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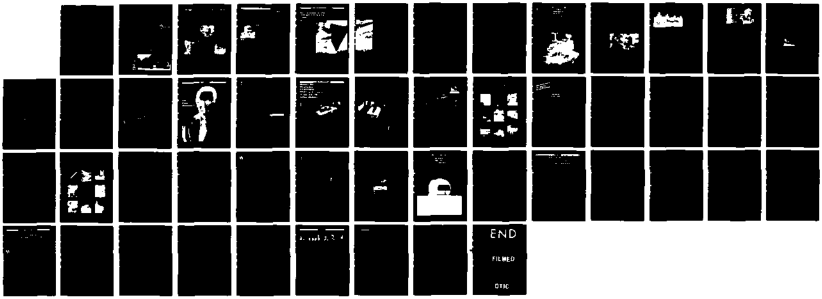

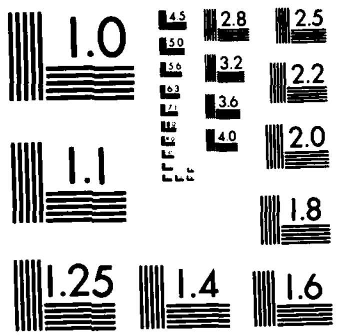
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March-April 1985

Program Manager

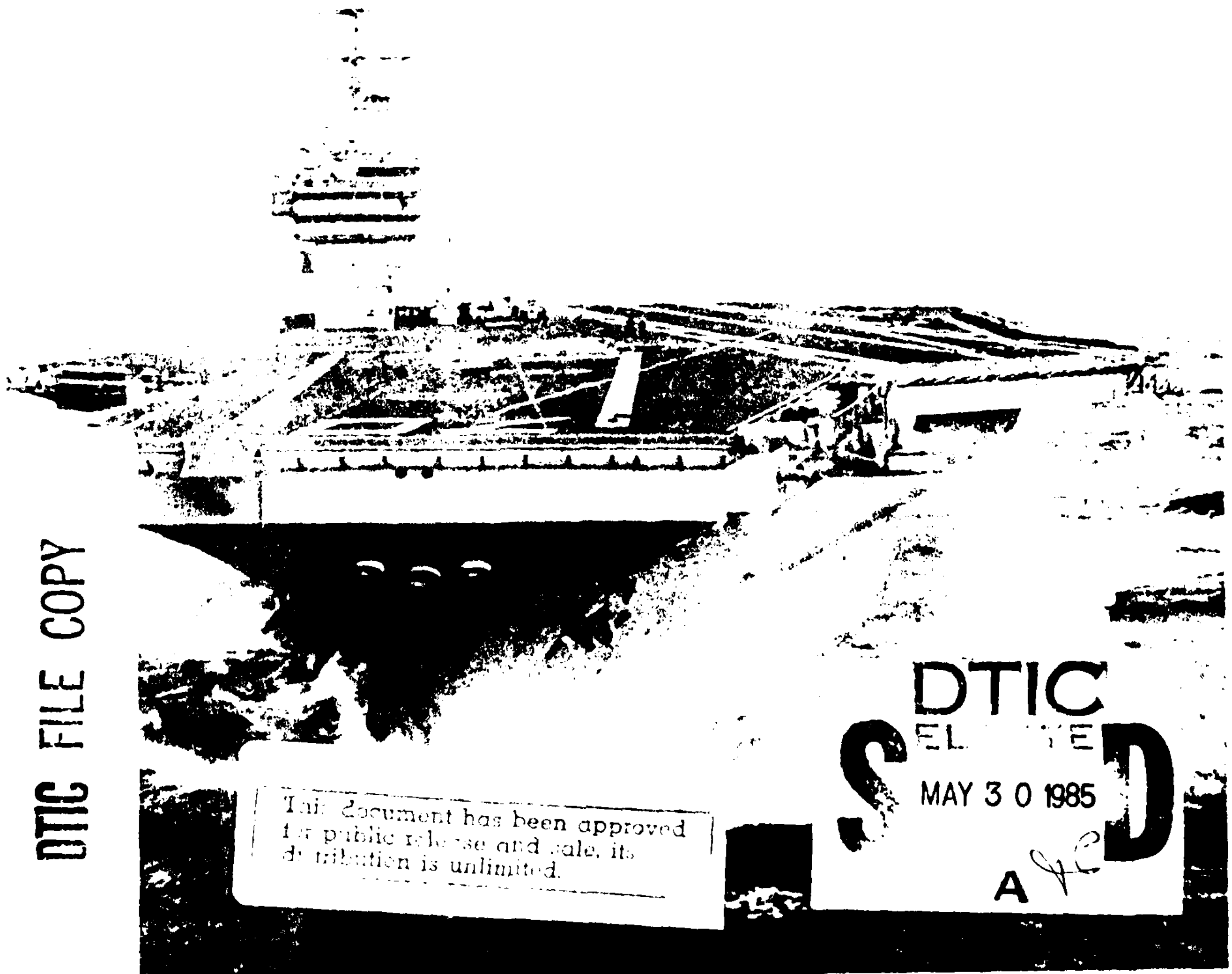
The Journal of the Defense Systems Management College

Streamlining the Advanced Tactical Fighter

Program Manager's Notebook

Light Helicopter Family (LHX) and the Streamlining Initiative

The Soldier-Machine Interface



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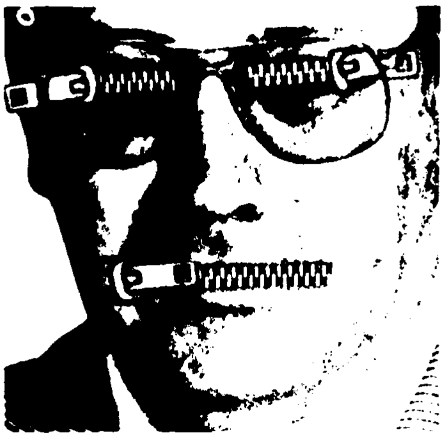

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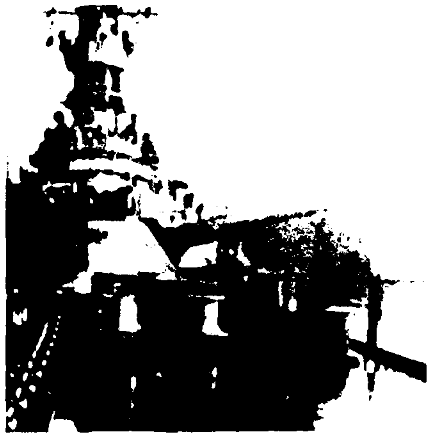

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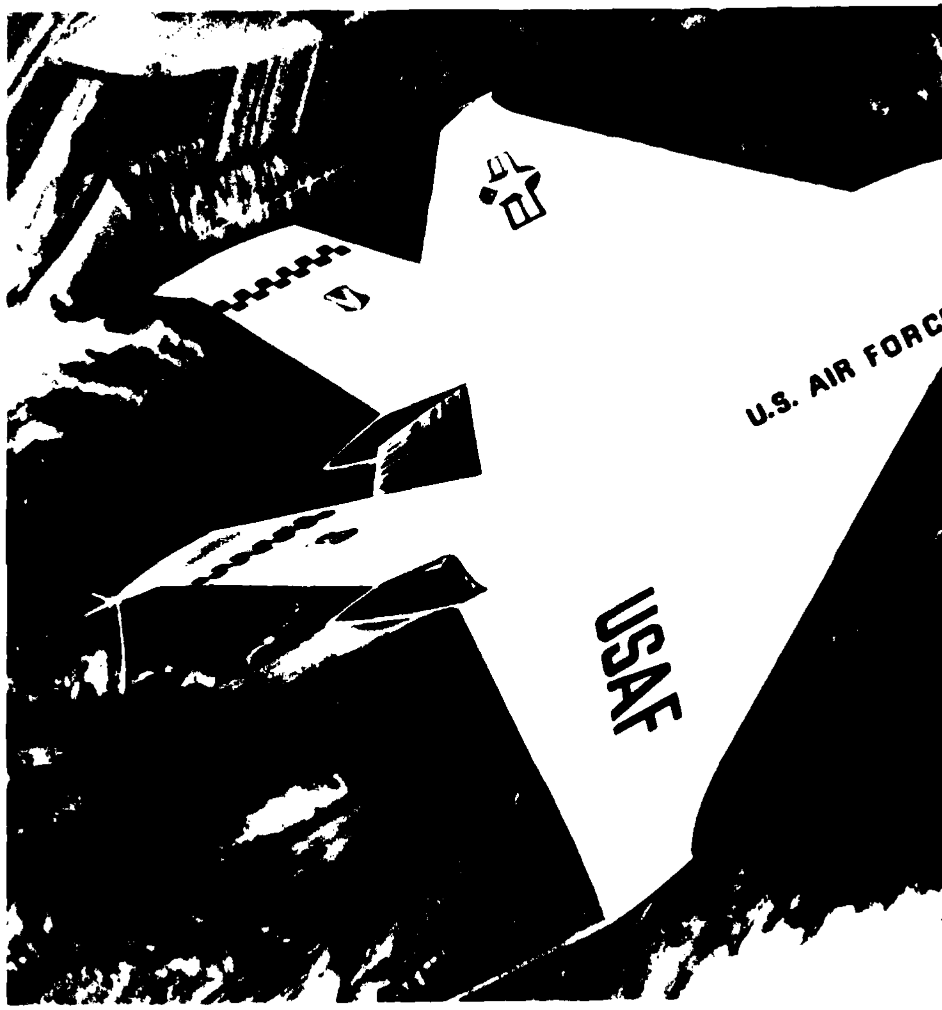
Streamlining the Advanced Tactical Fighter

Steve Rait

The advanced tactical fighter (ATF) is the U.S. Air Force response to expected increases late this century in the number and sophistication of Soviet fighter aircraft. To counter the enhanced threat, the advanced tactical fighter must incorporate the most advanced technologies, be highly automated, relatively invisible to Soviet radar, reliable and, importantly, *affordable*. To achieve affordability, we in the Advanced Tactical Fighter System Program Office, Wright-Patterson Air Force Base, Ohio, have enthusiastically adopted the Department of Defense Streamlining Initiative. This article includes a short description of this initiative, thumbnail sketch of the the advanced tactical fighter program, and description of several efforts to streamline the advanced tactical fighter acquisition.



Former deputy secretary of defense Paul Thayer signed January 11, 1984, a memorandum to secretaries of the military departments calling for improvement in Department of Defense contract requirements. The memorandum contains recommendations that "call for precluding untimely, untailored and accidentally-referenced application of specifications and standards and for specifying 'results' required rather than detailed 'how to' procedures in contracts and requests for proposals." The tenets of the streamlining initiative are (1) to utilize contractor ingenuity and experience; (2) to encourage early industry involvement, including use of draft requests for proposal (RFP); (3) to specify what is needed, not "how to"; (4) to specify system level functional requirements early; (5) to require contractors to tailor for the next phase of the program; (6) to preclude premature application of military specifications and standards; (7) to limit contractual applicability to one level of references; (8) to pursue economically producible, operationally suitable, and field supportable designs; and (9) to assure complete production specifications while providing contractor flexibility to optimize design.

Air Superiority

The requirement for the advanced tactical fighter originated earlier this decade. A mission element need statement (MENS) was approved by the Defense Resources Board in November 1981. The Tactical Air Force statement of operational need (SON) was validated by the Air Staff in October 1984, and a preliminary system operational concept (PSOC) has been completed and approved. The mission of the advanced tactical fighter is air superiority to counter the Soviet threat from the mid-1990s through the year 2010.

In order to meet and beat the threat, the advanced tactical fighter must possess enhanced lethality and survivability; it must acquire, identify and be able to destroy enemy aircraft beyond

Acquisition strategy is tailored to protect interests of Air Force and use taxpayer dollars most effectively.

visual range. Low observability will be essential to ensure survivability. The advanced tactical fighter must be able to cruise supersonically in dry power; i.e., without using afterburners. Dry power and more efficient engines will result in wider combat radii. Maneuverability comparable to an F-16 fighter aircraft will be inherent at subsonic speeds with great improvements in the supersonic region. To assure overall mission effectiveness, the advanced tactical fighter weapon system must be designed with supportability in mind. Common processing modules, fault tolerant avionics architecture, and reduced ground support equipment will result in higher reliability and better maintainability. Finally, the advanced tactical fighter must be able to operate from relatively austere airfields. Advanced technologies will permit the advanced tactical fighter to land on, and take off from, short segments of battle damaged runways and dispersed operating locations.

The real challenge for the designers and builders of the advanced tactical fighter, however, is the integration of all these technologies. (See Figure 1.) To be effective, these advanced systems must communicate with each other and be able to transfer critical functions among themselves in the event of damage to, or failure of, one system. The tremendous amount of data that will be generated must be sorted and displayed and made understandable to the pilot, and appropriate for the combat situation. The hardest integration task will be to reduce radar cross section while maintaining fighter performance.

Seven Contractors Assist

The advanced tactical fighter program is currently transitioning from a concept exploration phase to a demonstration/validation (D/V) phase. Defense Systems Acquisition Review Council approval is expected to occur later this year. Seven contractors (Boeing, General Dynamics, Grumman, Lockheed, McDonnell-Douglas, Northrop and Rockwell) participated in the concept exploration phase. We plan to choose four of these defense contractors this year to participate in a 3-year effort to demonstrate and validate advanced tactical fighter concepts. Development of critical subsystems will occur concurrently. Joint advanced fighter engine (JAFE) contracts have been awarded to General Electric and Pratt & Whitney to demonstrate advanced engines for the advanced tactical fighter. Late in 1988, we plan to select one airframe contractor or contractor team to proceed into full-scale development (FSD) of the advanced tactical fighter. First flight should occur in 1992 with initial operational capability occurring in 1995.

Acquisition strategy for the advanced tactical fighter has been specifically tailored to protect the interests of the Air Force and to use taxpayer dollars most effectively. We anticipate that as many as four contractors will be selected to demonstrate and validate the advanced tactical fighter in parallel; i.e., each contractor will be demonstrating and validating its own advanced tactical fighter concept, for a period of approximately 3 years. These D/V efforts will consist of computer simulations, wind-tunnel tests of advanced tactical fighter models, and other tests designed to demonstrate that risk is sufficiently low to proceed to full-scale development. There is no requirement for construction of demonstrator aircraft during D/V. A firm fixed-price contract type was selected in order to limit the Air Force cost risk in the environment that precedes a major down-selection; i.e., selection of an advanced tactical fighter FSC contractor. The primary incentive for contractors competing for award of the advanced tactical fighter FSD contract will be to outperform their competitors. To outperform could, and probably will, mean that contractors will "spend to win." The Air Force is unwilling to fund the difference in contract cost caused by these competitive pressures.

The D/V request for proposal will include funding profiles so that contractors are aware of available funding. Contracts will include proposed warranty provisions for application in future advanced tactical fighter production contracts. Hopefully, knowledge of planned warranty requirements will positively affect the quality of aircraft and subsystem designs. Contractors will be notified that the Air Force expects to be granted unlimited rights in data and computer software within a specified period after delivery of the first production aircraft. If unlimited rights cannot be granted for certain items, contractors will be required to develop alternate mechanisms; e.g., second sourcing, to ensure that excluded items may be competitively acquired by the government. Finally, associate contractor agreements and interface control working groups will be essential requirements of advanced tactical fighter D/V contracts to achieve necessary integration between the airframe and critical subsystems.

Business Strategy Meetings

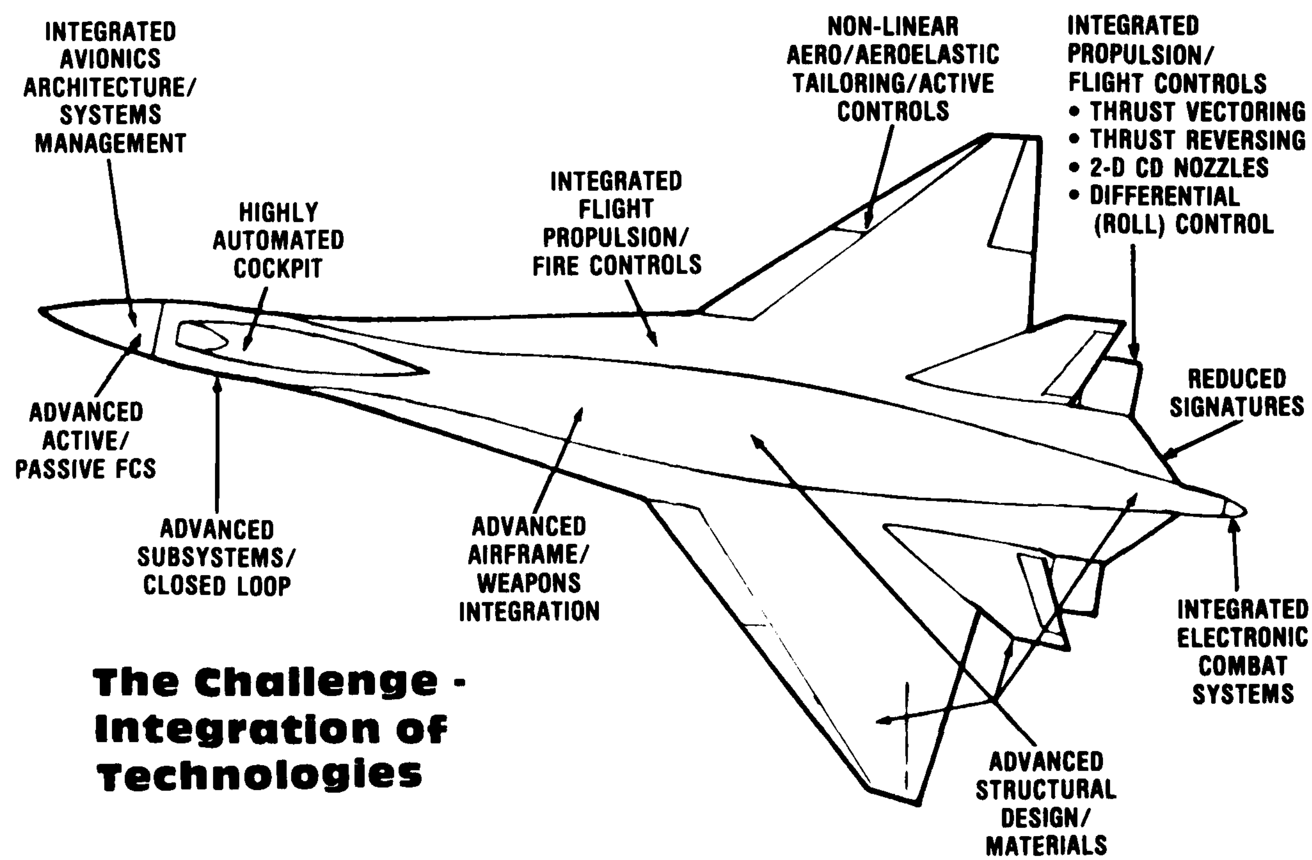
Internal advanced tactical fighter business strategy meetings were held in the spring and summer of 1984. In April 1984, separate planning meetings were held with each potential advanced tactical fighter D/V contractor to discuss and refine business strategies. A draft request for proposal (DRFP) was released October 16, 1984, to potential contractors, interested subcontractors, and government agencies. Formal request for proposal release is expected in the near future. Advanced tactical fighter D/V contracts should be awarded later this year.

The advanced tactical fighter system program office is actively working on each of the nine recommendations advanced in Secretary Thayer's memorandum. I would like to highlight our efforts in four of the areas. Specifically, I will address encouraging contractors to critique draft requests for proposal; specifying what is needed, not how; requiring contractors to tailor for the next phase of the program; and pursuing economically producible, operationally suitable, and field supportable designs.

First, however, I would like to relate how we involved industry in the development and refinement of the advanced tactical fighter business strategy before the draft request for proposal. Once a strategy was roughed out, we held a series of half-day business planning meetings. Each meeting involved one of the potential advanced tactical fighter D/V contractors. The purpose was to develop mutually acceptable and understandable business approaches for the advanced tactical fighter program. Results were used to polish, refine and, later, defend the advanced tactical fighter business strategy. We believe these meetings established the spirit of streamlining/tailoring sooner in the acquisition cycle. Industry comments were evaluated and, if accepted, incorporated into the business strategy before having the strategy officially "blessed" by the Air Force. Working with an unapproved strategy enabled us to evaluate more objectively the suggestions we received.

On October 16, 1984, the advanced tactical fighter system program office released 150 copies of the draft advanced tactical fighter D/V request for proposal. The executive summary let-

Figure 1. Advanced Tactical Fighter



ter stated in part, "Areas which should be specifically reviewed are engineering, quality assurance and military specifications, standards and requirements which may be overly restrictive or costly." Approximately 1,450 comments, primarily related to the statement of work and technical requirements document, were received by the November 13 cutoff date. Using a personal computer and data base management software, we developed a comment tracking system to sort comments in various ways, to identify duplicate and conflicting comments, and to ensure we responded to each comment.

A Decent Conversation

While reviewing comments, I was reminded of the woman who went to see a lawyer about a divorce. The lawyer asked if she had grounds.

"Grounds?" she asked. "Why, we've got five acres out back of our house."

A little confused, the lawyer asked if she had a grudge.

"Of course. There's a nice two-car garage attached to the house," she said.

Out of desperation, the lawyer asked if her husband beat her up. To which she replied, "No, I beat him up by an hour most every morning."

The lawyer, totally exasperated, blurted out, "Just why do you want a divorce?"

Said she, "We just can't seem to carry on a decent conversation."

In the area of streamlining/tailoring, it seems we cannot carry on a decent conversation. Not everyone is advocating the streamlining initiative. We received approximately 30 draft request for proposal comments recommending application of *additional* Department of Defense standards and specifications. Suggestions to tailor were, however, many and varied. One contractor proposed that tiering of specifications in full-scale development be limited to one level. The first level would be contractual. Subsequent levels would be non-contractual and for guidance only. Several agencies noted that our D/V requirements were too detailed for a demonstration validation program, and that specific goals stated in the draft request for proposal were too ambitious and unnecessary. One comment that indicated the Streamlining Initiative is not yet institutionalized came from a government contract administration activity. We state in the request for proposal that specific (many) specifications are cited for guidance only. The suggestion was to make them contractual in the D/V phase to "hold the contractor's feet to the fire."

We are specifying what is needed, not how to do the job. Tailoring has been an inherent part of our preparations for advanced tactical fighter demonstration/validation. Initially, we attempted to plagiarize from past D/V efforts. Fortunately, since plagiarism often leads to blind application of specs and standards, we were unable to do so. We realized that past D/V efforts were not applicable to an aircraft as unique as the advanced tactical fighter. The resulting request for proposal cites few standards and specifications; most cited provide parameters, not procedures; others were applied as a guide to develop system specifications.

"Mil Prime" Documents

Tailoring at the assistant secretary of defense is institutionalized. Everyone from the engineer to the contract analyst asks, "Why that requirement?" In this regard, the assistant secretary of defense has undertaken a project to develop "Mil Prime" documents. These documents are basically gutted specifications that contain no specific numerical requirements, and do not refer to, or cite, other specifications. Tailoring becomes a necessity when using a Mil Prime document, which is accompanied by a handbook explaining the Mil Prime concept; provides many "lessons learned" from previous specifications; and suggests how the particular document could be tailored. The assistant secretary of defense has developed 12 Mil Prime documents—soon there will be 50.

We have evaluated alternatives to initiate effectively contractor tailoring during demonstration/validation. An award fee to incentivize contractors to tailor was considered and rejected because the award fee amount would be insufficient. Further, measuring the effectiveness of a contractor's tailoring efforts would be difficult. We considered making tailoring an evaluatin criterion, but encountered difficulties in development of realistic evaluation standards. It is extremely difficult to determine how much tailoring is truly beneficial. We considered requiring establishment of a separate contractor organization to advocate tailoring. We would pay for such an organization in much the same manner as a contractually imposed value engineering program requirement. The idea was rejected because we believe tailoring is inherent in the systems engineering process. A tailoring organization in our opinion cannot operate effectively as a separate organization. In the end, we decided to inform prospective offerors that the Air Force is extremely interested in tailoring advanced tactical fighter specifications as a means of eliminating unnecessary cost drivers and removing impediments to competition. Offerors are to include in their proposals a description of the specification tailoring efforts to be implemented in the contractor's proposed D/V program. The plan will be evaluated by the technical evaluation panel during source selection.

Evaluation Criteria

Finally, we are pursuing economically producible, operationally suitable, and field supportable designs. Reliability, maintainability, and producibility are highly ranked evaluation criteria. Supportability is a major evaluation area. General Skantze, commander, Air Force Systems Command, is emphasizing reliability, maintainability, and producibility in all Air Force system command major systems acquisitions. Early emphasis in these areas is the key to affecting system design positively.

In response to the deputy secretary of defense initiative, the advanced tactical fighter system program office is working aggressively to streamline the advanced tactical fighter acquisition. We believe this will result in a capable and more affordable advanced tactical fighter. ■

■ *Mr. Rait is the contracting officer in the Advanced Tactical Fighter Program Office, Air Force Systems Command, WPAB, Ohio.*

SYSTEMS DESIGN

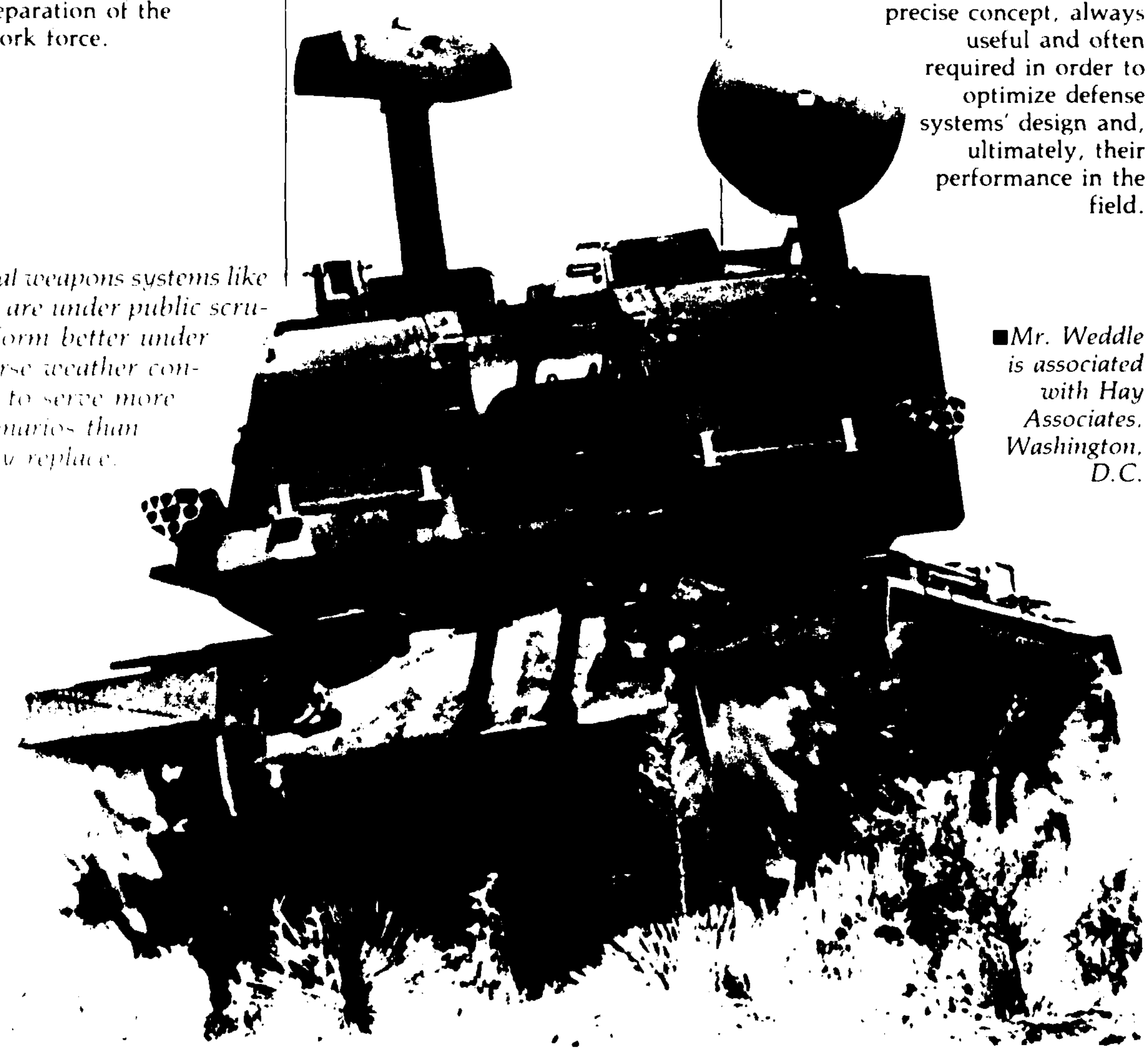
The Soldier-Machine Interface

Designing Military Systems For the Future

Peter D. Weddle

In 1982, the U.S. Army established five central thrusts to its ongoing force modernization program: distributed command, control, communications and intelligence; self-contained munitions; very intelligent surveillance and target acquisition technology; biotechnology; and the soldier-machine interface. This prioritization was based on the Army's judgment that these were high-leverage technologies with the potential for substantially increasing combat power and force effectiveness. The inclusion of the soldier-machine interface (SMI) in this select group underscored the Army's growing awareness of the critical relationship between soldier capabilities and the field performance of new and often very sophisticated military systems. This consideration is especially important in light of the armed services increasing reliance on high technology in defense systems and the declining size and technical preparation of the American work force.

The soldier-machine interface stretches across boundaries of several technical disciplines and is used to describe any number of often disparate approaches to systems design and analysis, logistics support analysis, and manpower planning. The designation as a thrust area notwithstanding, this proliferation of meanings has caused some people to question the usefulness of the soldier-machine interface concept, and other people to relegate it to the imprecision of slang. The term, however, does describe meaningfully a specific methodology for improving systems design in the defense systems development and acquisition process. This strategy fully integrates an emerging system's hardware, software, human and other support subsystems to achieve specified mission capabilities. In essence, the approach strives for total *system development*. Hence, soldier machine interface is a robust yet precise concept, always useful and often required in order to optimize defense systems' design and, ultimately, their performance in the field.



Controversial weapons systems like the DIVAD are under public scrutiny to perform better under more perverse weather conditions and to serve more possible scenarios than systems they replace.

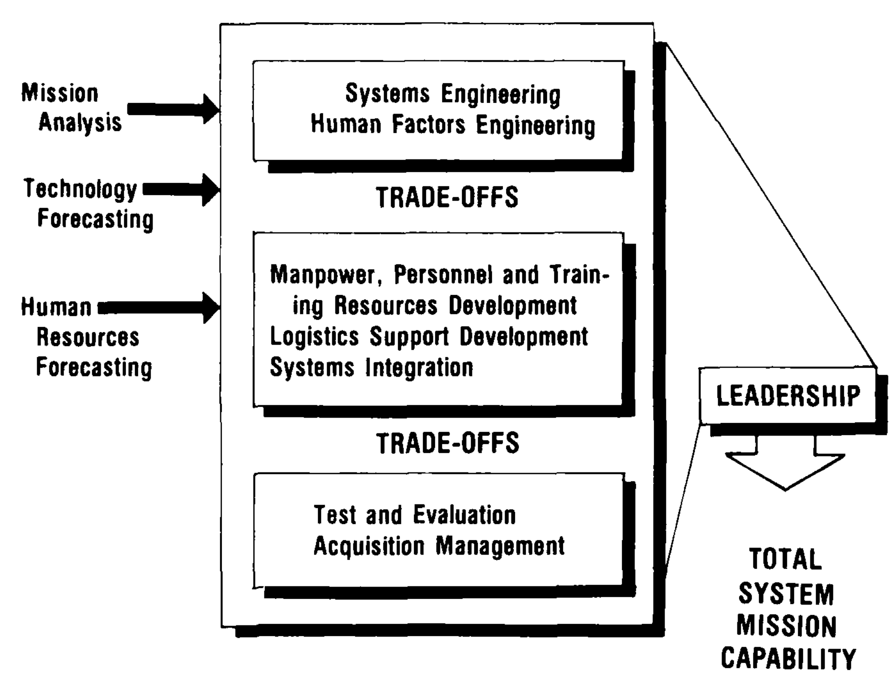
■*Mr. Weddle is associated with Hay Associates, Washington, D.C.*

The Coincidence of Trends

The Department of Defense has grown increasingly reliant on advanced technology to counter the threat from a numerically superior, potential adversary. By almost any measure, the density of high technology is up in the armed forces. For example, the number of pages in technical manuals required to support the Army M 1 tank is almost three times greater than that required by its predecessor, the M 60. Perhaps more important, the Army is experiencing a "skill creep" as more sophisticated systems demand more capable and better trained operators and maintainers. The DIVAD System Mechanic (MOS 24W), for example, requires 39 weeks of training while the "predecessor," Vulcan System Repairer (MOS 27F), requires 23 weeks. Similarly, the Navy has seen its training requirement for 15 ratings increase 580 percent during its transition from the Sumner class to the new Spruance class destroyer. Further, a background in science or mathematics is now desirable in more than 70 percent of the Air Force enlisted personnel. In effect, the advanced operational capability of high technology systems has been purchased, at least in part, with greater demands for human resources.

Yet, the absolute size of the American work force is shrinking. For the Department of Defense, this means a 22 percent decrease in the size of its primary recruiting pool (18-24-year-old males) between 1980 and the mid-1990s. The latest census reveals that the country's recovery from this decline in its working population will be slower than forecast. Nothing can be done to change these numbers. In order to sustain its recent recruiting successes, the Department of Defense must attract a greater proportion of the available labor force throughout this century.

Figure 1. Total System Development



The DIVAD system mechanic requires 39 weeks of training in contrast to 2-3 weeks required by the repairer of above-pictured Vulcan System.

Reading Grade Level

There has been an alarming dip in the quality or capability of this smaller pool. Estimates in the Department of Defense *Profile of American Youth* indicate that the median reading grade level of persons 18-23 years of age is 9.6; it is two to three reading grade levels lower for some minority groups. This is particularly troublesome for the Department of Defense, as minority representation in the primary recruiting pool will grow from 20 to 30 percent by the year 2000.

Equally as disturbing, the country experienced over 25 years of "significant declines" in the average scores in science and mathematics achieved on national tests like the American College Test (ACT) and the Scholastic Aptitude Test (SAT). The lack of student interest in science is identified as a major problem by 50 percent of teachers, based upon nationwide surveys. As Dr. Joseph I. Lipson, a researcher in the training field, noted, the United States is one of the world's most advanced technological societies, yet it is "not providing the majority of our children with even the most rudimentary knowledge and skills necessary to

Pages in technical manuals to support the Army M-1 tank are almost three times greater than those required by its predecessor, the M-60.

contribute to, manage and understand that society."

This coincidence of a smaller, less capable work force, and burgeoning high technology in defense systems is creating severe problems in military human resources and systems acquisition management. It is impacting negatively on combat readiness of the armed forces. For example, the overall system performance of the Army Stinger air defense system, defined as the probability of its successfully performing critical mission tasks, was designed to be 0.64; however, *human* performance limitations, as measured in system tests, have driven actual system performance down to approximately 0.44. Generals George S. Blanchard and Walter T. Kerwin described such situations as "a growing crisis" in their 1980 report for the Army Materiel Systems Analyses Activity. They said: "There are not enough qualified people to perform the tasks required to effectively operate, support and maintain current Army systems.... The problem is severe and will continue to get worse." More recently, General William E. DePuy and Dr. Seth Bonder described the Army requirement for additional manpower and skilled personnel, driven by its force modernization program, as "a demand beyond the accumulative capability of the Army to satisfy."

A Mismatch

This mismatch between advanced machines and the people who will have to operate and maintain them has been recognized elsewhere. The Naval Research Advisory Committee (NRAC) wrote in 1980, that "Given present trends, the Navy will find itself unable to operate and maintain its systems, in either the short or long term, with the numbers of skilled personnel necessary for effective mission accomplishment." The Air Force is confronting a national shortfall in aircraft mechanics and avionics technicians, yet its requirement for people with high electronic aptitudes will increase by about one third in the next 15 years. Even industry is not immune to the problem. According to *Fortune* magazine, "Millions of new jobs will be created, mostly in information systems, but they'll be so different that today's laid-off workers will be hard pushed to fill them."

Such mismatches severely strain service personnel and training systems and inevitably diminish the readiness and mission capability of the armed forces. A 1981 report to the Congress by the General Accounting Office attributed fully half of all military weapons and support system failures to human error. Further, inadequate scientific and technical training is cited as the cause of a 90 percent failure rate in tests administered to 385 nuclear weapons maintenance specialists; a 77 failure rate for 1,633 Army computer programmers; and a 98 percent failure rate for 371 tank turret and artillery repair personnel. Too often, old and new military systems are not achieving their design capability or readiness goals because soldiers cannot properly operate and maintain them.

Resolving the Mismatch Problem

In the Department of Defense, at least, the human-machine mismatch problem is as much a function of the way new defense systems are designed and developed as it is a product of shifts in the American population. Consequently, the solution requires a broad range of initiatives, involving human resources and acquisition management. In order to increase *total* system effectiveness, the Department of Defense needs to simplify system operation *and* maintenance, and to reduce manpower requirements, training time, and cost.

The net result is best characterized as an effective and efficient fit at the soldier-machine interface. Hence, the term usefully serves as a unifying concept for all actions taken to optimize the performance of both soldiers and equipment in order to achieve overall effectiveness equal to the design capabilities of a total system and, thereby, to maximize its combat power. In effect, soldier-machine interface is a strategy for *total system development*.

In the short term, this strategy will involve *ad hoc* actions in the system design process to ensure that emerging equipment is affordable and supportable from a human-resource perspective. The armed services must take steps to ensure they can efficiently access, train, and retain adequate personnel to operate and maintain new systems effectively. These actions include training developments, personnel management, systems engineering, human factors engineering, and medical science.

Soldier-Machine Interface

The initiatives are *ad hoc* in that they represent corrective and essentially independent efforts to redress immediate problems at the soldier-machine interface. For example, the Army developed a comprehensive format for reporting manpower, personnel and training considerations during the management reviews conducted for new systems. Although not a development process requirement, the document is useful in drawing together and providing management visibility to all human-resource considerations heretofore spread through other system and program documents. In another instance, the Naval Training Equipment Center is developing guidelines for trainer acquisitions, which will cost less than conventional training systems but provide equal training capability. To date, cockpit-procedures trainers have been designed successfully and built for the SH-3H and EA-3B aircraft for one quarter the cost of conventionally developed systems of comparable training capability.

In another case, the Army Human Engineering Laboratory (HEL) is exploring the capabilities of commercially available robotic systems for labor-intensive tasks like ammunition handling and resupply. Relying on automation to alleviate manpower and training problems makes sense providing, *always*, that the technology performs as advertised. Highly automated equipment often has insufficient reliability, and actually *increases* the demand for quality personnel, training, and logistics support. As with the HEL demonstration project, automation must be proved to work in the field if it is to be an acceptable approach to new system design.

The efforts described above focus management attention on advances in technology in a particular *part* of the total system, i.e., human resources component or logistics component. However, they are likely to have near-to mid term payoffs, which meaningfully improve the soldier-machine interface and contribute to operational readiness. In the longer-term, the soldier-machine interface must extend beyond these useful but disconnected efforts to an alternative concept of system design. This concept is best characterized as *total system development*. Total system development is not a strategy for accomplishing systems design differently (e.g., computer-aided design) or an adjustment to conventional design practices (e.g., pre-planned product improvement).

Inadequate scientific and technical training is cited as the cause of a 90 percent failure rate in tests administered to [illegible] nuclear weapons maintenance specialists, a [illegible] failure rate for [illegible] Army computer programmers, and a [illegible] percent failure rate for [illegible] tank turret and artillery personnel.

Rather, it is an alternative philosophy of system development.

A Different Concept

This philosophy begins with a different concept of the final product of design, the system. With total system development, that product is a means to an end. Software, hardware, human beings, and logistics support must be brought together creatively to provide a desired mission capability. The emphasis, then, is on achieving field performance rather than improving equipment, because only the former is genuine defense capability.

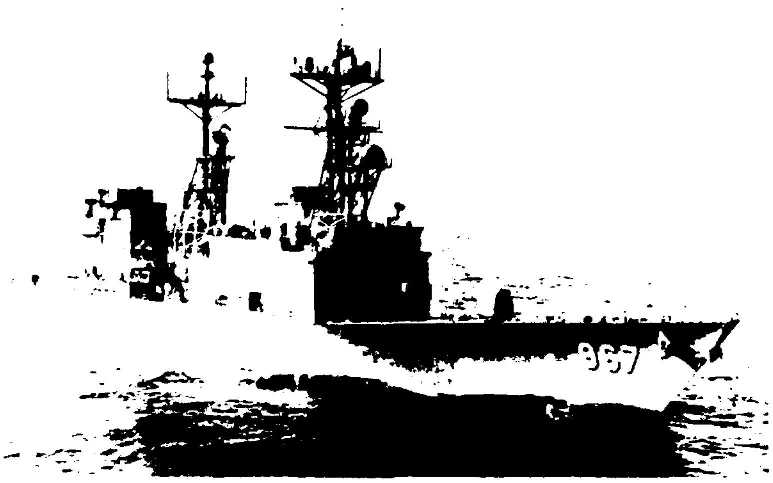
The *process* of creating a comprehensive system that actually provides a desired capability requires a working integration of all technical disciplines involved with the system during its life cycle. Heretofore in system development, the engineering community focused on system design and development, while other disciplines such as behavioral science and logistics were employed to make the system (with its soldiers and support) work in the field. All the words and regulations aside, the traditional emphasis has *not* been on developing and providing an operational mission capability. It has been on providing hardware that meets performance specifications, or on providing people who are available and trained to designated standards. Alone, however, neither aspect of the total system provides much capability. Very sophisticated weapon systems are useless without skilled operators *and* maintainers, while well-trained soldiers without appropriate systems are vulnerable in modern warfare. Either situation represents a mismatch at the soldier-machine interface and hinders mission capability. Both situations are the product of engineering and manpower planning and training development, and logistics support analysis *in a vacuum*.

The total system development process extends responsibility for *both* system design and field performance to all of these disciplines. It breaks down the old compartmentalization of the system life cycle; it brings engineering into the behavioral scientists' and logisticians' realms of system performance in the field, and behavioral scientists and logisticians into the engineers' domain of system design. Initially, this will be an uncomfortable and difficult process. Common languages and data bases, and interoperable analytical tools will have to be developed; so will new working relationships. Progress is being made in all of these areas, but more is needed.

Total system development will require changes in Department of Defense investment philosophy. Dr. Harry M. West III, Deputy Director for Army Manpower, Programs, and Budget, hypothesized a total system acquisition strategy involving "an intentional increase in capital investment expenditures to reduce manpower, personnel and training demands, as well as subsequent operating and support costs...." The return on that investment is expected to be lower, life-cycle costs and improved soldier-machine interface. The Army is spending approximately $2.6 million on soldier-machine interface research and development in its upgraded 155mm self-propelled howitzer improvement program. The savings in personnel and annual school training requirements are expected to total $740 million over the system's life cycle.

capability. In light of the aforementioned converging trends, leadership development is as critical a component of a sophisticated total system as is the design of its hardware, software, and training support subsystem. Indeed, leadership is the adhesive at the soldier-machine interface.

Navy training requirements for 15 ratings increased 580 percent during transition from the Sumner class to the new Spruance class destroyer.



Ultimately, the traditionally horizontal approach to systems development (i.e., from concept definition through concept demonstration and validation to full-scale engineering development) will shift to a more integrated and vertical strategy, as shown in Figure 1. The total system design will mature interatively. The constituent disciplines of the process will be applied concurrently, while interdisciplinary tradeoffs will integrate these activities to develop the concept best satisfying the mission need. Test and evaluation will verify the total system mission capability, and management will direct its procurement.

The concept of total system development acknowledges the role of leadership in achieving total system mission

Thinking New

Fundamentally, total system development will necessitate a new way of thinking about systems; that is, a philosophy that focuses on the system's purpose rather than on the specifications, standards, goals and objectives, however detailed, of its constituent components. A good fit at the soldier-machine interface pushes technology, and human and other support resources to their *collective* limits in pursuit of *mission capability*. Hitachi called this concept "humanication"; others described it as "equipping the man."

As a basic premise for force modernization in the future, it is best described as total system development. ■

Roy A. Anderson of Lockheed Corporation Receives James Forrestal Memorial Award

Roy A. Anderson, chairman and chief executive officer, Lockheed Corporation, has been presented the James Forrestal Memorial Award for 1984 by the National Security Industrial Association (NSIA). The award, first presented in 1954 to President Dwight D. Eisenhower, is bestowed annually on an American whose leadership has promoted significant understanding and cooperation between industry and government in the interest of national security. Forrestal, first secretary of defense, believed that a continuous and close working partnership between government and industry is essential to the nation's security.

Mr. Anderson accepted the award and spoke at the 31st annual dinner in Washington, D.C.

He was born in Ripon, Calif., Dec. 15, 1920, enlisted in the U.S. Navy in 1942, and earned a commission in 1945. He served in the Navy during World War II and the Korean Conflict. Released from active duty following World War II, he attended Stanford University and received a bachelor's degree in economics and accounting in 1947 and a master's degree in business administration in 1949. He was elected to Phi Beta Kappa. He became a certified public accountant and held executive positions with Westinghouse Electric Corporation and Ampex Instrumentation Products Company after the Korean Conflict.

Mr. Anderson first joined Lockheed Missiles and Space Company in 1956 as a staff accountant. During 29 years with Lockheed, he has been a champion of the American system and a proponent of a strong national security. He has contributed to a closer working relationship between government and industry.

Mr. Anderson is the sixth industry representative to be selected for the Forrestal Award. The NSIA was founded in 1944 and is a not-for-profit, non-political association of some 385 industrial, research, legal and educational organizations, representing all segments of the U.S. defense industry. ■

Program Manager's Notebook
Candidate Subject Area Fact Sheets

1. General Subject Areas
    *1.1 Government Acquisition Policies and Organization
    1.2 A-7D and A-10
    *1.3 System Life Cycle
    *1.3.1 The Engineering Process
    *1.4 The Planning, Programming, and Budgeting System
    1.5 Civilian Personnel Management
    *1.6 The DSARC Players and Process
    1.7 What Motivates Industry?
    *1.8 Foreign Military Sales
    *1.9 The Defense System Management College
    *1.10 Joint Programs
    *1.11 Multinational Programs
    *1.12 Why Systems?
    *1.13 Overview of the Function of Program Management

2. The Program Manager's Environment
    *2.1 The PM's Authority and Responsibility
        Professionalism
        Ethics
        Charter
    2.2 The PM's Mission
        JMSNS
        ROC
        SON
    2.3 The PM Internal Environment
        Teamwork
        Integration
        Communication
    *2.4 The PM External Environment
    *2.4.1 Presidential, Cabinet, and OMB Considerations
    *2.4.2 Congressional Considerations, and Selected Acquisition Reports
    *2.4.3 OSD Considerations
    *2.4.4 Service Considerations
    2.4.5 Developer, Producer, Trainer, Tester, and User Considerations
    2.4.6 Media Considerations
    2.4.7 International Considerations
    2.4.8 Contractor Relationships

3. Planning
    *3.1 Acquisition Strategy and Planning
    *3.1.1 Non-Development Items
    3.1.2 Milestones
    3.1.3 Program Baselines
    *3.1.4 The Competition Plan
    *3.1.5 P³I
    3.1.6 Warranties
    3.1.7 Post-Deployment Improvements
    3.1.8 Producibility
    3.1.9 Government Furnished Equipment Equipment
    3.1.10 Survivability (Include CHEM, BIO, NUC)
    *3.1.11 Multiyear Procurement
    3.1.12 Request for Proposals (Include SOW, CDRL, EVAL, DID)
    3.1.13 Make or Buy Decisions
    3.1.14 Testing
    3.1.15 Standardization
    3.1.16 Data Rights
    3.2 The Program Master Plan Program Management Plan
    *3.3 Risk Analysis, Risk Assessment and Management Plan
    3.4 LCCP
    3.5 Financial Management Plan
    3.6 Acquisition Plan
    *3.7 Source Selection Plan
    *3.8 SEMP Technical Plan
    *3.9 ILSP LSA LSAR Processes
    3.10 Reliability, Maintainability and Availability
    *3.11 TEMP
    *3.12 Production Plan
    3.13 Information Management Plan
    *3.14 Training Plan
    3.15 Deployment Plan
    3.16 Facilities Plan
    3.17 Disposal Plan
    3.18 SW Life-Cycle Management Plan
    3.19 Computer Resources Development Plan
    3.20 Data Management Plan
    3.21 Transition from Development to Production

4. Organization
    4.1 PM Office Organization
        Roles and Responsibilities
        Personnel Quantity and Quality
        Relationships, Development
        Training and Education
        Data Library and Repository
    *4.2 WBS
    4.3 Matrix Management

5. Resources
    5.1 PPBS - Functioning Within the System (Include enactment and execution)
    *5.2 Cost Estimating
    5.3 Tracking and Accounting
    5.4 Trade Offs and Sensitivity Analysis

NOTE: Areas marked with an * are currently being addressed by DSMC.

Figure 4.

FACT SHEET
PROGRAM MANAGER'S NOTEBOOK

DEFENSE SYSTEMS
MANAGEMENT COLLEGE

Author: E. Hirsch
Number 1.9
Version: Original
Date: March 1985

I. TITLE

The Defense Systems Management College (DSMC).

II. REFERENCES

—DSMC Catalog.
—DOD Directive 5160.55 "Defense Systems Management College."
—DOD Directive 5000.23 "Systems Acquisition Management Careers."

III. POINTS OF CONTACT

—Academic Information (703) 664-2152 AV 354-2152
—Academic Support (703) 664-1098 AV 354-1098
—Consultant Services (703) 664-4795 AV 354-4795
—Research Services (703) 664-4795 AV 354-4795
—Program Management Support Systems Services (703) 664-5783 AV 354-5783
—Information Services (Library) (703) 664-1537 AV 354-1537
—Publications Services (703) 664-5082 AV 354-5082

IV. PURPOSE AND SCOPE

This fact sheet is designed to:
—Present the mission and organization of the College.
—Summarize the ongoing academic activities of the College.
—Identify other services available.

V. DOD POLICY

See VI below.

VI. DOD ROLE

The DSMC was founded on July 1, 1971, as the academy of systems acquisition management for the Department of Defense and the military departments and as a center for research for improvement of managerial practices. It operates under the direction of the DSMC Policy Guidance Council, chaired by the Under Secretary of Defense for Research and Engineering. Its major course of study serves as the capstone for the professional education of DOD component personnel in program management and in system acquisition management.

VII. DSMC MISSION

—To educate acquisition professionals by conducting advance courses of study designed to prepare military officers and civilians for defense systems acquisition assignments at all echelons in both national and international programs;
—To conduct research to support and improve defense systems acquisition program management by performing tasks in all areas of activity related to national and multinational defense systems acquisition management;
—To assemble and disseminate information concerning new policies, management concepts, or procedures related to national or multinational defense systems acquisition.

Figure 3.

Program Manager's Notebook
Author's Guidelines

1. Read the *Introduction* to the notebook.
2. Read the list of candidate subject area fact sheets. Note where and how your area fits in with others. Unnumbered subject areas are provided as possible material for inclusion. Each may be the subject of an individual fact sheet or several may be combined at your discretion.
3. Read the sample fact sheet.
4. All fact sheets will include the following first five paragraphs:
   - I. TITLE (Self-Explanatory)
   - II. REFERENCES
     Include DOD, Agency, and DSMC references. Include military service references if your fact sheet uses a service-specific example.
   - III. POINTS OF CONTACT
     Where possible list DOD, agency, DSMC (if appropriate) Points of Contact by title, office code, address, and telephone number — DO NOT include individual names.
   - IV. PURPOSE AND SCOPE (Self-Explanatory)
   - V. DOD POLICY
     Succinctly state the Department of Defense policy governing the subject area described in your fact sheet.
5. Fact sheets should be as concise as possible without sacrificing clarity. Do not use the telegraphic form. Attempt to stay within the six-page target per fact sheet. Few, if any, should exceed six pages. Approximately 3 double-spaced, typewritten pages equal one page in our fact sheet format.
6. Write for the Program Manager. Attempt to personalize the paper by identifying how, when, where, and why he may use the material you have written. Remember, fact sheets are to provide:
   - —A ready reference
   - —Essential summarized guidance
   - —Succinct summations of Department of Defense and, if appropriate, service-unique acquisition philosophy and policy.

Figure 2.

Your responses have been supportive, constructive, and significant. You have talked, we listened, and we acted. The end result is certain to be better because of this interaction.

Continue to help. Write or call Edward Hirsch, Professor, Systems Acquisition Management, DSMC, DRI, Fort Belvoir, Virginia 22060-5426. Telephone:
Commercial (703)664-4795/5783 or
AUTOVON 354-4795/5783.

■ *Mr. Hirsch is a professor of acquisition management in the Research Directorate, and is the project officer for the* Program Manager's Notebook *at DSMC.*

Program Manager's Notebook
Introduction

The *Program Manager's Notebook* is intended to provide program managers[1] with a ready reference document which contains basic information and a reference list on selected subject areas of interest or concern to them. The fact sheets, approximately six pages in length, are designed to provide:

Ready reference to brush up quickly on a topic without searching through lengthy reports, studies or articles.

Essential summarized guidance for performance of functions or preparation of documents in the selected subject areas.

Succinct summations of Department of Defense and, if appropriate, military service philosophy and policy regarding acquisition subject areas.

This guidance will assist program managers as they perform the functions and prepare the documents associated with the systems acquisition cycle. The notebook does not attempt to provide guidance for accomplishment of service-unique functions or preparation of service-directed documents. It is not all-inclusive. In instances where DOD references/examples are insufficient to provide a suitable model, a single service's references/examples are used to construct one.

The *Table of Contents* identifies the subject areas for which fact sheets are currently available as well as those yet to be published and distributed. The notebook format was selected for ease of use and update. As new or revised fact sheets are available, they will be distributed with a revised and dated *Table of Contents*; the user need only replace the old with the new. No posting is necessary.

The subject areas were recommended by past, present, and potential program managers; acquisition managers representing all military services; and the staff and faculty of DSMC. We request your views to expand and improve the content and format of the notebook to make it more useful to you. Please use the tear-out sheets provided in the notebook to give us your comments for future revisions.

[1]For brevity, the term "program manager" is used for "program," "project," or "product manager," as well as for other variants.

Figure 1.

Response Is Overwhelming

"An outstanding idea. I want to be on your first mailing list."

"The notebook is needed—not only by PMs but by everyone in acquisition management."

"It's going to be a winner."

"Definitely be of great value."

"Exactly what we need."

" Will be one of the most used tools in my inventory."

"The concept is excellent—and long overdue."

Program Manager's Notebook: Status Report

Edward Hirsch

These are some extracts from your responses to the article, "On the Way! Program Manager's Notebook," (*Program Manager* Sept.-Oct. 1984) when DSMC announced it would produce such a ready-reference document. Virtually every segment of the acquisition community is represented among the supportive letters and telephone calls we have received.

The notebook will include fact sheets covering fundamentals of key aspects of acquisition management, and is intended to be a ready reference of essential and summarized guidance for program managers. The loose-leaf notebook format will facilitate your adding to the initial increment of fact sheets and should simplify the continual revision and updating process. With your help, our subject areas have grown from 33 to more than 120. Not all will be the subject of an individual fact sheet—some may be included within a related area; however, all will be addressed.

Distribution Later This Year

We anticipate distribution of the first edition of the notebook later this year. The DSMC staff and faculty are writing most of the fact sheets at this time. However, we know a significant body of current and empirical expertise in acquisition management resides with you who are working daily in the program manager offices (industry and government) and on staffs of acquisition managers throughout the country. We ask you to share your knowledge and, through DSMC, with everybody in the acquisition community.

Pick a subject area and write a fact sheet for our notebook. The *Introduction* to the notebook, Figure 1, provides essential information about its purpose, format, and scope. Figure 2, "Author's Guidelines," is designed to establish a uniform format and structure.

Figure 3 is the first page of an actual fact sheet that will be included in the notebook and reflects what we feel the typical fact sheet should be in terms of detail and substance.

Figure 4 shows our current listing of "Candidate Subject Area Fact Sheets." In its current or modified form, it will become the *Table of Contents*; however, it is still evolving. Make your selection from this list—note that subjects marked by an asterisk are being written by the DSMC faculty. Don't be constrained if your subject is not on the list; write about *any* subject you feel is appropriate and send it in. We suggest you write or call us first to ensure your subject has not been selected by someone else. Most importantly, share your knowledge and experience with people in the acquisition management business—we need all the help we can get. We ask only that you write for the acquisition community audience as a whole, not as a single service segment. Your fact sheet, if suitable, will be published in *Program Manager* as well as in the *Program Manager's Notebook*.

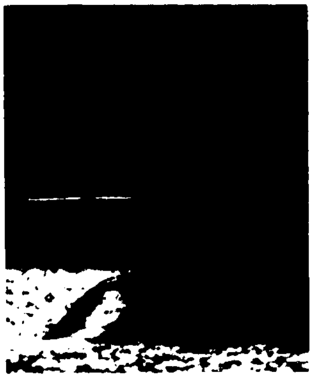
Continue to Help

To spread the word, each subsequent issue of *Program Manager* will contain one or more fact sheets from the notebook in a format that can be removed and put in your notebook. This will precede publication of the notebook and provide fact sheets for all *Program Manager* readers.

Defense
Systems
Management
College

PROGRAM MANAGER'S NOTEBOOK

Fort
Belvoir,
Virginia







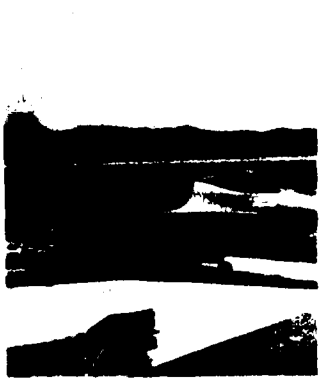
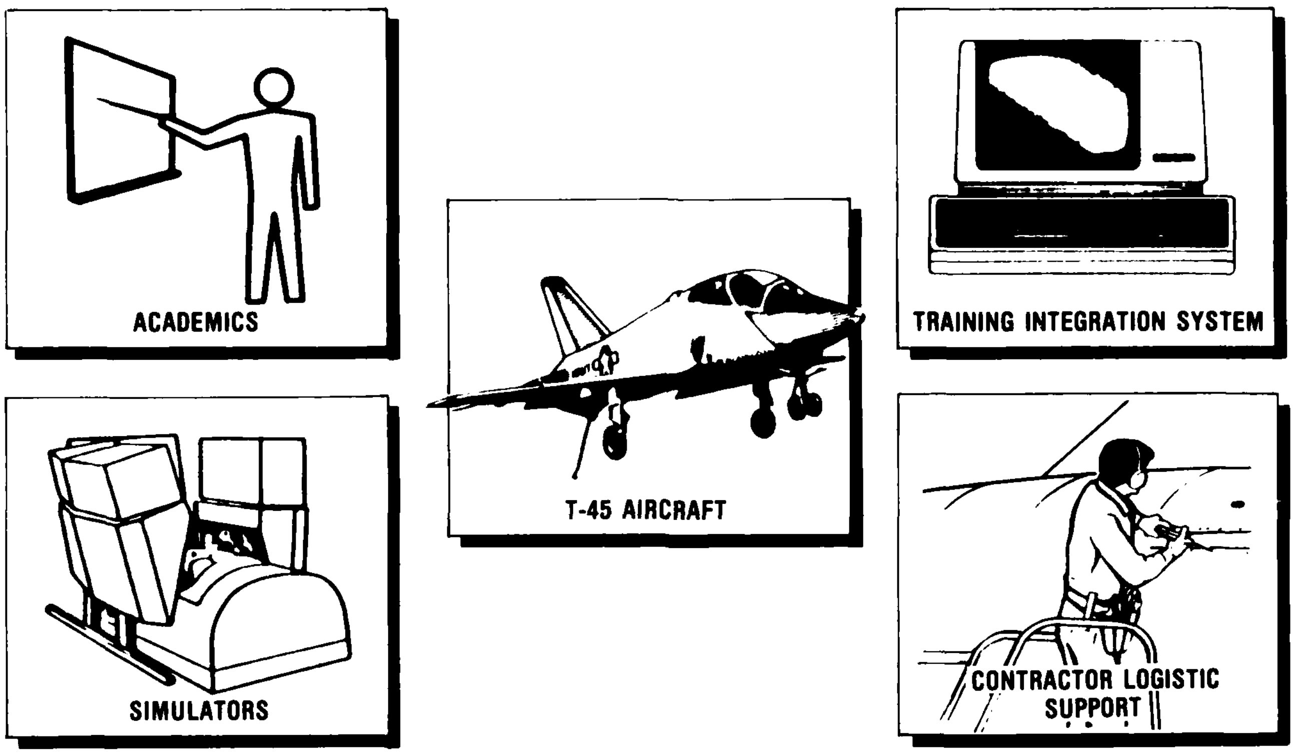


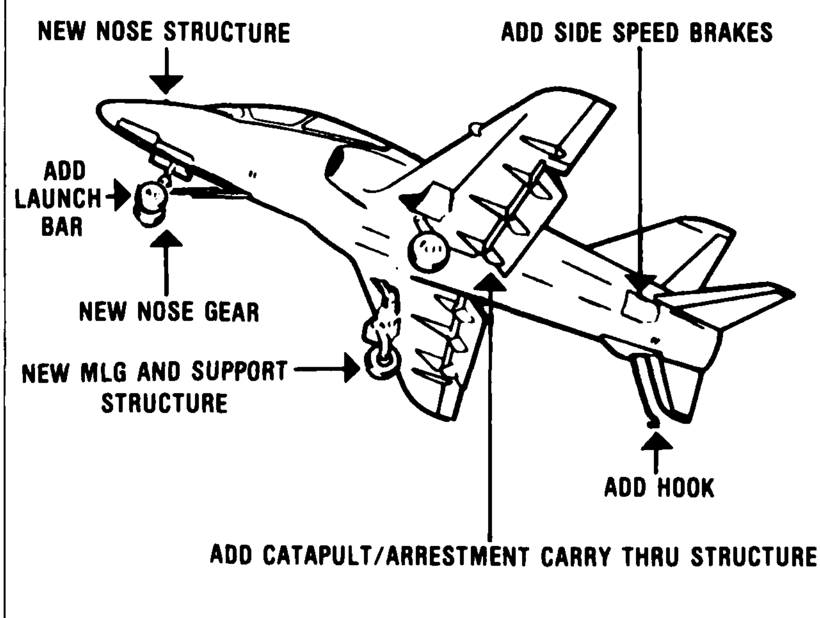
Figure 1.
T-45TS System Elements



the number of test articles, contractor flight-test hours, data requirements, specifications, and reduced development due to greater use of existing technology. Streamlining the flight test program was a major breakthrough. The economics resulting from reduced contractor flight test hours, and fewer test aircraft were primarily the result of making a more efficient program rather than cutting things out. Although schedule risk increased from low to moderate, the character of the program has not changed. The test-production concurrency risk was lowered at the expense of increased schedule risk.

The original approach to tooling was based on the concept of building the test aircraft, with the same array of tooling to be used later for low-rate initial production (two aircraft per month). The restructured program provides more economically for tooling sufficient to build the full-scale engineering development assets with good continuity to the pilot and limited production lots. Re-examination and subsequent use of the existing production MK 861 engine provided

Figure 2.
T45A Design Differences



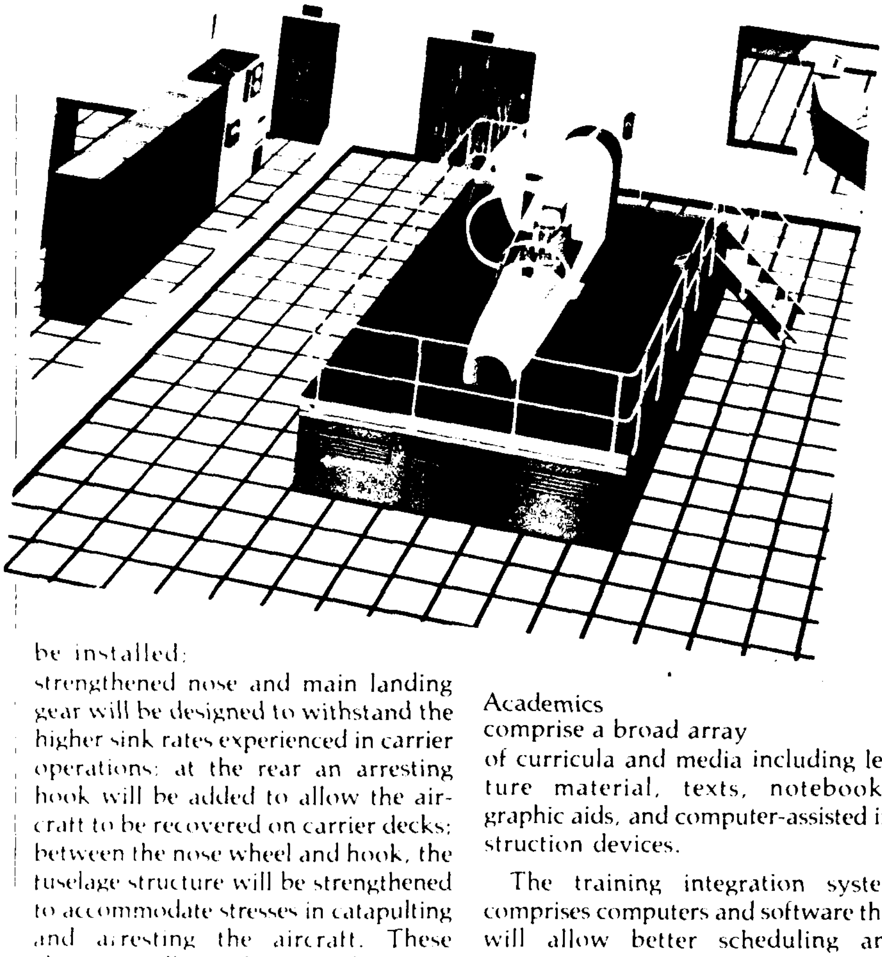
McDonnell Douglas Astronautics will develop the CAI and TIS.

The aircraft proposed by the Douglas-British Aerospace team is a derivative of the British Aerospace land-based Hawk currently flown by the British Royal Air Force and other countries. The T-45A (popular name for which has not been selected as of this writing) will be redesigned to include aircraft carrier capability.

Figure 2 shows key changes that transform the Hawk into the T-45A. Moving aft from the aircraft nose: A steerable nose wheel with a catapult launch bar will be installed; strengthened nose and main landing gear will be designed to withstand the higher sink rates experienced in carrier operations; at the rear an arresting hook will be added to allow the aircraft to be recovered on carrier decks; between the nose wheel and hook, the fuselage structure will be strengthened to accommodate stresses in catapulting and arresting the aircraft. These changes, collectively, provide carrier suitability.

The landing gear now on the British Hawk can safely withstand a 14-foot-per-second rate of sink; the T-45A landing gear will withstand up to 24-foot-per-second rate of sink. The T-45 speedbrakes will be side mounted. The new T-45 hook displaces the original HAWK speedbrake on the bottom of the tail section of the aircraft. There will be many changes in radio, navigation, and armament equipment to ensure compatibility with U.S. Navy facilities and equipment. A total of 300 production T-45A aircraft will be acquired.

In addition to the aircraft, 32 flight simulators will be acquired; 22 will be operational flight trainers (OFT) that have visual displays; the other ten, without visuals, will be instrument flight trainers (IFT). The simulators will be derivatives using applied technology developed from F/A-18 simulators.



Academics comprise a broad array of curricula and media including lecture material, texts, notebooks, graphic aids, and computer-assisted instruction devices.

The training integration system comprises computers and software that will allow better scheduling and monitoring of resources (people and machines), and improved tracking of academic and flight performance.

The logistics approach for the T-45TS utilizes the latest logistics strategy of the Naval Air Training Command, which makes extensive use of contractor maintenance and support for non-deployable weapon systems in order to lower life-cycle costs. The Navy is procuring in the initial contract the resources (spare and repair parts, publications, support equipment) that the contractor will utilize in supporting the aircraft. In addition, the contractor will develop—at a Navy activity—the ability to repair the top-logistics cost drivers. The contractor will deliver to the Navy the technical data necessary to compete both the maintenance and procurement of the top-logistics cost drivers. This approach will allow the Navy the necessary contracting flexibility in the outyears to ensure that an affordable and maintainable weapon system is available to the fleet.

Service View of Affordability

Because of the derivative nature of the T-45TS program and the general attitude that "it's just a trainer," the identification of adequate development funds has been an uphill effort. The combination of increasing weapons systems acquisition costs, limited development resources, and service priorities has forced the T-45TS program to be austere.

The Secretary of the Navy Decision Memorandum resulting from the Department of the Navy Systems Acquisition Review Council I placed a limit of $450 million (Fiscal Year 1984 dollars) on T-45TS full-scale engineering development costs beginning in Fiscal Year 1985. In addition, the contracting approach was changed from cost-plus-incentive fee to firm-fixed-price for both full-scale engineering development and associated limited-production options. These new ground rules provided the program staff with a monumental task.

The subsequent effort resulted in a program plan for full-scale engineering development that successfully accomplishes the Department of the Navy Systems Acquisition Review Council targets while still meeting the Navy requirement for an adequate and fully integrated training system. The production output for the system remains as originally planned. Figure 3 compares the program before and after restructuring. The primary reductions are in

■ *Captain Polski is the T-45 Training System Program Manager.*

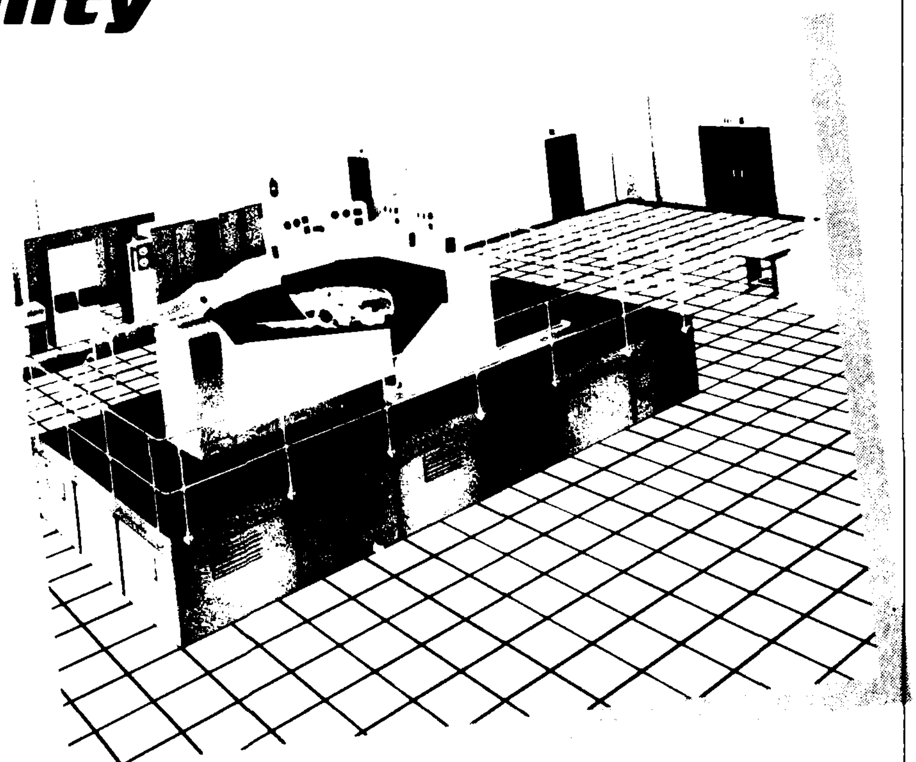
Naval Air Systems Command Restructures a Program for Affordability

Captain Paul A. Polski, USN

The Navy T-45 Training System (T-45TS), which began as the VTXTS (fixed wing aircraft experimental training system) with mission element need statement (MENS) approval in June 1979, is an Acquisition Category I (ACAT I) program that entered the full-scale engineering development (FSED) phase October 2, 1984. The initial operating (training) capability date is October 1990, and the mission is to provide and support a jet-flight training system for intermediate and advanced flight training of Navy and Marine jet pilots, who will be progressing from primary training in the T-34C aircraft and advancing into the T-45A aircraft. The T-45A is replacing two aircraft currently used for intermediate and advanced jet training. The Navy trains approximately 600 jet pilots per year.

From November 1981 to October 1984, the T-45TS program experienced a roller-coaster existence not unlike a complex Defense Systems Management College case study including extremes a program manager might encounter. One mandate that remained constant was reducing cost, which weighed heavily because of the system's nature.

This is a brief review of the effort completed to make the T-45TS development affordable; the first part describes the program and results of the restructuring effort; the second describes the process of the restructuring or program streamlining.



Navy T-45 Training System

The T-45 Training System includes a fixed-wing aircraft, an associated ground-training subsystem (GTS), and the logistics support for both. As shown in Figure 1, the ground-training subsystem contains instrument and operational flight simulators, an academics suite including computer assisted instruction (CAI), and a computer based training integration system (TIS) for managing training assets and tracking student progress.

The industry winner of the competition for development and production of the T-45TS was a team from Douglas Aircraft Company, British Aerospace, Rolls Royce, and Sperry Electronic Systems. Douglas is the prime contractor for system integration, as well as the joint developer with British Aerospace of the T-45A fixed wing aircraft; Rolls Royce provides the MK 861 Adour engine; Sperry is subcontractor for the instrument and operational flight simulators; and

The modern Aesop gathered his students about and told a fable of the quiet manager. Once upon a time there was a manager who performed all tasks on time and under budget. There were never any problems in this manager's office or in coordination with other managers' efforts and tasks. When others handed over their problems, this manager was prepared to handle them; indeed, many times just as the hand-over was to occur the problems seemed to disappear.

At staff meetings, the manager rarely spoke and then only to say everything was o.k. and no problems were anticipated. Then, the flow of the meeting was taken over by now problems of very high priority, requiring quick fixes and temporary work arounds and more money, usually lots more money. The manager remained unnoticed, doing a very good job very quietly.

"The moral of this," said the modern Aesop, "is that while the squeaking wheel may need grease, it also may not be the one needing imitation."

The students left, but one returned. "How did the quiet manager do this?" the student asked.

The Answer

"Well," said the modern Aesop, "that's the question the others should have asked as well, but you were smart enough to do so." He gave this answer.

The quiet manager looked ahead, looked to the sides and looked behind. This was different from the others, as everyone else looked behind to see what happened—they called this feedback. If anyone had asked, the manager would have called it using feedfront. In other words, using experience, knowledge, expectations, communication and being aware of what was happening, the quiet manager was ready to do the job when the job needed to be done. The manager, using feedfront available, made sure that assignments were clear and doable, that resources were adequate. The manager identified and took risks. The manager was ready to change before the change was necessary. The manager made sure that subordinates, peers, and higher organizational elements knew that change was going to happen. There were ways of recognizing, in advance, using feedfront, the need for change. There were effective communications to assure that change happened as it was needed and there was follow-up to make sure that the change happened the way it was supposed to. Success was rewarded.

"Mostly, I look around, people talk to me, and I listen and ask questions."

Of course, there were problems, failures, mistakes, shortcomings, wrong assumptions, and all sorts of other things going on, but the quiet manager was ready for them: If not for the exact situation, then something very close.

The manager, using early analysis of ongoing tasks which he called feed-in, moved to correct problems before they became serious. One of his strong concerns was to avoid continuing and repeating a mistake. If after a valid trial period a new approach wasn't paying off as expected, he would change to another, sometimes even going back to the old way. Failure was not punished; neither was it tolerated.

Cooperation, assistance, and a desire for continuous improvement, were group values. Using feedfront and a positive continuous change for improvement, the manager kept ahead in achieving the goals.

Prefers Large Picture

"That, and the pleasure of accomplishment, make this a fun job," the manager would have said had anyone asked.

No one asked, "are you a detail person?"

The manager would have said, "No, I prefer the large picture, but I know that details are important and have a system of planning, scheduling, budgeting, and reporting to tell when details are, or will be impacted. Mostly, I look around, people talk to me, and I listen and ask questions. I don't ask *why* questions, but *how* questions and *what's-happening-tomorrow* questions. I try to deal with what's next and my co-workers deal with what's now. I try to avoid surprises that I'm not ready for."

Look where you want to go and prepare the path ahead. Look behind only if that is where you want to go. ■

■ *Dr. Billings is the DSMC regional director, Huntsville, Ala.*

Modular Bridge
Curbs Logistical Problems

The U.S. Army Belvoir Research and Development Center awarded more than $12 million to the American Development Corporation, North Charleston, S.C., for production of 96 ribbon-bridge erection boats, first installment of a multiyear contract for 554 boats, with an option to buy 262 more. Constructed of welded aluminum and powered by two diesel engine-driven water jets, the 25-foot boat features a 22-inch draft and a top speed of 31 miles per hour. It can be transported to the crossing site and launched by the same vehicle that carries the ribbon bridge.

The ribbon bridge's modular design reduces logistical problems associated with the old M4T6 bridge. It took 260 men five hours to erect a 400-foot span; with the ribbon bridge, 50 men can do the same job in less than an hour. ■

Keeping Ahead of the Game

The Quiet Manager

Dr. Jay Billings

grams. In some cases, cost of full-scale development was "capped" to reflect a cost ceiling; however, cost for production and operation and support were only educated estimates without binding commitment on the selected contractor. The situation changed with the release of the request for proposal for the T800 engine. The negotiated contract will require that the engine developer commit at the start to a price for each of the three elements shown. The degree of binding commitment by each offeror affects proposal value. The features of this new approach to control contractor cost and performance are listed below.

—Establish basis for firm, fixed-price contract to conduct full-scale development.
—Establish design-to-cost goals. Negotiate firm, contractually binding commitment.
—Establish operating and support goals and negotiate firm and contractually binding commitment.
—Define government cost objectives and assumptions for purpose of setting industry's targets.
—Define relative importance of cost elements (above) to guide industry's emphasis.
—Establish prices of options.

Reliability and Maintainability/Integrated Logistics Support (RAM/ILS). In this request for proposal, reliability and maintainability were regarded important enough to raise to a major area of evaluation. They were joined with integrated logistics support and not included under technical or management, as was the case in previous requests for proposal. By so doing, RAM/ILS will be assured of receiving heavy emphasis and will become a significant part of the contractor's binding commitment. Until now, reliability and maintainability often represented a factor and subfactor input to the evaluation process and was too low in the structure to carry the needed impact. The same is the case with integrated logistics support. The eight factors that make up this area are:

—Reliability
—Maintainability
—Safety
—Human factors engineering
—Quality engineering
—Survivability/vulnerability
—Logistics/manpower integration (LOG/MANPRINT).
—Air Vehicle Support (AVS).

Summary

The acquisition strategy for the T800-XX-800 engine is based on establishing a competitive environment and designed to minimize life-cycle cost. Shifting more risk to the contractors during full-scale development is intended to make best use of industry expertise without detailed direction or involvement from the government. Less government involvement will reduce administrative burdens and costs.

The T800-XX-800 request for proposal and system specification, a concise and simplified document, states what results are needed, rather than detailed procedures and management systems for achieving those results. The request for proposal requires the contractor to develop an engine economically producible, operationally suitable, and field supportable while providing adequate flexibility to optimize the design. ■

Department of Defense Identifies

Acquisition Streamlining Advocates

William H. Taft IV, deputy secretary of defense, has announced the appointment of three military department acquisition streamlining advocates to help accelerate and intensify the momentum of the Department of Defense Acquisition Streamlining Initiative. They are:

Army: 697-1646
Brigadier General Lynn Stevens, Director, Materiel Plans and Programs in the office of the Deputy Chief of Staff for Research, Development, and Acquisition, Headquarters, U.S. Army;

Navy: 692-3201
Mr. Gerard Hoffmann, Headquarters, Navy Material Command;

Air Force: 697-6915
Colonel James Lindenfelser, Director, Program Integration in the office of the Deputy Chief of Staff, Research, Development, and Acquisition, Headquarters, U.S. Air Force.

Richard A. Stimson, Department of Defense director of industrial productivity will be coordinator for the initiative.

On Dec. 5, 1984, Deputy Secretary Taft issued a memorandum requiring the military services to accelerate the streamlining initiative, which is directed at eliminating over-specification and costly contract requirements. It is viewed as a significant, long-term solution to the problem of over-specification, and focuses on identifying the most economical contract requirements during early systems design. Emphasis will be on writing specifications for DOD contract requirements in terms of "what is needed" and "performance required" rather than detailed "how to" specifications in the early phases of design. Defense contractors would be required to identify and recommend inexpensive contract requirements for application to future acquisition phases as weapon system development programs evolve, and as more information about true-contract requirements is known. Twelve acquisition programs have been selected for initial implementation.

This approach is designed to give industry an opportunity to recommend the most affordable application of detailed specifications, standards, management systems, data, and other contract requirements. Initially, the advocates will expand the number of DOD programs to implement acquisition streamlining. ■

—Achieve status of two qualified sources for end-item in production by first production lot with full competition by the third production lot.
—Establish that government will not fund facilitization.
—Establish initiatives for small, small disadvantaged, and women-owned business participation.
—Develop options for qualified sources of parts.
—Develop willingness to accept alternatives (new and innovative approaches to parts competition).
—Emphasize planning and execution by the offeror contractor, not by the government.
—Describe end-product but allow industry innovations in details of managing the activity.
—Require contractor to concentrate on core issues (who does what, how, when, and where) in addressing producibility engineering and planning.

Technical. The thrust of the technical portion of the request for proposal was to specify the technical characteristics required of the engine in production and provide industry with the latitude to conduct tradeoffs for optimizing their designs. The objective was to place responsibility for the proposed engine design directly in the hands of the selected contractor(s). Given that this procurement will involve a binding commitment against a fixed-price contract, and that competition in production will be a driving consideration, the offerors were given freedom to specify how they will meet the government technical requirements. In addition, to provide the desired latitude and flexibility in arriving at a best overall design description and program, the request for proposal permitted offerors to fall within a band of performance and weight objectives.

It cannot be overemphasized that providing the industry with maximum flexibility in design must be accompanied by production contracts to the winners that enforce the performance guarantees. The Army does not intend to manage minute details of the firm, fixed-price development program, nor does the Army wish to specify "how to design and develop the engine." It is essential that this departure from previous practices be made clear and recognized by the offerors as a feature of their proposal and follow-on negotiations before executing binding, firm, fixed-price contracts. A summary of the technical approach is shown below:

—Eliminate "how to do it" from statement of work and system specifications.
—Permit offeror maximum flexibility in proposing a program that best meets requirements.
—Minimize government involvement in managing the development process.
—Establish firm understanding among bidders that the request for proposal is departure from "business as usual."
—Provide offerors with opportunity to develop optimizations and tradeoff the requirements.
—Emphasize that contractor(s) will be held accountable for development program and its internal controls.
—Specify performance requirements in a single place in request for proposal.
—Eliminate prime item development specifications and use government system specification.
—Retain test requirements for preliminary flight rating and qualification.

This article focuses on the process used to develop the LHX engine request for proposal (RFP).

—Retain performance, reliability, and schedule requirements.
—Require only essential data during development for government tracking.
—Minimize number of formal government reviews.

Management. This area of the request for proposal has been reduced in scope when compared to previous similar procurements. It is recognized that various management systems are in place in the industry and that these systems are well structured to conduct the engine development program. Therefore, it was the government's intention to avoid intrusion into established business practices, or involvement in internal control of the contractor's management structure. Of importance in evaluating proposals, of course, will be how the offeror and supporting organizations plan to manage the engine program. There is still a need to assess the offeror's understanding of responsibility in the role of managing and coordinating competition initiatives and the teaming or other contractor associations required to meet government objectives. Highlights of the management area are provided below.

—Increase industry responsibility and role while reducing government involvement in internal management tasks.
—Assign control of development to contractor and make him accountable on a firm, fixed-price basis.
—Use contractor-developed work breakdown structure, if appropriate, in minimizing cost of reporting.
—Use performance specifications rather than prime-item development specification (PIDs).
—Assign configuration management to contractor during development.
—Increase contractor flexibility in program decisions (permit novel and innovative approaches).
—Permit more timely decisions by contractor without requiring study and approval by government.
—Require that only essential system cost and engineering management plans be submitted for assessment.

Cost. The requirement to assess program costs has been extended well beyond the program development phase. The evaluation will include industry-proposed contractual commitments to control costs of production and follow-on operation and support. Offerors were provided Army cost goals in each area. The three cost elements that will receive detailed and concentrated attention in the evaluation process are:

—Development
—Procurement and production
—Operation and support.

Previous requests for proposal requested voluminous substantiating data, addressing requirements and stipulations on the part of the offeror. These, in turn, were used by the government to develop an independent assessment of overall life-cycle cost. At best, it was based on applying judgment derived from earlier, similar pro-

Light Helicopter Family (LHX) and the Streamlining Initiative

Brigadier General Ronald K. Andreson, USA

The objective of the Light Helicopter Family (LHX) program is to provide affordable and conventional helicopters with all-weather and night-operation capabilities to replace the aging and obsolescent light fleet, which includes the OH-6, OH-58, UH-1, and AH-1 aircraft. The LHX will provide a modern, more capable and survivable, less-costly-to-operate fleet that augments and complements existing operational capabilities of the AH-64, UH-60, and AHIP helicopters. The utility version of LHX (LHX-U) will embody extensive commonality with the scout-attack (LHX SCAT) version and will include the same dynamic systems and components (engines, transmissions, and rotors), and many common flight control and missing equipment items. Both the LHX-U and LHX SCAT will have worldwide operational capability and be self-deployable to overseas theaters of operations.

The current LHX program schedule calls for award of the LHX engine contract in June 1985, and the LHX air vehicle development and training systems contracts in January 1987. This article focuses on the process used to develop the LHX engine request for proposal (RFP).

Each LHX vehicle will use twin turboshaft engines designated as T800-XX-800. They will be rated at 900 kilowatts (1200 horsepower class) at sea-level standard conditions, and will have a built-in growth capability. To provide these engines, a full-scale development program through qualification is planned. The RFP covering the government end-product requirements for the engine was released to industry in December 1984, and source-selection activities began in March 1985.

The focus of the T800 acquisition strategy is on competitive development and procurement. The government reserves the right to award more than one development contract with down selection to one contract after preliminary flight rating (PFR) testing. Competition at the prime level for development and production of the T800-XX-800 engine is restricted to United States and Canadian sources; however, this does not preclude foreign sources from participating as subcontractors. A fundamental requirement for acquisition is a competitive procurement of the total engine end-item by the Lot Three production contract award; bidders will be required to propose and justify their methods of accomplishing this competitive procurement requirement. The Army will not fund production facilities. Facilitization, including brick and mortar, production tools, production test equipment, and other related items as used in the production process, will be contractor-funded. Producibility engineering and planning (PEP) funds will be provided, but this will not be construed as justification for detailed Army involvement in innovative industrial planning. The intent is to permit maximum flexibility and latitude in exercising corporate initiatives. Engines for final qualification test (QT) will be manufactured using pilot production tooling and will be required to demonstrate reliability, availability, and maintainability (RAM) requirements without follow-on RAM growth programs. The RFP is structured to define what the Army required, not how to do it. The average design-to-cost (DTC) goal is $245,000 per engine in fiscal year 85 dollars for a planned total quantity of approximately 10,000 engines.

RFP Highlights

Five evaluation areas were addressed in the Army performance-oriented request for proposal: production competition, technical, management, cost, and reliability and maintainability integrated logistics support (RAM ILS).

Production Competition. This area of the evaluation plan represents a significant departure from traditional RFP-related areas and elements. Production competition is the foundation upon which the government expects to minimize costs of the end-item and replenishment parts. To achieve this objective, the offerors were required to address specifically the following three elements to avoid having their proposals found non-responsive: end-item; spare parts; and producibility, engineering, and planning.

This is the first known procurement in Army aviation to require that competition initiatives be established by the offeror from the outset. In the same way, this is the first source selection activity that will emphasize evaluation of the offeror's plans to achieve competitive sourcing. Should the evaluation find that a proposal does not offer to provide for adequate competition of production of end-item and parts, the offeror will be deemed ineligible for award, regardless of other merits of the proposal in the areas of technical, management, cost, and RAM/ILS. Production competition, therefore, is an overriding aspect of the proposal, and the offeror must address how this initiative will be met.

The requirement for production competition was established and coordinated with industry well in advance of RFP release. Further, it was made clear that the contractor would be expected to pursue the initiatives at the start of full-scale development, and that proposed competition plans would be a major consideration during the evaluation process. Highlights of government expectations and contractor-generated agreements that summarize this area of the RFP are listed below.

—Allow industry to develop necessary plans and business arrangements for cooperative efforts.

—Minimize limits on proprietary rights to data and establish expiration dates.

■ *Brigadier General Andreson is program manager of the Light Helicopter Family (LHX).*

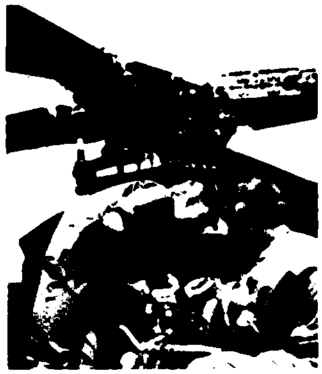
6. Direction Control

- 6.1 The Contracting Process
- *6.1.1 Contract Types
  - Methods of Contracting
  - Formal Advertising
  - Negotiation
  - *Solicitation Document/Contract Document
  - *Competition
  - Source Selection
  - *Incentive Contracting
  - *Negotiation Techniques
  - *Progress Payments or Contractor Financing
  - Contractual Clauses
  - *Subcontracting: Small and Minority Business Contracting
  - *Administration
    - COTR
    - *ACO
  - Changes
  - Termination
  - Close-out
- 6.2 Program Design Reviews/Audits
- *6.3 C/SCSC, Cost RPTG, Cost Control
- *6.4 Technical Performance Measurement
- *6.5 Configuration Management
- *6.6 DT/OT, Product Acceptance Tests as Control Functions
- *6.7 Quality Assurance
- *6.8 Design to Cost Management
- *6.9 Independent Cost Analysis
- *6.10 Embedded Computer Resources
- *6.11 Software Management
- *6.12 Contractor Overhead
- *6.13 Should Cost
- *6.14 Incentives for Investment Programs (Capital Investment for Cost Reduction)
- 6.15 Technical Interface Management

7. Other Subjects to Consider

- Interface Control
- Specification Management
- Safety
- Data Management
- Technical Manuals Management
- Transition Agreements
- Value Engineering

Appendix "A" Glossary of Acquisition Management Terms



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another cost breakthrough. By using existing designs for the engine and the ground-training system, costs have been reduced significantly.

The software specification for the ground-training system has been markedly simplified. The training integration system and computer-assisted instruction will be modeled on the McDonnell Douglas AIS II System, thus taking greater advantage of derivative technology. Procurement of traditional training materials and the installation of TIS and academic training equipment at the initial training site were deferred until production.

Approximately 75 percent of all T-45TS specifications and 65 percent of contract data requirements have been tailored. Fleet requirements for the ground-training system were redefined and streamlined by representatives of the ultimate system users (Chief of Naval Education and Training, and Chief of Naval Air Training), and program sponsors in the Office of the Chief of Naval Operations.

Figure 3. T-45TS Development Program Comparison

	BEFORE RESTRUCTURE	AFTER RESTRUCTURE	DELTA
FSED CONTRACT TYPE	CPIF	FFP	
GROUND TEST ARTICLES	3	2	–1
FLIGHT TEST AIRCRAFT	4	2	–2
FLIGHT TEST HRS			
CONTRACTOR	623	411	–212
NAVY DEVELOPMENT	160	160	0
NAVY TECH EVAL	90	90	0
NAVY OPTEST	40	40	0
AIRFRAME DESIGN		BASICALLY UNCHANGED	
ENGINE DESIGN		SIMPLIFIED	
GTS DESIGN		CHANGED	
SIMULATORS		SIMPLIFIED	SLIGHT
CAI		SIMPLIFIED	SMALL
TIS		SIGNIFICANT CHANGE	LARGE
DATA REQUIREMENTS	530	251	–279
SPECIFICATIONS	322	281	–41
RISKS			
DESIGN	LOW	LOW	UNCH
SCHEDULE	LOW	MODERATE	INC
CONCURRENCY	MODERATE	LOW	DEC
PROGRAMMATIC	LOW/MOD	MODERATE	INC
CONTRACTOR INVESTMENT	LOW	LOW/MOD	INC
LOGISTICS	LOW/MOD	LOW	DEC
COST	LOW/MOD	LOW	DEC

UNCH = UNCHANGED; DEC = DECREASED;
INC = INCREASED; MOD = MODERATE

The Streamlining Approach

Efforts have been made to reduce costs since the source selection in November 1981. Initial requirements were reviewed and redefined to leave only those hardware elements considered essential. Some items previously deleted in the pre-full-scale engineering development (demonstration validation) phase were an aerial situation trainer, head-up display, airborne computer, and multimedia display. This initial effort reduced estimated cost of the development program from $810 million to $727 million in Fiscal Year 1984 dollars. Other measures were taken early-on to reduce costs, the two most significant being a change from Navy organic logistics support to contractor logistics support, and a limitation on the applicable level of most military specifications to be used in the development to the second tier.

In the T-45TS program, the government aircraft specification document is called the "detailed or design specification." The tier below that document comprises documents referenced therein, mostly military specifications and standards; the second tier of specifications, therefore, comprises documents referenced in the first tier, and so on. For the T-45TS, the tiering of specifications was terminated at the second tier, with exception of third-tier specifications affecting operational safety.

Reductions in logistics support data requirements and documentation are limited by the amount of information necessary for competitive procurement of the contractor maintenance, and life-cycle support services.

The Tiger Team

In view of previous reduction effort there appeared to be little room for additional change; however, every aspect of the program was opened to the Tiger Team for scrutiny.

Initially, when the effort was being planned, the question was: "Is the desired restructuring possible?" This prompted development of a notional target program planned with a few informed people to provide quick identification of risks and problems. The notional program was a confidence builder, and stimulated thought on *how* to streamline.

Dedicated teams for an intensive short-term effort to accomplish a specific task have been used often, and the concept was appropriate for the T-45TS challenge. First item on the agenda after the Department of the Navy Systems Acquisition Review Council was to assemble and organize the Tiger Team. This is a critical step because it is at this time that the right people are assigned, the right attitudes are established, and an atmosphere of compromise is created. The "right people" are informed and experienced personnel in their professional disciplines who can expeditiously and effectively achieve the objective. Figure 4 shows the organization of the Tiger Team.

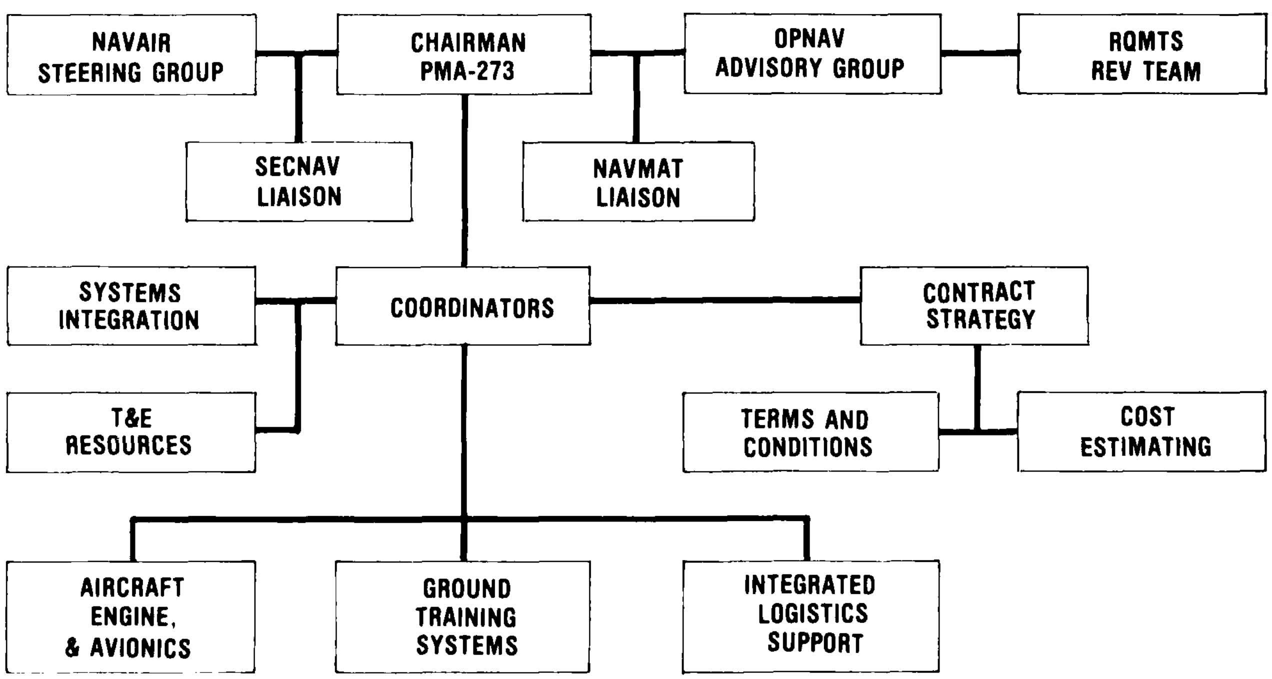
The program manager assumed overall responsibility. Part of setting an atmosphere of compromise was ensuring that outside elements made meaningful contributions to the restructuring process—not well intended but disruptive input.

Day-to-day Tiger Team management was the coordination function of the Navy deputy program manager and the prime contractor program manager. They solved log jams and encouraged team members to maintain the right attitude. The lower portion of Figure 4 identifies key functional disciplines, in which Navy and prime-contractor personnel worked together to reduce development costs. The full Tiger Team met four times—first for two weeks, the other times for a week each. Seven follow-on meetings were required to complete specific aspects of the new streamlined program. A high degree of electronic communication was employed. Full cooperation of industry contractors and users was necessary to achieve the desired funding reductions while satisfying program requirements. The significant reduction from the starting full-scale engineering development estimate of $727 million to $438 million required extraordinary measures.

Restructure Process

In mid-April, a request for quotation for full-scale engineering development was released on a cost-plus-fixed-fee basis. The request for quotation was used as a straw man for the restructured firm-fixed price contract. As shown in Figure 5, the straw man document was divided into four parts: contract data requirements lists, specifications, statements of work, and contract terms and conditions. A joint effort by the Navy and the prime contractor achieved layout of the straw man, providing each with a common understanding of the baseline program. The next three steps of Figure 5 show the role of the work-breakdown structure (WBS); Tiger Team responsibilities were assigned using the WBS, the cost estimate was divided on the basis of the WBS, and targets were set for the development of the desired cost reduction. WBS became the common language to discuss reduction opportunities.

Figure 4.
Tiger Team Responsibilities



When cost estimates were assigned according to work-breakdown structure elements, the usual secrecy regarding each participant's estimates had to fall by the wayside. Candor and flexibility were necessary to achieve a mutual understanding of the desired product and its cost. This key aspect of the restructuring process was known as "technical negotiating," traditionally a contracting no-no. Thus, the path for the Tiger Team was mapped out and the stage was set for the core iterative streamlining effort, Step 5 in Figure 5.

Technical specialists labored at defining and quantifying the minimum requirements necessary to meet Navy reporting and verification requirements, but remain within the WBS budget estimate. Past experience, and guidance documents like the U.S. Air Force AMST specification tailoring report and draft DOD-HDBK-248B, were used. Tiger Team members benefited from a DOD-Industry Workshop on contract requirements optimization held in the spring of 1984, immediately before their first meetings.

The cost-estimating subcommittee of the contract strategy committee (Figure 4) developed daily estimates of contract-cost changes made by technical committees. Eventually, team sessions yielded sufficient revisions to cut and paste a new straw man contract reflecting an acceptable restructured program. The final product consisted of the basic contract and 19 different attachments. This, subsequently, was refined into a letter contract signed October 2, 1984, by the Navy and Douglas Aircraft Company.

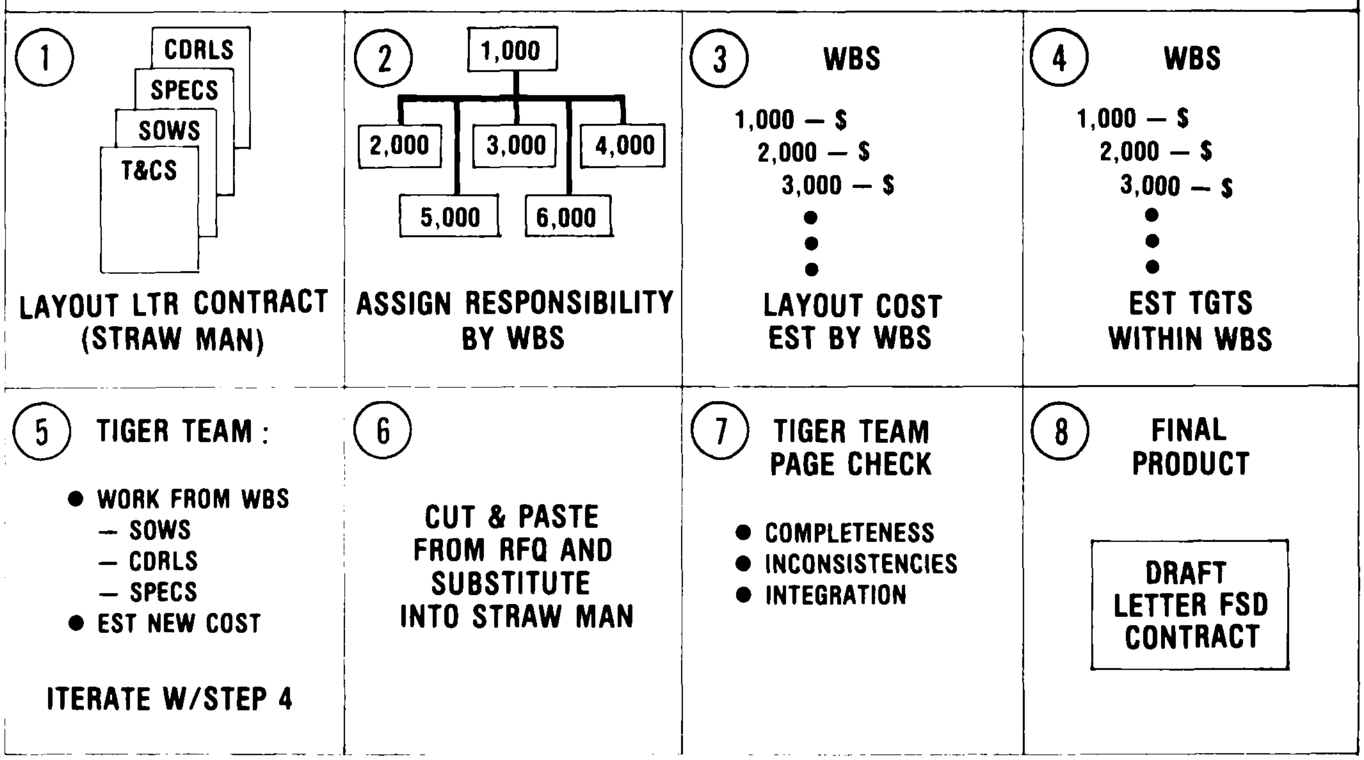
Lessons Learned

From May 1-October 2, 1984, program restructuring required dedicated management effort. Figure 6 summarizes major characteristics leading to a successful T-45TS program restructuring process; i.e., planning, approach, execution, communication, and leadership.

Planning

Before initiating efforts by the Tiger Team, a common baseline was needed, requiring a joint government-contractor understanding of words in the draft contract and proposed specifications (request for quotation), and a consensus of costs for specific services and products. The two parties reconciled existing differences into an agreed to baseline. While determining this baseline, there was ample opportunity to gain more insight into the establishment of cost-reduction goals. For example, cost-reduction goals were set to be attainable with acceptable sacrifice. The initial goal, set for a 30 percent reduction in cost across the board, was arbitrary but provided good starting points. Some items ultimately exceeded 30 percent savings, and others fell short. The key point is that the overall goal was achieved. Technical and schedule goals for Tiger Team sessions and for the program had to be established.

Figure 5.
T-45TS Program Restructure Process



Government and contractor policies had to be identified and clarified, and applicable government regulations and directives were available for reference. The Tiger Team and others doing the early planning were joint Navy contractor teams, usually working at the same site. The government site was preferred because it allowed improved access to principal government engineers intimately involved with yes no decisions regarding specification and data-requirement applicability.

Approach

The major reduction desired for the program required that a value analysis be done on all program facets from need, plan of action, and form of the documentation package. The severely reduced number of specifications was further reduced from 322 to 281. Data requirements were reduced from 530 to 251.

Using a derivative development approach facilitated reduction of documentation requirements because much of the aircraft, simulator, and curricular engineering did not have to be repeated. Lack of formal data in some areas was compensated for by in-depth Navy industry discussions.

The matter of controlling well-meaning outsiders was extended to subcontractors and vendors, so that the prime could later negotiate separately and more effectively with them. The Tiger Team technical negotiation process did not jeopardize subcontractors' negotiations, which mutually benefited the service and the prime.

Execution

The Tiger Team was under pressure to accomplish its job effectively and quickly. Long hours led to saturation; thus, the team schedule was limited to 2 weeks maximum per session. A break often resulted in the identification of overlooked streamlining opportunities.

An effective system for recording results was necessary, and Tiger Team used a "chit" system. Cost estimators provided a continuing "how goes it" on reaching cost-reduction goals. Obviously, common sense was needed to evaluate each program adjustment in the context of the total program.

Communications

Communications is an important function. Free-flowing communications were essential among the team's five committees and individual members. One-on-one meetings to informally exhange overlapping information between members of different committees was a common practice. There was a daily, mutually exclusive meeting of government and contractor personnel; these separate meetings provided a forum for formal status reports by each staff to their respective management, facilitating an exchange of ideas and generating an awareness of the progress being made. Situation summaries (SITSUMS) were issued each Friday during Tiger Team sessions to provide necessary information to people outside the basic streamlining activity.

The dynamic contractural technical interplay resulted in improved awareness of what was in the contract, as well as better knowledge by people in the service and in industry about what was being contracted for, and what was going to be delivered.

Figure 6. Key Elements In Successful T-45TS Program Scrub

PLANNING

- USE BASELINE
- NAVY OPENING EST
- KR OPENING EST
- NAVY-KR RATIONALIZE DIFFERENCES
- SET GOALS
- JOINT TEAM
- TEAM OBJECTIVE
- POLICY/REGS/DIRECTIVES

APPROACH

- AGENDA
- REVIEW NEED
- WHOLE PROGRAM
- TIER SPECS
- EDIT SPECS
- USE WBS
- DERIVATIVE SYSTEM
- KR CONTROL SUBS
- RELY ON TIGERS

EXECUTION

- MEET AT GOVT SITE
- MAX 2 WEEKS
- USE CHIT SYSTEM
- USE BOOK KEEPERS
- COMMON START
- BALANCE RISKS
- COMMON SENSE
- KEEP OUTSIDERS OUT

COMMUNICATIONS

- MORNING CAUCUS
- SITSUMS
- HOWGOZIT REVIEW
- TECHNICAL NEGOTIATION

LEADERSHIP

- TEAM SELECTION
- ATTITUDE
- POA&M
- CONFLICT RESOLUTION
- NOTIONAL PROGRAM

Leadership

I am highlighting leadership to emphasize its importance. Management leadership played important roles in selecting the team, establishing attitudes, setting the program plan of action and milestones, resolving conflict, and offering a notional target program to get the ball rolling. Each committee had three or four people participating from the Navy and industry. The selection of group leaders was important to assure effectiveness.

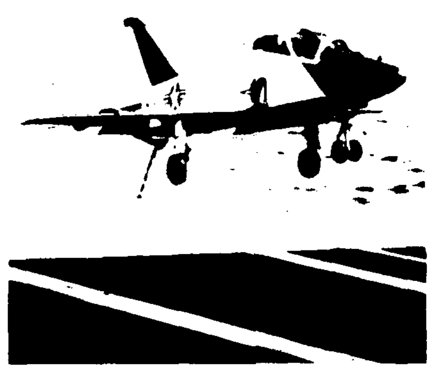
Establishing the right attitude was less difficult than anticipated; however, hidden agendas or dedication to an established functional discipline tended to influence actions when data or requirements had to be tailored or surrendered. The plan of action and milestones were critically important to the sense of objective and direction. It was important that team members have a clear understanding of how tasks were proceeding so they could agree to reductions in their areas. At the same time, there had to be a measure of progress for the individual, as well as for the committee, to evaluate team success.

There had to be a mechanism to resolve conflicts quickly. The mechanism used, a direct call by *anyone* to the program manager, allowed for conflicts to be surfaced quickly *and* at the best level for resolution. This allowed the program manager and seniors in the matrix organization to understand the roots of the conflict better, and to identify acceptable solutions.

Conclusion

This article presents highlights of a management approach to the restructuring of a specific program for more efficiency. Because all programs are different in some respects, what worked for the T-45TS program may not be successful for the next program.

A realistic restructuring outlook requires an evaluation of the program operational requirements and their costs. This means down-to-earth discussions with users and sponsors to review requirements from a practical cost-benefit perspective. Risks in the program have to be assessed. Increase in risk is difficult to avoid; moreover, a restructuring policy must be identified to channel this risk to the most acceptable areas. A derivative program like the T-45TS is a likely candidate to be faced with this challenge. The nature of a derivative program provides an attractive domain of data regarding support, performance, deficiencies, lessons learned and other opportunities. There has to be a detailed inspection of what can be applied from before, and what has to be done from scratch. Another obvious advantage for the T-45TS program was having only one prime contractor to deal with. Applying the streamlining process during a competitive selection would be more challenging, but not impossible.



The contractor's attitude is important in that he has to be willing to make sacrifices and, possibly, to accept additional investment risk to fit the work to the limitations. Government personnel must realize that regardless of their positions before, no matter how well supported or rationalized, they are in a new ball game—one requiring open minds and new strategies, new approaches, and a high degree of innovation.

The T-45TS program appears in all respects to be fully prepared for successful development and the subsequent transition to production. Only history can prove the ultimate ability of the T-45TS program streamlining process to meet a development limit of $438 million (Fiscal Year 1984 dollars), and conversion from a cost-plus-incentive fee to a firm-fixed-price contract. Inherent in the technical agreement to deliver the contracted products for the agreed price is the understanding that not only will the price be no higher than $438 million, but that funds ultimately allocated will be no lower in any given year than the established profile. Due to varying priorities, the restructuring process must include a management commitment similar to the United States Air Force technical baselining cost-capping approach, or a suitable array of cost and schedule sensitivities that address up-front the impacts of any subsequent funding reductions. This is the primary deficiency or vulnerability in a development program that is streamlined under a firm-fixed-price contracting strategy.

On a closing note, the element that undoubtedly contributed most to the T-45TS streamlining effort was *command attention*. There was full support from all superiors, the Navy Secretariat, the contractor's chief executive officer, commander of the Naval Air Systems Command, and others. They resolved issues beyond the control of program managers and were instrumental in the restructuring of the Navy T-45 Training System. ■

GLCM Seeks New Generator

The Air Force Ground Launch Cruise Missile (GLCM) System soon may be powered by a more reliable and maintainable generator through efforts of the U.S. Army Belvoir Research and Development Center, Product Assurance and Testing Directorate. The Test and Evaluation Division, based on experience with power units for missile systems, was chosen by the Air Force to devise a procedure to accomplish the necessary tests to aid in developing a new replacement battery for the GLCM system turbine, engine-driven generator.

Development of a virtually service-free battery, replacing the present refillable lead acid battery, should lower maintenance requirements of system generator sets, resulting in a reduction of manpower hours and equipment downtime. Personnel evaluated generator power requirements at temperatures ranging from minus 30 F to 120 F. Tests measured battery voltage, starter current, discharge current, and necessary thermocouple readings for each temperature, at quarter-second intervals. ■

REDUCING COSTS

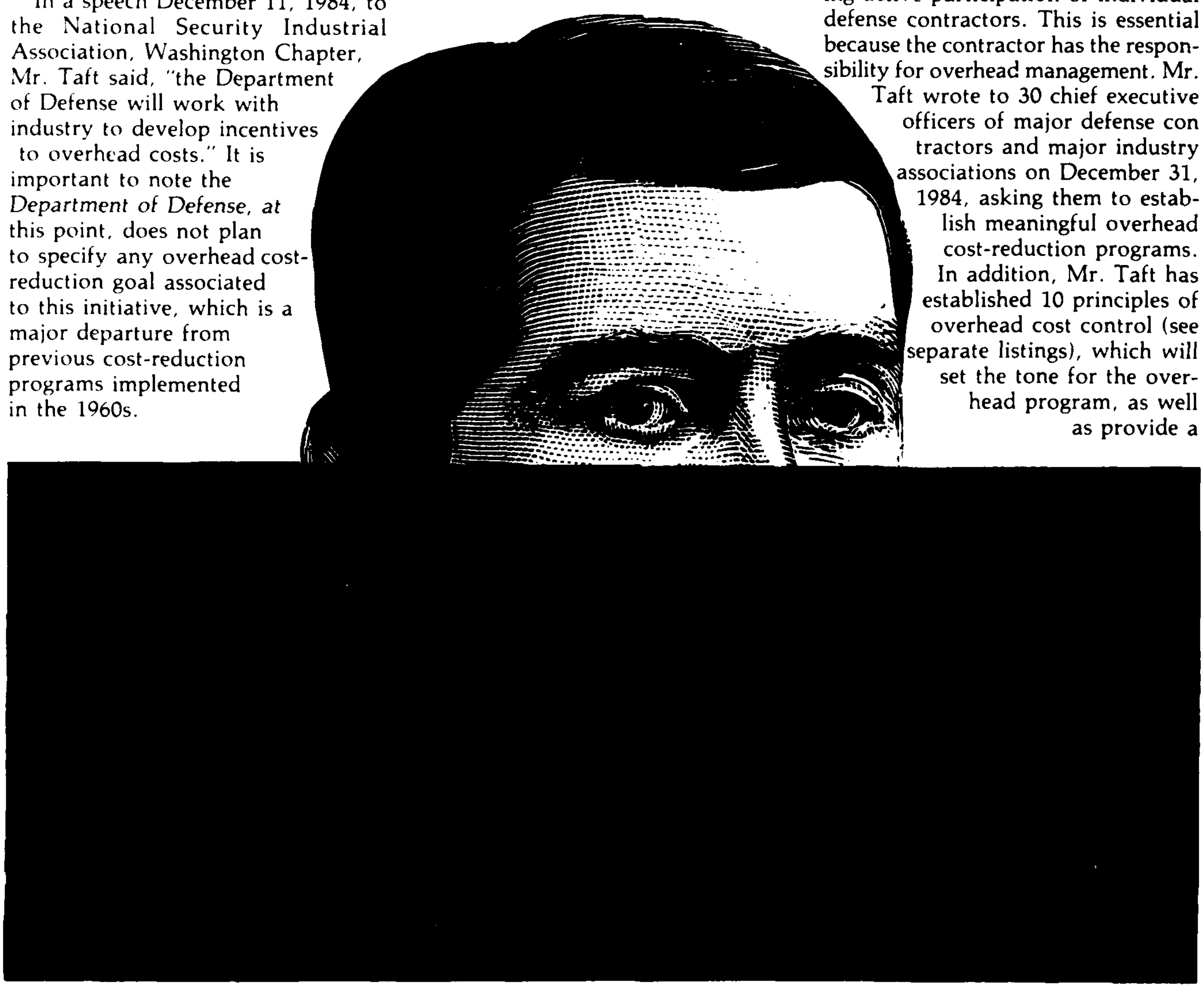
Heads Up on Overhead

Some New Ways to Keep Your Head Above Water With Contractor Overhead Costs

Ronald L. Baker

In early August 1984, Deputy Secretary of Defense William H. Taft IV directed the under secretary of defense for research and engineering (USDR&E) to lead a joint service review of contractor overhead costs. The objective was to identify opportunities where contractors' incentives could be developed, and where the government could improve its oversight. Although it was recognized that costs reduction initiatives should not lose sight of total price, Mr. Taft indicated that much can be gained from addressing the large components of contract price, like overhead. He further stated in a December 31, 1984, memorandum to the service secretaries..."typically, these costs have represented roughly a third of the price we pay for weapons systems." The results of the joint service review of contractor overheads costs were briefed to Mr. Taft in October 1984.

In a speech December 11, 1984, to the National Security Industrial Association, Washington Chapter, Mr. Taft said, "the Department of Defense will work with industry to develop incentives to overhead costs." It is important to note the *Department of Defense, at* this point, does not plan to specify any overhead cost-reduction goal associated to this initiative, which is a major departure from previous cost-reduction programs implemented in the 1960s.



Three Actions

On December 31, 1984, Mr. Taft outlined three actions to be taken by the Department of Defense in reducing contractor overhead costs.

—Each military service and the Defense Logistics Agency are to perform one should-cost review of plant-wide overhead at one contractor location during fiscal year 1985.

—The Defense Contract Audit Agency will perform a centrally directed audit of overhead allocation.

—The relationship between overhead and the Department of Defense profit policy should be examined under the existing Defense Financial and Investment Review study group. Particular emphasis should be directed toward developing applications for the special productivity factor where cost reductions in overhead are achieved.

The Department of Defense is seeking active participation of individual defense contractors. This is essential because the contractor has the responsibility for overhead management. Mr. Taft wrote to 30 chief executive officers of major defense contractors and major industry associations on December 31, 1984, asking them to establish meaningful overhead cost-reduction programs. In addition, Mr. Taft has established 10 principles of overhead cost control (see separate listings), which will set the tone for the overhead program, as well as provide a framework for further initiatives. The Department of Defense promises to develop incentives to give defense contractors inducements to cut overhead costs *voluntarily*, where incentives are necessary to produce desired results.

Initial Steps Only

These actions represent the initial steps for creating a worthwhile program to achieve a reduction in total cost of a weapon systems. The Department of Defense Indirect Cost Monitoring Office (ICMO), which includes representatives from the services and agencies, will be the principal action office to monitor further overhead initiatives within the principles established by the deputy secretary of defense. Additional update status reports on this overhead initiative will appear in *Program Manager.* ■

■ *Mr. Baker is a professor of financial management, Research Directorate, Department of Research and Information, at DSMC.*

Power Fair Set

The Army's Troop Support Command and the U.S. Army Engineer Center will co-host an electrical power fair at Fort Belvoir, Va., June 4 and 5.

The purpose will be to demonstrate current and future mobile electric power systems to defense personnel involved in their operation and acquisition. It will provide an opportunity for industrial firms involved in mobile electric power research, development, test, evaluation and manufacturing to meet with tactical power users and developers.

Exhibits will include the Army's military standard family of generators and power units; items under development, such as low-noise generators, power conditioners, and power-distribution equipment; areas of special interest and exhibits from private industry.

Military commanders, materiel developers, combat developers, communications and weapons systems contractors, and generator-set manufacturers and suppliers are invited to attend. For more information, write the Troop Support Command Belvoir Research and Development Center, ATTN: STRBE-E, Fort Belvoir, Va. 22060-5606. ■

Mr. Taft's 10 Principles Establish a Baseline for Developing Both Contractor Incentives and Improvement in Government Oversight

Prospective Pricing. Priority emphasis must be placed on prospective pricing of overhead costs. Government officials must strive for cost avoidance, using fair and reasonableness criteria, before contractor overhead costs are incurred. The most effective cost control will be realized through sound forward pricing rate agreements and advance agreements negotiated between the government and contractor.

Continuous Evaluation. Effective overhead cost control begins with forward pricing and ends with final settlement. The validity of forward pricing projections must be undertaken promptly by government officials.

Business Base. Future business forecasts are important in developing accurate, cost-effective overhead rates. It is imperative for government officials to understand the contractor's budgetary system used to estimate overhead allocation bases. The business volume underlying forward pricing rate agreements shall be regarded as cost and pricing data certified by the contractor.

Discrete Cost Analysis. Overhead costs must be evaluated on an element-by-element basis that concentrates on where contractor management decisions are made. Pricing methods that place undue emphasis on historical costs must be avoided. Evaluation tools such as should cost, cost monitoring reviews, operations audits, etc., should be used to the fullest.

Personnel Costs. The factors associated with contractor personnel costs, which include employee population, wage and salary structure, and fringe-benefit plans, represent nearly two-thirds of all overhead costs. While there must not be any interference with industry's collective bargaining processes, the government has a responsibility to ensure that costs absorbed on defense contracts are fair and reasonable. The Contractor Employee Compensation System Review is an important tool for evaluating these costs.

Accounting Systems. Government officials must possess a thorough understanding of the cost-accounting system used by the contractor. The cost-accounting system must provide overhead allocation on a credible benefits-received basis, not only in the aggregate but on individual items. Government officials must fully understand contractor management accounting systems, particularly as they relate to overhead planning and control.

Team Approach. Top management commitment to the team approach is absolutely essential. Contracting officers, cost and price analysts, functional experts, program managers, buying activities, and contract auditors must participate actively in all aspects of overhead cost control. Effective communication is vital.

Requirements. Government officials must be sensitive to the impact of their requirements on contractor overhead costs. Care should be taken through solicitation review processes to ensure that contract requirements and their attendant administration genuinely contribute to program objectives.

Contractor Incentives. Government officials are challenged to be creative in employing incentives and techniques that will give the contractor a credible inducement to reduce overhead costs. Such incentives could include contract incentive fee structure, industrial modernization incentives program, special productivity profit factor, source selection consideration, etc.

People. Meaningful overhead cost control can be accomplished only by the diligent efforts of individual people. Top management shall ensure that adequate personnel resources are applied to this area, not only in numbers but in talent. Recruitment, training, and retention of qualified people are a priority responsibility. ■

A PM AIDE

DSMC Publishes Acquisition Strategy Guide For Program Managers

Lieutenant Colonel Leslie R. Swanson, USAF
Dr. Harold S. Balaban
Dr. J. R. Nelson

Since 1976 when the Office of Management and Budget issued Circular A-109, "Major Systems Acquisition," program managers have been required to tailor an acquisition strategy for their programs. This is required as soon as an agency decides to solicit alternative system-design concepts that could lead to acquisition of a major new defense system. Moreover, revisions to this acquisition strategy are required as the program proceeds through the acquisition process.

Circular A-109 was the first of many documents providing policies and typical considerations to include in a program's acquisition strategy. The federal acquisition regulation (FAR) prescribes policies and procedures for acquisition planning and provides items to be included in written acquisition plans. Each military service has issued regulatory material providing requirements or guidance for items to be included in its service-acquisition strategies. Table 1 summarizes these major areas to be considered in acquisition planning, as presented by the key guidance materials at Department of Defense and military department levels. We include in Table 1 a recent example of an acquisition plan for comparison.

Acquisition strategy development is a difficult and complex process requiring considerable energy from the program manager and key members of the program management team. The many, and sometimes conflicting, requirements must be examined, developed, sorted, and integrated into a cohesive, concise, and executable strategy.

Until now, the program manager had little help as he tackled this difficult problem.

Table 1. Guidance on Acquisition Str

ELEMENTS OF A-109 ACQUISITION STRATEGY	ELEMENTS OF FAR ACQUISITION PLANNING (PART 7)	ELEMENTS OF DAR PROCUREMENT PLANNING (PART 21)
- Contracting Process - Scheduling of Essential Elements - Demonstration Test and Evaluation Criteria - Content of Solicitations for Proposals - Decisions On Whom to Solicit - Methods for Obtaining and Sustaining Competitors - Guidelines for Evaluation and Acceptance or Rejection of Proposals - Goals for Design-to-Cost - Methods for Projecting Life-Cycle Costs - Use of Data Rights - Use of Warranties - Methods for Analyzing and Evaluating Contractor and Government Risks - Need for Developing Contractor Incentives - Selection of the Type of Contract Best Suited For Each Stage in the Acquisition Process - Administration of Contracts	Acquisition Background and Objectives - Statement of Need - Applicable Conditions -- Requirements for Compatibility With Existing or Future Systems Program -- Any Known Cost, Schedule, Capability, or Performance Constraints - Cost -- Life-Cycle Cost -- Design-to-Cost -- Application of Should-Cost - Capability or Performance - Delivery or Performance-Period Requirements - Trade-Offs - Risks Plan of Action - Sources - Competition - Source-Selection Procedures - Contracting Considerations - Authority for Contracting By Negotiation - Budgeting and Funding - Product Descriptions - Priorities, Allocations, and Allotments - Contractor Versus Government Performance - Management Information Requirements - Make or Buy - Test and Evaluation - Logistics Considerations -- Assumptions Determining Contractor or Agency Support -- Reliability, Maintainability, and Quality Assurance Requirements, Including Any Planned Use Of Warranties Requirements for Contractor Data (Including Repurchase Data) and Data Rights, Their Estimated Cost, and the Use To Be Made of the Data - Government-Furnished Property - Government-Furnished Information - Environmental Considerations - Security Considerations - Other Considerations - Milestones for the Acquisition Cycle - Identification of Participants in Acquisition Plan Preparation	- Description of the Program, Item or System - Program Funding (R&D and Production), Including a Summary of Monies in the FYDP/Budget Submissions - Delivery Requirements, Both R&D and Production Contracts - Applicability of a Decision Coordinating Paper, Program Memorandum, Defense System Acquisition Review Council, Internal Service Reviews - Background and Procurement History - Discussion of Program Risk, Including Technical, Cost, and Schedule Risk - Integrated Logistics Support Planning Concept - Application of Design-to-Cost - Application of Life-Cycle Cost - Reliability and Maintainability Objective, Including Warranties - Test and Evaluation Approach - Management Information/Program Control Requirements - Approval for Operational Use - Government-Furnished Material/Facilities/Component Breakout - Application of Should-Cost - Milestone Chart Attachment Depicting the Objectives of the Acquisition - Milestones for Updating the Procurement Plan - Identification of Participants in the Procurement Plan Preparation - Procurement Approach for Each Proposed Contract

Fitting Strategy Puzzle Together

The benefits of developing and implementing a clear and concise acquisition strategy include:

—Organizing a consistent approach to system acquisition
—Permitting informed and timely decisions
—Achieving agreement on the program
—Providing communication about the program
—Building advocacy and support for the program.

Considerations in Table 1 and activities at the Defense System Management College—the Executive Refresher Course and the Program Management Course—reflect diversity of opinion about the mix of components for an acquisition strategy, and the most effective ways to develop and execute that strategy. However, consensus is that a strategy carefully developed, adjusted to meet changes in the acquisition environment, and consistently executed is one key to a successful program. Current guidance does not provide a structural methodology to fit pieces of the strategy puzzle into a clear and concise roadmap; nor does it provide criteria to evaluate the initial strategy and revisions thereto. Because there are so many considerations in developing an acquisition strategy for a particular system (one DSMC count showed 200 considerations), it became evident that there was a need to generate a structure for acquisition strategy development.

Difficulties that military program managers experience in implementing the acquisition requirements, and myraid competing considerations to

ategy and Planning

ELEMENTS OF ARMY ACQUISITION STRATEGY (AR 70-1)

- Program Structure
- Contracting Strategy
- Tailoring the Acquisition Process
- Supportability
- Manufacturing and Production
- Test and Evaluation
- Cost Growth and Drivers
- Technical Risks
- Safety and Health

ELEMENTS OF NAVY ACQUISITION STRATEGY (NAVMATINST 5000.29A)

- Section I: Needs, Constraints, Thresholds, and Program Structure
  -- Statement of Need
  -- Program Constraints and/or Thresholds
  -- Resources and Funding
  -- Program Structure
- Section II: Risk Analysis
- Section III: Strategy to Achieve Objectives and Implementation
  -- Objectives and Goals for the Acquisition Effort
  -- Considerations and Rationale for Program Schedule
  -- Planning and Control of Critical Program Activities
  -- Acquisition Alternatives
  -- The Plan for Selecting Among Alternatives and the Timing of Key Selection Decisions
  -- The Interdependence of the Acquisition Effort with Other Programs
  -- Risk Management Plan
  -- The Approach for Design Hardware Data Development and Preplanned Product Improvement (P^3I)
  -- Plans for Achieving Reliability in Design and manufacturing
  -- Standardization Considerations
  -- Design-to-Cost and Affordability Considerations
  -- Integrated Logistics Support Approach
  Use of Organizational Assets
  Mobilization Capability
  A Financial Strategy
  Plans For and Funding Required to Acquire Adequate Subsystems and System Test Hardware
  The Business Management Approach
  An Audit Trail of Key Acquisition Decisions

ELEMENTS OF AIR FORCE PROGRAM MANAGEMENT PLAN (AFR 800-2, 3)

- Program Summary and Authorization
- Intelligence
- Program Management
- System Engineering
- Test and Evaluation
- Communication/Electronics
- Operations
- Civil Engineering
- Logistics
- Manpower and Organization
- Personnel Training
- Security
- Directives Application

ELEMENTS OF RECENT *EXAMPLE ACQUISITION PLAN*

- Program Description
- Program Funding
- Delivery Requirements
- Applicability of Decision Coordinating Paper (DCP) and Defense Systems Acquisition Review Council (DSARC) Reviews
- Background and Acquisition History
- Program Risks
- Integrated Logistics Support (ILS) Planning
- Application of Design-To-Cost (DTC)
- Application of Life-Cycle Cost (LCC)
- Reliability, Maintainability, and Quality Assurance (R,M&QA) Objectives
- Test and Evaluation Approach
- Management Information and Program Controls
- Approval for Full Production (AFP)
- Government-Furnished Property/Facilities/Component Breakout
- Should-Cost
- Industrial Preparedness Planning
- Other Considerations
- Acquisition Milestones
- Schedule for Updating the Acquisition Plan
- Acquisition Plan Participants
- Contracting Approach
- Long-Range Plan

Table 2. Major Areas of Concern and Their Elements

Strategic	
	National Objectives
	Threat/Need/Technologies
	Program Objectives
	Market Factors
	Critical Issues
Technical	
	Design
	Test
	Production
	Deployment
Resource	
	Personnel/Organization
	Schedule
	Business/Financial
	Management Information
	Facilities

achieve program objectives in an economical and efficient manner have led to the publication of the *Acquisition Strategy Guide* by the Defense Systems Management College. The guide's purpose is to provide the program manager with a framework for developing and executing an acquisition strategy. Objectives are threefold:

—Provide a single-source reference document to guide the program manager in structuring, developing, and executing an effective acquisition strategy

—Provide applicable information to policy and staff offices involved in the review and approval process so that there is a common basis for communication

—Provide a document that enables a reference for training prospective program managers.

We attempted to restrict the guide's size to a usable length while providing essential information and references for further research and guidance. The guide is packaged so that each manager can tailor it to individual service and program needs by adding relevant information and data.

The *Acquisition Strategy Guide* focuses on major system acquisition programs; however, basic concepts and principles apply equally to all programs. The guide notes significant differences in service policy and procedures that influence development of acquisition strategy. After an overview of the systems/acquisition process, the guide develops criteria and structure for an acquisition strategy.

Within the structure for developing an acquisition strategy, the guide presents three major areas of concern—*strategic, technical,* and *resource*. Within each area, important elements are described. This structure, presented in Table 2, is discussed in detail in the new guide.

It became clear during our research that an acquisition strategy must meet certain criteria to provide a basis for achieving program objectives, and to aid in gaining program acceptance and support. The five key criteria we developed after interviews and discussions with DOD management and program managers are *realism, stability, controlled risk, resource balance,* and *flexibility*. To aid the program manager we developed some working definitions.

—*Realism*. An acquisition strategy is realistic if program objectives are attainable and the strategic approach to satisfy them can be successfully implemented with reasonable assurance.

—*Stability*. Acquisition stability is the characteristic that inhibits negative external or internal influences from seriously disrupting program progress. These negative influences frequently cause changes in cost, schedule, or performance requirements, and can threaten achievement of milestones.

—*Controlled Risk*. Technical, schedule, and cost risks must be addressed and managed to ensure program success. As applied to acquisition strategy, risk is a measure of the probability and consequences of achieving, or not achieving, a defined program goal.

—*Resource Balance*. This is a condition of equilibrium among, and within, major program objectives competing for resources.

—*Flexibility*. This is a characteristic of acquisition strategy related to the ease with which changes and failures can be accommodated without significant changes in resource requirements.

The guide provides a checklist of actions to achieve each criterion; also listed are pressures that work against achieving each criterion.

Once a program manager understands the needed criteria, acquisition strategy can be prepared. Our guide provides the following key steps to develop and revise an acquisition strategy to meet these criteria:

—Identify mission need
—Assess situational realities
—Assemble strategy development resources
—Establish strategic goals, risk levels, and priorities
—Identify specific alternatives
—Establish decision criteria
—Evaluate alternatives
—Develop overall strategy.

The acquisition strategy must then be documented, and approval obtained so that functional plans can be prepared and implemented. Progress is monitored and the acquisition strategy is revised when necessary; for instance, if resources, external events, or entering a new program phase require that an adjustment be made to the acquisition strategy, appropriate information is obtained and the above cycle is repeated as appropriate.

Widespread Research

During our early research we interviewed and talked with several dozen DOD management personnel and program managers to obtain insights into developing and implementing an acquisition strategy. The content and frequency of certain comments led to the development of a questionnaire to obtain insights and experiences from program managers in all services. A detailed questionnaire about development and execution of an acquisition strategy was mailed to 80 DOD program managers; more than 60 percent responded. Some of the questions are shown in the following tables. Several questions pertain to ranking of the following: importance of the acquisition strategy criteria; influences on acquisition strategy development and execution faced by program managers; and importance of program objectives. We obtained the rankings by assigning numerical weightings to responses.

Table 3 shows results for the acquisition strategy criteria. Realism was considered most important, with stability second, and controlled risk third; resource balance and flexibility were considered less important.

Table 4 ranks acquisition strategy influences; a tight schedule, external factors (Administration Congress), and austere funding lead this list.

Table 5 ranks the importance of program objectives on an individual basis; the top three are technical performance, operational readiness, and production unit cost. These same three prevailed when program managers were asked to select only the three most important program objectives from the same list. The order of the remaining six objectives did change when selected in that manner. We find it interesting that a tight schedule was considered most important in influencing acquisition strategy; yet, development schedule, or IOC date were not highly ranked as important program objectives.

We conducted follow-up interviews with 24 program managers from all services, and with higher-level management personnel from DOD. As a result of the DOD Acquisition Improvement Program and these interviews, we selected 13 major strategic issues alternatives (Table 6) to include in the guide. Level of importance, perceived lack of knowledge, and recent emphasis by the Congress and the Department of Defense were among criteria used to select issues in Table 6.

Each alternative is developed in detail in the following presentation format: definition, problem addressed, alternative forms, advantages, disadvantages, application criteria, analysis and development, functional interfaces, time-line, recent experiences, sources of information, applicable directives regulations, and pamphlets. The basic elements of developing a program acquisition strategy comprise blending alternatives, selecting appropriate approaches for implementing them to the applicable acquisition environment, and assessing how well the criteria were met.

Table 3. Ranking of Acquisition Strategy Development Criteria

Rank	Criteria
1	Realism
2	Stability
3	Controlled Risk
4	Resource Balance
5	Flexibility

Successful Program Management Characteristics

During our interviews, three characteristics of successful program management continually showed us why some program managers and their acquisition strategies were more successful than others. We express characteristics as *vision, innovation*, and *communication*.

Vision

A program manager must have a vision of his program. He must understand where the program fits in the grand design of national defense policy, why it is needed, what competitions for resources exist, where roadblocks may occur, and how to proceed to bring the program to fruition. Figure 1 provides a perspective of the program manager's domain concerning responsibilities and influence in the overall process of strategic planning and execution; it shows where other people have responsibilities and influence, and where the program manager must be aware of activ-

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■ *Dr. Nelson is principal engineer, Advanced Research and Development Group, ARINC Research Corporation, Annapolis.*

Table 4. Ranking of Acquisition Strategy Influences

Rank	Influence
1	Tight Schedule
2	Administration/Congress
3	Austere Funding
4	Lack of Resources
5	Lack of Data
6	Lack of Experienced Personnel
7	Lack of Tools/Techniques

Table 5. Ranking of the Importance of Program Objectives

Rank	Program Objectives
1	Technical Performance
2	Operational Readiness
3	Production Unit Cost
4	Logistic Support
5	Development Cost
6	Development Schedule
7	IOC Date
8	Life-Cycle Cost
9	Operational Life

'able 6. Strategic ssues/ \lternatives)eveloped in the \cquisition ;trategy Guide

- — Competition
- — Concurrency/Time Phasing
- — Data Rights
- — Design to Cost
- — Incentives
- — Make or Buy
- — Multiyear Procurement
- — Phased Acquisition
- — Preplanned Product Improvement
- — Source Selection
- — Standardization
- — Test and Evaluation
- — Warranties/Guarantees

ities that can impact on his program. The program manager can influence higher authorities if they perceive he has a well-controlled program. Congressional and administration activities need to be followed and assessed concerning potential impacts on the program.

The program manager must have a perspective of the defense industry, and know who the capable contractors are. Acquisition strategy criteria most appropriately a part of vision are *realism* and *balance*.

Innovation

When developing an overall program acquisition strategy, a program manager should be innovative in selecting and blending appropriate acquisition strategy alternatives that address the specific needs of his program. Figure 2 shows an overview for developing an acquisition strategy. A program manager should learn from his and other people's experiences, yet not apply them blindly to a program. Embracing "trendy" strategy elements may provide favorable visibility temporarily, but the program manager will be living with his decisions for as long as he is associated with the program. The program manager may be directed by higher authority to implement competition in production (macrostrategy), but he is responsible for determining how to accomplish the competitition (microstrategy) like teaming arrangements in development, leader-follower in production, etc. Criteria most appropriate in innovation are *stability, flexibility,* and *controlled risk*.

Communication

A program manager should be able to communicate his program up the chain of command to higher management, and down the chain to functional managers (and contractors). A well-developed and carefully articulated acquisition strategy can serve as a primary communications tool.

Figure 3 shows the flow of communication upward to higher management, and downward to functional staff members from acquisition strategy to functional strategies and plans; and then to the acquisition plan and the feedback, as the program is executed. Higher authorities may determine a specific direction for the program; e.g., macrostrategy. However, the program manager is responsible for accomplishing the direction; e.g., microstrategy. Communication must ensure that there are no "surprises" up or down the line.

Research shows that a well-developed and executed acquisition strategy is one of the keys to program success. The Defense Systems Management College *Acquisition Strategy Guide* was written to assist program managers and staffs to prepare or revise their program acquisition strategies. To obtain a copy, you can write to: Acquisition Strategy Guide, Defense Systems Management College, ATTN: DRI-P, Fort Belvoir, Va., 22060-5426. Your request must be in writing. Phone requests will not be accepted. ■

lew Look for Electronics and Communications Systems

The Army mobile electronics and ommunication systems soon may be owered, cooled, and heated by a ultirole and highly efficient unit ecause of efforts by the Belvoir esearch and Development Center actical Energy Systems Laboratory oordinating with the project manager Mobile Electric Power) the laboraory ordered combined power and enironmental control system prototypes om five firms. To be delivered in Iarch, the systems will feature elecical power, cooling and heating bilities for sheltered systems. The nter is procuring them for the Army Development and Employment Agency (ADEA), Fort Lewis, Washington, which tests new systems to determine feasibility technology for military application.

The Army uses a family of gasoline and diesel engine driven generator sets to provide electrical power to mobile electronics and communication systems. These systems usually are housed in shelters heated or cooled by electrically powered air conditioners; current generator sets require transport by a separate trailer, and present an aural and thermal detection threat. In addition, environmental control units in use need an average of 55 percent of the system's electrical power. Combining the electrical power, heating, and cooling functions in one unit mounted directly on the shelter will improve energy utilization, decrease threat of detection, and enhance system mobility.

The Belvoir Research and Development Center, subordinate element of the Army Materiel Command, is responsible for the acquisition and support of Army Weapons and equipment. ■

AMST Program Tailoring Specifications

For Advanced Medium Short Take-Off and Landing Transport

Samuel J. Kishline

This is taken from proceedings of the DOD Workshop on acquisition streamlining held in Leesburg, Va., the past spring.

My purpose is to describe the rationale, approach, and results of the specifications and standards tailoring effort initiated several years ago in the Advanced Medium Short Take-Off and Landing Transport (AMST) Program. The program director's viewpoint presented is on four key topics; problem with the current utilization of specifications, conceptual framework of the tailoring process, specific AMST tailoring process, and results of this process. The task of tailoring these specifications and standards is a big effort requiring complete cooperation of all personnel in the program office. It took almost 1 year to complete the tailoring and untiering of these documents in the AMST Program. The resultant documents had to be reviewed in detail by system program office (SPO) personnel; extensive performance requirements had to be negotiated between the SPO, prime contractors, and other Air Force organizations (Military Airlift Command, Air Force Logistics Command, Assistant Secretary of Defense). The resultant increase in flexibility accorded the contractor in design and problem-solving approaches is an essential part of the AMST cost-reduction program.

Lessons learned from past programs are primary drivers behind the initiation of this effort. For example, during the A-10 GAU-8 30MM gun program, a problem developed with the performance characteristics of the penetrator in the armor piercing ammunition. An over-application of a military specification was actually preventing the contractor from implementing a solution that was known to work. The system programs office tailored this specification to permit the use of a long tapered penetrator that gave the required armor penetration with no significant degradation in ballistic performance. If that ammo had not worked, the program would have been lost.

The obvious questions to be asked now are: "What is the problem with our current system of specifications, and how did it develop?" *Table 1* presents a sample of unnecessary requirements found in the first draft of the AMST proposal instructions. It is easy to conclude that paper grocery bags, curled animal hair, and packing procedures for submarine spare parts might have little utility for an aircraft acquisition program. These examples and many more non-applicable specifications and standards were removed. It is possible that the government unintentionally discourages contractors from entering the Department of Defense procurement business because of the inclusion of unrealistic specifications. Perhaps some potential contractors do not recognize that not all of these requirements are enforced. A problem of equal magnitude with unnecessary requirements is the tiering of specifications, also called the "spec snowball" or "pyramid" effect, wherein each specification references more specifications. This problem is compounded by bringing all specifications and references into the contract as requirements. *Table 2* shows four specifications with 143 specifications in the second-tier and over 4,000 in the third-tier. Costs of researching all these requirements are high; complying with all these specifications is enormous.

How did this situation develop? The specification problem is caused by not understanding the specification and standards included in the request for proposal (RFP). The typical approach of gathering the "boiler plate" from the last similar program and using it in the new RFPs and specs is quick and easy, but is inefficient and very costly. At the heart of this problem are habits, not understanding requirements, and the inappropriate use of the "boiler plate." To avert the large development

Table 1. Why Tailor Unnecessary Requirements?

FED SPEC PPP-C-0020	STEEL FILING CABINETS
FED SPEC UU-B-36	PAPER GROCERS BAGS
FED SPEC PPP-P-50	PACKAGING AND PACKING OF THREAD
FED SPEC C-H-111	CURLED ANIMAL HAIR
FED SPEC UU-P-271	DRAFT WRAPPING PAPER
MIL-STD-758A	PACKAGING PROCEDURES FOR SUBMARINE REPAIR PARTS

Table 2. Example: The Spec Snowball

1ST TIER	2ND TIER	3RD TIER
MIL-P-9024 (PKG/HANDLING/TRANSP)	50	1,009
MIL-S-8512 (GENERAL S.E. SPEC)	75	3,111
MIL-STD-490 (SPEC PRACTICES)	10	112
MIL-STD-1561 (PROVISIONING)	8	38
	143	4,270

costs associated with these problems, specifications must be tailored early in the acquisition program, and an understanding of the effects of this tailoring on life-cycle costs must be developed and factored into the tailoring decisions. We recognize that the short time allowed to get a request for proposal out to industry greatly aggravates this problem.

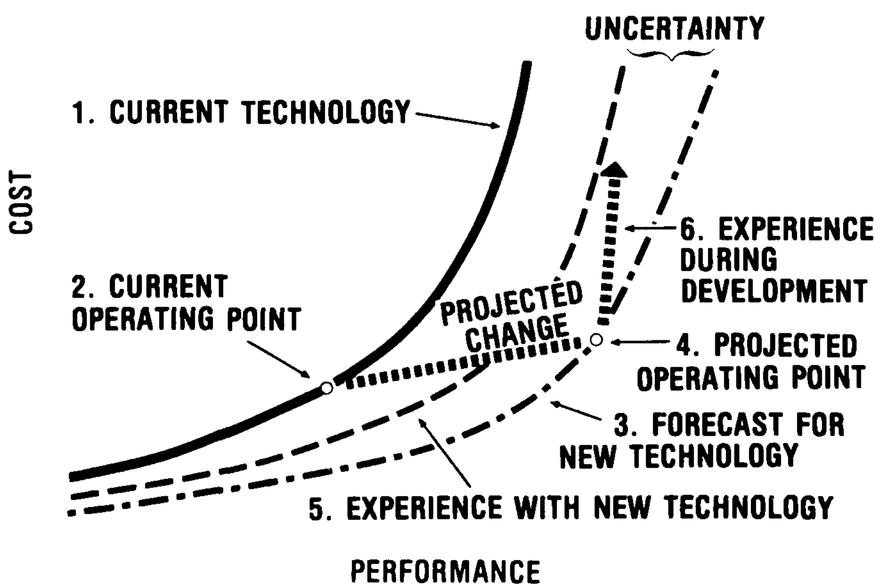
Management Approach

There are many key factors that significantly contribute to a cost-effective specification tailoring program. Foremost is the need to develop definitive performance-oriented requirements that can be used as a form of contractual control in lieu of specified design solutions. These requirements must reflect a thorough understanding of the employment, maintenance, and support concepts planned by the using command. An understanding of technology and the uncertainty in forecasting performance and cost are shown in *Figure 1*. This shows the potential increase in cost when incorrectly forecasting performance versus cost on a new technology. Therefore, where possible, the performance that was required was negotiated with the using command as both a minimum requirement and a goal to bracket the span of uncertainty, and then placed in the request for proposal. Second, a competitive contractual environment greatly assists in developing the realistic control parameters which assure that the system procured satisfies user needs, and that the contractor has the necessary flexibility in design to pursue low-cost approaches. The effort requires competent contractors, a procurement strategy controllable at high management levels, and a total commitment to the task of tailoring specifications by all people (particularly upper management) in the system project office and contractor organizations. Finally, the program requires time.

The specifications and standards tailoring effort in the AMST Program took more than a year to complete. The process started with extensive requirement iterations with the contractors to identify high-cost drivers in the specifications and standards, to quantify these cost drivers in comparison with tradeoffs on research and development, production, and operations and support (O&S) costs. The cost-effective tradeoffs were then reviewed by the using command and support agencies to assure the end-product satisfied their requirements. This review process provided a set of well scrutinized, performance-related requirements, which were used by the engineers to limit the number and scope of the specifications on contract.

Once the requirements were defined, a zero-based budget specification approach was adopted; that is, all commonly used specifications were eliminated and only replaced when the appropriate system project office discipline adequately justified the need for the specification in terms of the approved performance requirements. Lists of tailored specifications were reviewed in detail by the system project office director. Entire lists of specifications were thrown out if the tailoring job had not been performed satisfactorily. Teams of engineers, project managers, logisticians, and configuration managers reviewed item-by-item every specification in each area. After acceptable specifications were determined, a functional review was conducted by outside experts selected because of their understood specifications and their application to an acquisition program. The experts were used to assure that radical surgery had not removed important requirements. Some critical specifications that have been developed to avoid past problems (i.e., corrosion control specs, critical materials, processing specifications,

Figure 1. Impact of Uncertainty on Systems Acquisition Costs and Performance



and ASIP specifications) were included as contractual requirements, even when they specified design solutions in lieu of performance requirements.

A major problem found in tailoring the specifications was communications, which must be from the top down. People must be convinced that the approach is right. At the functional level there are many specialists with narrow levels of responsibility, and management must be prepared to educate, lecture, and reason with them. Resistance is common. Support from top-level management people in the organization is essential to overcome the resistance in the support bureaucracy. Management must set deadlines and compel employees to put best efforts toward those deadlines. This high level of management attention challenges the pride of the people within the systems project office to develop well-prepared documents.

AMST Specification Tailoring

The initial AMST program guidance in specification tailoring was provided by the director of research and engineering, Office of the Secretary of Defense, as follows: "Request the Air Force investigate all feasible ways to decrease costs, such as: eliminate hardware, specifications, test and special requirements which are not absolutely essential and which can be eliminated at acceptable risks..."

DOD Directive, "Specifications and Standards Applications," directs the program director to tailor specifications to particular program needs. To be effective, the tailoring concept must be woven into the procurement strategy (see *Table 3*). First, only one procurement officer should be used for all contracts to include a development contract with production options, depot interim contractor support, and spares. Second, performance-oriented specifications should be used at the system and subsystem levels to allow the contractor to perform the highly iterative process of design, without being stopped or delayed by the approval of government for each iteration via the laborious and costly engineering change proposal (ECP) process. Third, although plans and design proposals were made during the response to the request for proposal, these were not to be put on contract. This allowed an evaluation of the contractor's management capability without telling the contractor how to do his job. The design freedom required in iterating to the final-design solution was accomplished by not putting the proposed design on contract and, thus, avoiding the engineering change proposal process described above. Fourth, award-fee and incentive-fee provisions were used in the contract and will be described later in this paper.

Table 3. Key Features of C-IXA Procurement Strategy

ONE CONTRACT DEVELOPMENT/PRODUCTION
DEPOT INTERIM CONTRACTOR SUPPORT
SPARES
PERFORMANCE ORIENTED SPECS
NO PROPOSALS/PLANS ON CONTRACT
AWARD FEE/INCENTIVE FEE
DON'T DICTATE DESIGN SOLUTIONS

A key feature of the AMST procurement strategy is the philosophy of "not dictating design solutions to the contractor." In other words, tell the contractor what is required in the request for proposal but not how to do it. The systems project office management adopted a basic philosophy that is correlative to not dictating design solutions; namely, if it works, don't fix it. It is interesting to note that the Russians have a similar saying; the evil of good is better.

Experience has shown that engineering a fix to make something better opens up a whole new family of design problems, which can be either better or worse than the original design; it is usually the latter. This philosophy was required because of the Department of Defense program guidance stated above. Another equally important aspect of the procurement approach is the procurement clause in the statement of work (SOW) that untiers the specifications. The legal clause written into the AMST statement of work limited the incorporation of specifications to only those specified in the contract.

The key elements of the support concept that were incorporated into the contract were interim contractor support, concurrent spares, and a high degree of common support equipment. First, interim contractor support was to be negotiated for depot support for the first 3 years of operations on a fixed-price contract. This interim support was used because, historically, the depot support has never been successful early in a program. The numerous design changes would be reflected in the depot support equipment, resulting in a high cost and late organic depot capability. If the contractor was successful in providing an early-organic depot capability, he would share in the cost savings. Conversely, if the contractor was not successful in providing an organic-depot capability, he was to share in the cost past the 3d year. This provision was to motivate him to get out of the depot-support business.

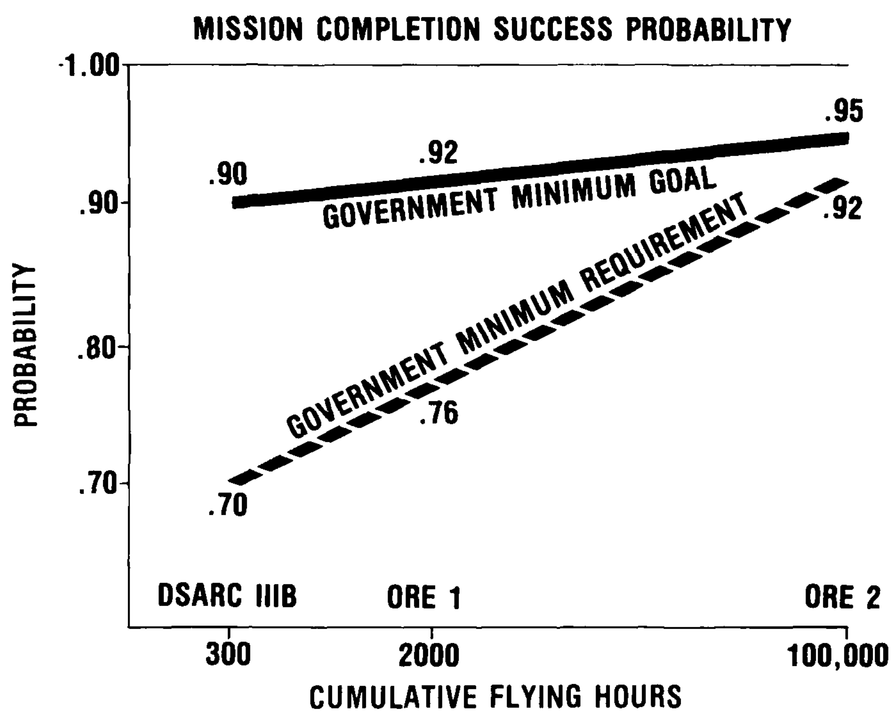
Second, the spares were to be purchased on an agreed-on pricing formula. The spares contract was to be negotiated in a competitive environment with the spares proportionate to, and purchased with, the installed systems.

Third, the goal for support equipment was to have 80 percent either government or commercially common support equipment. Historically, up to 90 percent of new support equipment has been designed on a new program. A fixed-price bid for the total support equipment capability was an incentive for the contractor to increase the amount of common-support equipment. In addition, the fixed-price depot interim contractor support is an incentive for the contractor to deliver base-support equipment that works and when required; o[illegible] wise the repairables would be sent back to the depot to be repaired under a fixed-price contract.

Contractor control was to be maintained at systems level, rather than the subsystem level, during development of the AMST. The data-management procedures would make maximum use of commercial data and contractors' data formats. The specifications have been minimized to include primarily the system air vehicle and training support equipment specifications. Commercial-type maintenance practices and technical orders, such as job guides and fault-isolation manuals were to be used. A minimum specifications tree was proposed. The number of configuration items (CIs) and computer program configuration items (DPDIs) were cut to a minimum; each tends to be treated as a separate program in development. A limit of 100 data items was established as a target. The request for proposal came in a few over this number. In addition, a page limit was placed on the proposal volumes from the contractors. This placed a constraint on what was asked for, and what was proposed.

The design verification at the completion of the development program was to be accomplished by the use of two operational readiness evaluations (ORE) of the production aircraft; one at 2,000 flight hours on the fleet, and a second at 100,000 flight hours on the fleet. These operational readiness evaluations were to be accomplished by the Air Force Test and Evaluation Center (AFTEC) with blue-suit operators and maintenance. With this operational readiness evaluation approach the Air Force could evaluate the aircraft in a near real-world environment and verify that the system-level contract requirements were met. During this evaluation, a blue-suit organization was to operate six aircraft for over 600 flying hours, including 23 days of simulated peacetime sorties and 7 days of simulated wartime sorties. These evaluations would include a simulated deployment of the aircraft. Maintenance was to be performed by the manning and skill levels that the contractor had proposed during source selection. Six aircraft were to be maintained by the Air Force with the contractor providing depot repair. All repair items for both blue-suit and contractor maintenance was to be tracked. All failures were to be counted against the contractor, even when the man pulled the wrong piece of equipment because the technical orders were incorrect, the personnel were improperly trained, or there were failures in the built-in test equipment. The Air Force goal was to have the contractor work-

Figure 2. Reliability



ing Air Force problems in an Air Force environment. Key operational and support parameters were to be evauated during the operational readiness evaluation, such as: reliability, to include mission completion success probability and meantime between removals; maintainability, to include maintenance manhours per flying hour and meantime between maintenance actions; availability, to include operational ready rate, flyable rate, and maintenance downtime per mission; fuel burned, depot repair, and spares usage. The probability of archiving specific levels of these parameters was to be bid by the contractor for three different times: at the defense system acquisition review council full production authorization (DSARC IIIB); at Operational Readiness Evaluation 1; and, at Operational Readiness Evaluation 2, as shown in *Figure* 2 for the parameter of reliability, mission completion, and success probability. The contractor was to specify minimum value and a goal for each parameter, at each point in time, indicating the improvement with maturity of the weapon system. These values had to be above a minimum requirement and a minimum goal set by the government in the request for proposal, and parameters bid by the contractor were to be part of the basis for award of the contract. In addition, a cost incentive was provided on each parameter at Operational Readiness Evaluation 1 and Operational Readiness Evaluation 2 to motivate the contractor to go from his minimum requirement bid toward his goal. The incentive fee was $6 million on Operational Readiness Evaluation 1, and $2 million on Operational Readiness Evaluation 2. If the contractor was to be judged to be below minimum requirement on any one parameter, he was to lose one-half of the total incentive fee at that operational readiness evaluation. This approach would provide Air Force control at the systems level, and a direct assessment of system capabilities and key operating and support variables.

Program Results

One of the most important observations made early in the program was good specifications, which merit full application even when they dictate design solutions. Examples of these include MIL-STD-1530A (aircraft structural integrity program), MIL-STD-1568 (materials and processes for corrosion control), and MIL-STD-1587 (materials and process requirements for Air Force systems). These standards reflected the Air Force position

Table 4. System Specification Results

28 MIL SPECS/STANDARDS
3 TECHNICAL ORDERS
12 HANDBOOKS
4 OTHER FEDERAL STANDARDS

based upon lessons-learned on other programs. Some tailoring was accomplished on these standards in accordance with contractor challenges and cargo-type aircraft requirements. For example, MIL-STD-1568 requires the contractor to install fasteners wet with paint for corrosion protection. The commercial practice was to wet-install fasteners only in corrosion susceptible areas. Also, the Air Force practice was to shot-peen all forgings for fatigue purposes. The commercial practice is to shot-peen only in the fatigue critical areas. The system project office has agreed to adopt both of these commercial practices.

Table 4 shows results of the tailoring effort on the AMST system specification. A total of 47 references have been specified in the system specification. The engine provides a good example of the advantages of tailoring military specifications. A case was found where use of one common specification so radically drove the design of the engine that the contractor could not follow system project office direction to use commercial engines.

Had this restriction not been removed, there would have been a major increase in the cost of developing the AMST.

Results of specification tailoring in the AMST subsystems were dramatic. The flying quality specification was tailored by modifying MIL-F-8785B to include STOL operations. The flight-control specification for the AMST was reduced from 66 to 51 pages by eliminating requirements that dictate design solutions, and by eliminating 82 sub-tier specifications. For the landing gear, eight military specifications and two military standards (over 200 pages of requirements) covering tires, wheels and brakes, shock struts, etc., were replaced with 13 pages in the subsystem requirements document; this allowed the contractor to maximize use of prototype flight-test experience, and to allow the contractor to use modern analytical techniques and his own methods of design verification. For the cargo winch, a 1-page military specification with 28 applicable sub-tier specifications (materials, design, performance, dimensions, testing) were replaced by 75 words in the subsystem requirements document indicating locations, capability, and operation. The inertial navigation system requirements, as previously described in 12 military specs, 19 military standards, 5 publications, and 125 pages of INS specifications, were reduced to a half-page requirement giving four key elements (position accuracy, velocity accuracy, attitude heading, and alignment).

The story on additional subsystems goes on and on. A good example of how requirements were tailored is the brake system. The then-current military specification required a deceleration capability of 10 feet/sec/sec, an energy capacity to stop the design landing weight at a deceleration of 10 feet/sec/sec, a design life of 100 stops in a laboratory test, and no turn-around capability. The AMST approach specified that the contractor is required to design the brakes to decelerate the aircraft as needed to satisfy the AMST specified missions and runways. This approach will assure adequate deceleration, energy capacity, life, and a turn-around capability to satisfy user needs, and will be validated during the operational readiness evaluation.

Conclusions

There were important lessons learned from the AMST specification tailoring program. First, don't blindly copy other specifications, but clearly understand what is included in the request for proposal.

Second, use definitive requirements.

Third, contractor government cooperation is essential and can be best derived in a competitive environment.

Fourth, the government must lead in the tailoring program. Many people will resent and resist the tailoring process, and this can only be overcome by strong leadership and direction by the procuring agency's upper management.

Fifth, the iterative process will take much time. The AMST tailoring program took in excess of 20,000 man-hours to complete.

Finally, the management should be prepared for resistance not only from the government but from the contractor. Some engineers in the contractor organization have used military specifications for years as a buffer from contractor management, and were uncomfortable when the military specs were tailored and untiered. These engineers will resist the change to the standard methods of operation.

Four elements are essential to provide the design freedom required in the highly iterative design process to reach a cost-effective design solution. The over application of management controls and procedures on contract, and the detailed contractual control of the design too early in design process literally chokes this iterative process, which is required to reach a balanced design of a weapon system.

First, provide performance oriented specifications. Second, do not place design proposals and plans on contract. Third, do not dictate design solutions. Fourth, tailor and untier the military specifications.

There are risks in this radical tailoring of specifications. Backing off and controlling the design at the system level, rather than the subsystem level, may produce incompatibilities with Air Force policy and procedures. There is a risk that contract requirements may not be specified adequately but experience with this system-level control approach should rapidly diminish this risk. When control is maintained at the system level, instead of the subsystem level, design flexibility is gained but some design configuration control is lost. This leads to continuous fears of "what was forgotten?"

Experience to date shows that benefits far outweigh risks incurred. Contractor methods and procedures are often more efficient and cost-effective than are standard, sometimes obsolete, government-design solutions. Given the flexibility to utilize this ingenuity, the contractor can go a long way in reducing today's trend of spiraling weapon systems costs. ■

■ *Colonel Kishline is manager of advanced systems at Boeing Military.*

People on the Move


Bruce


Burgay


Cash


Doeppner


Goldschmidt


Sheldon

John B. Bruce, the new registrar at DSMC, holds a B.S. degree from Eastern Michigan University. He also holds a master of arts degree and a doctor of education degree from the University of Michigan.

Hugh T. Burgay is a professor of engineering management, Technical Management Department. Previously, he was an electrical engineer, Strategic Systems Program Office. Mr. Burgay received a B.S.E.E. degree from the University of Miami, and an M.B.A. degree from Rollins College.

Jack D. Cash is a professor of financial management, Business Management Department. He came to DSMC from the Lockheed Georgia Company, Marietta, Ga., where he had been a manager, supervisor, and senior auditor. Mr. Cash received a B.S. degree in accounting from the University of North Alabama, and an M.B.A. degree from the University of Alabama.

Thomas W. Doeppner is a professor of engineering management, Technical Management Department. He came to DSMC from the General Research Corporation, where he was director of logistics engineering. Mr. Doeppner received a B.S.E.E. degree from Kansas State University, and an M.S.E.E. degree from the University of California.

Jerome X. Goldschmidt holds the Navy Chair, Executive Institute. His last position was director, Mission and Effectiveness Analysis, NAVAIR. Mr. Goldschmidt received a B.S. degree in mathematics from the University of Dayton, and an M.S. degree in mathematics from Michigan State University.

James S. Sheldon is a professor of systems acquisition management, Policy and Or~anization Management Department. He was last assigned to the Army Materiel Command. Mr. Sheldon has a B.A. degree in psychology from Syracuse University, and an M.S. degree in systems management from the University of Southern California (Washington, D.C.)

Losses

Theodore L. Bloomer, Acting Director, Program Managers Workshop, to NAVAIR as head of Corporate Strategy Branch.

Dr. William N. Hunter, OFPP Chair, Executive Institute, returned to Federal Acquisition Institute as director.

Elizabeth C. Hussain, professor of financial management, Business Management Department, to Defense Intelligence Agency.

Captain Michael W. Means, Executive Officer, Office of the Commandant, separated from the U.S. Army after 9½ years of service. He is associated with Esscube Engineering Inc., Pitman, N.J.

Master Sergeant Bill Smith, USAF, Audiovisual Division, to Elmendorf Air Force Base, Anchorage, Alaska, to support the Armed Forces Radio/Television Service. First, he will attend school at Lowry Air Force Base, Col.

Kenneth H. Stavenjord, Acquisition Management Laboratory, to DOD Major Systems Acquisition Office as supervisory business and industrial analyst.

Robert L. Swart, Jr., Navy Chair, Executive Institute, retired.

Vicki White, secretary to deputy commandant, to U.S. Army Family Community Support Service Center, Alexandria, Va.

Promotions

Mike Adkins, USA, Supply and Procurement Division, to Sergeant (E-5).

PHAN John Chapman, USN, Graphic Arts Division, selected for E-4; also, chosen "EM of the Year" at DSMC.

Gerald J. Chasko, Technical Management Department, to be director, DSMC Regional Center, Boston, Mass.

Kathryn S. Coffman to be research assistant, PMSS Directorate, Department of Research and Information.

Lieutenant Colonel Melvin B. Gambrell, USAF, Policy and Organization Management Department, promoted to present rank Jan. 7, 1985.

Mike Nadolski, USN, Military Personnel Division, selected for promotion to YN1 (E-6).

Staff Additions

Margaret Baker, Acquisition Management Laboratory.

Cynthia L. Ferrell, Acquisition Management Laboratory.

Marie E. Sheehan, Acquisition Management Laboratory.

Jeanette Montoya, secretary to Dean, Department of Research and Information, to Educational Research Team Directorate as technical information specialist, an upward mobility position.

U.S. GOVERNMENT PRINTING OFFICE

Three PMC Graduates Nominated for First Star

Three of the six Air Force Systems Command colonels recently nominated for promotion to brigadier general are graduates of the Program Management Course at the Defense Systems Management College. They are Colonel Edward P. Barry, Jr., PMC 71-1; Colonel John D. Slinkard, PMC 72-1; and Colonel David J. Teal, PMC 72-2, who is also a graduate of ERC 79-3.

Colonel Barry is the assistant deputy chief of staff for systems, Headquarters AFSC, before which he was deputy for defense support systems, Space Division, Los Angeles AFS, Calif. Colonel Slinkard is the deputy chief of staff for contracting and manufacturing, Headquarters AFS, and was deputy for contracting, Electronic Systems Division, Hanscom AFB, Mass. Colonel Teal is deputy for reconnaissance/strike and electronic warfare, ASD, where he served as deputy director of the F-16 Multinational Fighter Aircraft Program.

Graduate Update

Lieutenant Colonel James A. Patterson, USA, PMC 83-2, promoted to current rank Dec. 1, 1984, and assigned Chief, Air Defense Team, Advanced Systems Concepts Office, U.S. Army Missile Laboratory, Redstone Arsenal, Ala. He had been assistant project manager for project development, Joint Anti-Tactical Missile System, U.S. Army Missile Command.

John A. Manzione, PMC 84-1, has been promoted to GS-13 in the Marine Division, Logistics Support Laboratory, Belvoir R&D Center, Fort Belvoir, Va. He recently received a master's degree in engineering administration from George Washington University, and the Virginia professional engineering license.

ROWPU Developmental Testing to End

Prototypes for a new, larger Army reverse osmosis water purification unit (ROWPU) will complete developmental testing, shortly.

The units were produced by Brunswick Corporation's Defense Division, Deland, Fla., and Aqua-Chem Corporation's Water Technology Division, Milwaukee, Wis., under two contracts awarded by the Troop Support Command's Belvoir Research and Development Center. Under terms of the contracts, each corporation built three prototypes for competitive evaluation.

Because of the urgent requirement for this system, the new ROWPU, rated at 3,000 gallon per hour, is being given special attention to shorten the time from concept to production. This system was considered an excellent candidate for speeded-up development because of confidence in the RO technology.

The prototypes are designed to be a complete water purification plant housed in a standard shipping container mounted on a semitrailer. In operation, the system would purify raw fresh water, sea water, brackish water, and water contaminated by nuclear, biological or chemical agents. Reverse osmosis accomplishes this by forcing water through a special membrane under pressure. Conventional techniques require four different pieces of equipment to handle all these potential contaminants. ■

Corrections

On Page S-6 of the January-February *Program Manager*, Provisions 12 and 13 were transposed under "Statutory Provisions Affecting Contractors."

Provisions 14 and 15 were transposed under the "Statutory Reference Competition in Contracting Act PL 98-389."

Also, § 2731 (41 USC(8)) should have appeared in Provision 11 under "Statutory Reference Competition in Contracting Act PL 98 369."

We regret the errors.

New Lathe Saves Thousands of Man-Hours

A new, computerized numerically controlled lathe (CNCL) recently installed in the Combat Systems Test Activity (CSTA) Technical Shops Branch, Aberdeen Proving Ground, Md., is expected to save more than 7,500 man-hours annually. According to John F. Reynolds, technical shops branch chief, the $86,000 system will be used primarily to manufacture M-11 crusher-type pressure gauges used by CSTA in proof-testing large caliber weapons. The gauges, not available commercially, are individually machined by hand, a process taking about 90 minutes per gauge. About 15,000 gauges are used annually at U.S. and allied nation testing facilities around the world.

"We tried having these gauges made under contract by commercial manufacturers," Reynolds said, "but we found that the commercial products cannot be made to tolerances as fine as we require. That is why we make them ourselves. Using the new CNCL, we expect to cut 30 minutes or more from the manufacturing time for each gauge."

George Theisen, CNCL operator, said, "The lathe doesn't give us a finished product, but it does provide a greatly enhanced rough product which can be more easily ground to the fine tolerances we require. Another advantage is that the CNCL does not require a human operator. Once the program is loaded into the computer, the lathe will make M-11 pressure gauges all day. About the only human involvement deals with inserting steel bars (from which the gauges are made) into the lathe feed system and an occasional check to ensure the system is working properly." Theisen said 10 machining processes the CNCL can perform are center drilling, drilling, roughing of outer and inner figures, semi-finishing of outer and inner figures, finishing of outer and inner figures, grooving, and threading.

Reynolds feels the CNCL will pay for itself in the first year of operation in terms of speeded workflow, less time consumed, a better product for the customer, and less waste of raw materials. ■

Program Manager

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