-1 tank, little information about the tank had been made available to Switzerland. The leader of the delegation confided to us that the Swiss government had instead had difficulty getting permission from DOD to visit the program office. At that time, Germany had already submitted a detailed offer to the Swiss for the sale of the Leopard 2 tank, even though production of the Leopard 2 was still a year away.

Krauss-Maffei conducted an effective PR campaign in Switzerland by skillfully exploiting negative U.S. media reports on the M1 tank and feeding them to the Swiss; by advertising heavily in the Swiss press; by inviting Swiss notables to Krauss-Maffei production and testing facilities, etc. As a result, the Swiss public was very familiar with the Leopard 2 tank, but had little favorable information on the M1.

Lessons Learned

Until now, the M1 tank has always been the underdog in any competition with the Leopard 2. Being classified as an austere tank, lacking many of the amenities attributed to the Leopard 2 (120mm gun, pan sight, windshield wipers, directional signals, etc.), it never quite measured up to the potential buyers' expectations when compared to the Leopard 2. This will, of course, change with the introduction of the M1E1, especially with the inclusion of the Block 2 improvement program, which will greatly assist the foreign sales potential of the Abrams.

What then could, or should, be done to improve the competitive posture of the M1?

—Enter the competition early: Any interested country should be approached by soliciting an invitation. If DOD does not grab the initiative, the Abrams tank may never be considered.

—Attempt to assist the interested country in the drawing up of a materiel need (MN) document. It is interesting to notice that the Swiss MN document was almost identical to that of the Leopard 2. This being the case, we learned that we did not have a real entry until the M1E1 could go into production.

—Make an early decision on FMS charges. Waive them to the maximum extent possible.

—Be clear on the transfer of technology, and do not appear to be overly restrictive, particularly when the interested country intends to either license or coproduce the tank.

—Demonstrate high-level interest. Avoid the appearance of aloofness by government/industry personnel at the highest levels. Germany always provides a steady stream of top-level ministry officials who deal directly with the interested country, showing that Germany considers the tank sales to be very important.

—Seek early involvement of U.S. congressional representatives to keep them informed as to the benefits of the program to the United States.

—Develop a test plan for our offshore evaluation. This is mandatory prior to the initiation of test operations. Having such a document early would have highlighted technical problems and permitted appropriate technicians to be present for necessary maintenance follow-up actions.

—Establish a rapid and responsive logistical system for spare parts support.

—Make prior contractual arrangements for subcontractors "tech rep" support. Such personnel need not be on site permanently, but should provide support on a periodic, "as required" basis.

—Establish a comprehensive government/industry policy for international sales.

—Identify the real decision-makers or the power behind the decision-makers.

—Identify the motives other than military that drive major decisions in the country in which we are dealing.

—Be knowledgeable about the competition, and be aware of the deals and incentives they offer.

—Determine the influence of public opinion and learn how to sway it. Refraining from PR in Switzerland, a country that enters all major decisions on a consensus basis, was a mistake.

—Retain a local consultant who is familiar with the political and economic scene, and do it relatively early in the competition.

—Establish an in-country office early in the process and maintain it throughout all phases of the program. It portrays a commitment to the program.

—Be prepared to provide more government support and assistance through the Office of Defense Cooperation.

—Use the local language in personal contacts.

Summary—Three Points

Point 1: International programs are different!

Point 2: In order to "meet the competition," the United States must first be serious in its desire to have a two-way street. Second, the United States needs a consistent international strategy—this involves the support from the highest levels of government and, most importantly, a single consistent voice within the Office of Secretary of Defense. Third, we must be competitive in terms of price, warranties, training packages, offset, logistics support, waiver of R&D recoupment, spares, potential production, and on, and on. Fourth, we must have stronger congressional support of the Culver-Nunn amendment, which suggests that rationalization, standardization, and interoperability of our weapons systems is a must if we are to have a credible deterrent.

Point 3: Each U.S. program that is/will be involved in the international competitive marketplace is unique unto itself. The lessons learned in Switzerland should be seriously considered as we look at meeting future competition.■

INSIDE DSMC

People on the Move

Allen

Jones

Kost

Tate

Lieutenant Colonel Frank D. Allen, USAF, is an Instructor of Acquisition Management, Policy and Organization Management Department. His previous assignment was Deputy Program Manager for Logistics on the B-1B bomber engine and the alternate fighter engine at Wright-Patterson AFB, Ohio. Lieutenant Colonel Allen received his M.B.A. degree from the University of Missouri, an M.S. degree from Central Missouri State University, and a B.A. degree from the University of Buffalo.

Wilbur D. Jones, Jr., is a Professor of Systems Acquisition Management, Policy and Organization Management Department. He came here from the Pentagon, Office of the Chief of Naval Operations, where he was Head of the Acquisition Logistics Branch. Mr. Jones received a B.A. degree from the University of North Carolina.

Commander Lawrence M. Kost, USN, is an Instructor in the Acquisition Management Laboratory. Previously, he was assigned to the Joint Cruise Missiles Project (PM-3) as Ship Weapon Control System Interface Branch Head and Deputy Program Manager for weapons control requirements coordination. Commander Kost holds a B.S. degree from Penn State University, an M.S. degree and the degree of electrical engineer, both from the Naval Postgraduate School.

Robert L. Tate is a Professor of Engineering Manager[illegible] in the Technical Management Department. His last assignment was in the Directorate of Aerospace Studies, Kirtland Air Force Base, N.M. Mr. Tate holds a B.S. degree from San Diego State College.

Other Staff Additions

Myrna Bass, Policy and Organization Management Department.

Jacqueline Boyd, Technical Management Department.

Sharon Boyd, Business Management Department.

Debra Brutski, Department of Research and Information.

Sergeant Lori Reah Feldt, USAF, to Audiovisual Division, from Lowry AFB, Colo.

Staff Sergeant Dennis Hagenow, USAF, to Audiovisual Division from the 1363d Audiovisual Squadron, Hickam AFB, Hawaii.

Losses

Deberal Denson, Business Management Department, resigned, to accompany husband to U.S. Coast Guard assignment in California.

Karen Dover, Secretary to the Dean, Department of Research and Information, to Fort Belvoir Research and Development Center for an upward mobility position as a contract specialist.

Colonel John D. Edgar, USAF, Dean, Department of Research and Information, to Electronic Systems Division, Hanscom AFB, Mass., for a senior-level position.

Betty Kriegel, Civilian Personnel and Administration Division, resigned.

Anne Linkous, Research Directorate, resigned.

Robert Wayne Moore, Director, Publications Directorate, to Pentagon to be Deputy Chief, News Clipping and Analysis Service.

Charles N. Moser Professor of Financial Management, transferred to Wright-Patterson AFB, Ohio.

Captain Michael A. Pearce, USN, Dean, School of Systems Acquisition Education, to head the Navy Reserve Officer Training Corps, Iowa State University, Ames.

Susan Pollock, Senior Editorial Assistant, Publications Directorate, transferred to U.S. Information Agency, Washington, D.C., for upward mobility position as magazine production coordinator of *English Teaching Forum*.

Carolyn Prentice, Program Managers Support System Directorate, resigned.

Technical Sergeant Chris Scott, USAF, Audiovisual Division, to Langley AFB, Va.

Commander David R. Timmons, USN, Policy and Organization Management Department, to Naval Air Systems Command Headquarters, Arlington, Va.

Noncompetitive Procurement

Faces New Restrictions

Dr. William N. Hunter

The Office of Federal Procurement Policy (OFPP) has issued new policy restricting use of noncompetitive procurement procedures.

The new policy, issued in a February 27 memorandum to heads of federal agencies, implements the President's August 11, 1983, letter on "Competition in Federal Procurement," and is an essential element of the President's Reform '88 Management Improvement Program. It will also hasten the implementation of Executive Order 12352 which directs the establishment of "criteria for enhancing effective competition and limiting noncompetitive procurement."

The memorandum directs DOD, GSA, and NASA to publish tight controls on noncompetitive procurements in the Federal Acquisition Regulations (FAR). It also directs procurement executives to establish internal procedures for review and approval of noncompetitive procurements.

The new policy calls upon agency heads to:

—Communicate to department or agency program and procurement personnel a strong commitment to competition;
—Promote advance procurement planning, market research and early communication between program and procurement personnel to identify opportunities for competition early in the acquisition cycle;
—Strictly enforce the requirement for complete justification of noncompetitive procurements and careful scrutiny by review officials;
—Take reasonable steps, where competition is impracticable, to remove or overcome barriers to competition for subsequent procurements;
—Provide appropriate training; and
—Use data systems to tract noncompetitive procurements and progress toward increasing competition.

For procurements of property or services that exceed the small purchase ceiling, competitive procedures will be used unless at least one of the following circumstances prevails:

—The property or service needed is available from only one source, there is no competitive alternative, and none can be developed in time to satisfy the requirements.
—The property or service is urgently required as result of circumstances other than lack of advance planning or funding concerns.
—An award must be made to a specified source or sources to support the industrial mobilization base or maintain an essential research capability.
—The award will establish or maintain an alternative source which may increase or maintain competition and will likely result in lower overall cost to the government.
—The follow-on procurements, in order to avoid (a) substantial duplication of cost to the government for the property or service being procured, which cannot be expected to be recovered through competition, or (b) unacceptable delays in accomplishing the agency's mission objectives.
—The contract to be awarded results from acceptance of a bona fide unsolicited proposal that demonstrates a unique or innovative concept which fills a requirement or general mission need of the government. (The term "unsolicited proposal" means a proposal that is submitted to a federal department or agency on the initiative of the submitter for the purpose of obtaining a contract with the U.S. government, and which is not in response to a formal or informal request [other than a departmental request constituting a publicized general statement of need in areas of science- and technology-based research and development that are of interest to the department].)
—A specific source is required by international agreement or for directed procurements for foreign governments.
—The property or service is authorized or required by statute to be obtained from or through another federal agency, or required by statute to be obtained from a specified source.
—Disclosure of the property or service needed by the government to more than one source would jeopardize the national security.

The policy will become effective upon implementation in the Federal Acquisition Regulation later this year.■

■ *Editor's note: Dr. William N. Hunter, former Director of the Federal Acquisition Institute and current occupant of the Office of Federal Procurement Policy Chair in the DSMC Executive Institute, uses this space to keep* Program Manager *readers informed about the activities of the Office of Federal Procurement Policy (OFPP).*

Playing to Win
in the Acquisition Game

Most players soon learn that efficiency and cost control aren't always part of the game.

D. A. Stuart and R. C. Smith

The problem of cost growth in acquisition programs is endemic at all levels of government—federal, state, and local. And the problem is not limited to exotic hardware, it afflicts even relatively straightforward construction programs. Programs are estimated, or "sold," at one value and after implementation (i.e., when development and production are completed) are found to have cost much more than was expected when the project was initially approved.

Our focus here, of course, is on weapon system programs, where such "overruns" generate an enormous amount of media attention and internal probing. Numerous studies and analyses have documented the phenomenon of cost growth in defense acquisition programs. Many causes of the problem have been identified, including the following:

—General economic inflation
—Technological uncertainty
—Specification changes

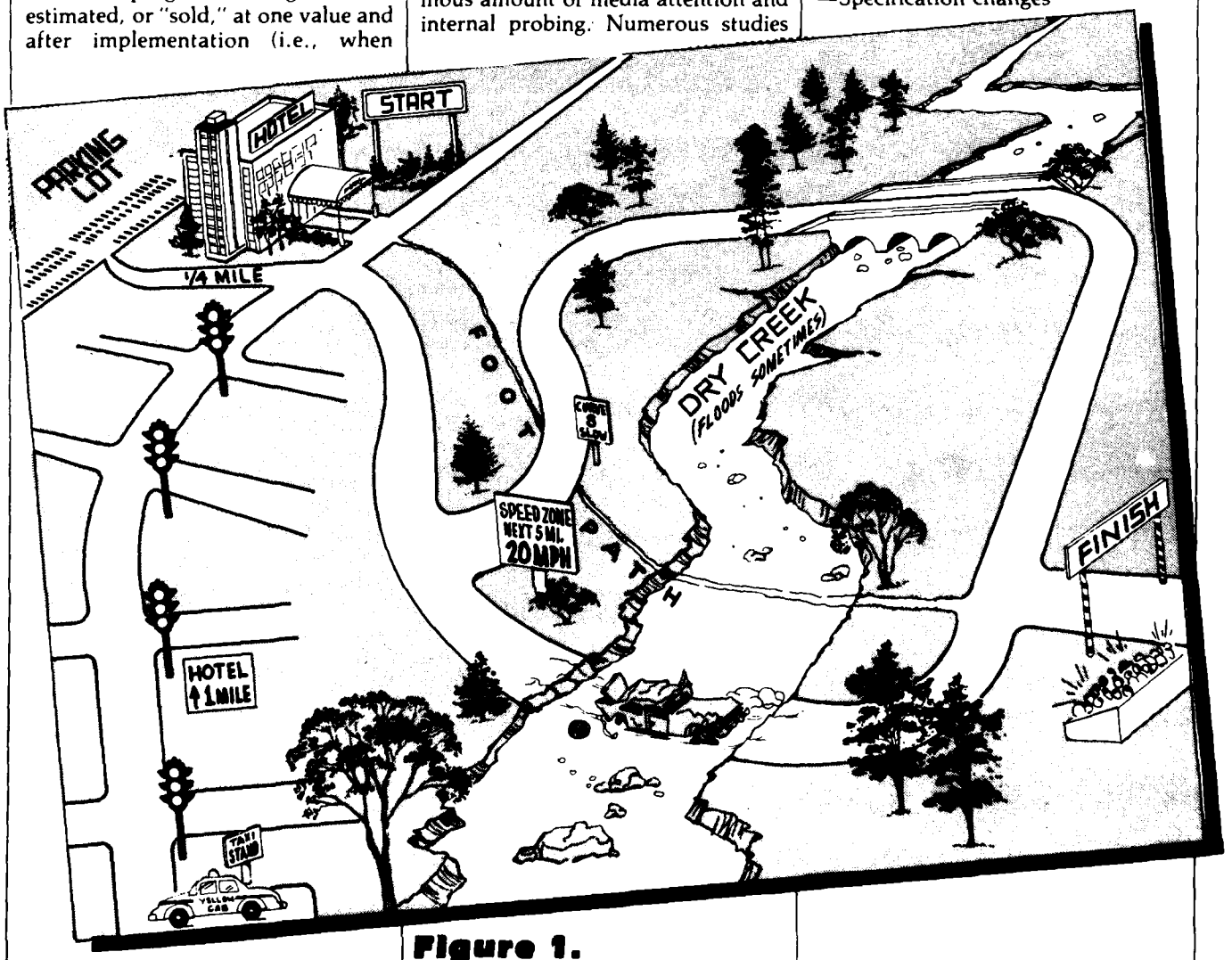


Figure 1.

—Budgetary constraints
—Changes in threat
—Supply and labor shortages
—Poor initial cost estimates

In addition to these causes, some claim that cost overruns in weapon programs are the result of "puffing" and "selling"; some claim they are the result of a conspiracy between defense industry and its customers in the Defense Department, or that they are the result of mismanagement by industry or government—or both. Others claim that overruns are mislabeled—that cost growth is simply the consequence of changes in program timing and requirements.

In truth, all of these "causes" play some part in the consistent underestimation of total program costs. Unfortunately, there are other factors that play an even more important role in creating real or perceived overruns, and those factors are much harder to control. They spring, in fact, from the very nature of the acquisition process itself, and from the environmental pressures that influence it.

To show what we mean, we have devised the "acquisition game." The purpose of the game is to show, in everyday, familiar terms, the factors that influence both the development of a cost estimate for an acquisition program, and the selection of the winning contractor. You will also see why the *estimated* cost for a project rarely approximates the *actual* cost. Now, let's play.

The objective of this project is to have some packages taken from the hotel across town and delivered to the "finish" line (see Figure 1). It is important that the delivery time be short, but it is also important that the delivery does not cost too much.

Now, there are several methods available for making the deliveries. It is possible to walk, using the footpath, but that takes time, and time is money.

It is possible to drive. This is much faster than walking—even though the parking lot is ¼ mile away—and it is cheaper—that is, unless Dry Creek is flooded (as it is 20 percent of the time), when it takes an extra 30 minutes to drive around the ford and across the bridge.

It is also possible to take a cab. That is even faster and cheaper, unless it is rush hour, when it takes the cab 30 minutes longer to reach the hotel from the cab stand (which happens 10 percent of the time), or unless Dry Creek is flooded.

It is difficult in this forum to play the game completely, what with estimating times and probable costs, so some of that work has been provided.

Figure 2 shows a comparison of three "best-case" possibilities for estimating the cost of making our deliveries.

There is quite a variation, isn't there? In our best-case scenario, the times vary from 4 minutes to 20 minutes (a factor of five), and the cost per trip varies from $16 to $20. But what if things go wrong? Figure 3 shows three "worst-case" situations. The times now vary from 20 minutes to 62 mintues, and the cost per trip runs from $20 to $194. (As strange as it may seem, such a spread in possible performance and cost is *not* likely with high-technology programs.)

Now, pretend for a moment that you are a member of Congress. Before the program manager can set up any delivery system, you must authorize it and appropriate money for it. You know what the overall budget situation is—there are more projects proposed than there is money available—and hard choices must be made.

For the purpose of our game, pretend that this project is a "must"—you cannot, or do not, want to "kill it," but what is the "right" budget level? If you agree to fund one of the worst cases, you may be precluding the possibility of pursuing some other project you consider worthy. On the other hand, if you accept, agree to, or force the budget to cover just one of the best cases, you may be able to approve some other project.

If you are a strong supporter of the program in question, you will probably push the first (worst-case) approach; if you oppose the program, you will probably go for the latter (best-case).

Now, if the program manager knows (or believes) that you, the approver, think this project is essential, he will probably push to get the budget based on a situation other than best-case in order to provide for contingencies—both the "known unknowns" and the "unknown unknowns." If you are *not* convinced the effort is truly essential, you will likely refuse to listen to any argument that the budget should be on any other than a best-case basis.

This is the dilemma faced by every program manager and every "approver of the budget" in the government. If commitments are made on a worst-case basis, funds will be available to cover unforseen problems in the program. The bad news is that, by the time it is discovered that the funds are not needed, it may be too late to use them somewhere else and an opportunity will have been lost. On the other hand, if commitments are made on a best-case basis, today's opportunities will not be lost,

Figure 2. Best-On-Best Cases

HOW	TIME	RATES	COST	PERFORMANCE TARGET (TIME X COST)
WALK	20 MIN.	$1/MIN.	$20	400
DRIVE (USE FORD)	5 MIN. TO CAR + 2 MIN. DRIVE = 7 MIN.	$1/MIN. + $10/MILE	$17	119
TAXI (USE FORD)	2 MIN. WAIT + 2 MIN. DRIVE = 4 MIN.	$1/MIN. + $12/MILE	$16	64

and there is *some* possibility that it will really work out. If not, additional funds to cover unforseen problems can still be requested/appropriated next year.

Everyone understands, or should understand, that both the best-case and worst-case budgets are unrealistic and should be avoided. But who is to say that the best case can *never* be achieved? Because of this possibility, however remote, budget approvers tend to eliminate contingencies; requestors accept the challenge; and the uncertainty that is so obvious to the participants is seldom voiced. As a consequence, nonparticipants (and even some participants) are likely to believe what we call the myth of the forseeable future:

Myth

Cost, performance, and schedules are predeterminable.

Reality

Cost, performance, and schedule estimates are just estimates and, for successful programs, must include provisions for things going wrong.

Accepting the myth rather than facing reality leads one to incorrect conclusions about cost overruns. When a project does not come in on target, it may be, but is *not necessarily*, the fault of those who established the original targets. Culpability only exists when unachievable goals are knowingly and deliberately established. Remember, even a best-case scenario is *possible*, even if unlikely. When such a best-case approach is adopted, it may reveal ignorance and managerial incompetence when the estimate proves to be far off the mark, but it does not indicate fraud.

There is another type of possible misrepresentation or "underestimation" that, in today's world, should not be considered culpability, for it seems to be necessary in the *federal* budgeting process, though not elsewhere.

It happens because the program manager can, for example, estimate the man hours and tons of steel required to build a new ship—and when those resources will be expended—with a reasonable degree of precision. He knows what the labor rate and materials costs are this year. But what about next year, and the year after that, and 5 years or 8 years

Figure 3. Worst-On-Worst Cases

HOW	TIME	RATES	COST	PERFORMANCE TARGET (TIME X COST)
WALK	20 MIN.	$ 1/MIN.	$ 20	400
DRIVE (FLOODED, USE BRIDGE)	5 MIN. TO CAR + 32 MIN. DRIVE = 37 MIN.	$ 1/MIN. + $10/MILE	$147	5,439
TAXI (RUSH HOUR AND FORD FLOODED)	30 MIN. WAIT + 32 MIN. DRIVE = 62 MIN.	$ 1/MIN. + $12/MILE	$194	12,028

Figure 4. Expected Values

HOW	TIME	COST	PERFORMANCE TARGET (AVG TIME X AVG COST)
WALK	20 MIN.	$20	400
DRIVE ONLY	13 MIN. (AVG.) (37 MIN. MAX.)	$43 (AVG.)	559
TAXI ONLY	12.8 MIN. (AVG.) (62 MIN. MAX.)	$53.40 (AVG.)	684
TAXI (WALK IF RUSH HOUR)	11.5 MIN. (AVG.) (32 MIN. MAX.)	$43.90 (AVG.)	505
DRIVE OR DRIVE + WALK	8 MIN. (AVG.)	$18 (AVG.)	144
TAXI OR WALK OR TAXI & WALK	7 MIN. (AVG.) (25 MIN. MAX.)	$17.80 (AVG.)	125

from now? What will the costs be then? The usual procedure is to estimate costs as though all efforts were occurring this year, then compensate for cost growth (meaning inflation) by increasing the out-years estimate by an identified inflation factor provided by the Office of Management and Budget (OMB). The trouble is, historically, those factors have been low, reflecting what OMB has wanted to see and not necessarily what was actually expected. Because of its political role, OMB must provide inflation factors that would result if the administration's inflation-control efforts were *completely successful*. This is understandable from a political point of view, but it sets a trap for the program manager, who is a victim rather than a culprit when true inflation exceeds the predicted figure.

Now, let's return to the acquisition game. Pretend that you are a potential supplier of the package delivery system we have been discussing. The need for the system has been "sold," and the cost target has been based on walking, since this is a reasonable compromise.

A request for proposal (RFP) is issued with the intent of awarding the contract to one who makes the best believable offer. Since the requirement is for a delivery system that is both fast and low in cost, the "best" offer is defined as the one that provides the smallest product of delivery cost and delivery time. This is represented by the "target" column in Figures 2 and 3.

As an "expert" in delivering packages, you recognize that neither a best case nor worst case should be, or could be, the basis for a successful proposal. So you look at the conditions that might reasonably be expected to prevail over the life of the contract. You make your estimate based on the average cost for a large number of trips, say 100, with 20 in rainstorms and 10 during rush hour. You find that the results are quite different from either the best- or worst-case scenarios, and that the costs for the various modes of travel are very close together. Then you do some contingency planning. If you had planned to take a cab, but one does not show up within a reasonable time, say 5 mintues, you could walk and eliminate that 30-minute rush-hour wait. Or you could park and cross by foot if Dry Creek were flooded. Making these calculations, you find that the "expected" times and costs have decreased substantially, and you bid accordingly. (Figure 4).

Not surprisingly, you are awarded the contract based on the cost of your combination of using the cab and walking. But the possibility of a 25-minute delivery time is not as desirable as something shorter. Because one of the objectives is to minimize cost, a balanced incentive plan in agreed to, one that provides a 20/80 sharing of cost variances and reward or penalties on the basis of $.50 for each minute the trip time differs from 7 minutes. In this way, you gain or lose if your actual time/cost performance is better or worse than the target.

Now, suppose this program had been sold on one of the best-case situations, for example, driving. Since this was the basis for program approval, it is common knowledge at the time the RFP is issued that a time of 7 minutes, a cost per trip of $17, and a target cost of $119 are expected. How many proposals do you suppose will come in with a time greater than 7 minutes, costs more than $17, or a target more than $119? Very few—probably none. Not many potential bidders are willing to propose at a price they know cannot be accepted immediately by the program manager or the buyer.

It may not be clear to some readers why any bids would be expected at all when the target has been established on an unrealistic best-case basis. Aren't the bidders aware that the budget is insufficient? Why "buy in," especially if "get-well" possibilities aren't obvious? The answer is that many people like to gamble, to put up stakes with the *potential* of a win, but the true mathematical expectation of a loss. If you doubt that, just look at the success of gambling casinos and state lotteries.

The uninitiated may think that bidders will ignore what has been allocated for a project and will base their bids on "real-world" expectations, meaning that the bids received will confirm or belie the reasonableness of the established targets. It rarely happens that way. The buyer must exercise judgment. Here, too *myth* and *reality* differ.

Myth

The acquisition process should be (can be) objective and judgment-free.

Reality

Acquisition of complex systems is an art, not a science, and requires judgment.

Now back to our game. You, as the contractor, now have the contract. So the first thing you do is buy a bicycle, which can be operated over the entire footpath. The trips take 4 minutes total, independent of weather or rush hour, at a cost to you of $5.00 ($1 per minute, plus $1 per mile). The cost to me is $5.00 basic, plus a $1.50 reward for the 3-minute time saving, plus 20 percent of the $12.80 cost saving, or a total cost to me of $9.06. That is a saving of 49 percent from the expected $17.80!

That makes me very happy. Or does it? If I didn't know about your underrun until it was too late to take advantage of it (to fund some other projects, or to turn funds back in to protect my "source"), then I would be very upset. Otherwise,, I would be delighted—unless I feel as though I have been "snookered" by being led to believe or expect one thing while you were planning something else. Even if I had not been misled, I probably would not appreciate being "surprised," even though it means lower cost.

But most of the surprises we see in defense acquisition result in overruns, not underruns. And they happen, to a large extent, because the system has been trained to expect, and even to accept, the discovery that an initial cost estimate was *optimistic*. And, while it will grumble and complain, the system will tolerate "explanations." In ironic contrast, the system is *in*tolerant of the discovery of *pessimistic* estimates, especially those that penalize another activity. This is why successful program managers "warn" the approving authorities about unusual situations—underruns *and* overruns—and that is why the rule is, "Never turn back budget!"

What it boils down to is that our government budget system is biased, and the bias *cannot* be eliminated. From the Congress through all levels of the administration, and into the industrial base, the penalty for making or accepting pessimistic estimates is immediate: as a proposer, the project is not approved; as an approver another effort cannot be funded. But the penalty for optimistic estimates does not show up immediately. It comes up sometime in the future—possibly on someone else's watch.

This conflict between short-term and long-term penalties is aggravated by the extensive use of short-term assignments, whether it be the 2 year term of a congressman, the 2-3 year term of most military assignments, or the 4-year terms of the President and his appointees. A "short-termer" is forced to concentrate on short-term consequences and is *encouraged* to ignore long-term consequences. His successor can, and is expected to, claim, "I'm fixing the errors of my predecessor."

This built-in bias is often overlooked when the causes of cost-not afford to be complacent, because we must deal with those long-term consequences. We must insist that our representatives act in our *long-term* interests. Only then will the bias be reduced. In the meantine, it can be corrected in unusual cases (big programs) by making long-term assignments to program managers; by demanding realistic commitments with known identifiable contingency provisions; by encouraging cooperative, vice adversarial, actions; and by holding program managers, their superiors, and their team-members *all* accountable for the total program. While we are at it, we should work on exploding other all-too-common growth are discussed. The public can-myths—that buyer/seller relationships should be adversarial in nature; that business is intended to sell products; that mistakes should not happen; and that quality is expensive.

None of these myths describe reality; none of them are necessary in government business, and all are forms of self-fulfilling prophecy.

None of these myths describe reality; none of them are necessary in government business, and all are forms of self-fulfilling prophecy. There is a reality, illustrated by the Japanese and some large government activities, where buyer/seller relationships are not adversarial; where the business role is to create valued customers; when it is not a sin to make a mistake, but a sin to hide it, or not correct it; and where quality is free. This approach is laudable.

We do not expect a big change in the basic cost-growth phenomena as a result of administration initiatives. The public is not sufficiently aware, concerned, or interested. But that is changing. We, the public, are *beginning* to awaken. Let's hope that we can begin to focus on the inherent problems with the system itself and make meaningful changes. The process and its products, as a whole, will not get better until we do.■

■ *Dr. Stuart is vice president and general manager of Lockheed Missiles and Space Company's Missile System Division and a vice president of the Lockheed Corporation.*

Mr. Smith is assistant to the Senior Vice-President for Science and Engineering for the Lockheed Corporation. He is a graduate of PMC 81-1.

Send Us Your DSMC Memorabilia for College History

The Defense Systems Management College is compiling a complete history to commemorate its 15th anniversary in 1986. We need YOUR help to make this history complete in every way, thus adding an important chapter to U.S. military archives, especially in the research and development field.

According to Dave Acker, of the DSMC Research Directorate, who is serving as Editor-in-Chief, anyone *ever* connected with DSMC in *any* way can help by contributing information suitable for inclusion in this historical publication.

Dave is looking for such DSMC memorabilia as photographs, cartoons, anecdotes, quotations—whatever. He would appreciate the help of everyone who has been a student or a faculty or staff member at DSMC since 1971, when then Deputy Secretary of Defense Packard recommended that the Defense Weapon Systems Management Center at Wright-Patterson AFB, Ohio, be moved closer to Washington, D.C., to prepare military and civilian students for roles in management. Since 1971, more than 16,000 military and civilian personnel from the armed services and other federal agencies, as well as middle managers from the defense industry, have studied at DSMC.

Send your contributions to Professor David D. Acker, Defense Systems Management College, Directorate of Research, Fort Belvoir, Va., 22060. Pictures and/or documents will be returned as requested.

Let Dave hear from you.■

DARCOM Becomes AMC

Department of Army redesignated its Materiel Development and Readiness Command, with headquarters in Alexandria, Va., to the U.S. Army Materiel Command, effective August 1.

The command will continue the same mission, which is to research, develop, procure and support weapons and equipment at 64 installations in the United States and overseas. The command has about 120,000 military and civilian personnel.

It was established August 1, 1962, as the U.S. Army Materiel Command and was redesignated in 1976 the U.S. Army Materiel Development and Readiness Command (DARCOM). A distinction was made, at that time, between the development mission and logistics support as the Army prepared for a massive materiel modernization following the Vietnam era.

The redesignation is the culmination of five years of examination and organizational change to strengthen the Army's management of materiel. The redesignation will remove a perceived boundary between development and logistics support implied in the DARCOM name, features brevity and simplicity, and will be better understood by allies and the general public.

In addition, the headquarters will undergo some organizational adjustments designed to better structurally describe it as a military organization, and reinforce unity of command.

U.S. Army Materiel Command, commanded by General Richard H. Thompson, will continue to be a major command of the U.S. Army.

These command changes will cause no reduction in employment. ■

Top 100 Companies Receiving Largest Dollar Volume of DOD FY83 Prime Contract Awards

1. General Dynamics Corp.
2. McDonnell Douglas Corp.
3. Rockwell International Corp.
4. General Electric Co.
5. Boeing Co.
6. Lockheed Corp.
7. United Technologies Corp.
8. Tenneco Inc.
9. Howard Hughes Medical Institute
10. Raytheon Co.
11. Grumman Corp.
12. Martin Marietta Corp.
13. Litton Industries, Inc.
14. Westinghouse Electric Corp.
15. International Business Machines Co.
16. LTV Corp.
17. FMC Corp.
18. RCA Corp.
19. TRW Inc.
20. Sperry Corp.
21. Honeywell Inc.
22. Ford Motor Co.
23. General Motors Corp.
24. American Telephone & Telegraph Co.
25. Exxon Corp.
26. Northrop Corp.
27. Allied Corp.
28. Maersk Line Ltd.
29. Avco Corp.
30. GTE Corp.
31. Textron Inc.
32. Singer Co.
33. Texas Instruments Inc.
34. Estate of Howard Hughes
35. General Tire & Rubber Co.
36. ITT Corp.
37. Standard Oil Co. of California
38. Teledyne Inc.
39. Motor Oil Hellas
40. Soberbio Inc.
41. Pan American World Airways Inc.
42. Harris Corp.
43. Todd Shipyards Corp.
44. Eaton Corp.
45. Goodyear Tire & Rubber Co.
46. Guam Oil & Refining Co., Inc.
47. Atlantic Richfield Co.
48. Sanders Associates Inc.
49. Waterman Marine Corp.
50. The Signal Companies Inc.
51. Royal Dutch Shell Group
52. Motorola Inc.
53. North American Philips Corp.
54. E Systems Inc.
55. Hercules, Inc.
56. Morrison Knudsen Co. Inc.
57. Mobil Corp.
58. Ogden Corp.
59. Morton Thiokol Inc.
60. Gould, Inc.
61. Congoleum Corp.
62. Caterpillar Tractor Co.
63. Emerson Electric Co.
64. Control Data Corp.
65. Standard Oil of Indiana
66. Coastal Corp.
67. Penn Central Corp.
68. Aerospace Corp.
69. Fairchild Industries Inc.
70. HBH Co.
71. Massachusetts Institute Technology
72. Burroughs Corp.
73. Pacific Resources Inc.
74. Johns Hopkins University
75. Oshkosh Truck Corp.
76. Gulf Oil Corp.
77. Ashland Oil Inc.
78. The Mitre Corp.
79. Rolls Royce Ltd.
80. Dupont E. I. De Nemours & Co.
81. Williams International Corp.
82. R. J. Reynolds Industries Inc.
83. Duchossois Thrall Group, Inc.
84. NI Industries
85. Sam Whan Corp.
86. Computer Sciences Corp.
87. Xerox Corp.
88. Brunswick Corp.
89. Hewlett Packard Co.
90. Gulf States Oil & Refining Co.
91. Science Applications International Inc.
92. Sundstrand Corp.
93. Kaman Corp.
94. Kuwait Petroleum Corp.
95. Harsco Corp.
96. Lear Siegler Inc.
97. Varian Associates Inc.
98. Southern Union Co.
99. Cubic Corp.
100. Digital Equipment Corp.

We're Looking for a Few Good People

Ted Ingalls

Of the three primary concerns the defense program manager has—cost, schedule, and performance—schedule is being neglected. We always have been concerned with attaining a specified performance for a weapon system, and rightfully so, because the bottom line of the entire defense acquisition process is to produce systems that provide the performance required to effectively counter threats. In recent years for good business reasons and because of tremendous pressures, we have placed increased emphasis on controlling the costs of weapon systems. But, unfortunately this same emphasis has not been placed on managing a program schedule.

Because of the close interrelationships among cost, schedule, and performance, it is impossible to change any one without affecting the others. Thus, if we truly hope to realize the economies and efficiencies in the defense acquisition process that we constantly pursue, all three elements must be managed concurrently, and considered during every program decision. The same interest we are placing on controlling program cost and attaining required performance, also must be applied to managing the program schedule.

Here is what I mean by managing a program schedule. As used here, schedule management includes the familiar efforts of passively tracking or monitoring a program's progress, a task almost all programs adequately perform. But in addition to monitoring, schedule management includes the active reviewing and questioning of the progress of program activities, identifying potential problem areas, conducting "What If?" exercises, and developing "work-arounds" to schedule conflicts. In my opinion, performing this function in the detail needed to manage a complex weapon system program requires an automated, network-based system providing reports tailored for use by management personnel.

To investigate this apparent lack of interest in program scheduling management, DSMC conducted a survey of DOD Program Management Offices (PMOs) in late 1983 and early 1984. The purpose was to determine what techniques were being applied to manage program schedules and to identify the systems being used to assist this management process. More than 100 DOD PMOs and major command support offices in all services were contacted. In only about a third of the offices surveyed it appeared that the means were in place to perform the schedule management functions as defined above; nearly all of these offices were using one of two systems—either a modified version of VIS1ON,* a commercial system, or the government-owned CSNAS ** system.

These results cause concern when we consider that most of the PMOs surveyed were important weapons systems offices where multiple contractors were involved in the program, where often the government was furnishing critical components, and where there was substantial interface and review by service and OSD staff offices. In short, most of the offices surveyed were the type needing the capability to actively manage complex program schedules with numerous interrelated activities. However, approximately two-thirds did not have this capability.

These results raise the question: Why don't more PMOs appear to aggressively manage their schedules? There are many reasons, but the most likely can be determined by comparing related costs and benefits. In too many cases, the PMO has perceived

■ *Mr. Ingalls is a Professor of Engineering Management, Department of Research and Information, at the Defense Systems Management College.*

* VIS1ON is a network-based scheduling system developed by Systonetics, Inc., 801 E. Chapman Avenue, Fullerton, Calif. 92631. It has been modified for use by several Army acquisition activities, and notably CECOM, Fort Monmouth, N.J.; TACOM, Warren, Mich.; ERADCOM, Adelphi, Md.; and BRDC, Fort Belvoir, Va. We recommend that any DOD activity desiring more information on using VIS1ON contact one of these Army users.

** CSNAS is a network-based scheduling system developed and operated by the Air Force Acquisition Logistics Center (AFALC/XRI), Wright-Patterson AFB, Ohio 45433. The point of contact for this system is Al Clark, AFALC, AV 785-3731/4695. CSNAS currently is being used by a number of Air Force program offices. We recommend that any DOD activities desiring to start a schedule management effort contact AFALC and consider CSNAS.

that costs (dollars, people, and time) to manage a program schedule have outweighed the expected benefits.

On the cost side we must realize that it is difficult and time consuming to schedule complex program activities in the detail necessary to provide a good management tool. It requires many resources and a strong commitment to initially plan a complex program, and even more to maintain and manage that schedule.

On the benefit side, the assistance provided to managers from automated scheduling systems within PMOs has often been marginal. Typically, the outputs of these systems have not contained the information necessary to aid management decision-making in a defense PMO—at least information in the form that can be used directly by managers. Many have experienced the situation where systems could produce enough network printouts to paper the walls, but failed to produce reports that a manager could readily understand and use to adjust time-critical activities.

Because of a belief that schedule management is important and that schedules can clearly drive costs, DSMC has undertaken a project to attempt to change the cost/benefit relationship by both reducing the costs associated with managing schedules and by increasing the benefits to be derived from doing so. This is where we are soliciting your help. By the time you read this, we expect to have a contract to develop a software package for a microcomputer that will assist *managers* in creating a network of program activities and will then assist management of that schedule. Emphasis is being placed on the manager in this effort. The software will be designed explicitly for the manager in a defense PMO. If we do our job right, the manager will not have to be experienced in the use of computers or be an expert in network scheduling techniques to use the software.

We are looking for a few good men or women to assist in the design of this computer program. Specifically, we are seeking a few volunteers with certain qualifications to review contract progress and products during the early stages of the contract. The purpose is to ensure that we do, indeed, produce a package useable by and useful to managers within a PMO. Later in the contract we will need volunteers to evaluate the prototype software and provide suggestions for improvements.

The qualifications we are seeking are:

- Significant experience in a DOD weapon system PMO particularly in the area of program scheduling.
- Knowledge of the needs and capabilities of PMO managers as related to scheduling activities.
- Interest in helping to direct the design of this software package.
- Ability to travel (probably at parent organization expense) to DSMC for approximately two 1-day reviews as well as time to review contract materials (estimate 15 hours) during October 1984-May 1985.

If you meet these qualifications or have other comments or suggestions, please complete and return the form in the box to DSMC, ATTN: DRI-S, Fort Belvoir, Va. 22060. We will provide all those who respond with additional information.■

VOLUNTEER APPLICATION

Name_____ **Phone No.** _____

Activity

and Address

Brief statement

of PMO scheduling

experience and

knowledge of PMO needs

Comments/Suggestions

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A Few Things Have Changed Down at the Old Factory

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