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Defense Acquisition: The Process and the Problems

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*Brigadier General William E. Thurman, USAF
Commandant
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Behind every technological step forward is a background or, more appropriately, a foundation, of basic research. Without this foundation of scientific examination and investigation, technological advance is impossible. To a great extent, the same holds true for advances in our understanding and application of the procedures that govern and direct the defense acquisition process. Any improvements that are made to those procedures must be based on the results of acquisition research. I think the papers we present in the *Review* are ample evidence that acquisition research is alive and well.

It is imperative that we never stop examining the way we do things and evaluating our procedures in terms of how well they are accomplishing the desired objectives. It is a discouraging fact of life that procedures and policies, like civil laws, almost inevitably take on lives of their own soon after taking effect and are all too often divorced from the problems they were meant to address. We cannot afford to let this happen in defense acquisition. Our objective in this business is to field efficient equipment efficiently. We must develop and adhere to those policies and techniques that help us to do that and eliminate those that do not. This is where acquisition research shows its real worth. It is good, valid acquisition research that lets us know what our problems are and where changes are needed. This is a serious business and we must examine ourselves and our work seriously.

Not everyone will agree with the theses and recommendations put forth in the papers that follow. If there weren't some controversy associated with these issues, they probably wouldn't be issues at all. We don't ask that you *agree* with them, only that you *think* about them. Some of these authors may be wrong, but if they force you to think about the problem, maybe you will come up with the answer that is right. In that case, everybody wins.

If there is a discouraging aspect to the papers included here, it is that so many of the issues discussed are so familiar. The problem of an increasingly lengthy acquisition cycle has an all-too-familiar ring to it, as does the controversy surrounding concurrency and the application of A-109 to defense acquisition. One explanation for the abundance of attention devoted to these issues may be that they go to the very heart of defense acquisition management, and hard evidence can be garnered to support almost any view. Another explanation may be that we spend more time talking about problems than we spend correcting them. It isn't enough to identify a problem, or even to devise a solution; we must also take action. Obviously, the more substantive policy changes can only come from the highest levels of defense management. Still, those of us who are actively involved in acquisition management at the operating level can and must be ready to adapt techniques and procedures to our particular programs. In short, while someone else may do the talking, the doing is up to us. ||

from the editor...

If we're lucky, this issue of the Defense Systems Management Review, dated Autumn 1979, should reach our audience by late February 1980. If we're not lucky . . . well, let's just hope we're lucky. While some wag may have it that this situation is appropriate for a publication devoted to systems acquisition, we find it totally unacceptable and are determined to do something about it. We have recently increased the size of our staff and have made other changes that we think will help get both the Review and our companion publication, Program Manager, back on track. Please bear with us as we try to continue to stimulate your thinking on acquisition issues—and to do it on a more timely basis. In the meantime, we welcome your comments, your criticisms, and, especially, your manuscripts.

Both the Review and Program Manager are converting to a new mailing system. Until the conversion is complete, we will be using the old mailing list. This means that any address correction you may have sent us during our recent mailing list update has not yet been put into effect. If you did not receive from and return to us an orange mailing-list-update card, you must send us your correct mailing address or be dropped from our mailing list. You must do this even if the address we now have for you is correct. Send your address to us at the address provided on the inside front cover. We hope the new distribution system will give us better control of our constantly changing mailing list.



Acquisition Costing in the Federal Government

Richard T. Cheslow
James R. Dever

Any attempt to precisely describe costing in the acquisition process in the Federal Government would be lengthy and confusing. Acquisition costing and its process varies among the agencies. It depends on the types of goods or services generally acquired, average contract size, organizational placement of the program management, budgeting, and contracting functions, agency mission, and traditional roles of technical and administrative personnel.

We have, however, developed a general description of costing in the federal acquisition process (Figure 1). Our objective was to present the steps that are common to most agencies. The description is not based on published directives or instructions, but on information obtained during interviews in 19 departments and agencies. It should not be considered as descriptive of any one agency or department, but the elements are present in all agencies.

Figure 1 emphasizes the costing aspects of acquisition. Thus, the procedures and reviews inherent in needs determination, budget preparation and approval, and contracting and contract administration are not shown.

It is apparent that the acquisition process is a series of interative steps. Ideally, if everything "works right," there is a steady progression from need determination to receipt and use of the purchased equipment or service. In fact, however, there is usually a series of reviews, redeterminations, and adjustments to accommodate changes in need or resource availability.

The acquisition of a major, complex system is a series of iterations of the process shown in Figure 1. The phases of concept formulation, engineering development, prototyping, and production are each acquisitions in their own right. The same actions are taken during each phase, and a costing and review function is added between phases.

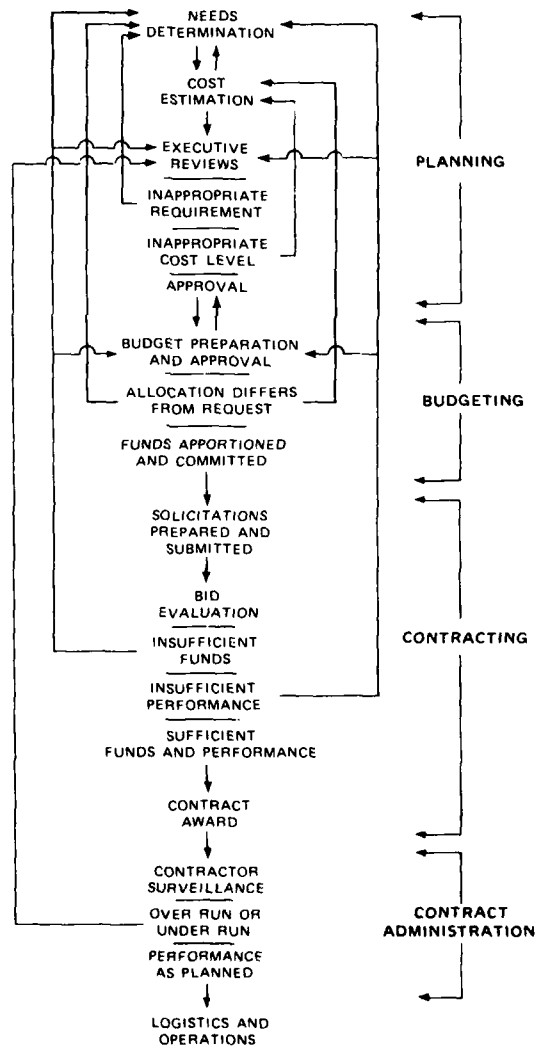
The acquisition process spans a number of traditional functions—planning, budgeting, contracting, and contract administration. Each of these functions has developed into a distinct area of specialization.

Authors' note: This work was performed while both authors were at the Logistics Management Institute.

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FIGURE 1
Costing and Pricing in the Federal Acquisition Process



The traditional functional span in the acquisition process has produced a problem in definition. The costing effort and techniques in the planning process differ from those used in the contracting process. Therefore, we have defined the following terms for this paper.

Acquisition Costing—The total process of developing, preparing, and monitoring a cost for goods or services. It encompasses the activities of cost estimating, cost analysis, and price analysis.

Cost Estimating—The development of an expected value of the total cost without the knowledge of a definite bid for the specific goods or services.

Cost Analysis—The review and evaluation of a contractor's cost and pricing data to determine the probable cost to the contractor to supply the goods or services.

Price Analysis—The review, in varying detail, of a prospective price, without evaluation of the separate cost elements of that price.

Findings and Conclusions

It is apparent that costing in the acquisition process covers a broad span of activities and a number of functional specialities. When the missions of specific agencies are considered, most areas of concern become associated with specific technologies and agencies. We have, however, identified issues common to all government agencies involved with costing: organization, communication, traceability of estimates, cost estimating methods, cost and price analysis methods, data availability, training, and estimating error.

ORGANIZATION

Historically, legislation creating a department or agency does not address the specifics of its internal structure. With differing mission requirements, the agency acquisition functions differ in organizational placement and in the role assigned the costing function.

The most common organizational situation has separate estimating and analysis units for each stage in the acquisition process. Each of the traditional functional specialities (programming, budgeting, contracting and contract administration) has developed a separate approach to the costing process. Typically, an estimate will be generated in the program office for each project. This estimate may be made by a program person with no formal background in cost estimating. The estimate is then forwarded through a series of program and technical management offices through the organizational hierarchy to the budget office where it may again be analyzed by an internal cost estimating branch. After approval and inclusion in the budget, the program office will request the contracting office to acquire the item.

As in the program and technical management structure, the request may be reviewed and analyzed by contracting offices at any or all hierarchical levels: department, bureau, region, district, or field office. Each level has a limit to its contracting authority above which it needs approval.

Within the contracting function at the department and agency level there is normally a policy and review office. This office may operate either as a full-fledged reviewing office, or it may only review submissions for procedural completeness. In some organizations, this office devotes almost all of its time to policy, with at best a cursory review of large acquisitions for procedural completeness. In other organizations, policy and review offices devote a much higher percentage of their time to reviewing acquisitions. In these cases, the threshold for review is lower and acquisitions forwarded to them may be subjected to fairly sophisticated financial review.

A few agencies and bureaus employ centralized cost estimating and cost and price analysis offices. The central estimating unit is unique in that, rather than furnishing estimates and analyzing costs for only one phase of the acquisition process, it serves all acquisition phases. Depending on the size of the acquisition, either one person or a team will be assigned to the project at its earliest planning stages. This person or team will then follow the acquisition through the entire process, providing appropriate recurring estimates or analyses. The estimator/analyst retains familiarity with the project and updates and refines outputs as more information becomes available.

In summary, we have found that costing is performed by a number of individuals located in separate offices concerned with discrete parts of the acquisition process. In a few cases, a centralized costing office exists. Unless extraordinarily good intra-agency communication is maintained among the various offices, there is redundancy in costing effort and an intra-agency communication problem.

COMMUNICATION

This section is focused on communication among similar types of offices in different agencies. The questions we asked were: What systems now exist for exchange of information? Is the exchange of information of benefit in cost estimating and cost and price analysis? What is the best way to facilitate an effective exchange of information?

When asked if an effective formal communication system exists to exchange information, the answer was universally negative. Most interviewees were reasonably sure that such a system was not in existence, and the ones who were not sure were quite specific as to its lack of effectiveness. On the other hand, most

of the analysts confided that they had an informal system of information exchange between and among their counterparts in similar offices.

The benefit to be derived from a formalized exchange of information is a function of the universality or transferability of that information. The expressed belief was that the only level where this exchange would be practicable would be within small functional groups that have a close identity of interests. An example of this level would be office building construction as opposed to general construction estimation.

Of the effective methods suggested for exchanging information and techniques, there was a marked preference among those interviewed for meetings or seminars of adequate duration to allow meaningful discussion and analysis of the subject matter.

Our finding is that no effective formal inter-agency system of information exchange exists, although informal communication links exist at all levels. Based on our interviews, we conclude that (1) information is transferable and valuable if exchanged at a level where the exchanging agencies have strong identity of subject matter; (2) the government should facilitate exchange of information at a level where there is identity of interest; and (3) this exchange would be most effective if conducted on a person-to-person basis through meetings and seminars.

TRACEABILITY

Managers and practitioners throughout the acquisition process expressed concern about the lack of traceability of estimates. Estimates undergo numerous modifications at various stages of the acquisition process. Consequently, errors in estimating are difficult to isolate. A related problem is that actual contract expenditures are rarely tracked against the original estimates. Intra-agency communication is so sparse that normal procedures do not produce a feedback of information through all process steps. This is especially true of the step from budgeting to contracting. The General Accounting Office's report on the *Financial Status of Major Federal Acquisitions* does succeed in gathering data on this subject. However, this is accomplished only by the extraordinary effort of an outside agency rather than by a normal internal process.

We therefore perceive a need for improved feedback of acquisition information in order to improve subsequent estimating and to improve understanding of the technical requirements during contracting.

COST ESTIMATING METHODS

Cost estimating is the development of an expected cost without benefit or knowledge of a definite bid or proposal. The planning and budgeting officer must rely on cost estimating because contractors' proposals are rarely available at these

phases. Contracting and contract administration offices may also use cost estimating methods to generate a government estimate without the aid of a contractor's proposal. This independent estimate is then compared to those submitted by contractors. This provides some objectivity that might otherwise be lacking if the only figures available were those of the contractors.

Cost estimating methods and techniques employed by government agencies and industry are almost identical; it is the correct application of a technique to a particular set of data that enables the estimator to achieve acceptable results. The techniques are widely known, and no one technique was found to be inherently superior.

Computer models apply these techniques and are a time-saving aid to the estimator. The models in use in both government and industry have been tailored for specific purposes and would rarely be useful for other acquisitions in their present form. These models may be transferable and valuable to other estimators if they possess the skills necessary to modify the model to fit their particular purpose. While one agency may be achieving good results utilizing a given model or technique, this does not mean that other agencies would achieve the same results.

COST ANALYSIS METHODS

Cost analysis is the element-by-element examination of the estimated or actual cost of contract performance to determine the probable cost to the vendor of supplying goods and services. It is practiced in the contracting and contract administration stages because these are the only stages where a contractor's proposal is available. The techniques employed by cost analysts are common knowledge to most people in this field. They include statistical techniques, auditing, trend analysis, indexing and learning curves.

For both cost estimating and cost and price analysis, the key to the effective application of these tools is familiarity with the goods and services being acquired. If a contractor submits pricing data for the labor cost proposal of producing a certain item, the two factors involved will be labor hours required and cost per hour. The analyst can easily determine if the labor rate is within acceptable limits, but will be unable to evaluate production hours unless he is familiar with the production process involved. Accordingly, management stated that familiarity with the production processes for the item to be acquired was the most valuable background for a cost analyst. A skilled analyst may still operate effectively, however, if he has sufficient data at his disposal.

Very few cost analysts, with or without production expertise, are currently employed by the agencies surveyed. Lack of qualified personnel was a commonly heard complaint from management.

DATA AVAILABILITY

Adequate data is the key to both cost estimating and cost and price analysis. Due to the large amount of data that could be advantageous to the estimator/analyst, automatic data retrieval systems offer the advantages of both saving space and enabling the data to be indexed in different ways. One of the more common complaints we received concerned the inadequacy of data information systems. Many of the noncomputerized historical data sources identified were simply files in desk drawers. Some of these systems were well kept and others were in such an apparent state of disarray as to be useless.

TRAINING

Except for contractor proposal cost analysis, training in acquisition costing is lacking. The preponderance of such training is obtained from the Department of Defense. However, it was alleged by contracting personnel in civilian agencies that this training is not relevant to the missions and operating procedures of their agencies.

In planning and budgeting, training is generally obtained by individual initiative through journals, professional associations, or local college courses. In contracting, however, training is more extensive; only two offices indicated that no training was provided.

ESTIMATING ERROR

There is a general perception that federal projects suffer consistent cost overruns. Because of this perception, there is pressure to make "better estimates." The GAO periodically conducts a study of major federal acquisitions in which it attempts to determine the sources of the overruns.¹ Seven sources of cost change were defined—quantity changes, engineering changes, support changes, schedule changes, economic changes (inflation), inadequate estimating (error), and "sundry." The report considered 808 federal projects with a baseline value (budget allocation) of over \$250 billion. Figure 2 summarizes the information on cost changes due to estimating error for selected projects with a baseline value of \$177 billion.

The average change attributed to estimating error was 7.1 percent of the baseline estimate—a value well within the bounds of acceptable estimating error.² LMI's examination of the GAO data indicates that this figure would be even lower if it were not for the fact that several projects had such large overruns that

1. Comptroller General of the United States, PSAD-78-60, *Financial Status of Major Federal Acquisitions*, September 30, 1977, January 20, 1978, published annually since February 27, 1976.

2. Professional guidelines for acceptable estimating error are provided in Section Aa-4.000 of the *Cost Engineer's Notebook*, published by the American Association of Cost Engineers, Morgantown, West Virginia.

FIGURE 2
Cost Change Due to Estimating Error (Dollars in Millions)

AGENCY	NO. OF PROJECTS	ORIGINAL/ BASELINE ESTIMATE	CHANGE DUE TO ESTIMATING ERROR	PERCENT
Appalachian Regional Commission	1	\$ 1,150.0	0	0
Department of Energy	8	978.3	\$ 381.1	39.0
U.S. Army Corps of Engineers	90	6,305.0	597.3	9.5
Bureau of Reclamation	15	2,360.8	497.2	21.1
National Park Service	3	170.8	57.7	33.8
Federal Highway Administration	1	37,570.0	1,235.0	3.3
U.S. Coast Guard	1	83.3	147.8	177.4
Urban Mass Transportation Admin.	3	366.3	13.0	3.5
Environmental Protection Agency	8	191.3	29.0	15.2
Tennessee Valley Authority	9	3,724.5	638.1	17.1
Veterans Administration	7	242.5	17.1	7.1
Washington Metro	1	2,394.6	428.4	17.2
Department of the Air Force	13	38,811.5	1,765.8	4.5
Department of the Army	15	22,628.6	1,778.4	7.9
Department of the Navy	25	60,532.6	5,022.8	8.3
	200	\$177,610.1	\$12,608.7	7.1

Source: Comptroller General of the United States, PSAD-78-60, Financial Status of Major Federal Acquisitions, September 30, 1977. January 20, 1978.

their inclusion biases the results. It became apparent that there are special situations that deserve to be viewed independently. These include the following:

—One project in the Bureau of Reclamation accounted for most of the agency's estimating error. The remaining 14 projects showed an average estimating error of 5.1 percent.

—All of the estimating error in the National Park Service occurred on one project. The same is true of the Urban Mass Transportation Administration.

—Almost one-half of the estimating error in the EPA listing occurred on one project. The remaining seven projects averaged an estimating error of 8.5 percent.

—In the Army, removing the effect of the SAM-D and Roland missiles results in the remaining 13 projects averaging 2.4 percent estimating error.

—In the Navy, removing the effect of the FFG-7 ships results in the remaining 24 projects averaging a 5.5 percent estimating error.

—New technology of complicated items generally shows a higher estimating error (e.g., Department of Energy development programs, dams, new technology

surface transportation systems, etc.). This does not hold true, however in the Department of Defense or NASA.³

The GAO report does not include all acquisitions and all agencies. The GAO noted that the information had not been "verified." The civil agency acquisitions included only those having a greater-than-100-percent cost overrun.

Conversely, the data cover a large acquisition value (\$177 billion) and a number of acquisitions (200). The data also covered the "worst case" situations with substantial overruns.

From this limited information, we cannot conclude that major changes in acquisition costing in the Federal Government are needed. There are indications of a need for refining the process. This data review shows a potential need for specific training of some individuals and offices. There is also an indication that the practices of the Department of Defense and NASA should be considered by other departments and agencies engaged in new technology or complex acquisitions.

As an indication of the refinement needed, some additional study of specific estimating situations, as noted above, may be appropriate.

Results and Recommendations

In view of our principal conclusion that the quality of cost estimating and analysis within the Federal Government is generally acceptable, particularly in light of the data reported by the General Accounting Office, we do not believe that drastic remedial changes are either necessary or desirable. This does not mean that we think no improvements can be made. Indeed, there are several actions that can be taken to upgrade capabilities where marginal performance has been observed. These actions, however, are in the nature of refinements and should not be construed as corrections of major deficiencies.

We were requested to recommend methods for transferring information about costing techniques among various professional disciplines. We have interpreted "professional discipline," for purposes of this study, to mean "function" since the separation of costing by functional boundaries is the primary impediment to the transfer of costing information. This separation has had the effect of making costing a functional sub-set, performed by estimators identified with discrete functions who are remote from their counterparts attached to other functions. This condition produces discontinuity and wasteful repetition where continuity and constructive iteration flowing directly from earlier analyses are desired.

3. Causal relationships were not published for any NASA projects. However, the total change in 16 NASA projects equalled 22.8 percent. Dropping the changes in the space shuttle, the remaining 15 projects had a total change of 3.5 percent. Allowing any amount for changes due to inflation, engineering changes, etc., indicates an extraordinarily small amount of change due to "estimating error."

If cost estimating and cost and price analysis, taken together, are recognized as a continuum which serves each part of the acquisition process, its role as an ongoing function, integral to the whole process, becomes clear. Accordingly, it is recommended that the Office of Federal Procurement Policy make cost estimating and cost/price analysis a unified function within each government agency and that, organizationally, each agency be allowed to situate the function as may be most appropriate to achieve unification.

Acceptance of this recommendation should serve several ends. Unification of the costing function should mitigate problems, identified earlier, relating to transfer of techniques, traceability, data availability and training.

Regardless of the organizational alignment adopted by agencies, unification should produce improved communication opportunities, both intra- and inter-agency; exchange and use of appropriate techniques; continuity in data use and feedback and traceability of information pertaining to program and contract changes with their concomitant cost changes. These are all desirable objectives.

As to training and career development for those engaged in costing, it became evident during our study that improved training programs are perceived as necessary by acquisition and costing managers. We concur in those perceptions. Accordingly, it is recommended that the Federal Acquisition Institute review possibilities for improving training programs in cost estimating and cost and price analysis. Among such possibilities, the following have been suggested by acquisition managers:

- A short (1-week) course in price analysis;
- "Civilianized" versions of Department of Defense contracting courses;
- A guide on the principles of commodity purchasing;
- Courses on implementation of each of the Cost Accounting Standards Board standards;
- A "civilianized" version of Armed Service Procurement Manual No. 1;
- A program to provide government personnel an opportunity to spend several weeks with suppliers of the commodities or services for which they have costing responsibilities.

It is also of interest to note that there exists within the Federal Government an office with the responsibility to identify and inventory software models of use to government activities. The Federal Software Exchange Center, located in the General Services Administration, is a repository for, among other things, cost estimating models. Since it is a relatively new activity, its cost estimating information files are not yet extensive. However, as the center matures, it should be a valuable source of data.

Inasmuch as the existence of the Federal Software Exchange Center does not seem to be well known, we suggest that the Office of Federal Procurement Policy advise all federal agencies of its potential value as a source of cost estimating information and of the importance of providing the center with information about new computer models as they are developed or identified. |

Design-to-Affordability: One Industry View

Lawrence E. Stewart

Key personnel of the Hughes Aircraft Company have met in two company-wide conferences on "design-to" procurement. The conferences were held to review actual experience gained while operating in the design-to-cost environment. The conferences were organized to identify and to evaluate strategies and techniques needed to function successfully in this environment, and to recommend approaches or developments needed to strengthen the company's capability to compete under this new acquisition approach.

The first conference was held in 1976. At that time the company had a variety of programs under the general category of design-to-cost. Program managers from five product lines reviewed customer implementation of design-to-cost on specific contracts. The experience gained by company personnel in responding to these new requirements was aired. General observations were made, lessons learned compiled, problems encountered were listed, and actions needed were identified.

The second company-wide conference was held more than a year later. This time the emphasis was placed on four distinct areas essential to successful design-to-cost programs: (1) cost analysis and target setting, (2) cost tracking and reporting, (3) achieving design-to-cost goals through a team approach, and (4) proposals and contract negotiations. Panels were organized for each topic. Panelists having recent design-to-cost experience were selected to share their experiences. Individual conference participants represented the company's principal engineering, manufacturing and support organizations.

To put this second conference in proper perspective, the sessions were opened with a presentation on new business acquisition. It was brought out that while design-to-cost philosophy and management tools were needed and are probably here to stay, individual customer emphasis, competitive pressures, and technology considerations inevitably dictate additional priorities as well.

Definition of Requirements

Early Participation by Industry. Experience shows that industry should participate with the government very early in the acquisition process; otherwise, neither government nor industry will have a sufficiently clear understanding of the mission need and the parameters chosen to define system requirements for the program to go through the acquisition process effectively. Industry participation should be increased in such areas as threat evaluation, mission need analysis,

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priority setting, identification of alternative concepts, system analysis, performance parameter definition, and cost analysis.

Conference panelists pointed out several examples of how the marketplace for defense systems is increasing in complexity. There is continuing emphasis on technology, but at the same time there are growing customer demands with regard to total cost and warranties for product performance. Industry is obliged to take on higher and higher risk in both the technical and the financial aspects of a program. This is reflected, in turn, in more risk for the government too, in that failure by industry to achieve stiff program goals may break through thresholds that trigger program reassessments. However, the conference participants felt that if industry were brought in early and contributed to the studies made during mission analysis and concept formulation, requirements would more likely reflect practical limits, and industry would be better able to make realistic assessments and commitments.

Clear Definition and Communication of Requirements. Poor definition and communication of requirements and criteria for decision-making can result in waste of time, talent, and money on the part of industry and government alike. This conclusion is based on experience by conference participants with a wide variety of programs from all three of the military services. It was found that cost objectives and decision-making criteria were not consistent among the different customers or the different tiers within a single customer's management hierarchy. This leads to confusion and misdirected effort.

We perceived that the term "design-to-cost" and its various customer interpretations, while important, may be misleading. The best design-to-cost proposal may not win the award. Yet, neither is a company likely to win without a credible design-to-cost plan. Industry's task actually seems to be to "design-to-(what the real customer really wants, including) cost." Sometimes the real customer is hard to find as programs get successive reviews up the line, including Congress and the President. The real wants may not be the least cost to achieve minimum acceptable performance levels. The customer may prefer a higher performance, more flexible product that has growth potential. Customer objectives and the real decision-makers may change as the program progresses through the acquisition process.

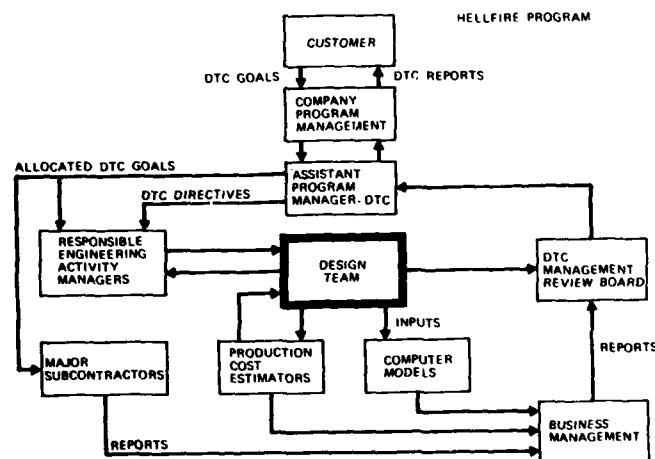
Management levels must be clear as to what they really want from the design-to-affordability approach, and unambiguously project this to the implementing organization that will use design-to-cost and life-cycle-cost techniques to achieve the objectives. The latitude for decision-making and trade-offs should be carved out in negotiations and then reflected in the contract so industry has well-defined objectives.

Industry Can Achieve Realistic Cost and Performance Goals. Given clear and reasonable objectives, industry is able to achieve both cost and performance

goals. There was evidence on each program reviewed in the company-wide conferences that industry could establish cost goals and manage the iterative design and cost estimating process required to meet these goals. A substantial award fee, in fact, was earned by the company on the HELLFIRE program as a result of demonstrating an effective design-to-cost management process. (See Figure 1.)

We found that design-to-cost has proven to be a career challenge to individual engineering and manufacturing people. Engineers enjoy design-to-cost problem solving, and are able to work the problems as long as there is sufficient latitude to make decisions and trade-offs. Engineers who have worked on design-to-cost programs are as interested and motivated to reduce cost as they have been—and still are—to improve performance. Individuals who have participated in cost reduction programs on Maverick, TOW, Phoenix, F-15 radar, and other programs prior to formal "design-to-cost" contract requirements accept design-to-cost as a matter of course.

FIGURE 1
Hughes Design-To-Cost (DTC) System



Front-End Funding Is Required. During mission analysis, concept formulation, and validation phases of a program, decisions are made that have the greatest impact on weapon-system capability and life-cycle cost. Obviously, these decisions need to be based on adequate analysis and verification testing. Sufficient time and customer funds are required by both government and industry to support this early work. More money is needed for mission analysis,

trade-offs, design iterations, re-estimates, producibility studies, etc., to optimize the balance between performance, cost and schedule.

Unfortunately, there is little evidence that the customer will pay more for analysis early in a program, particularly when the program is in the competitive phases, even though this early investment will be offset by reduced weapon system life-cycle costs. A further complication is that in the past much of the needed work, such as producibility studies, cost estimating, supplier quotations, etc., has been associated with proposal activity and has not been direct cost to the program. Now, with more extensive work of this type needed for analysis and trade-offs early in the program, means must be found to provide financing for it within established cost accounting standards.

Another problem involving funding support is the need to maintain continuity between the completion of one phase of program effort and the next. Dispersion of skilled staff and the redirection of their interest results in wasted time and money to reindoctrinate personnel in program requirements when the work is started up again. Maintaining continuity of key personnel, from the early trade-off analyses into engineering design, is a serious problem for industry that will become more acute under design-to-affordability.

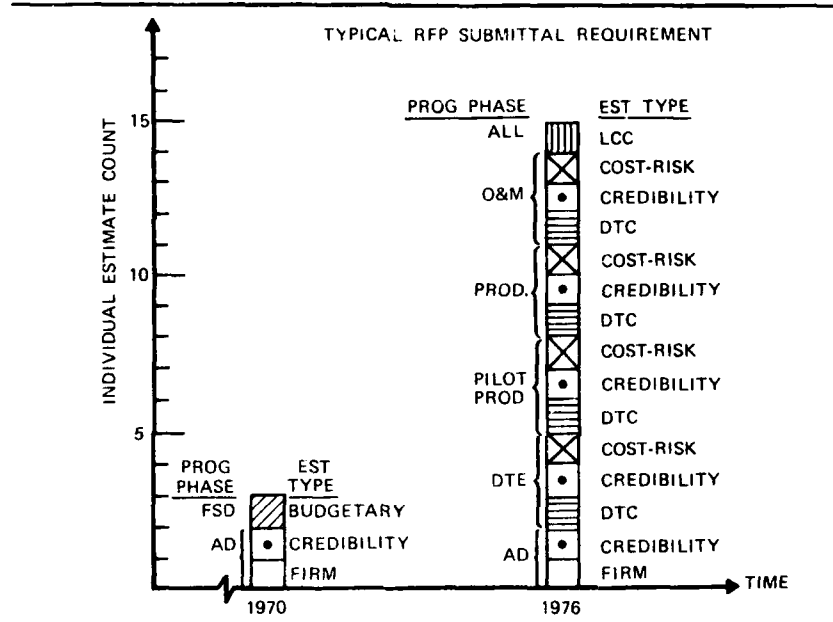
Cost Analysis

The Costing Load Is Increasing. The conference discussions brought out the fact that the costing load has been greatly increased by the design-to-life-cycle-cost approach. All phases of the life-cycle must be costed. Funding requirements must be scoped, and relative cost of various approaches to meet mission needs must be estimated early in the acquisition process. (See Figure 2.) System costs must be broken down into subsystem costs, and these in turn to system elements with specific design parameters identified. Often there are several options that must be costed. Each trade-off study involves cost analysis, too.

Also, cost credibility is growing in importance as cost becomes a more significant factor in decision-making. Unfortunately, the process of proving that the numbers are right is becoming more complicated as well. It is made more so by the proliferation of options to be costed, and the shift to life-cycle cost considerations.

New Costing Techniques Are Needed. The increasing demand for cost information has resulted in development of improved cost-analysis techniques, models, cost-accounting systems (particularly of operational and support costs), cost-history data bases, and personnel with the necessary skills to use them. Detailed grass-roots estimating can no longer keep up with the demand for cost data. Also, where estimates are needed early in the program, the definition of the hardware and operational support plans are so preliminary that detailed estimating cannot be used.

FIGURE 2
The Cost Load Is Increasing



Correlation of cost history to system performance parameters and operational concepts is needed to permit cost estimating from a system concept basis (i.e., cost per function, weight, type of equipment, etc.). The problem is to select the most cost-effective alternative at the system level without the need to translate the design concept into detailed end-item product specifications for costing.

New parametric techniques are required. Some techniques being developed include the use of standard work breakdown structures, and correlation of detailed cost history with performance parameters, production methods, support concepts, and time constraints. Data bases containing useful information on product configuration, vendor prices, and physical characteristics that can be readily interfaced are being developed to facilitate analysis.

Another important area where innovations are needed is in the assessment of future market conditions where rapid technological growth can cause wide changes in prices, such as in electronic components.

Shift from Detail to Parametric Cost Estimating. There must be a shift away from detail cost estimating and auditing toward a parametric approach, or financial analysis will not be able to keep pace with and support the technical analysis. Numerous requests for detailed cost data in different forms by different customers bog industry down. We need to develop more flexibility and rapid turnaround in our cost-data systems to be able to respond.

The customer seems to know only one way to review and analyze cost estimates and prices. That is, to use the detailed audit approach. This results in industry generating masses of detail cost data early in the programs, when the accuracy of this data may be no better than that available from parametric cost analysis techniques.

As industry builds up adequate data bases of cost history and correlates this with design parameters and other program constraints, this should become the basis for cost estimating and pricing by industry. Government procurement and audit agencies should change their policies and procedures so as to be able to accept this type of financial back-up. A data workload reduction could be negotiated with the customer to reduce the amount of cost information required down to the level which the customer has time to analyze.

What Do We Do Differently?

Implementation of design-to-affordability in the system acquisition process causes some significant changes in operation for both government and industry. The conferences highlighted some of the areas where new responses are required on the part of industry.

Scope Out the Real Customer's Cost Objectives. The affordability limitations or "real cost objectives of the real customer" for a new weapon system are established very early in the acquisition process. Industry must determine what these cost boundaries are as early as possible, because the cost limitations color the whole approach to the design problem by industry. Do you want a Cadillac or a Chevrolet? Do you want a flexible product that has growth potential? Do you want a high risk or a conservative approach toward cost in trade-offs? Is affordability really a primary consideration on this program? Is cost going to grow in importance as time goes on? Industry must find answers to these questions. The answers are the criteria that the "real customer" will use in making key program decisions.

Set Firm Cost Goals Early. Firm cost goals for each weapon system must be set much earlier in the program under the design-to-cost concept than heretofore. This means that techniques must be found to establish relationships between performance parameters, design features, and cost at the system level in order to perform early trade-offs. The weapon system cost goals must then be broken down for each system element that is to be contracted for separately. Industry must in

turn break these cost goals down further to the subsystem or unit-level where they can be dealt with by a design team.

Bridge the Engineering/Manufacturing/Logistics Interface. One of the primary lessons learned as reported in the conference was the need to colocate engineering, manufacturing, and logistics personnel. Manufacturing should provide working specialists for the design-to-cost effort, not just organizational representatives. For example, use specialists, rather than a single generalist, in tooling, testing, processing, fabrication, assembly, inspection, etc. Material representatives should be included too, because material dollars are usually a major part of total cost.

It was also observed that engineers need to learn more about manufacturing methods. Many of them could benefit from exposure to the manufacturing environment. Sometimes engineers try to drive manufacturing costs down rather than creating lower-cost designs. They often question the manufacturing information and try to determine the validity of it rather than working on improved design.

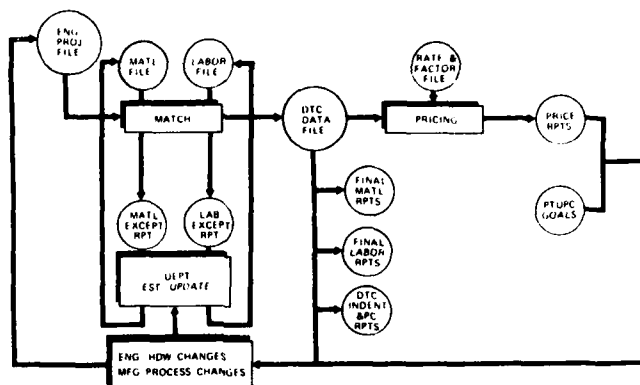
Balance Cost, Schedule, and Performance. Trade-offs are to include cost as a parameter equal in importance to performance and schedule. It is difficult to make cost/performance trade-offs because there are no easy conversions of performance parameters to dollars. Also, performance parameters are usually specified at the system level, and industry must convert them to design requirements at the unit level to be traded-off against cost.

Define Product Configuration Earlier. Under design-to-cost it is necessary to identify cost estimates to the corresponding design alternatives from the early stages of the program. The configuration of the product must be identified, tracked, and communicated to all organizations contributing to the trade-offs. Accordingly, a new kind of configuration data base or product definition system is needed that can expand as the design evolves, picking up more detail as it becomes available. It must be able to accommodate several alternative designs for each unit simultaneously.

Track and Report Unit Production Cost and Life-Cycle Cost. Design-to-cost requires tracking current estimates of future production costs and support costs, and controlling the development so as to drive those estimates toward established goals. This control is over and above the control of actual costs on the instant contract to keep within the financial limitations of that contract. Tracking and reporting systems with cost data banks have been established by the manufacturing organizations. (See Figure 3.) They are capable of rapid feedback of production cost estimates on design changes to engineering. These systems are linked automatically with engineering configuration data banks.

Of course the question remains: Will the customer put faith in design-to-cost and life-cycle cost numbers in making key program decisions in competitive procurement? Cost is critical in source selection, but decisions are usually made using

FIGURE 3
Tracking and Reporting System



firm quotations for full-scale engineering development and initial production quantities. If design-to-cost and life-cycle cost projects become more significant, then the tracking and reporting systems will be swept up in the bidding process and be influenced by pricing considerations.

Feedback Cost Estimates to Designers in Real Time. It is difficult for engineers to do both the technical job and cost estimating as well. But the design engineer must have elemental production cost visibility if cost is to become a factor in design decisions. The use of design and cost handbooks is helpful, but it is much better to support the engineer with a team of manufacturing, material, and logistic experts that can cost out his design as it is evolving, or give him relative costs for trade-offs. That way the cost estimates come from the organizations that, later in the program, will do the manufacturing and support. The estimates take on the air of a commitment and are likely to be more realistic. However, the feedback of cost estimates to the designer must be fast so that the cost information is available while the design is evolving and flexible.

Live with Stiffer Incentives and Warranties. In contracting design-to-cost programs, the government is to define the design-to-cost targets in terms that are auditable, contractually enforceable, and meaningful to both the contractor and the government, according to the *Joint Design to Cost Guide*.

Requirements are to be clearly defined, yet must allow the contractor latitude to tailor his design to fit the design-to-cost targets. The contractor's progress toward the targets is to be reported. In addition, the government is to provide incentives that will effectively motivate the contractor to achieve the design-to-cost targets.

Fixed-Price Incentive

This means that industry can expect new customer approaches to incentives and warranties. It is hoped that these approaches will stress realism and appropriate contractual vehicles, i.e., fixed-price incentive fee and cost-plus incentive fee contracts for development, in lieu of firm fixed price as now frequently seen. Industry should be given an opportunity to profit to a greater extent than is now possible, if design to affordability objectives are to be achieved. Also, the ability to recover many of the costs presently disallowed would provide constructive support, i.e., interest payments on loans to float progress payment shortfall, contractor-required investments, and others associated with A-109 implementation.

Manage the Work So As to Achieve Cost Goals. Leaders in government and industry must show the working levels that management really wants to achieve the financial objectives of design-to-affordability. There can be no ambivalence. The signal must be clear and continuing. Design-to-affordability must permeate the whole operation. There can be no design-to-affordability cult. Teams of capable innovative people from all disciplines should be brought together, given the cost/performance/schedule objectives, and motivated to work the problem. The management structure should be simple. Management reviews should only be frequent enough to keep the momentum up, and to identify problems before they adversely affect schedule and cost.

The industry program manager has a special role as a challenger and stimulator. He should establish a design philosophy, e.g., minimum risks. He should establish a procurement philosophy, e.g., spread the risk via firm-fixed-price purchase orders. He should cut off performance improvements when contractual objectives have been achieved. He should establish a plan to achieve a production design during development, because the best way to get production costs down is to get the production support costs out by putting a mature design into production. This will minimize the cost of changes and engineering and manufacturing support.

Special management attention should be focused on material costs. Material costs are often the largest single cost element on production programs. Standardization and reduction of part content in designs can pay big dividends. On new items, allow vendors to quote against design specifications, giving them freedom to consider alternatives rather than bidding against detailed requirements. Sometimes, vendors are reluctant to quote against design-to-cost objectives in the absence of a firm buy in the near future; however, bringing them on the team and having them participate in trade-off analyses can mitigate this.

Summary

Industry must participate with the government early in the acquisition process when mission elements are prioritized and affordability limits are being established. Good definition of requirements, limitations, and criteria for decision-making, and clear communication of them to the procuring commands and industry, are essential for design-to-affordability to become an effective acquisition tool. Development of adequate cost-analysis capability is also necessary, with a shift to reliance on parametric techniques for cost estimating and review rather than detailed costing.

Implementation of design-to-affordability in the system acquisition process will institute some significant changes in operation for both government and industry, particularly in the early phases of mission analysis, concept formulation, and validation. Industry can achieve realistic cost and performance goals. However, this will require more customer funding during the early phases of the program to support the added effort by government and industry; but this investment should be offset by lower life-cycle costs for the weapon system.

This means that industry can expect new customer approaches to incentives and warranties. Industry should be given an opportunity to profit to a greater extent than is now possible, if design-to-affordability objectives are to be achieved. ||

27 || OMB Circular A-109 Impact on New Development

Dean E. Roberts

Prior to OMB Circular A-109 the principal policies on major system acquisitions were made at the agency or agency component level (e.g., DOD or the services). Circular A-109 takes the procurement policy-making decisions out of the hands of the agencies and places them in the Executive Office of the President, Office of Management and Budget (Office of Federal Procurement Policy). A-109 sets forth the policies to be followed by the executive branch agencies in the acquisition of major systems. Major systems acquisition programs are those that (1) are directed at and critical to fulfilling any agency mission, (2) entail the allocation of relatively large resources, and (3) warrant special management attention. The discretion of setting dollar-level thresholds is retained by the agency head.¹

A-109 did not suddenly appear as a result of any one government or industry action. There has been heavy concentration on the fundamental issues of procurement practices in DOD for almost two decades. The McNamara-Hitch team introduced the programming, planning, and budgeting system (PPBS) and the development concept paper (DCP) (now the decision coordinating paper), and the Laird-Packard team caused a comprehensive restructuring of the DOD procurement practices, which included the introduction of the Defense Systems Acquisition Review Council (DSARC) milestone review system. Many of the Packard innovations for procurement practices were adopted by the Commission on Government Procurement and later incorporated in OMB A-109. With all this heavy concentration on fundamental issues of procurement practices within DOD and DOD's relationships with industry, one would think that all procurement problems would have been solved and that a workable process would be in effect.

Background

In gaining an appreciation of the problems of procurement practices related to major system acquisitions, it is worthwhile to review the evolutionary process that took place in DOD starting back in the pre-1961 time frame. In looking at the pre-1961 period, it becomes apparent that DOD had no unified basis for budgeting or determining the defense posture, and furthermore, that the Secretary of Defense lacked the tools to manage overall multi-service acquisition programs. Under the "budget ceiling" methods of budgeting of that period, the DOD budget was allocated to the three services on a percentage basis, and each

1. Executive Office of the President, Office of Management and Budget, OMB Circular A-109.

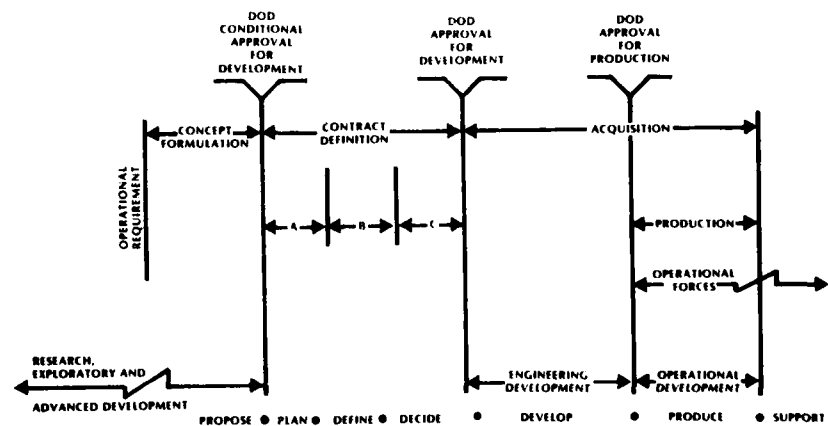
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service was required to set its own priorities based on the budget allocation. Each service exercised its own priorities and laid the groundwork for an increased share of the budget for future years. There was every incentive for the services to propose a large number of new starts since full-cost dimensions would not be apparent until later years. This foot-in-the-door technique was encouraged further by the annual budgeting process, which looked at only one year at a time for budget requirements. This combination of planning and development of new acquisitions, decoupled from the budget process, created an atmosphere of cost overruns, cost growth, and the stretching out or delaying of programs that were vying for budget support.

The PPBS was developed and implemented by Secretary of Defense McNamara and Deputy Secretary of Defense Hitch in order to bring the realities of budgeting and planning into line with each other on a five-year basis that included both the short-term and the long-term planning and budgeting. Coupled with the PPBS, a formalized system of major system acquisition evolved under McNamara-Hitch that consisted of three parts: concept formulation, contract definition, and acquisition. Figure 1 depicts these relationships.

Concept formulation consisted of the engineering and analytical studies and other activities that provided not only the technical, but also the economic and

FIGURE 1
Concept Formulation, Contract Definition and Acquisition



military basis for a conditional approval for development. This phase had certain prerequisites that included definitions of mission and performance, the selection of the best technical approaches, and the analyses of trade-offs among the effectiveness of cost, schedule, and performance. These prerequisites led to conditional approval for development. Concept formulation stages of research and exploratory development, including the testing to prove feasibility and the establishment of the technological building blocks, were for the most part accomplished by DOD in-house laboratories and federal contract research centers (e.g., the Applied Physics Laboratory of Johns Hopkins University).

Contract definition was where defense managers were required to make final decisions as to whether to proceed with full-scale development. For purposes of administration, DOD divided contract definition into three phases, A, B, C. Phase A began upon conditional approval of the Secretary of Defense, usually before concept formulation was fully completed. A series of actions took place that resulted in a contract definition contract award to two or three selected contractors who participate in the process of defining a technical approach to engineering development. During phase B the contractors responded to the request for proposal (RFP), and in phase C the successful engineering development (ED) contractor(s) was selected. Contract development set the basis for engineering development in that the development specifications were defined and reliability and maintainability goals were established. A validation process to ensure that the performance specifications were achievable during engineering development to support a production decision was to be developed during this phase.

The McNamara-Hitch procurement processes probably would have solved most of the problems with the later phases of the acquisition procedures. However, they opted to further improve on the system by combining the approval of the development and production in what was termed "total package procurement concept," or TPPC. This concurrent approval of development and production was believed to have great advantages for the government in terms of greater competition for DOD contracts. The TPPC called for competitive procurement of the development, production, and logistics support of a system and was to occur immediately following contract definition. McNamara felt that competition would increase, and therefore fixed-price contracts could be used. Furthermore, no single contractor would have gained an advantage in his bid for a production contract over other contractors through the government paid-for investment in tooling, training, and technical insight realized during the engineering development work.

The TPPC was first used by the Air Force in contracting for the development and production of the C-5A, and the Navy used the scheme in contracting for the LHA and the DD963 Class ships. Under TPPC it was expected that the contractor would commit to the cost and performance of the system before the detail design

phase and would have a strong incentive from the outset to design for economical production, reliable operation, and low operating and maintenance costs. What really happened was the addition of some new words to the general procurement vocabulary, such as "claims," "adjudications," and "adjusted payments" to the contractor.

McNamara introduced a new key decision document in the management of defense research and development, the development concept paper (DCP). The DCP was a summary document containing all the pertinent technical, economic, and strategic factors bearing on certain selected R&D programs. The DCP became the key management tool of the Director of Defense Research and Engineering (DDR&E) in the initial stages of development.

People, Not Paper

The period that started under Secretary of Defense Melvin R. Laird marked an elaboration of a changing U.S. defense policy and a new method of management inside the DOD. Laird instituted a policy of participating management in DOD, which contrasted with his predecessor's emphasis on systems analyses and computers. His slogan was "people, not paper." Laird placed major responsibility for DOD policy on Deputy Secretary David Packard.

Packard instituted significant changes in the major system acquisition process, some of which led directly into the policies promulgated by OMB Circular A-109. In May 1969 he established the Defense Systems Acquisition Review Council (DSARC) within the Office of Secretary of Defense, which was to advise the Deputy Secretary of Defense of the status and readiness of each major system to proceed to the next phase of effort in its life cycle. The Council would serve to complement the decision coordinating paper process, which would continue as a formal DOD management and decision-making process for the acquisition of major systems.

The DSARC functions, as initiated by Packard, included the review and evaluation of the status of each appropriate system acquisition program at three basic milestone points:

- (1) When transition from the contract definition (or equivalent effort) is proposed;
- (2) When transition from the contract definition phase to full-scale development is proposed;
- (3) When transition from the development phase into production for service deployment is proposed.

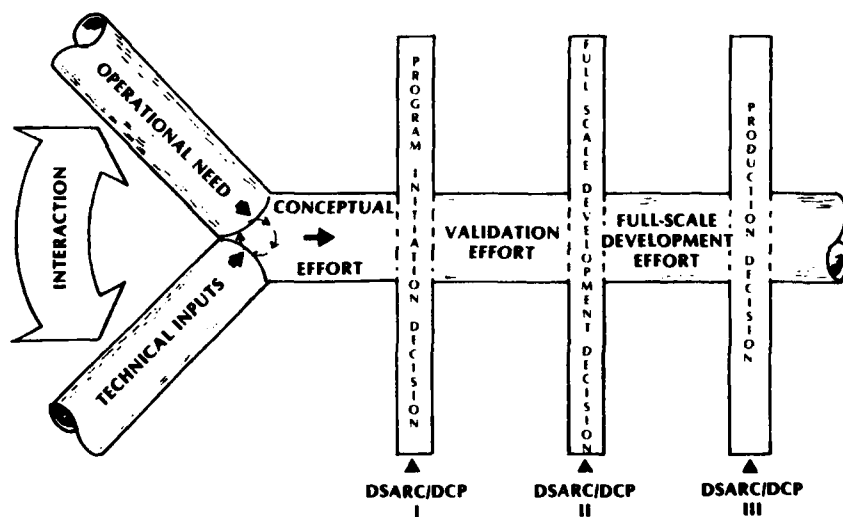
The first review would support the basic DCP and would provide a forum for discussion and possible resolution of the various viewpoints of the participating principals, including the Secretary of the military service sponsoring the program. The later reviews served to function as a validation that the system was

ready to proceed to the next stage, i.e., normally full-scale development or production. Figure 2 depicts the DSARC/DCP relationship to the development process prior to the inclusion of DSARC 0.

It was inevitable that Congress would have to take some action in the government procurement process. It was believed in Congress that the wrong questions were being asked by top government management at the start of a new major system development. When the right questions were asked, they were too late to be relevant. Programs were started like small snowballs at the top of a mountain, and by the time Congress became aware of them they had become avalanches.

Legislation establishing the Congressional Commission on Government Procurement was enacted as Public Law 91-729 in November 1969, following the testimony from more than 100 witnesses, which filled 10 volumes of hearings. The legislation was sponsored by Congressman Chet Holifield of California and Senator Henry M. Jackson of Washington. The Commission was established to study the government procurement process and to make recommendations for improving the efficiency and effectiveness of federal procurement practices.

FIGURE 2
DSARC/DCP Relationship to the Development Process Prior to the Inclusion of DSARC 0



The Commission proposed a series of 12 recommendations under major system acquisition which, in effect, called for taking a systems approach to the systems acquisition process. The recommendations were categorized under (1) establishing needs and goals, (2) exploring alternative systems, (3) choosing a preferred system, (4) system implementation, (5) organization, management, and personnel. During 1975, the Subcommittee on Federal Spending Practices of the Senate Government Operations Committee held extensive hearings on the 12 recommendations of the Commission. During those hearings there was broad support from Congress, industry, the comptroller general, and the principally affected agencies, i.e., DOD, ERDA (now DOE), NASA, and DOT. Also during 1975, the DOD's Acquisition Advisory Group reviewed separate recommendations of individual service studies (Army Materiel Acquisition Review Committee, Navy Marine Materiel Acquisition Review Committee, and other studies by the Air Force). This group, too, independently supported the Commission's major systems reform recommendations.

Following formal coordination, publication in the *Federal Register* for comments, public hearings, and a 30-day review by Congress, OMB Circular A-109 was issued by OFPP within P.L. 93-400 in 1976 with implementation to apply to specific programs beginning Fiscal Year 1977. OMB A-109 forms the basis for the current procurement policies on major systems acquisition and, in DOD, caused the issuing of the revised DOD Directives 5000.1 and 5000.2 dated January 17, 1977.

Discussion

In order to view the impact of OMB Circular A-109 in context, past procurement practices of DOD were reviewed to show that DOD has undergone continued comprehensive restructuring to improve the acquisition process. As will be shown, A-109 is directed toward the "front end" and fills a gap that was not covered under the McNamara-Hitch CF/CD (Figure 1) or the DSARC/DCP concept of Laird-Packard (Figure 2).

A-109 is not a completely revolutionary change in the way DOD does business. However, the requirement of A-109 to perform mission analyses on a continuing basis, and to develop a mission element need statement that addresses specific agency mission deficiencies does impose an entirely new approach to initiating a new major system acquisition.

The requirement imposed by A-109 and the resulting DOD directives is that new acquisition be expressed as mission needs performance criteria rather than in explicit system or equipment terms. A mission element need statement (MENS) is developed which, when approved at DSARC 0 by the Secretary of Defense, initiates a new acquisition program. This is followed by the assignment of a program manager and the exploration of alternative solutions to the mission deficiencies,

all of which become effective at program initiation, i.e., DSARC 0 or Milestone 0. Both Milestone 0 and Milestone 1 (the program phase where proposed system concepts are validated) are conducted on a competitive basis with industry. The procedure for developing the MENS and the selection and validation of alternatives to fulfill mission needs is where exceptional care must be taken to gain full advantage of the competitive process without incurring the adverse effects of technical leveling and the gaining of less than full support from industry.

MENS Development

There can be problems in developing a MENS where the needs are not defined narrowly enough to control the responses to the requested solutions to the mission deficiencies. Valid threat forecasting is difficult and directly affects the mission analysis, which must be performed in a manner to enable specific deficiencies to be highlighted. Otherwise, the development of the needed technological insight within DOD is spread too thin to allow the preparation of a MENS that will receive approval and result in program initiation.

Program Management

Considerable emphasis is placed on program management in both A-109 and the DOD directives. All major system acquisition programs, plus any additional programs selected by the DOD component, are to be managed by a program manager (PM). The PM will be assigned at Milestone 0 except that when the urgency or the magnitude of the effort dictates, a prospective PM and nucleus staff may be assigned prior to Milestone 0. The first task of the PM is to develop an acquisition strategy tailored to meet the mission need in an economical, effective, and efficient manner.²

In accordance with his charter, the PM will head the program team consisting of technical, business, financial, and logistics personnel, along with an assigned, dedicated contracting officer. The program team will, in all likelihood, feel responsible for ensuring program continuance and will guard against organizational entropy. The team will have to become fully cognizant of the in-house technological base and the concepts proposed by the contractors in order to perform its function. This will require visits to contractors' facilities and briefings that will ensure that the government becomes a "smart buyer" in the selection and validation of alternative designs.

SELECTION OF ALTERNATIVES

As part of the acquisition strategy, if it is decided that industry will be asked to participate, the program manager will ask contractors to submit their concept

2. Executive Office of the President, Office of Management and Budget; *Discussion of Application of OMB Circular A-109*, OFPP Pamphlet No. 1, August 1976; p. 11.

of alternative system designs based on mission need, schedule, costs, capability objectives, and the operating constraints.³ This competitive exploration of concepts to satisfy the need can only be as effective as the government's technological base (against which the solicited concept will be measured) will permit. The selection of one of the alternative system designs points toward the possibility that the program manager perceives the solution to the mission deficiency and can logically predict and direct the correct design. The selection process includes the issuance of parallel short-term contracts that will be renewed as long as the contractor's approach is acceptable.⁴ This could be the primary source of technical leveling.

The contractor who prefers to stay in the running probably has a significant investment of Independent Research and Development (IR&D) funds, and is therefore forced to sense the desires and to respond to the PM. The tendency on the part of the program office team to inquire of the contractor as to his design motives and to make suggestions that can be interpreted as direction can further cause technical leveling.

There is a certain amount of cross-pollination among the contractors and with the developing technological base of DOD. Even though the contractors are not to be restricted by detailed government specifications and standards,⁵ the need on the part of the program managers to have a standard yardstick for comparison drives the alternative systems design efforts toward a standard baseline. The participating contractors are to be provided the life-cycle cost factors, mission performance criteria, the relevant operational support experience, and other such significant information needed to develop performance and design trade-offs. Since performance is no longer "king" and must be traded-off against designated cost and life-cycle cost, the above information provided by the program manager can significantly affect the alternative designs. Thus the weighting factors being communicated from the program office on the performance parameters versus design-to-cost and life-cycle cost can effect technical leveling and restrict the selections available.

COMPETITIVE DEMONSTRATION

The contractors selected for a prototype demonstration contract will be required to provide development and production specifications. Where there is to be competitive prototype contracts, it has to be recognized that multiple awards are very costly to the government and to the contractors as well. Industry, for the

3. OMB A-109, Para. 11e.

4. OFPP No. 1, p. 16.

5. OMB A-109, Para. 11f.

most part, makes profit on production. Without fairly good assurance that the IR&D efforts, coupled with the development contract, will produce a production contract, the competitive advantage to the government could fail to materialize. Furthermore, the longer the process is dragged out from alternative design selection to demonstration and full-scale development, the more probability there is that the continual mission analysis will bring further design changes that will cause the production contract to be pushed out. Also, production costs will increase proportionately.

Conclusions

OMB A-109 and the implementing DODD's 5000.1 and 5000.2 are not the original sources of technical leveling; however, the parallel short-term contracts and the procedures for alternative system design and selection encourage technical leveling and cross-pollination of industry's ideas and concepts.

The impression of industry that DOD is out to "milk" the contractors of their IR&D-developed design concepts has to be guarded against in the alternative design selection process.

DOD cannot afford to thwart the incentives of contractors to provide new innovative solutions to DOD's problems.

Industry makes profit on production, and therefore dragging out the "front end" of the acquisition process can have an adverse effect on the selection and demonstration processes. Only those contractors who can afford a long IR&D effort will ever reach the competitive prototype demonstration stage.

Further reason to shorten the front-end process is that the threat will continue to increase; therefore, mission analyses performed on a continual basis will cause a perturbation of the selection and development process. It effects a built-in obsolescence in meeting the DOD mission needs.

The program manager and his staff, in the process of building a strong technological base and becoming a "smart buyer," must not anticipate or direct the contractors toward the specific system design or the advantages of competitive selection and demonstration will be lost.

OMB A-109 and the DOD directives implementing it will improve the acquisition process within DOD, provided the mission analysis and mission element need statement are not used to stop or delay needed programs. The new concentration to improve the "front end" should not be the excuse to do nothing. ||

Alternatives for Shortening the Acquisition Process 36

Major David T. Spencer, USAF

The time required to complete the current systems acquisition cycle is excessive. The 1977 Defense Science Board Task Force on the Acquisition Cycle pointed out that it takes 12-13 years to complete the acquisition cycle from program initiation through deployment. Further, the DSB revealed that the length of the acquisition cycle occurred prior to Defense Systems Acquisition Review Council (DSARC) II and during production. The average time required to reach DSARC II increased from 2 years in 1950 to more than 5 years by 1977. Production times have increased significantly because of program stretchouts caused by excessive testing, government funding constraints, and reduced concurrency. However, the time required to complete full-scale development has remained constant. The DSB concluded that "the lengthening period between initial consensus on a perceived mission need and full operational deployment is causing the United States to lose its technological lead."¹

Since World War II, we have gone through a generation of weapons faster than the acquisition process can replace them.² There are two reasons for this phenomenon. First, the acquisition process is taking longer. Second, the technology turnover rate is faster than in the past. For example, "the evolution of microelectronic technology over the past decade has been so rapid that it is sometimes called a revolution."³ The number and quality of most advanced integrated circuits has doubled every year since 1959.⁴ This technological advancement, plus increased acquisition time, is pushing modern weapons into obsolescence before they can be used.

Technological obsolescence has resulted in program cancellations. Since World War II, the Snark, Navaho, and Regulus air-breathing missile programs were cancelled and replaced by less vulnerable ballistic missiles.⁵ General Thomas Power, former commander of the Strategic Air Command said, in referring to the Snark program, "Let's face it, it came too late . . . they have very limited value to SAC."⁶ Yet in 1947 when the program began, a 6,000-mile guided subsonic missile was a significant advance in weaponry.⁷ Other cancelled programs include

1. Report of the Defense Science Board Task Force on the Acquisition Cycle 1977 Summer Study, vii (1978).

2. M. J. Peck and F. M. Scherer, *The Weapons Acquisition Process: An Economic Analysis*, Boston Graduate School of Business Administration, Harvard University, 46 (1962).

3. R. N. Noyce, "Microelectronics," *Scientific American* 273, No. 3, 63 (1977).

4. *Ibid.*

5. Peck, *op. cit.*

6. U. S. Congress, House Committee on Appropriation Hearings, Department of Defense Appropriations for 1960, 86th Congress, 1st Session, Part 2, 393 (1959).

7. Peck, *op. cit.*

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the GAM-87A Skybolt, Main Battle Tank-70, Cheyenne Helicopter, and B-1. In fact, during the 20-year period prior to 1976, the Department of Defense invested approximately \$11 billion in weapon systems which were terminated before production.⁸ This investment has risen another billion dollars or more with the cancellation of the B-1 program. Eleven to \$12 billion is a great deal of "wheel spinning" with little return on investment in terms of military superiority. We must seek alternatives that avoid commitment to unverified needs but, at the same time, make the best use of technology. The most recent policy that expounds this philosophy is the Office of Management and Budget (OMB) Circular A-109.

Briefly, OMB Circular A-109 is intended to determine that a new system is needed before committing the system to full-scale development (FSD) and to prevent cost overruns. The policy emphasizes the need for competition as a new program moves from initial concept definition to FSD. However, the advent of A-109 has also heightened the anxiety over excessive systems acquisition time. Critics of the new policy claim the added requirements to conduct mission area analyses, develop a statement of operational needs, prepare a mission element need statement (MENS), add a new Milestone 0 to the DSARC process, and require more competition, will significantly lengthen the acquisition cycle. As a result, a major problem facing acquisition managers is to find alternatives within the framework of A-109 that will shorten the acquisition cycle.

This study presents recommendations aimed at reducing the acquisition cycle, streamlining the acquisition process, and otherwise improving the acquisition environment. My task is to identify alternatives that will have a high propensity for near-term benefits. In addition, it is my intent to suggest initiatives or areas for additional study that have a high potential for sustaining and shortening the acquisition cycle in the long term.

OMB Circular A-109 will not in itself have any appreciable effect on the length of the systems acquisition cycle. How quickly or how slowly weapon systems are acquired depends on the extent of U.S. commitment to the support of national defense. The variables that determine time requirements include the amount of money available, complexity of the weapon system, political climate, international situations, and the intensity of national commitment or sense of urgency. Despite these variables, there must be an ordered set of criteria from which to construct the acquisition process. These criteria must be comprehensive enough to insure control and statutory responsibility. They must be flexible enough to allow rational decision-making. They must be responsive enough to take advantage of contingencies without jeopardizing system performance or the national budget.

8. Chet Holifield, "Federal Procurement and Contracting Reform," *Brooklyn Law Review*, 41, No. 3, 481 (1975).

The thrust of this study is to identify alternatives for shortening the systems acquisition cycle within the policy guidance of OMB Circular A-109. The main emphasis will be on the competitive source selection process. Using a hypothetical requirement, I will describe the acquisition process in sufficient detail to illustrate the constraints that contribute to excessive time. From this illustration, specific events are isolated for discussion. These events become the alternatives that could shorten the acquisition cycle.

It is important to selectively review historical events that contributed to today's acquisition policies, organizational structures, and management philosophies. Past successes and failures must be considered in selecting the methodology and alternatives to improve the present acquisition process. Consequently, this study will begin with a brief overview of management techniques and government actions that have influenced the acquisition process since World War II.

Evolution of Systems Acquisition

Generally, the problems associated with systems acquisition have remained the same. Typical problems have included cost overruns, poor systems performance, late deliveries, or excessive acquisition time. Moreover, the response to eliminate these problems follows an established pattern. First, Congress conducts a series of hearings, and then creates committees and commissions to find alternative means of attempting to deal with the problems. Based on the results of congressional action, DOD performs additional studies and analyses. The results of the above activities take the form of reorganizations, new management policies, tighter controls, and regulatory changes. This cycle repeats itself because laws, directives, regulations, and management policies were adopted to address problems associated with specific systems. In essence, present-day procedures may not be universally applicable to future acquisition problems.

Historically, there are a number of developments that are germane to existing methods for managing the systems acquisition process. Among the significant events since World War II were the War Powers Act, which was designed to speed by the procurement process by restricting formal advertising in favor of negotiated procurements; the Armed Services Procurement Act of 1947, which allowed for a more flexible use of negotiation in peacetime; the second Hoover Commission resulting in the DOD Reorganization Act of 1958; and, most recently, the 1972 Commission on Government Procurement.

The Air Force did not elude the impact of a changing systems acquisition environment. New management systems were needed to offset a growing acquisition cycle. Foremost among recommendations for speeding up the acquisition cycle in the 1950s came from a committee chaired by Hyde Gillette. The purpose

of the committee was to find ways to speed up the ballistic missile program. The committee recommended a set of procedures (Gillette Procedures) providing:

- A special review and approval channel for ballistic missile program plans;
- That detailed funding, programming, and program action requirements were determined by the program office;
- A special review committee with the Air Staff and a comparable committee at the defense secretariat level;
- That key people were kept informed but out of the decision cycle;
- Continuous involvement of decision makers in program status;
- Protecting funds from reallocation.⁹

There were two major accomplishments of the Gillette procedures. First, they were effective in speeding up the ballistic missile programs by minimizing review and approval processing time. Second, all parts of the program were considered as one "package," thereby avoiding program hold-ups for parallel approval cycles.¹⁰ The Gillette procedures were not successfully applied to aircraft acquisition.

A number of other studies conducted at the beginning of the Kennedy administration reflected a need to overhaul the approach to acquisition management. One study, at the request of the newly appointed Secretary of Defense, Robert S. McNamara, was commissioned to develop a detailed plan for improving the Air Force management and organization for research and development efforts.¹¹ As a result of these studies, Secretary McNamara assigned research and development responsibility for military space programs to the Air Force. This action spurred the Air Force to strengthen its systems management. The Air Force reacted by creating three new organizations: Office of Aerospace Research, for basic research; Air Force Systems Command, for applied research, development, procurement, and production; and Air Force Logistics Command for logistics, supply, and maintenance.¹²

The acquisition process was significantly changed by Secretary of Defense David C. Packard in a memo published in May 1970. The memo stressed:

- Cutting out numerous layers of authority;
- Reducing directives and regulations to a minimum;
- Encouraging initiative and innovation;
- Putting more capable people into program management;
- Giving them responsibility and authority;
- Keeping them long enough to get the job done right.¹³

9. W. D. Putnam, "The Evolution of the Air Force Systems Acquisition Management," Rand Corporation, 9 (1972).

10. *Ibid.*

11. *Ibid.*

12. *Ibid.*

13. David C. Packard, "Defense and Industry Must Do a Better Job," *Defense Industry Bulletin*, 7, No. 4, 3 (1971).

By 1970, the Congress demanded a complete review of the procurement process. There had not been a comprehensive overhaul of the procurement system since the Hoover Commissions of 1949 and 1955. The procurement process was viewed as being overly complex: a patchwork of regulatory solutions to procurement problems. Expressed in the words of Chet Holifield, former member of Congress and Chairman of the Committee on Government Operations:

At a time in our nation's history when the waste of precious tax dollars by the Federal Government can no longer be quietly tolerated by the American people, it is reassuring to note that, in the area of Federal procurement, significant reforms have been, and continue to be undertaken to correct such consumption of our revenues. Although much of the waste and inequity characterizing Federal procurement may be attributed to such factors as cost overruns and performance deficiencies, i.e., problems created by internal technical judgments and therefore not easily rectified from without, a good deal of the ills attending Federal procurement may be ascribed to the system itself.¹⁴

The root cause of procurement problems was suspected to be fragmented policy, leadership, and responsibility; and an outmoded statutory base.¹⁵ Consequently, a Commission on Government Procurement was created "to study and recommend to Congress methods to promote the economy, efficiency, and effectiveness of procurement by the Executive Branch of the Federal Government."¹⁶

The 1972 Commission on Government Procurement had the most profound influence on procurement policy and the acquisition process since the Armed Services Procurement Act of 1947. Foremost among the 149 recommendations of the board was to establish a central Office of Federal Procurement Policy (OFPP) within the Office of Management and Budget, an executive office of the President. With regard to major systems acquisitions, the committee made 13 recommendations calling for an "integrated system approach" to solving major systems acquisition problems by:

- Establishing a framework for conducting and controlling acquisition programs to highlight the key decisions for all involved organizations—Congress, agency heads, agency components, and the private sector;
- Defining the role each organization is to play in order to exercise its proper level of responsibility and control over acquisition programs; and
- Giving visibility to Congress and agency heads to exercise their responsibilities by providing them with the information needed to make key program decisions and commitments.¹⁷

14. Holifield, *op. cit.*

15. Commission on Government Procurement. *Summary of the Report of the Commission on Government Procurement*. Washington: Government Printing Office, 3 (1972).

16. *Ibid.*

17. Comptroller General, *Legislative Recommendations of the Commission on Government Procurement: 5 Years Later Report to the Congress*, Washington, 53 (1978).

These recommendations became the charter of the OFPP for reconciling major systems acquisition problems. The result that was published in April 1976 as a new major systems acquisition policy was recognized as Office of Management and Budget Circular A-109.

The new policy purports to be consistent with the recommendations of the Commission on Government Procurement. The salient features of OMB Circular A-109 required:

- Top level management attention to the determination of agency mission needs and goals;
- An integrated systematic approach for establishing mission needs, budgeting, contracting, and managing problems;
- Early direction of research and development efforts to satisfy mission needs and goals;
- Improved opportunities for innovative private sector contributions to national needs;
- Avoidance of premature commitments to full-scale development and production;
- Early communication with Congress in the acquisition process by relating major system acquisitions to agency mission needs and goals.¹⁸

The events leading to the Commission on Government Procurement and OMB Circular A-109 originated as early as 1966.¹⁹ This observation suggests that it took 10 years to build up enough momentum to cause a profound change to the acquisition process. Therefore, a responsive alternative, in order to deal with even more complex issues anticipated in the future, now may be to streamline and improve what has already been established.

New Initiatives

Perhaps the "renaissance" of major systems acquisition policy is OMB Circular A-109. So far, I have surveyed the background and history of this policy. I will address the questions related to why A-109 was written: More specifically, just what is in the policy and where has it gone since April 1976? In this context, I will develop the growth of the statement of operational need (SON) and the mission element need statement (MENS). I will discuss the usefulness of competition, a key factor in implementing A-109.

As pointed out earlier, the Commission on Government Procurement is the genesis of new initiatives. According to Lester Fettig, Administrator of the Office of Federal Procurement Policy (OFPP), "One of the basic conclusions of the

18. OMB. *A Discussion of the Application of OMB Circular A-109*. OFPP, Pamphlet No. 1, 2 (1976).

19. Holifield, *op. cit.*

Commission was that all the common defects in our weapons programs—cost overruns, schedule slippages, performance deficiencies, buy-ins, bail outs, and contractual contests—were all symptomatic of the problems sewn into the program earlier at the 'front end.'²⁰

Associated with this observation were five cause factors:

- Congress was not in a position to participate in the acquisition process until a significant dollar commitment had been made. Congressional reaction was to criticize the DOD by detailed intervention across the broad spectrum of the acquisition process;
- Programs were seen overlapping and duplicating one another. More programs were being initiated than logically could be produced and supported once deployed;
- Innovation and our ability to apply new technology was viewed as being hindered by a lack of competition early in the process. The apparent shortcoming resulted in a premature commitment to a single kind of weapons system—one which demanded higher levels of performance out of an old approach or a familiar weapon;
- Test and evaluation procedures were erratic. Greater emphasis on demonstration and the concept of "fly-before-buy" has shifted to the point of criticism for being over zealous by demanding stringent test procedures; and
- Programs were shredded, diffused, and managed by more than one program manager, programs were stopped and started, and program schedules often changed resulting in delayed deliveries and higher costs.²¹

Actions occurred to remedy these problem areas, particularly with regard to competition. First, Public Law 93-400 was enacted in 1974 creating the OFPP. The OFPP is chartered with responsibility for making acquisition policy reforms such as OMB Circular A-109. Second, a related Public Law 93-344, known as the Budget Reform Act of 1974, established a "mission budgeting" requirement. Both of these laws influence the acquisition process.

Competition

The objectives of competition are to lower program costs, increase technological innovation, and assure fairness in distribution of contracts. The degree to which competition does or does not do these things is a matter of debate. For example, awards through competition take more time to administer.

20. L. A. Fettig, A Submittal to the Subcommittee on Research and Development, House Committee on Armed Forces, OFPP, 9 (1977).

21. R. J. Lorette, "Major Acquisition Problems, Policy, and Research," *National Contract Management Journal*, 10, No. 2, 8 (1976-1977).

This causes programs to be more expensive simply by virtue of inflation added to an extended contract start date. Technological innovation may, in fact, be inhibited because a contractor may not come forward with company secrets if there is a danger of technical transfusion in a multiple award competitive follow-on scenario. Finally, fairness in the distribution of contracts can be disturbed by political competition. These thoughts do not suggest that competition should be discarded as the preferred method of systems acquisition. On the contrary, competition is highly effective, but only if it is applied with specific objectives in mind.

The application of competition in the past has not sufficiently reduced large cost overruns, late deliveries, or poor system performance. Perhaps this situation is leading to disenchantment with competition. In a lecture to the Air Command and Staff College, the OMB indicated that the frequency and total dollars expended through the use of competition is declining. This trend may reflect a decreased competitive base brought about by the highly complex and specialized technology required to produce a variety of modern weapon systems. Or, it may show that competition is not the most desirable method of acquisition because the results do not measurably demonstrate the advantages over a well-managed selected source procurement. Whatever the cause, traditional sentiment for competition should be challenged in the interest of designing a more efficient acquisition process.

Dr. Richard J. Lorette, in his article, "Major Acquisition Problems, Policy and Research," suggests eight benefits that new alternatives to systems acquisition should provide:

1. Eliminate the need for contractors to deliberately underbid in order to win a contract;
2. Decrease drastically the time between DSARC I and initial operational capability by reducing the amount of time required to select the prime contractor for the next major award;
3. Reduce the millions of dollars of "out-of-pocket" costs involved in preparing RFPs and in evaluating the responses to the RFP;
4. Allow us to retain the effective management techniques that we have developed and implemented while discarding those that do not meet our needs;
5. Assure the survival of a large enough defense industry resource base to protect our long-run national interests;
6. Motivate the contractors to move toward more realistic bids while increasing our own ability to assess accurately the validity of their estimates;
7. Encourage all responsible contractors to have a part in providing the system or equipment that their capabilities will permit;

8. While guaranteeing 7 above, still monitor carefully the contractors performances so as to assure the American taxpayer that his dollars are buying the best available defenses at a reasonable cost.²²

Dr. Lorette suggests that competition may be a real cause for many overruns. He says, "Their (contractors') best judgments are modified considerably today by cost reductions considered mandatory if the contract is to be won. These reductions are based on industrial intelligence sources that reveal 'ball park' approximations of what competitors are likely to submit as the price and educated guesses as to what Congress and the military services are likely to buy."

Furthermore, he proposes an alternative to competition in the traditional sense by making contract awards based on a rotating system. He points out that most of our major aerospace contractors are equally qualified and able to build anything the services want with relatively equal ability. This suggestion points to the infallibility of competition in the purest sense.

Theoretically, superior companies will just out-perform and out-bid their competition. In the end, such "unfettered competition could lead to attrition among prime contractors."²³ As expressed by Senator Otis Pike, "If we really try to make real competition in all our procurements, it is perfectly possible that if the competitors are honest one company is going to win them all. I greatly believe in competitive procurement. But I also see an awful danger, too. Some companies are just plain better than others are. I don't know what we can do about it."²⁴

The real world competitive environment does not lean in the direction of Senator Pike's fear. Most defense companies are very selective in deciding which programs will be pursued. They do not possess unlimited resources to bid and manage every program for which each is qualified. Consequently, there is every opportunity for companies to break into a new field if they have an aggressive design and proposal preparation team. The objectivity of the source selection process follows to protect the competitive base from total encroachment by dominant players.

Government source selection teams evaluate what contractors put in their proposals. A contractor's ability to write a winning proposal will vary depending on such conditions as demonstrated capability to perform the task, timing of the new business, and availability of key people. These considerations contribute to a natural distribution of contract awards. Another reason why the competitive base is not likely to be reduced is distributional considerations.²⁵

Source selection decisions are sometimes disturbed by "political competition." Michael D. Rich, in his report, *Congress and Competition*, pointed to the source

22. M. D. Rich, "Congress and Competition," Rand Corporation, 7 (1977).

24. *Ibid.*

25. *Ibid.*

of this term. Senator William Proxmire, when asked if there was any competition in bidding for the DD-963 destroyers or whether the awards were made on other grounds, replied, "I guess polical competition."²⁶ In another example, he cites Representative Charles Wilson calling "for award of the B-1 contract to North American Rockwell (a constituent) on the grounds that 'all recent procurements had gone elsewhere.'"²⁷ Congress relies on the flexibility of the procurement process to use "defense spending as a tool of fiscal policy and social engineering and aversion to attrition of major defense contractors."²⁸ For these reasons and those cited above, real competition has not been a frequent occurrence. Ostensibly, it has been misapplied.

The OMB Circular A-109 initiative emphasizes a revolutionary application of competition. The new application stresses mission-oriented competition rather than competition constrained to a specific weapons type. The drafters of A-109 contended that real competition in the past was restricted by over specifying needs in the initial solicitation. This contention is better expressed by Robert B. Hall, assistant director, GAO Procurement and Systems Acquisition Division. In his article, "Reinstating Competition in Systems Acquisition: A Four-Dimensional Framework;" he argues,

... our statement of the requirement of the system need is couched in such a way as to restrict real competition and generate high and uncontrollable cost. . . when the buyer specifies the system solution in detail at the very outset of development, he chooses the particular kind of system, picks, arranges, and sizes the technology in advance, and specifies system performance requirements. In so doing, he presets about 80 to 90 percent of the ultimate program costs.²⁹

Consequently, the system specification had to be comprehensive and visionary. Otherwise, there was no room to adjust for changes in the design without incurring a cost overrun, schedule slip, or program descoping. Competition injected into the acquisition process after selection of system performance characteristics did not stave off the inherent fate of an ill-conceived program.

The mission-need approach may revitalize competition as the preferred method of systems acquisition. In any case, OMB Circular A-109 means to put emphasis on competition continually through the system acquisition process.³⁰ This translates into a potential for increased program costs and delayed initial operational capability if competition is applied without a specific objective and with flexibility.

26. *Ibid.*

27. *Ibid.*

28. *Ibid.*

29. R. B. Hall, "Congress and Competition," Rand Corporation, 7 (1977).

30. Fettig, *op. cit.*

The program manager should demonstrate the specific benefits to the program for any method of procurement: competition or selected source. This action may be accomplished through the business strategy process. Currently, it only is required to justify a selected source procurement. A selected-source memorandum containing specific rationale must accompany each approved acquisition plan prior to receiving business clearance in order to issue a selected-source request for proposal. On the other hand, no specific justification is required when using competition. Given the potential for program protraction and increased costs resulting from competition, better rationale should be required for competition. The objective is to optimize the benefits from real competition with that of an acceptable program schedule and a delivery date. This goal is achieved through a more flexible-use competition.

Associated with the mission-oriented need is increased visibility of Congress in the acquisition decision process. As mentioned earlier, Congress is now actively involved in the acquisition decision cycle through a budget process entitled "mission budgeting."

Mission Budgeting

The Budget Reform Act of 1974 requires agency budgets to be presented in terms of needs, missions, and programs.³¹ Indeed, beginning with the FY 1979 budget submittal, "All agencies will, as part of the budget process, present budgets in terms of agency missions in consonance with the Congressional Budget Act of 1974 In so doing, the agencies . . . must separately identify research and development funding for the general technology base in support of the Agency's overall mission, the specific development effort in support of alternative system design concepts to accomplish each mission need, and full-scale development."³²

Heretofore, budgets were broken out by program element, project, and task. These breakouts were not specifically associated with national objectives and needs. This has been a sore spot with Congress; has frustrated their ability to be involved in the decision-making process.

The answer to congressional frustrations is mission budgeting, an attempt to organize the budget in a top-down view of national needs and agency missions, programs, and activities. The objective of mission budgeting is to get Congress to reconcile the appropriation in support of approved mission need. For this reason, both A-109 and mission budgeting affect the length of the acquisition cycle. This is because MENS approval only means a program competes for funds.

31. Fettig, *op. cit.*

32. OMB Circular No. A-109. *Major Systems Acquisitions*. Washington: Executive Office of the President, 11 (1976).

The availability of funds at Milestone 0 is a key factor in speeding up the acquisition process. Currently, funding will not be available for program initiation until after the new approved program has finished the planning, programming, and budgeting cycle, competed for funds within the Congress, and is authorized as part of the next FY appropriation. New programs need to be funded at Milestone 0 if there is to be any substantive shortening of the acquisition cycle.

A-109 And Applied Source Selection Procedures

The purpose of this section is to summarize the results of a test of OMB Circular A-109 against present acquisition strategy, procedures, techniques, and constraints. The exercise was an experiment designed to artificially determine how A-109 will impact the front end of the acquisition process. The approach was to build up an event chart that included the major tasks necessary to process a competitive source selection. The objective was to arrive at a time required to proceed from Milestone 0 to Milestone II of the DSARC. In this way, it is possible to compare the probable result of A-109 with the previous estimates for completing the acquisition cycle. An artificial requirement was used because existing program experience with A-109 is limited.

Prior to starting the experiment, some ground rules were necessary. First, the artificial program had a business strategy requiring maximum use of competition. Maximum use was defined as three consecutive source selections—one for each DSARC phase. Second, the acquisition strategy called for one or more contract awards for the first two phases. Third, no delays were added because of program decisions or budget cuts. Fourth, the artificial program was a low technical risk. Finally, regulations and procedures were those primarily used by the Air Force. With this understanding, let us delve into the systems acquisition process.

The initial step in the acquisition process within the Air Force is to identify a need and formalize it in a statement of operational need (SON). This task is performed by a lower echelon within the major air command that will eventually be the user of the new system. When the SON is approved by the major air command, it is forwarded through Air Force Systems Command for staffing at Headquarters, USAF. This step involves validating the SON and determining if a MENS is required.

The MENS development process results in a recognizable starting point that authorizes the implementing agency to begin systems concept development. The recognizable starting point is when the Secretary of Defense approves the MENS, known as Milestone 0.³³ Adding a MENS to the front end of the acquisition process seemingly adds more time to the acquisition cycle. One cannot be certain

33. DODD 5000.1. *Major Systems Acquisition*. Washington: DOD, 6 (1977).

about this because actual program start dates in the past were not easily definable. Currently, the MENS process outlined in AFR 57-1 requires about 185 days. Reportedly, the actual track record is more like 210 days. In the future, less time may be needed as more proficiency is gained while developing the MENS; however, the greatest problem and potential for a delay in the acquisition process comes after Milestone 0.

Ideally, alternative system design concepts should be initiated concurrently with the Milestone 0 decision. But they are not. Milestone 0 is a decision point only, because no funds are available. Consequently, a new program must compete for funding within the planning, programming, and budgeting system (PPBS).³⁴ If the Milestone 0 decision occurs concurrently with the program objective memorandum (POM), the earliest date funds can be available is 14 months later. More pessimistically, if the new requirement misses inclusion in the POM, the delay for funding could be as long as 24 months. This is a major deficiency that must be overcome if any significant progress is to be made toward shortening the acquisition cycle. Once the program is funded, official program direction is given to the program manager to start.

An important part of the systems acquisition process begins with planning. Prior to RFP release for a major program, an acquisition plan, a source selection plan, and a source selection guide are developed. In addition, the systems program office develops a program management plan addressing the overall program objectives and responsibilities. The SPO also develops the RFP package containing the statement of work, contract data requirements list, evaluation criteria for award, specific instructions to potential offerors, contractual terms and conditions, and security requirements. Particular attention will be given to what is in these documents, how they are developed, by whom, and for what purpose. First, the prerequisite to starting the acquisition cycle is to have some kind of overall strategy.

BUSINESS STRATEGY

The conduct of business strategy meetings is crucial to getting off on the right foot. All participating activities need to be made part of the initial decision process. In so doing, the business strategy meetings becomes a forum for evaluating problems and expressing alternative points of view from all disciplines and special-interest offices. It serves as a sounding board to test new ideas and alternatives. The outcome is the basis for writing the approval documents that follow. Therefore, it is essential to get a group consensus on the general plan for proceeding. If this does not happen, expect delays to occur during the ensuing ap-

34. W. C. Svetlich, "The Systems Acquisition Process in the Department of Defense and Its Limitation," *National Defense Management*, National Defense University, Washington, D. C. (June).

proval process. At this point, the experiment turned to an assessment of the documents and events leading to contract awards for alternative system designs.

The first objective is to prepare the RFP. This task is, by far, the most critical to the success of the total program. If the job of putting together a new weapon system is not done correctly in the initial RFP preparation, no amount of competition or management will completely correct it later. Consequently, the events that make up the RFP preparation process must be held sacrosanct. Unfortunately, they are not, as is illustrated in the analysis of the approval documents required in planning for an RFP release. As noted earlier, these documents include the acquisition plan, source selection plan, and the source selection guide. Separate from these documents, but very much a part of the SPO activity, is the program management plan. I will attempt to orchestrate the real-world events that bring these plans into existence. This exercise will illustrate potential alternatives for reducing workload and shortening the acquisition cycle. First, let us discuss the program management plan and its relationship to the acquisition plan.

PROGRAM MANAGEMENT PLAN

The program manager is responsible for developing the entire systems acquisition strategy.³⁵ This task is communicated to other agencies in the program management plan. By definition the program management plan is, "The document developed by the Program Manager (PM) with assistance from participating commands. It shows the program objectives as well as the integrated time phase activities and resources required to complete the task specified in the PMP The PMP . . . is directive on participating commands."³⁶

Unfortunately, not everyone complies with the requirements of this document. The program management plan is frequently overtaken by events resulting in changes to the program without regard for what is in the plan. This fact is borne out by reviewing a number of instances where the Inspector General has criticized program offices for out-of-date PMPs. The specific criticisms indicated that the PMPs are not consistent with the acquisition plan.

A significant obstacle to overcome in preparing for any new program is to get collateral agencies and special interest groups motivated to support in the writing of program plans. This task could be enhanced by combining the functions of the acquisition plan and the program management plan into one master plan. Heightening the importance of planning in this way will force a wider range of participating agencies into the planning process. Furthermore, it will reduce inconsistencies and duplication, drastically reducing administrative preparation time. Finally, the most significant reason for combining the two plans is that it would focus the acquisition community on one acquisition strategy, forcing decisions to occur earlier.

35. OMB, *op. cit.*

36. AFR 800-2. *Acquisition Program Management*. Washington: DAF 38 (1977).

ACQUISITION PLAN

The objective of writing the acquisition plan is to get a secretarial determination and findings (D&F) and final procurement (Acquisition) action approval. These documents provide the legal (statutory) authority for the program manager to begin negotiations. Therefore, release of the RFP cannot occur until the determination and findings is received. Within the Air Force, this process requires about 185 days. Actual experience indicates this objective is optimistic. Acquisition plans consume from 6 to 9 months on the average. The primary reason for this much time is that the senior service's acquisition executives use the acquisition plans as control documents. As a result, they are scrutinized extensively by several layers of service staffs. For example, they are reviewed at least 14 times by the Air Staff and the Office of the Secretary of the Air Force. This study shall not rationalize the necessity of this time as it is the prerogative of the senior service acquisition executive, and partly a legal requirement. I believe that combined and consolidated planning practices will meet with less objections in the review and approval process. In addition to the determination and findings, an approved source selection plan is required by AFR 70-15 prior to RFP release.

SOURCE SELECTION PLAN

Once the acquisition plan is out the door, the next major task is to write the source selection plan. According to AFR 70-15, the source selection plan is intended to act as the key document for initiating and conducting the source selection process. It is normally written by the same person who wrote the acquisition plans. It follows the same coordination cycle as the acquisition plan and takes the same amount of time, 6-9 months. Although the source selection plan is prepared for all competitive procurements, it must be prepared (and has in the past been submitted to the Secretary of the Air Force) when the plan addresses a major program or any part thereof. The Secretary only reviews the plan; his review initiates source selection procedures by identifying the level of source selection authority. The source selection authority is normally the individual who ultimately approves the source selection plan. This action must occur prior to release of the request for proposal. The source selection plan will not be examined more critically.

Early identification of the key members of the source selection organization is absolutely crucial to ensure the best possible preparation for source selection, evaluation, and subsequent follow-through after contract award. Predictably, when this is not done, there will be oversights resulting in a minimum 6-week delay and, probably, hasty program strategy decisions that ultimately jeopardize the integrity of the whole program. This is borne out by reviewing lessons learned from significant Air Force competitive procurements. Frequently, chairmen of the source selection evaluation boards indicated that failure to establish the source selection organization early caused oversights and delays.

As the time moves closer to RFP release, the workload increases. An efficient organization is required to offset the brunt of this workload. Most likely, the whole project office at this point consists of one or two people. The project officer(s), along with the contracting officer and "buyer," are the principal actors that keep the program together until the source selection organization begins to function. However, if this happens too late, the principal actors are put in a position of having to make decisions they should not be making; or of getting someone to make a decision who is not authorized to do so because a source selection board has not been established. Potential members work in *ad hoc* groups without support of dedicated leadership until the source selection authority and the source selection evaluation board chairman are appointed. This is because nothing can formally happen until the source selection plan is returned from the Secretary of the Air Force, granting authority to establish a source selection organization.

I contend that the source selection plan is made out to be far more important than it really is. The only thing it does is provide a mechanism to delegate source selection authority from the Secretary of the Air Force to a lower level of command. It also approves establishing a source selection organization. However, the present methods for writing and coordinating the source selection plan cause these events to happen entirely too late. It would be more expedient to accomplish these administrative appointments in some other way. Of course, the source selection plan has undergone a thorough review prior to any action by the Secretary of the Air Force. If the plan is deleted, how does the Secretary determine the adequacy of the source selection planning? The answer to this question will be developed under the ensuing discussion of the request for proposal.

SOURCE SELECTION GUIDE

From my point of view, the most useful product developed by the source selection evaluation boards is the source selection guide. That guide provides each member, evaluator, and advisor of the source selection organization *specific* operating instructions. It contains a summary of the overall source selection process, a summary of regulatory procedures, source selection organization, milestone schedule, forms, evaluation criteria, standards, and others. Essentially, it has everything, and more, that is now included in the source selection plan. For this reason, what is now called the "source selection guide" should be renamed "source selection plan"—assuming the source selection plan used for obtaining a source selection authority, and authority to establish a source selection organization, is rescinded.

REQUEST FOR PROPOSAL

The hinge-pin around which all preceding and follow-on events revolve is the initial RFP. The initial RFP is even more significant under OMB Circular A-109

because of the potential for multiple and consecutive competitive awards. This award approach significantly complicates the source selection process. Therefore, extreme caution is required when structuring the first RFP even though it is only for conceptual paper studies. Whatever the rules set forth initially, industry will expect consistency later on. Changing the ground rules as the acquisition process proceeds from one RFP cycle to the next can scuttle the whole program with protests and threats of protests. This can be avoided by placing more emphasis on scrubbing the initial RFP for alternative system designs.

It is the policy of Air Force Systems Command to conduct a formal review of RFPs prior to release. These reviews are more commonly referred to as "murder boards." This title is most appropriate because the opportunity exists for all participants to thoroughly ring out weaknesses and make appropriate additions and/or deletions to the RFP. Consequently, the murder board is a valuable mechanism for testing the proposed acquisition strategy. This is the best time to make sense out of the statement of work, the evaluation factors for award, and the standards to be used in measuring the contractor's proposal against those factors. This argument supports the justification for deleting the source selection plan in that the evaluation factors are sometimes changed at the murder boards. Therefore, the source selection plan contains nothing more than draft evaluation criteria. With the advent of OMB Circular A-109, greater emphasis should be placed on murder boards.

Unforeseen problems sewn into the initial RFP may constrain possible courses of action in subsequent phases for demonstration and validation or full-scale development. For this reason, I would encourage a policy to conduct murder boards at the major air command level for all RFPs, regardless of dollar amount, when the initial RFP is in response to a MENS, and a business strategy contemplates multiple awards. Once the RFP is adjusted to the recommendations of the murder board, it essentially is ready for distribution. This brings us to a discussion of source selection procedures.

SOURCE SELECTION PROCEDURES

The framework for conducting competitive source selections is a good one. There are, however, two areas affecting source selection procedure which, if modified, could save time. These are the source selection organization itself, and the reports that are written by the source selection organization.

The source selection organization consists of the source selection authority, source selection advisory council, and a source selection evaluation board. The source selection advisory council is staffed by high-level military officers and civilians. They are advisors to the source selection authority; they analyze the results of the findings of the source selection evaluation board, and write a report. My experience, further substantiated by lessons learned from other source

selections, suggests that the source selection advisory council functions more as an advisory group than a functional group. The absence of the SSAC has resulted in streamlining the decision process by keeping responsibility below the source selection authority level. Another time-saving consideration might be to eliminate, or combine, source selection reports.

AFR 70-15 requires four written reports to support the findings of the source selection organization. These include the source selection advisory council analysis report, the source selection evaluation board evaluation report, a summary evaluation board report, and the decision document. The need for all of these reports should be challenged because there are probably only three or four people on the evaluation board that write all the reports (including the advisory board who write council analysis reports), and prepare all the briefing charts. It takes time for the same people to deal with all the paperwork generated to support the decision document. The decision document becomes the single most important paper written, and supports the entire proceedings up to this point. Therefore, the advisory council report seems to be redundant; it is more efficient to write only a source selection evaluation board report and a decision document.

At this point, the experiment turned toward making an assessment of the total time required to complete the acquisition cycle through DSARC II. Given the original assumptions, it was estimated that 93 months would be required. This included the amount of time for developing the statement of need, MENS approval requirements, and conducting three consecutive multiple award competitive source selections. The time required to reach DSARC I was 42 months. To this time, it was necessary to compensate for program uncertainty. Based on earlier studies,³⁷ the 42-month-period was multiplied by a factor of 1.5—totaling 63 months. The period from DSARC I to DSARC II was estimated at 30 months, developed from an analysis of real-world programs performed by the 1977 Defense Services Board.³⁸ As a result, no additional time was added to this figure for program uncertainty.

I have sought to predict the time required to accomplish multiple consecutive competitive procurements as envisioned under OMB Circular A-109. It is not the purpose of this study to justify the need for this amount of time; rather, if the time is acceptable, A-109 can maintain the *status quo*. On the other hand, if this time is deemed excessive, this study offers recommendations and alternatives to shorten it.

Recommended Solutions

I have previewed problem areas that lengthen the systems acquisition cycle, but there is no value in identifying problem areas unless some attempt is made to

37. Peck, *op. cit.*

38. Report of Defense Science Board, *op. cit.*

resolve them. Therefore, in this section I will recommend possible solutions in a format that follows the organization of key points discussed previously.

Problem: Approved programs at Milestone 0 are not funded. No mechanism is established to fund new major programs outside of the PPBS. As a result, there is a built-in 14-to 29-month lag in program initiation.

Ideally, the start of a new program should occur as soon as possible after Milestone 0. This objective is theoretical and probably could never be achieved because no formal organization (SPO) exists at this time; no program strategy has been developed, and funds are not readily available. From a practical point of view, program initiation should start not later than 6 months after Milestone 0. The key to avoiding initial program delay is to get funds up-front where they can be used immediately. This would require by-passing the PPBS. Such action need not be viewed as an effort to deceive and manipulate the PPBS with devious intent. On the contrary, there are workable alternatives that may serve to enhance the PPBS. In any case, we are not talking about very much money in relation to the total DOD budget. So what are some possible alternatives?

One mechanism used in the past has been reprogramming. This means that a service must seek funds from other parts of its approved budget, and at the expense of some other program. Reallocating funds in this manner is considered to be "dirty pool" because it translates into increased overall program cost, overruns, or cancelled programs.³⁹ However, this alternative nullifies any management initiatives achieved to that point. Therefore, reprogramming should not be pursued as the permanent fix to this budget problem.

Another alternative is to establish an OSD contingency fund.⁴⁰ This fund would be a separate program element line item to be established in the DOD budget and forecasts by each service in the program objective memorandum. The contingency fund would be used to support a new program until dedicated resources are available in the normal PPBS cycle. However, a contingency fund might perpetrate greater delays should Congress elect to cut the DOD budget—the fund being an easy mark. A better solution should be permanent.

Why not allow for industry support of alternative system designs using independent research and development (IR&D) funds? The framework and legal bases for funding alternative system designs may already be in existence. The Military Procurement Act of 1971 (Public Law 91-441, Sec 203) provides the rules for using IR&D. It requires the Secretary of Defense to determine if efforts generating IR&D costs have a potential relationship to a military program. Program initiation, being in direct relation to an approved MENS, supports this criteria. Control and visibility of funds are maintained because the Secretary of

39. Svetlich, *op. cit.*

40. M. G. Richardson, "OMB Circular A-109, What It's Done." Panel No. 5, Defense Systems Acquisition Conference, Hershey, Pa., 2 (1978).

Defense must submit an annual report to Congress indicating how IR&D funds are spent. Advance IR&D agreements and detailed company plans already provide the necessary government-industry interface, and controls to manage program initiation with IR&D funds.⁴¹

Solution: Fund alternative system design concepts with IR&D money. Subsequently, plan to fund program validation and demonstration through the normal PPBS cycle.

Problem: OMB Circular A-109 implies that a program manager should be appointed as soon as possible after Milestone 0.

The program manager and SPO organization should not be identified until after a specific weapon system has been determined. In order to be effective, the program manager/SPO team should have expertise in a particular system such as aircraft, missiles, ship building, or electronics. Furthermore, formally establishing a SPO too early will create a built-in constituency for a program that perhaps should be cancelled.

Solution: Delay appointing program managers until a system design alternative is selected. Support alternative system design source selection with matrix organizations and laboratories.

Problem: Present systems acquisition plans are redundant and are reviewed excessively.

Basically, the program management plan, acquisition plan, source selection plan, and source selection guide contain redundant information. They require many reviews before approval. Major delays occur waiting for plan approvals and business clearance.

Solutions: (1) Combine the program management plan and the acquisition plan into one document. Call this document a program acquisition plan.

(2) Delete the requirement for acquisition plans in support of secretarial determination and findings for program initiation.

(3) Delete the requirement for a source selection plan (SSP). Present contents should be combined into the acquisition plan and the source selection guide. Deleting the SPP means appointing a source selection authority and authorizing a source selection board along with MENS approval (Milestone 0).

(4) Provide a secretarial determination and findings for program initiation along with MENS approval. This recommendation is presented and required for statutory approval and expedient release of the standard RFP package described below.

(5) Develop and publish a common source selection guide. Make it the operating manual for all source selection organizations.

(6) Revise DODD 4105.62 and AFR 70-15 to implement 3 above.

(7) Revise the DARS to implement 1, 2, and 4, above.

41. DOD Military Procurement Authorization Act of 1971, Public Law 91-441, Section 203.

Problem: Source selection organizations are not established early enough. Their structure needs to be more efficient.

The source selection organization, including the source selection authority, the source selection evaluation board chairman, recorder, and panel chairman should be appointed not later than 4 months prior to RFP release. This will reduce the possibility of oversights that frequently contribute to delays and unworkable contract relationships. The need for a source selection advisory council (SSAC) is questionable as a line function of the source selection organization.

Solutions: As above, appoint the source selection authority, *et al*, with MENS approval. Further, modify AFR 70-15 to delete the SSAC as a *line* function in the source selection organization structure.

Problem: Multiple consecutive competitive procurements require more people to manage them and can cause program problems later if the entire program is not strategized properly prior to the RFP for alternative system design concepts.

Personnel resources are difficult to obtain at the time of concept development when most of the activity relative to planning and source selection is taking place. Short-fused milestone objectives are required to prevent gaps between phases, and to ensure R&D funds can be obligated and spent within the fiscal-year time constraints. Failure to keep up with the milestone events or to obligate funds will lead to delays and perhaps unfounded crises management.

It is recommended that the availability of personnel resources be enhanced through a matrix. This action will alleviate some of the burdens and "growing pains" associated with the newly formed SPO. There are other actions which could save time and people, if adopted.

Solutions: (1) Place greater emphasis on business strategy meetings and murder boards. Both should be mandatory for major programs regardless of the dollar amounts. That is, they should be required for low-cost conceptual studies if concept development contains instructions and criteria for subsequent competitive phases leading to a major program.

(2) Develop a standard RFP package for alternative system designs. Include in the standard package rules for subsequent competition, instructions on proposal formats, deliverables, specific evaluation criteria for the instant procurement and general evaluation criteria for subsequent criteria, a standardized statement of work, standardization contract data requirement list, and a common model contract with appropriate clause to accommodate allowance for recovery of IR&D expenses. Standard RFP packages can be developed because deliverable products should be the same since they will address mission need instead of performance specifications. Leave only space to describe the given mission need. This action will reduce workload and speed up the review process prior to RFP release.

Problem: Reporting requirements for major source selection involving both a source selection advisory council and a source selection evaluation board are confusing and redundant.

Eliminating the source selection advisory council will solve part of this problem. Only a few members of the evaluation board write the reports, decision document, and prepare briefings; it has to be that way to ensure fairness and traceability from the evaluators work sheets, through the various area and item summaries, to the decision document. However, it takes time to wade through the detail, and report the findings of the evaluation board. About 2 weeks can be saved by eliminating unnecessary, redundant reports.

Decision documents are difficult to write. They must clearly explain the basis for the final decision, and must avoid references to any other report or document. Consequently, the sensitive nature of this document requires legal skills beyond the ability of most evaluation board members.

Solutions: (1) Revise AFR 70-15 to delete requirements for an SSAC analysis report and a summary SSEB report. Provide more definitive instructions on format and content of the SSEB report and decision document.

(2) Assign a lawyer as a working member of the SSEB. The primary function of this person will be to write the decision document.

Problem: The decision process is overburdened with levels of staff reviews. Within the DOD, each hierarchy has its staff.

Individual staffs, and staffs within staffs gradually grow and increase the time required to complete the review process. Staffs should have three functions: Provide advice, remove barriers, and fight fires. If, in fact, more barriers are being created than removed, either the multilayering of staffs with the DOD is counter-productive, or the field is ill-adapted to be responsive to staff-review expectations.

Solutions: (1) Perform a top-down trace of every policy, directive, regulation, supplement, and operational instruction. Challenge the necessity for all of them. Remove any chaff.

(2) Review position descriptions. Determine how many are justified based on reviewing acquisitions products above the major air command level. Delete these tasks from position descriptions.

Problem: Training in system acquisition procedures is inadequate.

Many younger project officers do not know how to start the competitive process. This occurrence is more predominate for less-than-major programs, but it is indicative of inadequate basic training. Competitive source selections do not occur often. Even the more experienced people, and those who have been involved before, are not proficient in "how-to-do-it" skills. Therefore, standardizing much of the process into handouts, and eliminating anything unnecessary, is desirable.

There is a need for more training of higher quality and longer duration. The separate service procurement schools should be consolidated into a center for professional development of acquisition specialists. Higher standards for individuals should be required before they can be assigned increased responsibility.

There needs to be a meaningful set of specific, criteria-setting standards for levels of expertise and achievement. People need to know where they are going, what they need to get there, and when they are expected to meet specified objectives.

Solutions: (1) Consolidate all systems acquisition training at one location. Both technical and contract specialists should attend. Training should last a minimum of 12 months, 6 months operational training and 6 months education-with-industry.

(2) Establish comprehensive training requirements, and upgrade criteria for technical and contract specialists. Training manuals should be developed by the major air command and issued to newly assigned personnel. Training progress should be monitored at both NAF and major air command levels, as well as by individual supervisors.

The acquisition process length can be drastically reduced if these recommendations are adopted. The adjusted reduction in time required to reach DSARC II, using these recommendations, is approximately 26 months. Of course, any action to by-pass parts of the total, multiple-consecutive-competitive process will save even more time. Reduction of time will not occur, however, unless all levels of management within the DOD are required to get on with it.

Conclusion

The executive systems acquisition policy OMB Circular A-109 was "designed to assure the effectiveness and efficiency of the process of acquiring major systems."⁴² Experience with this policy has not progressed enough to demonstrate its total impact on the length of the acquisition cycle. Like past policies of total package procurement (fly-before-buy, full-scale prototyping, etc.), A-109 was written for some other purpose than saving time. In the case of A-109, it was to put discipline into the front end of the cycle; in fact, A-109 may actually lengthen the acquisition process. This potential is not directly an inherent part of the policy *per se*; rather, it is because the policy was placed on top of existing directives and regulations for acquiring funding, business clearance, and source selection procedures. The details embodied in A-109 will be difficult to achieve unless the entire system for manually processing documents is *forced* to be more efficient.

OMB Circular A-109 will not work unless it is *made* to work by genuine support, from the bottom up. To begin, emphasis and greater priority should be given to training and indoctrination at the lowest working levels. The word needs to get to a greater cross section of people who make the acquisition process move, not just the fortunate few who attend high-level DOD schools. The time

42. Report of Defense Science Board, *op. cit.*

element will take care of itself if the system can be made to operate more efficiently. Beyond the individual commitment, there needs to be a greater sense of urgency.

The threat to national security today is probably greater than ever. Consequently, new weapon system requirements that are justified and approved through mission area analysis and scrutinized in the MENS approval process require a certain degree of protection. Indiscriminate budget cuts, verbal attacks, or political sand-bagging should not be tolerated after DSARC I without supporting analysis equivalent to that supporting the MENS. This protection might come by way of artificial urgency criteria.

In the long term, the acquisition process might be matched to better coincide with national policy objectives. These objectives, combined with well-established (published) doctrine and strategy, become the pacing element and measures by which new weapon system commitments are resolved; an artificial urgency-generator system. Within this system, the acquisition cycle must be made to function in support of time constraints that are more adamantly established in the text of the national policy objectives. Such an idea would be a major change from our present emphasis on competing our systems within the budget cycle to a system that competes weapons requirements better oriented toward strategic doctrine. Unfortunately, such alternative philosophies are not likely in the near future.

Over optimism and expectation of great strides toward shortening the acquisition cycle will cause disappointment. For example, it took 10 years from the initial idea to the publication of OMB Circular A-109. The lesson learned from this observation suggests that near-term improvement for shortening the acquisition cycle are more likely to occur by changing existing procedures than by making new ones. These are the tasks and procedures performed by each operative involved in systems acquisition, from preparing a statement of operational need to contract award.

My purpose has been to analyze the acquisition process within the context of OMB Circular A-109. Using existing procedures, it became apparent that the acquisition process may be longer if competition is carried all the way to DSARC II. From my experience with the competitive source selection process, and from those lessons learned by others, recommendations were made that offer alternatives that can be used to shorten, by approximately 26 months, the front end of the acquisition process. These recommendations are not by any means comprehensive. In fact, they barely scratch the surface and may not be totally workable as presented. But, at least they should be used as a catalyst to stimulate other ideas.

Finally, you recognize two points: First, the task of shortening the acquisition cycle will never be completed; second, you must continually tap your personal knowledge and seek out those alternatives that still exist within the knowledge of the acquisition community at large. ||

Shortening the Acquisition Cycle

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Augie G. Martinez

Shortening the acquisition cycle is becoming an obsession within the Department of Defense (DOD), the office of Management and Budget (OMB), the Congress, Office of Federal Procurement Policy (OFPP), industry, and numerous societies. The undertaking is by no means easy; countless efforts have been made by people from all walks of life.

As yet, it is difficult to measure the success gained from papers, new policies, and revised regulations. The procurement cycle for a major system acquisition has jumped from 6-7 years to 10-18 years, depending on your point of view. Some hard-line members of the establishment feel the addition of OMB Circular A-109 (centralization of regulations) will add to the time it takes to acquire a major system. Regardless of your point of view, the only sure way to improve the acquisition process is to get involved by making recommendations that will encourage and stimulate others to do the same. This year the buzz words for shortening the acquisition cycle are flexibility, consolidation, concurrency, and increasing program manager authority.

When all is said and done, we can be sure of only one thing—there will be an acquisition system of sorts that will require a continuing look from all of us. The game remains the same; only the players change.

Can the Acquisition Cycle Be Shortened?

The intention is to investigate ways to shorten the acquisition cycle. We desire to minimize the potential delays in technological progress, to reduce cost to both government and contractor, and to encourage competition with the time and resources required to stay with a negotiated procurement. The continuing increases in today's inflation rate will mean the research, development, test, and evaluation FY 1979 budget of \$12.5 billion will probably buy less than the \$11.3 billion budgeted in FY 1978.¹ There doesn't seem to be any relief in government expenditures in the near term.

On April 6, 1978, Dr. William J. Perry, Under Secretary of Defense, Research and Engineering, presented his concern to the Subcommittee on Research and Development of the House Armed Services Committee. Dr. Perry's message centered around the vital challenges facing the development of our major system acquisition policy. He felt that we should work together to shorten the length of

1. Electronics Industries Association (EIA), *Ten Year Forecast, 1978-1988*, October 24, 1978.

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the acquisition cycle.² The Defense Science Board Summer Study, 1977, found that the time period between Milestone 0 and initial operating capability (IOC) was reaching 10-18 years instead of the usual 6-7 years.

The trend in the acquisition life cycle has been on the rise; the Congress, OMB, the services, industry, and countless associations have concentrated on ways to streamline the DOD acquisition process.

The OMB Circular A-109 was intended to provide competition for developing a solution to satisfy a recognized mission need. This "front-end" review is really a "go" decision for identifying and exploring alternative solutions. It was hoped this enhancement of competition would eventually lead to a shortening of the acquisition process. At this time, the only conclusion is that the Defense Acquisition Executive (DAE) and the Secretary of Defense recognize that a deficiency or need exists, but the process remains lengthy. Business persons and their military counterparts realize that major system procurement represents a billion-dollar business. This is reason enough for numerous personnel to be involved in the decision-making process. The issue here is not one of formal or informal procedures, but one of flexibility. In the words of Dr. Perry: "The emphasis on flexibility is aimed at preventing the process from adding additional hurdles as the result of rigid implementation procedures."³

It is too early to examine what effects A-109 will have on the acquisition process time period. However, it is safe to say that the Congress and OMB can be expected to assume more and more control of the front-end steps of the major system acquisition process. With the passage of the 1974 Congressional Budget and Impoundment Act, the Congress is not only concerned with providing the initial funding requirements of a given acquisition; it wants the services, agencies, and the public to be aware of the full commitment (time, funds, and need) when the acquisition is being considered for appropriation. The increased participation by the Congress in the acquisition process could affect the roles and activities of all groups involved. If this is the case, it may be the time to examine those areas that play a role in establishing priorities of all new systems at pre-Milestone 0. Restructuring the role of internal groups is a step that could open the door for the implementation of flexibility in the acquisition cycle.

The acquisition time period involved, assuming that weapon system and space system procurements are similar for this exercise, consists of two main

2. Dr. William J. Perry, "The Department of Defense Major Acquisition Process and the Implementation of the Office of Management and Budget Circular A-109 on Major System Acquisitions," Statement to the Subcommittee on Research and Development of the Committee on Armed Services, House of Representatives, 95th Congress, Second Session, April 6, 1978.

3. *Ibid.*

parts; the complexity of the technology, and the administrative process. The components of technological complexity depend on the status of the present state-of-the-art, degree of risk assessment, and priority of the need. The administrative process is determined by the urgency of the need and the size of the expenditure. The more special interest the need receives, the greater the number of reviews that will be held by upper management. This is called "top-down structured" (involvement) management. Once the Congress, OMB, and OSD members get involved in the acquisition process, the endless cycle of briefings, writings, and revising takes its natural course. It is not easy to recommend that this review process be compressed, improved, and streamlined in order to minimize the time period at the expense of watering down the meanings of the review process or the bureaucratic structure.

In the government structure it is even more difficult to devise a systematic approach owing to the turnover of key Defense Systems Acquisition Review Council (DSARC) personnel. In January 1978 GAO findings showed that OSD personnel remained in office for an average of 28 months, while service personnel were in office 24 months.⁴ The changes that are continually integrated into the acquisition process (i.e., the incorporation of Circular A-109, addition of zero-base budgeting, mission-base budgeting, and the recent administration change incorporated into the planning programs budgeting system), are other contributors to the confusion which prolongs the acquisition cycle. Constant turnover creates uncertainty in the priority of needs, from the command level down.

Standardizing the procurement regulation and specifying the critical requirements are ways to provide stability in the acquisition process. The OMB A-109 has made progress in the administrative process by specifying the critical requirements, i.e., decision coordinating paper (DCP), and mission element need statement (MENS), that are required at the five phases and four key decision points during the acquisition cycle. The recent draft of DODD 5000.1 identifies the five main phases that make up the acquisition process for all major systems:⁵

- Mission Analysis; MENS preparation, or Milestone 0 decision.
- Concept Development; evaluation of alternative systems or Milestone I decision, selection of design for demonstration.
- Demonstration and Validation; a Milestone II decision; selection of system for full-scale development.
- Full-scale development or Milestone III decision; proceed with production.
- Production.⁶

4. Report to the Congress, "A Critique of the Performance of the Defense Systems Acquisition Review Council; Billions in Public Funds Involved," by the Comptroller General of the United States, Washington, January 30, 1978.

5. *Ibid.*

6. Major Vito J. Pagamo, USAF, *Criteria for a Defense System Acquisition Process Designed for Satellite and Space System Acquisition*, Air Command and Staff College, August 1978, pp. 156A-K.

Briefings that necessitate more briefings contribute to the cumbersome process. It is these critical review periods that cause the multi-review briefings in the middle-management sector. The DSARC process is standardized, but the preliminaries are not.

In January 1978, GAO published a critique of the performance of the DSARC. Recommendations included decentralization of program reviews with proper safeguards. The safeguards, stated the report, should have included a system for control of the number of briefings/revisions and rebriefings prior to DSARC. Every program office is subjected to unnecessary reviews; every level of reviewing authority individualizes the briefings. (An examination of the private business structure would show similar behavioral patterns.) Safeguards must be standardized and implemented before the acquisition cycle can be streamlined. The GAO recommended that OSD participate in service reviews for the sake of continuity; this would only increase the number of briefings/revisions in the service bureaucracy prior to the OSD review; moreover, every commander would require briefings before exposing findings to higher levels.

The GAO report specifically recommended that the Secretary of Defense:

—Undertake a review of administrative practices in weapon system acquisition management.

—Incorporate ways to streamline and eliminate the many layers and office reviewing and commenting on major DSARC-bound programs.

I do not intend to discuss the pros and cons of the DSARC, or the role of Congress, or the concern of program funding, or whether the established milestones are essential. My intent is to discuss consolidation of pre-briefings associated with meeting the milestones. The review process needs to be standardized to simplify the requirements that are necessary for the procurement of major weapon systems. Consolidating approval loops will minimize the number of program reviews.

Regardless of whether the acquisition need originates externally or internally to the military services, the management administrative process is a top-down structured environment. Needs may be generated by OSD, OMB, National Security Council, etc.

Internal needs are created by the respective services and result from the modification of existing systems, program follow-ons, updating capabilities, etc. Once a procurement assumes the characteristics of a major system, from either the external or internal sector, the OSD and the staff, down to the responsible program office, are involved in the strategy. This is top-down structured management to the nth degree. Dr. Perry commented that the acquisition strategy should take on an integrated approach to management—more like that of the business-like taken by firms in the private sector. Thus far, realignment of personnel

resources has not brought flexibility to the acquisition process, nor has it shortened the time required at each milestone.

Consolidating the Review Groups

It appears necessary to minimize the number of pre-briefings required before the DSARC offers advice to the Secretary of Defense on key issues. Recommending the elimination of the many layers of review is not a "first."

However, when a program is being jointly shared by two or more services, each service should not have to attend AFSARC and NSARC (for example) briefings/revisions independently of one another. This procedure could be combined in the interest of saving time and money; parallelism is unnecessarily expensive and risky. Review procedures are not separate and distinct, but rather are inter-related and interconnected. Each service tends to concentrate on its own reviews, resulting in duplicative and parochial efforts in developing major acquisition systems. Standardization is the key. A step toward avoiding duplicative efforts would be to establish a uniform set of standards with the degree of participation by each service defined according to its respective role. This discussion is not intended as a plug for mission-base budgeting, although there are significant advantages for implementing such a system.

It may sound contradictory to specify a need for flexibility in the administrative process and, at the same time to request specific requirements prior to each review period. Standardizing the inputs and minimizing the review stations would not make the administrative process rigid. If a standard implementation procedure were used to consolidate program briefings without minimizing controls, the time span in the acquisition cycle would be reduced. Today's logic seems to be—when in doubt, let *everybody* review the critical milestones.

Flexibility and Concurrency

The recent draft of DODD 5000.1, "Major System Acquisition," is the first real attempt by the DOD to shorten the acquisition process. Its first revision, dated January 18, 1977, was nothing more than a reordering of the content of the original document, plus the addition of a few paragraphs on the recognition of the Defense Acquisition Executive (DAE) and OMB Circular A-109.

The section that deals with acquisition strategy/plans (AS/Ps) is the potential framework that could lead to cycle shortening. The key is to give the program manager responsibility to incorporate flexibility into the review cycle during the infant stages of a program.

Some individuals feel flexibility is largely a state of mind, a condition that cannot be implemented or ensured. Others feel the military bureaucracy could

never provide a conducive atmosphere for the program manager to use the optional procedures that would result from combining of review cycles. However, the program manager must be given the authority (opportunity) to consolidate or promote direct participation in problem-solving with related organizations at all levels. Concurrency has to become a standard practice in the review of documentation. The program manager cannot take the initiative to combine reviews of the base commander, deputy of procurement, comptroller, program office organization, murder board representatives, etc. To compound this endless review cycle, there are also joint service participation reviews. There is no procedure or unwritten policy to handle joint service program reviews.

In addition, the number of reviews increases as the MENS, or the statement of operational need (SON), or Category I (latest DSARC term) program status go through the Air Force Systems Command (AFSC), Pentagon staff, and OSD. The implementation procedures must encourage consolidation or concurrency of reviews.

Recommendation for the promotion of oral agreements (later documented) between cognizant organizations and the program manager is a step in the right direction. This would minimize the exchange of correspondence.

The solution is not an easy one for me. The key may be in the decentralization of the reporting centers. If the SAMSOs, SAC, MAC, and TAC were autonomous and submitted their needs or requirements to a requirements review group (RRG) based at AFSC, the internal reviews and priorities could be streamlined. The harmonization and the minimizing of duplication would be a responsibility of the RRG. Before recalling all of the pitfalls, remember that many other government agencies (like NASA) use a similar configuration. If nothing else, the foregoing is food for thought.

The solution may be a compromise between control and cost. One of the intentions of A-109 is to provide the framework for program manager flexibility. The program manager should be able to minimize or consolidate the required program reviews prior to DSARC. It seems redundant and unnecessary to hold both an AFSARC and NSARC independently of one another. One way to shorten the acquisition cycle is to ensure that the implementation procedures include standardized program requirements in a manner that will give program managers the ability to "selectively" consolidate the layers and offices which review and comment on DSARC reviews. If one could establish a maximum time frame for the completion of each "significant event" held prior to the DAE and respective OSD staff, the number of months for each review cycle would be reduced.

We all are aware that the program manager has the sole responsibility of keeping his program alive. He has to gather support from his immediate command level, the Air Force Systems Command, and then obtain the solidarity of

the Air Staff level. This must occur before the OSD staff hears the briefing. The organizational structure is such that the pre-briefings must be made individually to the staff next to each command level. The 15 scheduled pre-briefings prior to the DSARC (not counting reruns) must be consolidated. There must be an easier, simpler, and less costly way to do business. The question is, can it be done without restructuring our entire society?

Conclusions and Recommendations

In general terms, it has been suggested that an effective major acquisition program must incorporate flexibility in its administration. Recent changes, additions, and modification of the acquisition policy have been oriented toward the implementation of flexibility to enhance the competitive side of procurement. Depending on the meaning of "competition," this may not lead to shortening the acquisition cycle. Our energies thus far have been focused on verifying the need, providing more overviews, promoting program stability, and emphasizing affordability. The policy-makers provided A-109, mission base budgeting, and zero base budget to the existing acquisition regulations. This framework was meant to integrate the technical and business management policies and allow the choice of strategies to be selected by responsible personnel. These acquisition guidelines, while broad enough to enable flexibility, fail to meet most of the goals and objectives of government officials. It is time to supplement the implementation of this framework.

The responsibility lies with the users and players of the acquisition process. Examination of the structure of the DSARC process implies that the system can work formally and informally. The informal process at pre-Milestone 0 is used to reach an agreement on the MENS. This is considered the informal DSARC because the key players are the same, only the sessions are not formally documented. There have not been enough cases to determine whether the formal or informal structure is more efficient. When one examines the DCP/DSARC guide attachment listed in HOI-800-1, it is possible to jump to the conclusion that the informal process is faster. The formal procedure is hampered by structure delineations. It takes three pages to itemize the schedule, the activity event, responsibilities, and action required for each major DSARC.

These criticisms are not new or unique. The solution for shortening the administrative acquisition process has escaped the instruction manuals and the ASPRs thus far. The consolidation of review groups, more decision-making authority for the program manager, flexibility, and standardization in the administrative process will remain rhetoric unless we face the challenge of simplification.

Today, the OSD staff members are proposing a number of attachments to the recently revised DODD 5000 series. It is to be hoped that they will provide the framework for simplifying the administrative action management. ||

Robert G. Gibson

In periods of national emergency, the question of concurrent or overlapping phases of development, production, testing, and logistics support is not raised. It is when we think we have the luxury of time that the issue becomes heated. Even though major industrial projects are almost always concurrent, the first reference to the term by the Department of Defense appears to have been made by General Schriever in early 1958. He claimed that it was a striking new approach. He said, "I wonder, however, how many of you are as familiar with still another important advance which has been perhaps unduly overlooked.

"I refer to the management concept which pervades the AFBM (Air Force Ballistic Missile) program. This concept, which we will call the concept of concurrency, represents an invention that may prove to be of quite as much importance as the physical inventions represented by new devices, machinery, and apparatus for the ballistic missile itself."

He further stated the impetus for this approach was "... our overriding objective being to achieve an operational capability at the earliest possible date."

In January 1959, a report was published entitled "The United States Guided Missile Program." It was prepared by the Legislative Reference Service of the Library of Congress for the Senate Armed Services Committee. The report spoke to concurrency as follows:

[The Air Force] ... has adopted and expanded another technique often used by industry where competition in getting to a market is keen; that is compressing the periods of development of new products and getting production started. In the case of the missile program ... the Air Force is undertaking to do this by what they call the "concept of concurrency."¹

The report also noted that the Navy's Polaris program was being accelerated and compressed in much the same way.

Through most of the 1960s, concurrency was an accepted approach in the sense of "the conduct of steps leading to production for inventory before the end of the full-scale development time span."² Production funds were programmed and used during the later stages of development. Then came some severe system acquisition problems. In several cases, the problems were of such perceived difficulty that programs were cancelled late in development with loss of production

1. Congressional Record, January 27, 1958.

2. Defense Science Board Report of the Acquisition Cycle Task Force, March 15, 1978.

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investment. Among these were MBT-70, Cheyenne, Condor, and F111B. Secretary Packard expressed the view, "As I reviewed program after program in the spring of 1969, almost all were in trouble with a common fault—production. They had been started before engineering development was finished. I am sure you all know about this problem."³ A RAND report supported this view and recommended a sequential approach to major system acquisitions with clearly defined decision milestones. The report recommended "... the normal strategy for system acquisition in the 1970s should involve a conscious decision to produce (or not to produce) only after the development is completed."⁴ The current DSARC process is certainly consistent with the views noted.

It is not clear who was influencing whom during the period 1969-71, but there is a remarkable consistency among the RAND report, Secretary Packard's speeches and memos, and recommendations contained in the Blue Ribbon Defense Panel report of July 1970.⁵ A staff report on major weapons acquisition recommended "a general rule against concurrent development and production efforts, with the production decision deferred until successful demonstration of developmental prototypes." The recommendation is not discussed in the report, no evidence is presented, and no rationale is given.

The sequential approach to acquisition strategy is reflected in the first DOD directive on "Acquisition of Major Defense Systems," (DOD Directive 5000.1 dated July 13, 1971). The directive cautioned against "... unnecessary overlapping or concurrency" and clearly indicated that the development decision and production decisions were separate and independent.

Definition of Concurrency

There is no generally accepted definition of concurrency. In fact, there is no such word in Webster's dictionary. The Defense Science Board (DSB) Task Force defined it as "the conduct of steps leading to production before the end of the full-scale development time span." These steps are such actions as manufacturing planning, process development, tool and test equipment design and fabrication, and ordering long-lead materials.

Commercial Airplane Programs

When one compares commercial and military airplane programs, the most dramatic differences are the much greater concurrency in commercial programs and the commitment to production at the outset of the program. The commercial programs do not push the state-of-the-art as much as the military so the technical

3. Defense Industry Bulletin, Fall 1971.

4. RAND Report, "System Acquisition Strategies," Robert Berry, *et al*, June 1971.

5. Blue Ribbon Defense Panel Report, July 1970.

risks are lower. On the other hand, the financial risks are very large in the commercial world. In spite of risks, concurrency is viewed as a necessary method of doing business.

Another driving factor in a large commercial program is the urgency to get to efficient production rates. This must be balanced against the knowledge that changes *will* occur late in the production build and they *must* be expected and accommodated quickly. Changes cost money and every effort is made to minimize them, yet they are less costly than low production rates. Figure 1, taken from the DSB report, rather dramatically illustrates this point.

Figures 2 and 3 illustrate the manner in which commercial aircraft programs are planned. Figure 2 shows a typical new development program and Figure 3 illustrates a major derivative program. Both must pass FAA certification. It is to be noted that production steps start very early in the program. The engineering release schedule and its relation to fabrication and assembly is shown in Figure 3.

Finally, Figure 4 shows the difference in deliveries of military and commercial aircraft. Concurrency is part of the reason for the faster buildup.

Impact of Production Decision Timing

Through the period of the late 1950s and early 1960s, the concurrent approach to development and production was used for important, large systems. Programs were initiated with the clear intent to produce and deploy them. Consequently,

FIGURE 1
Low Production Rate vs. Cost

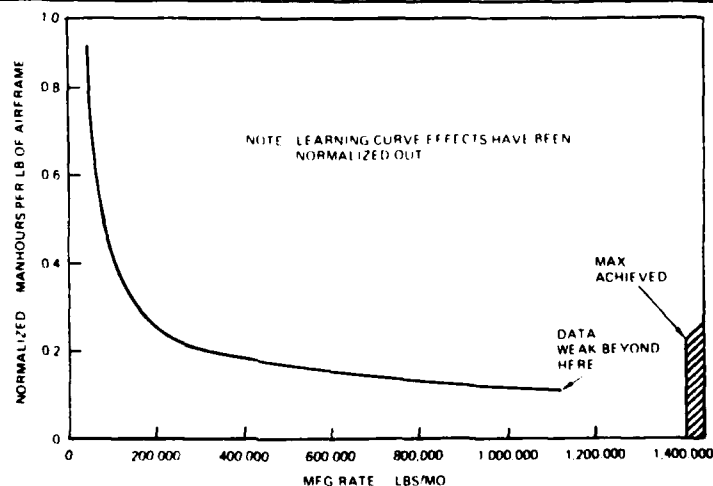


FIGURE 2
Typical New Development Program

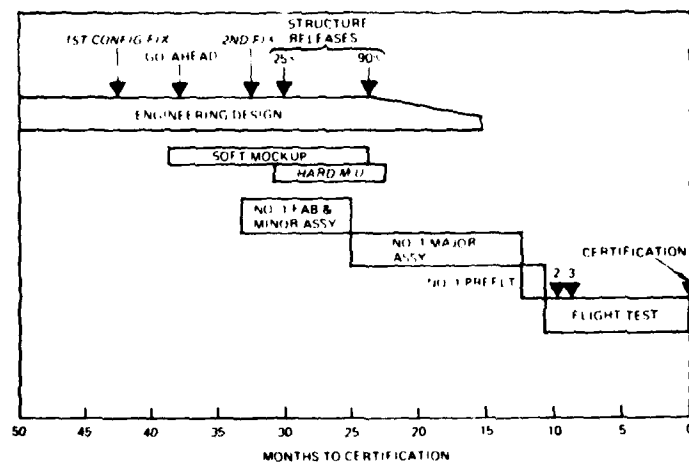


FIGURE 3
Major Derivative Program

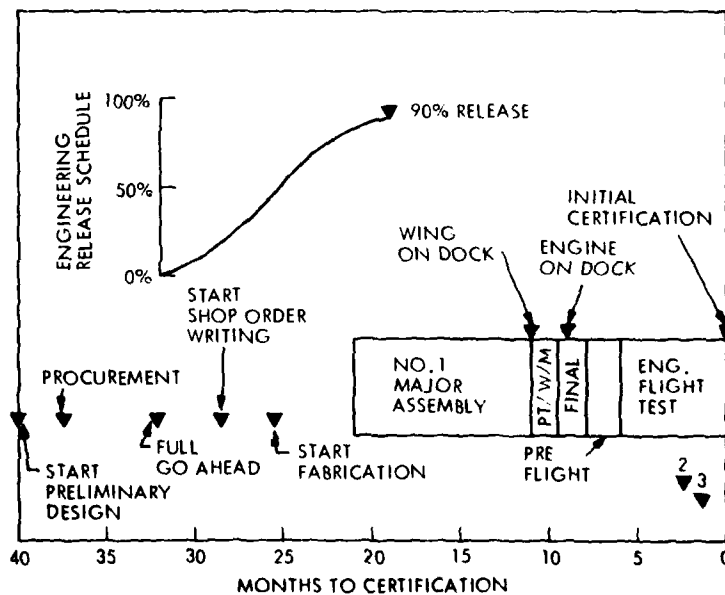
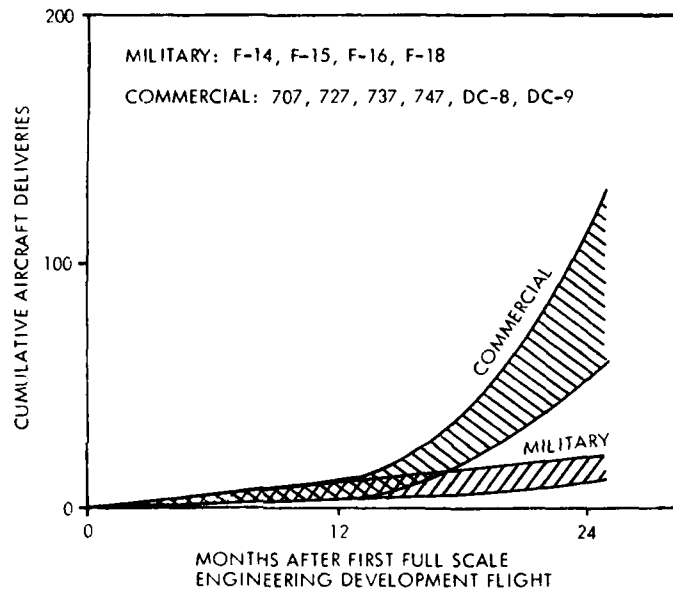


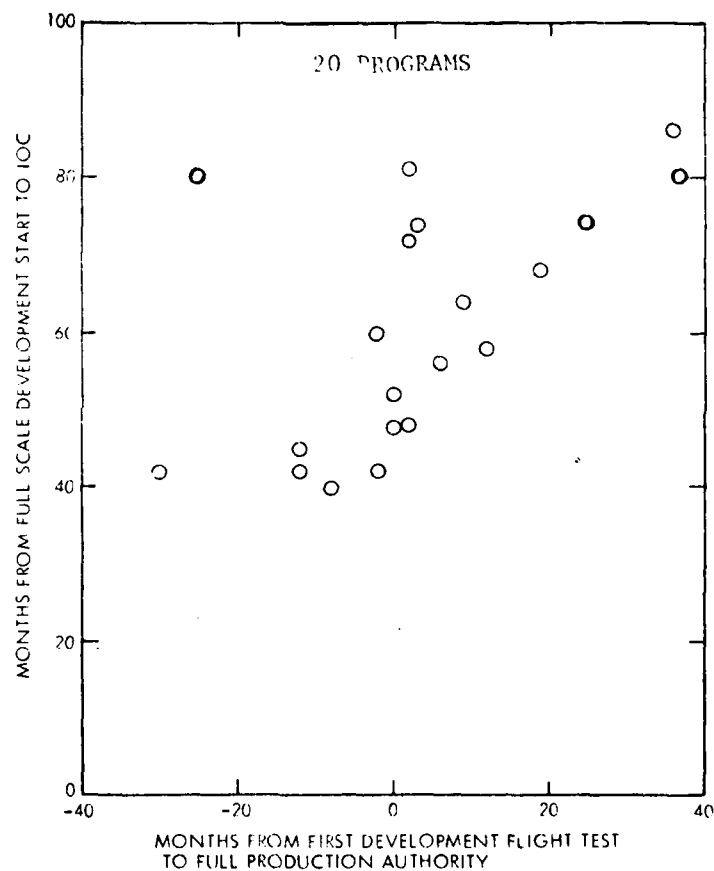
FIGURE 4
Difference in Deliveries of Military and Commercial Aircraft



the programs were structured so that test articles were as close to production configuration as possible, consistent with the need to demonstrate acceptable solutions to development problems. In these earlier programs, the production decision was made, in effect, at the start of development; however, the actual release of production funds and the authority to initiate formal production activities were usually related to some significant demonstration in the development program.

A convenient milestone is first development flight test for airplane, helicopter, and missile programs. The Defense Science Board examined a number of such systems and developed data on the relationship among the first development flight test, the production decision date, and the initial operational capability. These data are shown in Figure 5. Not surprisingly, there is a strong correlation between the date of production decision and the fielding of capability. However, early production commitment (sometimes before first flight) did not cause the programs to slip to correct development problems. It is clear that the "non-concurrency" policy of the 1970s added time to programs. As noted in the DSB study, other factors also were influential, i.e., the addition of a more formalized operational test and evaluation sequence. However, the net effect of operational test and engineering is to delay the production decision.

FIGURE 5
Production to Deployment



Some Further History

Towards the end of the 1960s, a number of major systems were terminated late in the development process. Generally, these programs were concurrent, and varying amounts of production funds had been expended. One of the arguments against concurrency is that substantial funds are wasted if the program is not

completed. As previously noted, the disadvantages of concurrency were strongly articulated by Deputy Defense Secretary Packard. The data supporting his position are sparse to nonexistent. RAND has published some papers on the subject, and has over the years supported the "sequential" approach to development and production.

In order to examine the costs of proceeding with production activities on programs that never were fielded, some information was provided to the DSB Task Force. It is incomplete, but it does give an indication of what concurrency costs for unsuccessful programs. (No data was obtained on Air Force programs.) The information is shown in Table I.

The concurrent programs that were successful and which added to U.S. military capability have not been examined in detail. In fact, the failures are much more interesting to analysts. It is suggested that additional research in successful programs might be useful. The DSB drew the conclusion that programs were *not* cancelled for reasons of concurrency. The reasons were technical or political or because of requirements changes—not because production had started.

The Fleet Ballistic Missile Experience

The fleet ballistic missile (FBM) program has always been one of many parallel activities. The program was greatly accelerated in 1958 and the only possible way to meet the critical initial operational capability dates was to have a highly concurrent program. Because of the success of the program, the later versions of Polaris and Poseidon all were conducted with production approval early in the process. The management methods developed early in the program were based on the philosophy that the development was conducted with the intent to produce and deploy. Policies and procedures were developed that became a way of life for the FBM team. Vice Admiral Levering Smith (Ret.), who was associated

TABLE I
Costs at Program Cancellation

<u>PROGRAM</u>	<u>EXPENDITURES (MILLIONS)</u>	
	<u>RDT&E</u>	<u>PRODUCTION</u>
F111B	111*	148
Condor	223	77
MBT-70	226	139
Cheyenne	332	121

*Navy share of joint development

with the program for nearly 20 years, strongly believed in a continuity from development to production. He supported this position in testimony to Congress, in speeches, but more importantly, in the management of the program. As a reflection of his approach, as early as 1961 he instituted a rigorous change control policy to ensure "that all tactical missiles be essentially identical within any missile type. . . . This desire can be realized by freezing and documenting design and manufacturing processes at the time that it has been reasonably determined that a reliable, operable and maintainable missile can be manufactured to that design using those manufacturing processes."

In the same letter he further stated:

When in the early phases of the tactical production program using the authenticated documents, it is discovered that the product produced is different than; produced by a different process than; or tested by a different method or to different limits than those used during the R&D and flight test phase of the program, then changes to the authenticated documents shall be accepted to make the tactical production part the same as that produced during the successful R&D and flight test program."⁶

During the early 1970s, when the Packard changes to acquisition policy were being implemented, the Navy was challenged on their concurrent approach. A detailed study was conducted of the experience on the Poseidon program, that is, the cost of alterations after deployment of production missiles. Cost estimates were developed on several non-concurrent approaches to the forthcoming Trident program. The additional costs ranged from \$80 million when production was delayed until the 20th development flight, to \$130 million when production go-ahead was delayed until after first production evaluation missiles were flown. These costs were in excess of the costs of field alterations on previous programs. In consideration of the fact that the IOC would be slipped from 2 to 3 years and that no cost savings were evident, the Deputy Secretary of Defense waived the provisions of DOD Directive 5000.1.⁷ The Trident program is concurrent.

In general, it has been found that overlapping development and production in the FBM program is highly advantageous. The advantages of concurrency have been:

- Lower overall program cost.
- Early design maturity.
- Early production rate problem visibility.
- The program requires less time and provides an early deployment date.

⁶ Special Projects Letter, "POLARIS Missile Design and Process Change Control Policy," December 5, 1961.

⁷ Memorandum for the Secretary of the Navy from the Deputy Secretary of Defense, July 16, 1973.

The start of procurement at the earliest time consistent with acceptable risk of retrofit aids in decreasing overall program costs, because elimination of "gapping" between program phases also reduces requalification and firing and rehiring costs caused by work force fluctuations. Concurrence also forces design maturity on the program early enough that samples of production items built to an authenticated design on proofed tooling can be tested to evaluate the reliability, production processes, maintainability, and repetitive production cost of the end item prior to deployment.

Late design changes tend to be more expensive on a concurrent than on a non-concurrent program since they require retrofit of any delivered production hardware. Concurrence provides the advantage that production rate problems become visible early in the program, while the program development team is still on board, if the proper evaluation tests are conducted on the product planned for deployment. Problems of service life and material degradation with time have generally been found, in FBM programs, to occur so late that their occurrence and solution are independent of whether the program had been concurrent or non-concurrent.

Management of Concurrence

Managing a concurrent program is demanding. The development must be disciplined by the production considerations from very early in the program. Hard decisions have to be made on how much testing, the degree of risk on technological advancement, the trade-offs between performance and early operational capability, the maturity of design, and many such factors. There must be continuous risk analysis to weigh the degree of production investment.

There are several requirements that must be met if a concurrent program is to succeed. Most obvious is that funding support must be carefully planned and must have continuity. Radical changes in funding levels must be avoided or the whole process is seriously impacted. Second, the contract type must provide flexibility for both the government and the contractor. Too early an imposition of fixed-price contracting makes it difficult to handle the start-up problems (and they do occur) during production and deployment.

Experience has indicated that concurrent programs can be successful. As has been indicated several times, to make it work the whole program must be structured to an end objective of production and deployment. A decision to move to production at the later stages of a development program will cause a great deal of rework, retest, and redo of development, if the product is process-sensitive.

Final Comments

The issue is far from settled. There are many people and organizations who take strong positions on the subject. The most recent pronouncement is included in the Defense Resource Management Study of February 1979. This report repeats

the RAND positions that have developed over the years, i.e., the sequential approach. In addition, the GAO has rather consistently opposed early production start-up, and congressmen tend to reflect the GAO position.

Partly on the other side of the argument is the Office of Federal Procurement Policy. In OMB Circular A109 on major systems, one of the key decisions identified is "Commitment of a system to full-scale development and unlimited production." The DSB study strongly supported the concept of development and production overlap, but indicated that it took good managers to make it work. The following extract summarizes the DSB position.

- Concurrency provides a smooth transition from development to production. The developing agency's technical people are available to correct problems arising during early production, operational testing, and introduction to service usage. The engineering force can properly evaluate the impact of changes on the original design. Further, the development article/production article similarity is protected by continuity of the manufacturing process.

- Concurrency minimizes the acquisition time span. It has a psychological advantage of forcing a planned "end of development." Design freeze points and change control must be established. The shorter span avoids line gap and restart time losses and requalification of process-intensive hardware.

- Finally, properly done, concurrency drives the total system to be ready—training, logistics, support services, etc. There is nothing quite like an approaching IOC date to get everyone moving and working together.

On the basis of the data and information available to the Task Force, including discussions with knowledgeable and experienced people, the following conclusions are offered with respect to concurrency:

- Concurrency is the normal way of doing business in the commercial business world.

- There is no convincing evidence that concurrency necessarily adversely affects program outcome in terms of cost, performance, or field utility.

- The transition from development to production is smoothed significantly by the right degree of concurrency.

- The acquisition time span from FSD to IOC can be minimized if concurrency is properly employed.

- Program trade-off flexibility must be available to support successful development progress in a concurrent program.

- Assuming the intent to deploy clearly exists at the start of FSD, concurrency is highly desirable.

- The degree of concurrency should reflect the extent of risk.

- Low-rate initial production is desirable with operational suitability testing preceding the high-rate production go-ahead.

Finally, the testimony of Vice Admiral Smith in 1976 summarizes his views, and they should be considered in planning future programs.

The conventional wisdom, frequently identified by the short title "fly-before-buy," that an overlap of development and production is undesirable because costs are increased by such overlap is true in certain specific circumstances. The specific circumstances are those in which the product will continue in production regardless of our decision to buy or not to buy or those in which a very similar product made from identical materials on the same equipment with the same tooling by the same people following the same procedures and processes, will continue in production regardless of our decision to buy or not to buy. The conventional wisdom holds that fly-before-buy reduces costs by avoiding costly alterations of material already produced at the time the need for such alteration is disclosed by the test program. However, except for the quite special circumstance where a new technology permits designing the large design safety factors, it is more likely that the need for alterations will develop in those cases where new materials and new technology are essential to the design than where well established materials and technology will serve. This is also true of those items such as missiles which could not be repetitively and non-destructively tested during development, rather than those items, such as an automobile, tank or airplane, which can be repetitively tested non-destructively a very large number of times.

Nevertheless, it is in the case of items such as those missiles which must depend on the newest of materials and the most advanced technology to meet their needed performance, and cannot be non-destructively tested, that it is most likely that production of a quite similar product made from identical materials, on the same equipment, with the same tooling, by the same people, using the same processes and procedures will *not* continue if "fly-before-buy" is enforced. Then, because it is completely impractical to specify materials and define processes at all component levels in absolute detail, when production is instituted after completion of the "fly" test program. It will be found that the items produced do not perform in the same manner as the item "fly" tested and hence making it necessary to redevelop the production processes and generally also change the product design; as well as repeating much of the testing. This was well recognized twenty-five years or so ago but many whose experience extends that far back have forgotten and most who do not have that length of experience have not learned.⁸

8. Testimony of RADM Levering Smith before Defense Subcommittee, House Armed Services Committee, March 9, 1976.

Socio-Economic Objectives: Impact on Civil and Defense Agencies

78

Major Richard J. Hampton, USAF
Dr. Richard J. Lorette

The purpose of this study was to systematically investigate the burden to the acquisition/procurement process created by using the process as a socio-economic vehicle. The study attempts, qualitatively, to explain the disparate cost effects and mission impacts of individual socio-economic programs. The information, when analyzed completely and presented in its final report form, should provide data that will contribute to an improved regulatory and operational process.

Two of the first such attempts, to use the federal acquisition process for implementing socio-economic policies, were the Naval Service Appropriation Act of 1865 and the Army Appropriation Act of 1876.

These policies mandated the purchase of only American bunting and preferred American labor and materials for public improvement contracts. Other programs have also been implemented in an attempt to address specific problems. For example, wages were set on government contracts in World War I in an attempt to avoid labor disputes and to keep supply lines open. The economic dislocations occasioned by the Depression also caused a plethora of legislation to be passed. The Davis-Bacon and Walsh-Healey Acts were both passed in an attempt to regulate wages in construction and supply contracts respectively, as was done during World War I. Other Depression-era legislation included the Buy American, Miller, and Copeland "Anti-Kickback" Act.

World War II and Korea precipitated a concern for maximum use of the nation's manpower. Executive Order 8802 was issued in 1941 and provided for mandatory inclusion of a non-discrimination clause in government contracts. In 1951 the Congress provided for the targeting of contracts to small business by an exclusive set-aside procedure. Further, in 1952 the Congress provided for the further targeting of contracts to geographical areas of high unemployment through Defense Manpower Policy 4.

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1. U.S. Commission on Government Procurement, *Report of the Commission on Government Procurement*, Volume 1 (Wash., D.C.: Government Printing Office, 1972), p. 111.
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The fifties and sixties saw an expansion of already-established policies. For example, the wage protection of the Davis-Bacon and Walsh-Healey Acts was extended to service contracts by the Service Contract Act of 1965. Further, nondiscrimination protection was expanded by Equal Employment Opportunity Affirmative Action programs. Finally, use of set-aside contracts increased in 1969 as a result of emphasis by President Nixon.

The seventies saw an expansion of use of the acquisition process to enforce environmental provisions. The Clean Air and Clean Water Acts prohibited the award of contracts to firms in violation of these acts.

To review some of the more recent history, let's go back to the Commission on Government Procurement (COGP) which explored, in its 1972 research, how the acquisition process is employed to accomplish socio-economic goals. The COGP report identified 39 such socio-economic programs and concluded: "The cumulative effect of programs (socio-economic) already imposed on the procurement process and the addition of those contemplated could overburden it to the point of threatening breakdown."¹ As a result, the COGP made three recommendations which were accepted by both the executive and legislative branches of the Federal Government. These were:

Recommendation A-43. Establish a comprehensive program for legislative and executive branch reexamination of the full range of social and economic programs applied to the procurement process and the administrative practices followed in their application.

Recommendation A-44. Raise to \$10,000 the minimum level at which social and economic programs are applied to the procurement process.

Recommendation A-45. Consider means to make the costs of implementing social and economic goals through the procurement process more visible.

Since publication of the COGP report, the socio-economic program recommendations have not been implemented, except in the case of the Miller Act. The GAO, in evaluating legislative actions on the COGP recommendations, noted "As yet, congressional support is not forthcoming. A major problem is that there is no committee in the Congress with jurisdiction over both procurement and the various socio-economic programs."² As a result, two laws are passed and decision-makers in the executive agencies are faced many times with a choice. If there is a conflict (between the implementing legislation for a socio-economic program and the procurement statutes), whose law takes precedence? Another example: Do we try to follow the President's directives that we double and then triple the number of contracts awarded to minority firms, or do we comply with the procurement statutes?

2. U.S. Comptroller General, *Legislative Recommendations of the Commission on Government Procurement: 5 Years Later*, DSAD 78-100 (Washington, July 31, 1978), p. 22.

Socio-Economic Programs Expanded

In the years following acceptance of the COGP report, many socio-economic programs have been expanded. For example, the Congress recently passed a bill amending the Small Business Act and the Small Business Investment Act of 1958. Now the procuring activity is required to negotiate, with the prime contractor, a subcontracting plan for use of small and minority-owned business. Further, under the amendment, if the subcontracting plan is not acceptable to the Small Business Administration (SBA), the SBA can hold up contract award by appealing to the head of the procuring agency.

Aside from that amendment and the resultant subcontracting plan approval delays, we found many other issues and problems in the interfaces between the SBA and the procuring agencies. For example, the award of contracts, under Paragraph 8(a) of the Small Business Act, requires preferential treatment to firms owned by "economically and socially disadvantaged" minorities. Interviewees asked many questions such as the following:

- How can we identify qualified high-technology minority businesses?
- What is the definition of a minority?
- How does using a minority contractor help my program?
- Why should we push 8(a) awards? They cause extra work, delay the program and provide no reward.

Another amendment introduced in the Senate would modify the Buy American Act.³ The amendment would require that an item be at least 75 percent (by value) of domestic origin before it can be called a domestic article (compared with 50 percent at present); would have a flow-down requirement for subcontracts that make up 10 percent or more of product value; and would require the computation of hidden economic costs which accrue to the U.S. from the foreign purchase of goods. These costs include, among other things, lost tax revenues and higher unemployment compensation. This particular amendment does not appear to be a significant cause for concern among the civil agencies; nor was the Buy American Act itself mentioned by anyone of the 300-plus people interviewed.

So far, we have been describing briefly the various social programs and how they have been extended and refined over the years. In addition to expanding the basic socio-economic program, there has been a general and gradual, but accelerating, increase in the specific use of the federal acquisition process to achieve these socio-economic goals.

Presently, over 40 socio-economic programs are superimposed on the acquisition process. They seek to achieve diverse goals such as: improving working conditions under the Davis-Bacon and Walsh-Healey Acts; favoring disadvantaged

3. The Buy American Act of 1979 (S533), with a companion bill introduced into the House (HR 2618).

groups, as in the Equal Employment Opportunity (EEO) or small and minority business provisions; favoring American companies, as with the Buy American Act, jewel bearings source, and the Berry Amendment; protecting the quality of life; and achieving other government purposes, as in the Convict Labor Act and prohibition on purchases from Communist sources.

The implementation of these programs is accomplished through detailed rules that often prescribe specific behavior for both government and contractor personnel and organizations.

Bureaucratic Paper Procedures

Comments from interviewees, that we have chosen to quote up to this point, may have reflected confusion with, and sometimes outright resentment toward, socio-economic objectives that degrade agencies' progress toward their own goals. However, there were many government people who were concerned that the complexity of the bureaucratic paper procedures was harming the social program as well. These points of view were expressed in this manner:

- We must simplify paperwork procedures for small businessmen.
- Small businesses have problems dealing with the Federal Government; procedures are too expensive.
- Socio-economic objectives and requirements for different programs conflict with each other.
- FSS (GSA) effectively has ruled out of consideration thousands of minority businesses which are available but not on the list.
- The system is bogged down with bureaucratic requirements.
- The process has become so complicated that we are forced to become quasi-illegal to get the job done.

It was these "burdens" of specific behavior to which the COGP addressed its recommendations. Our study attempts, 6-7 years later, to identify the burdens qualitatively through interviews with qualified government and contractor personnel, and through examination of organizational records. The definition of burden for purposes of the study was one of opportunity cost; that is, the identification of either direct or indirect costs incurred that could be used for another purpose in the absence of the socio-economic program. The research revealed that the disparate cost effects of socio-economic programs permeated the acquisition process, and impacted seriously on resources, morale, efficiency, and agency mission in military and civil agencies.

There can be little doubt that morale and efficiency have been seriously degraded by the chaotic environment of socio-economic program implementation in the acquisition process as we know it today. One supporting fact is that, in the civil agency research that included more than 300 managers (GS-14 through

assistant secretaries), the area of socio-economic objectives was ranked as second from the top for its numerous issues and problems. Typical quotes from 136 specific comments included the following:

—Awards emphasizing 8(a), women, and labor surplus areas are now costing a fortune; the costs are high and the quality of the products is low.

—We are being forced to give too many contracts to small businesses; in all of the Federal Government, 2 percent of R&D goes to small businesses; in our agency, it is 35 percent.

—We have limited dollars for contracts; when we set aside 25 percent for labor surplus, 15 percent for small business, and 15 percent for minority business, we don't have much flexibility left to do our major mission.

—We're told to compete on one hand but to award sole source to minority businesses.

—At what point will we have given SBA, OMB, etc., enough?

—Many new minority business firm managers seem to have little knowledge of the business world; it's hard to work with them.

—The burden of socio-economic legislation has tripled in the last 5 years.

—We're "catching hell" from all directions—from SBA, from minority business types, labor surplus advocates, women in business, etc. Everybody's unhappy, because we're not setting aside enough. All the interest groups are fighting for the same piece of pie.

Further analysis of the research interviews within the Department of Defense revealed that socio-economic programs with high perceived burden had certain common characteristics. Conversely, those with low perceived burden were lacking in these characteristics. (See Figure 1.)

The positive action characteristic has manifested itself, for example, where affirmative action plans must be developed and monitored. Currently, formal affirmative action plans are required on higher dollar threshold contracts for equal employment opportunity, small business subcontracting, labor surplus subcontracting, minority business subcontracting, and Vietnam veterans employment. DOD interviewees indicated that direct costs are incurred in the preparation of the plans through the hiring of specialists to prepare plans; reviewing of the plans by government and contractor personnel; locating of qualified employees or sources to comply with plans as drafted; and using technical and business management support to work with and train minority business subcontractors.

In the civil agencies, much concern involves 8(a) of the Small Business Act. Acquisition/procurement field personnel expend many hours trying to locate qualified minority-owned businesses and then are unable to get the firms added to SBA's list. Much effort is also wasted in trying to determine wage rates as

FIGURE 1
Characteristics of High Burden Socio-Economic Programs

CHARACTERISTIC	DESCRIPTION
Positive action requirement	Requirement for positive action of acquisition personnel to accomplish program.
Program documentation requirement	Program actions must be documented to provide proof of compliance.
Program reporting requirement	Program actions must be reported to government agencies for statistical consolidation.
Established program goals	Performance objectives are established for the specific program.
Interagency program interface	Acquisition actions require coordination with a government agency other than procuring agency.

appropriate for Service Contract Act awards. Requests for approval of recommended rates must be submitted and then resubmitted to the Department of Labor. Even the President's new anti-inflation program, with its use of the contract to encourage adherence to specified rates of inflation, involves positive actions of the acquisition/procurement function in questions of waivers and terminations.

Some Comments

Further, contracts placed with minority firms in many cases have a higher initial contract face value than similar contracts previously awarded. This is a complaint voiced by most procurement and program management officials who, while supporting socio-economic goals, see their limited financial resources being squandered to buy goods and services of low quality. Typical comments include these:

—One item we were required to purchase from the Federal Prison Industries costs \$4,000 per item and requires 6 months for delivery; we were getting the equivalent product for \$150 with immediate delivery.

—Using firms of SBA's approved 8(a) list results in cost proposals 20-50 percent higher.

—We get locked in to 8(a) awards, lose our freedom to choose, and end up with an annual price escalation.

—Projects that are procured under the 8(a) program always cost more than if procured under the competitive bidding system.

—Socio-economic objectives conflict with meeting the basic procurement philosophy, such as getting the best product at the lowest price. We have gone way beyond the basic problems we're trying to correct.

Program documentation requirements also manifest themselves in areas where positive action requirements exist. For example, contractors must document the number of minority applicants, minority hires, and minority non-hires. Also, contractor purchasing personnel must maintain information on the number of small and minority firms solicited, as well as on awards made to them for purchase actions greater than \$10,000.

Nor are the government's agencies exempt from documentation requirements. Reports must be submitted on progress toward doubling and tripling the number of contracts awarded to minority firms; similar reports are also mandatory—within individual agencies—on numbers and dollar value of awards to 8(a) firms, small businesses, women-owned companies, labor surplus areas, etc. It's reasonable to expect, also, that where goals have been set but not met, supporting statements are to be submitted to explain and clarify the shortfall.

To the above internal agency reporting procedures, we must add reports that flow between agencies such as those to SBA concerning small business awards, and those to Labor dealing with wage-rate determinations. The phenomenon we have, then, is independent federal agencies responding to and interpreting the public laws that direct their activities. They, in turn, develop program reporting requirements and establish the need for other equally independent agencies to monitor and report on program accomplishment. These reporting activities require manpower and generate costs to accumulate, prepare, and forward data to the appropriate government agency. For example, one study reported that over 3 million pages of information were required by 48 surveyed companies merely to supply and maintain 1977 EEO information.⁴

Within the civil agencies, most individuals contacted did not comment on burdens associated with processing paperwork reporting on accomplishments; their major related grievances dealt with the delays and frustrations inherent in processing basic statements of work, requests for proposal, contracts, changes, etc.

Established program goals generally exist in the areas where affirmative action plans have been required. Interviewees in DOD indicated that these goals

4. *Cost of Government Regulation Study* (Washington, D.C.: The Business Board, March 1979), p. 29.

led in many cases to higher salaries and turnover for "qualifiable" versus "qualified" employees, higher recruitment costs, and costs for attendance at workshops, seminars, and conferences. Further, many DOD interviewees indicated that decreased productivity occurred because of training time required and high turnover. Within DOD, therefore, this high burden characteristic—established program goals—seemed to hinge on internal hiring practices and qualifications of employees.

Within the civil agencies, there was a greater emphasis on the effects of various formal and informal goals, set-asides, and quotas related to increased numbers of contracts to be awarded to minority businesses, small businesses, and labor surplus areas. Some individuals did state that an additional full-time position was required to handle the added workload generated by socio-economic programs and that, generally, personnel resources had not kept pace with the increased program activity.

Hierarchical Pressures

Finally, both DOD and civil agency interviewees indicated that strong-to-intense hierarchical pressures were exerted to achieve established goals. They also revealed that, if goals were missed, a detailed analysis of reasons had to be accomplished, which further increased administrative costs.

Interagency program interfaces burden the acquisition process in several ways. First, interagency coordination requires additional paperwork and time; second, the price of the product often increases, because its delayed purchase price is affected by inflation. Another costly outcome may be the maintenance of higher inventories to cover longer acquisition cycle lead time.

Interviewees also frequently indicated that other agencies were suboptimizing advocates of their own programs. For example, the Department of Labor (through Davis-Bacon Act and EEO requirements) generally implemented programs in a way that would favor its clientele; this generally comes about through its directing adherence to complex administrative policies and procedures that created additional cost burdens on the procuring activities.

The above-described characteristics of burden are neither exhaustive nor mutually exclusive. However, they do serve as bellwether characteristics of high burden programs.

As a result of the research conducted in seven major civil agencies and the Department of Defense, the researchers feel that a more careful analysis must be conducted prior to implementation of socio-economic programs through the acquisition process, to ensure that program objectives are attainable at an acceptable cost. This would require an evaluation of both benefits and costs when making the implementation decision. As such, when existing programs are reexamined as recommended by COGP *Recommendation A-43*, or when new programs are considered, those possessing high-burden characteristics can receive a

more detailed cost/benefit analysis to answer the important question: Should socio-economic programs be implemented through the contract/procurement/acquisition process, or is there a better, more productive approach which allows for both desired goals and agency mission accomplishment?

Conclusions

In the course of our year of data collection, we interviewed almost 500 individuals in the Department of Defense and major civil agencies. On the other hand, a routine Gallup or Harris poll of the American voting population (let's say 45 million-plus people) might obtain points of view from only 1,200-1,500 individuals. Since the Federal Government employs directly less than 4 million, and could not possibly include more than 500,000 in acquisition/procurement-related activities, our sample size lends a high degree of confidence to the survey results.⁵

We have concluded that the overwhelming majority (99.9 percent or greater) of federal employees support the basic concepts underlying the current collection of socio-economic programs. They are in favor of maintaining a "small business" component in our free-enterprise economy; they agree that minority-owned firms should be helped to get a start in business and to grow into strong, healthy, competitive organizations; they don't want their government to use its tax dollars to deprive workers of a fair wage or decent standard of living; they understand the need to assist labor surplus, economically distressed areas with federal contracts; and they believe that women should have equal opportunities with men. As is often the case among reasonable people, there's little disagreement about the "ends" being sought.

At the same time, they do have many questions about the "means" to achieve these goals; they have serious doubts about the cost-effectiveness of the current socio-economic program; they are concerned that attempts to implement these programs (through the acquisition/contracting/procurement process) may be seriously degrading other equally important national objectives.

Recommendations

There are a number of recommendations we can offer. Again, their validity may not be questioned; we're back to the question of how they can be implemented.

First, we (the federal employees, the public, the taxpayers, the Congress, and the President) must ask ourselves some questions:

1. What benefits do we expect to receive from the socio-economic program?
2. What are we willing to pay to achieve those benefits?

5. Voting population of 45,000,000; sample size of 1500; 1 out of 30,000. Federal acquisition/procurement population of 500,000 (purposely overstated); sample size of 500; 1 out of 1,000.

3. What benefits are we actually receiving from the socio-economic programs?

4. What are we paying to achieve those benefits?

5. Are we satisfied that what we're getting is worth what we're paying?

6. If we're not, what can we do about it?

It probably would be possible to get a satisfactory answer to Question 1 by reading the appropriate enabling legislation. We don't think Question 2 has ever been answered, assuming it's been asked. We don't believe anyone knows the answers to Questions 3 or 4, but this study has tried to open up a discussion of Question 4. The suspicion of many individuals interviewed (and the researchers) is that we are paying much and not receiving an adequate return. While the first 5 questions should be answered (and many program advocates may not even care to have the questions asked) before we answer the sixth, the following are our recommendations for improving the process. We have categorized them as immediate, short-run and long-run.

Immediate:

—Staff appropriate procurement/acquisition offices with full-time, trained personnel responsible solely for socio-economic programs.

—Require that all program management and acquisition/procurement personnel attend short indoctrination briefings on socio-economic programs (history, goals, philosophy, need, duration, etc.).

—Encourage federal agency field offices and program managers to support socio-economic programs (specifically 8(a), small business, labor surplus, women-owned businesses, minority-owned) by giving them authority to award contracts (less than \$100,000) to local firms they select. Establish dollar threshold for sampling, by appropriate agency (SBA) headquarters staffs, of contracts awarded.

—Allocate one-half credit (of number of contracts and dollar value)—for contracts (greater than \$100,000) awarded by SBA to small businesses, 8(a) firms, etc.—to SBA and one-half to initiating procuring agency.

Short-Run:

—Establish procedure for review by SBA every 2 years of decentralized award of contracts to local firms. Consider raising \$100,000 threshold of local (agency field offices and program managers) authority dependent upon record of compliance with appropriate directives and rulings and proven ability to select competent suppliers.

—Establish for each socio-economic program a date for "sunset" type review; develop measurable quantifiable criteria for evaluating benefits received against

costs incurred; plan to modify program following sunset review if achievements are not satisfactory; and consider setting a time limit for duration of preferential treatment.

—Congressional leadership should require that oversight committees analyze impact of new laws (and amendments to current statutes) on the acquisition/procurement process; attempt to evaluate effect on other equally important national objectives also being advanced by use of federal contracts and grants; establish a separate oversight sub-committee (possibly under Government Operations) in both the Senate and the House of Representatives with this responsibility.

—Design, approve, and initiate research studies to:

—Measure possible inflationary effects of current Department of Labor interpretations and decisions on Davis-Bacon and Service Contract Act; include analysis of wage rate determination capabilities in rural and/or desolate geographical location.

—Investigate need for, and value of, Davis-Bacon and Service Contract Act inclusion in contracts with firms already associated with strong, well-established unions.

—Compare benefits achieved in applying limited federal resources to conflicting socio-economic goals.

—Determine delays (and related direct-costs) generated in the overall acquisition/procurement cycle by including socio-economic programs in the process.

—Propose alternatives (to use of the federal contract) for forwarding the objectives of socio-economic programs.

—Design a "dog-and-pony" show that would tour federal installations nationwide and clarify administration views on competition; sole-source versus competitive negotiation versus formal advertising; acceptable ranges of contract product quality and costs; definitions of the term "minority," set-asides for various programs; and personnel performance measures trading off agency mission versus socio-economic objectives.

Long-Run:

—Establish a new federal cabinet-level agency responsible for the socio-economic programs. ||

Socio-Economic Program Impact on Acquisition Management

Patrick D. Sullivan

U.S. Contracts as Lever Seen Illegal," reported the *Washington Post* recently in response to the General Accounting Office's expected testimony on President Carter's use of government contracts to force compliance with his voluntary wage-price guidelines.¹ "Sears Sues U.S. in Challenge to Job Bias Policy," announced another headline, alleging that the government's own policies had created an "unbalanced work force."² These and other news items, such as Senator Chiles warning the Small Business Administration to clean up the "flagrant abuses" in the government's largest minority business development program,³ have begun to raise questions about the direction federal socio-economic policies will take, and what their effect will be on government and industry managers.

Precedence for Policies

Use of the federal contract as an instrument of social change has been long established; yet, do we fully understand where we are headed and what the impact of these programs will be on the acquisition manager? As early as the 1940s, President Roosevelt initiated a requirement that there be no discrimination in hiring when performing a federal contract. This preceded by nearly two decades the civil rights movement within our country. While preference for awards to labor surplus areas was initiated during the Korean conflict, President Carter last year adopted the labor surplus area program as a part of his urban policy. These and other policies reflected in the nearly 40 socio-economic policies (see Table I), portray important and varied concerns of the public and our leaders during the last half century.

Recent Change—P.L. 95-507

But what do these policies mean to today's acquisition manager? Perhaps part of the answer can be found by briefly examining a few of the more recent changes in acquisition policy. Among these changes, the passage of Public Law 95-507 has had, perhaps, the most profound impact. Through its amendment of the Small Business Act, procurements of an anticipated value of less than \$10,000 "which

1. "U.S. Contracts As Lever Seen Illegal," *Washington Post*, February 4, 1979.

2. "Sears Sues U.S. in Challenge to Job Bias Policy," *Washington Post*, February 16, 1979.

3. "Chiles Charges Lack of SBA Cleanup," *Washington Post*, March 7, 1978.

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are subject to small purchase procedures shall be reserved exclusively for small business concerns unless the Contracting Officer is unable to obtain offers from two or more small business concerns that are competitive with market prices and in terms of quality and delivery of the goods or services being purchased."⁴ In addition, P.L. 95-507 provides that all solicitations for contracts which may exceed \$1 million in the case of construction of any public facility, or \$500,000 in the case of all other contracts, shall contain a clause requiring any bidder who is selected to be awarded a contract to submit, to the federal agency concerned, a subcontracting plan which includes, among its other provisions, percentage goals for the utilization of small business concerns owned and controlled by socially and economically disadvantaged individuals. This plan shall include not only "a description of the efforts the offeror or bidder will take to assure that small business concerns and small business concerns owned and controlled by the socially and economically disadvantaged individuals will have an equitable opportunity to compete for subcontracts,"⁵ but also "assurances that the offeror or bidder will include the clause furthering these policies in all subcontracts which offer further contracting opportunities." Similar requirements apply to high-value subcontracts. Public Law 95-507 additionally provides that failure of any contractor or subcontractor to comply in good faith with the basic clause or any plan required of such contractor shall be a material breach of the contract or subcontract.⁶

Impact on the Acquisition Manager

To the acquisition manager, this may seem to have little effect on his or her program, but the new restrictions on contractor selection mark a significant change in direction. Previously, prospective procurements under \$10,000 were reviewed for potential award to small business by the Small Business Administration representative and the contracting officer. If there was an expectation of adequate competition from among small businesses, the procurement would be set-aside for exclusive participation by these concerns. This resulted in the preponderance of small purchases being made through competition between predominantly large firms. Now, however, the contracting officer must reserve all these procurements for small businesses unless it can be shown that insufficient competition among small businesses is expected to exist. The acquisition manager can anticipate that a number of former supplies will be displaced, and the possibility exists that program costs will increase through the absence of the competitive pressures of large business.

4. Public Law 95-507, Title II, Amendments to the Small Business Act, Chapter 3, Sec. 221(j).

5. Public Law 95-507, Title II, Amendments to the Small Business Act, Chapter 2, Sec. 221(d)(5) and (6).

6. Public Law 95-507, Title II, Amendments to the Small Business Act, Chapter 2, Sec. 221(d)(8).

With regard to the new requirement for subcontracting plans containing percentage goals for awards to small and socially and economically disadvantaged firms, the acquisition manager has two concerns. First, there is the danger that prime contractors and major subcontractors may fail to meet their goals. According to the law this could result in the government initiating a termination for default action against the prime contractor.

The second concern involves the effect the new law will have on bids received as a result of formal advertising. Under the revised formal advertising procedures, the failure of a bidder to submit a satisfactory subcontracting plan will cause the bidder to be considered nonresponsive and ineligible for award. Assuming that a bidder finds, after bid opening, that he has obtained other business which is more profitable, or any of a host of other reasons which would motivate a bidder to seek release from his bid, the opportunity to be declared nonresponsive for failure to present an acceptable subcontracting plan offers the perfect solution to escape from his obligations. The "firm bid rule" by which a bidder could not be released from his bid now has a loophole through which a number of contractors will pass.

Clarification Needed

Public Law 95-507 also states in Chapter 2 that "Nothing contained in this subsection shall be construed to supercede the requirements of Defense Manpower Policy 4A or any successor policy."⁷ However, in Chapter 3, which prescribes the reservation of all contracts under \$10,000 exclusively for small business concerns, there is no such statement. This raises a question of possible conflict between P.L. 95-507 and P.L. 95-89, an earlier law, which prescribes the priorities for awards under labor surplus areas and small business set-aside programs. These priorities, implemented through Defense Manpower Policy 4A, apply to contracts of \$2,500 and above, and contain as a fourth priority, "Concerns which are located in labor surplus areas on the basis of a total set-aside."⁸ Under this provision, a concern of any size, including large businesses, would be eligible for award if it met the criteria as a labor surplus area concern. While it might be argued that P.L. 95-507 is a later expression of Congress and, therefore, supercedes the application of these priorities under P.L. 95-89 for purchases between \$2,500 and \$10,000, there is an apparent need to clarify this point so that contracting and program personnel will know which policy to follow.

7. *Ibid.*

8. Public Law 95-89, Title V, Procurement Assistance, Sec. 502(e).

Lack of Simplified Procedures

The establishment of a \$2,500 threshold for the labor surplus area set-aside program was reportedly done to accommodate the Department of Defense. But the net effect was to add another program threshold at a level below the \$10,000 ceiling for simplified small purchase procedures. The Commission on Government Procurement recommended the change, which Congress subsequently enacted, of raising the small purchase ceiling from \$2,500 to \$10,000.⁹ Yet, there are other socio-economic requirements that have not been revised upward. For instance, the Service Contract Act applies to awards in excess of \$2,000, and Davis-Bacon applies to awards over \$2,500. A recent General Accounting Office draft report called for repeal of Davis-Bacon but, irrespective of the disposition of this Act, small purchase buyers are faced with obtaining prevailing wage determinations on small dollar contracts. The simplified small purchase procedures have yet to be completely simplified.

Resources Conservation and Recovery Act

Acquisition managers are also faced with other requirements, such as compliance with the Resources Conservation and Recovery Act of 1976. The OFPP Policy Letter 77-1, in implementation of this Act, requires that "Federal procurement shall be effected in a manner that maximizes the use of recovered materials. This policy shall be a consideration, along with price and other relevant factors, in the formulation of purchase requests and solicitations, in the evaluation of bids and proposals, and in the selection of contractors. Although the policy applies generally to all purchases, it specifically applies to transactions exceeding \$10,000."¹⁰ Only three conditions permit exceptions to this policy. Acquisition managers need to understand that this is a statutory requirement with which one must comply. A small informal sample of contracting officers and project officers indicates that there is almost no knowledge that the requirement exists, and even less knowledge of how to apply it effectively in the procurement process.

Energy Policy and Conservation Act

In a closely related area, energy conservation, the Energy Policy and Conservation Act has as its intent "...to ensure the application of the principles of energy conservation and efficiency in the procurement of property and services."¹¹ To

9. *Report of the Commission on Government Procurement*, Vol. 3, Washington, D.C.: U.S. Government Printing Office, December 1977.

10. Office of Federal Procurement Policy, Policy Letter No. 77-1, dated February 2, 1977, Subj: Procurement of Products That Contain Recycled Material.

11. Title 41, Public Contracts and Property Management, Subpart 1-1.339, Energy Conservation.

accomplish this, "Energy conservation and energy efficiency criteria shall be applied in the determination of requirements and source selection decisions whenever the application of such criteria would be meaningful, practical and consistent with agency programs and operational needs. Under this policy, energy conservation and efficiency criteria shall be considered for application along with price and other factors in the preparation of solicitations, the evaluation of offers and the selection of bids and proposals for award."¹² While the implementation of this act focuses on consumer products such as refrigerators, freezers, etc., the Secretary of Energy can classify any other type of product as being covered by this policy.

Policy Conflict

There appears to be an inherent conflict between the application of the Energy Policy and Conservation Act and the Resources Conservation and Recovery Act. For example, some products may consume less energy but may require more natural resources in their manufacture. How is the acquisition manager to judge which policy is to receive preference in the preparation of work statements and in the source selection process? Is it possible to apply them equally? Even if this should be theoretically possible, there remains the problem of the absence of efficiency labels, and prescribed energy efficiency standards for most products. The acquisition manager is in a "no-win" situation with regard to these two policies because of the absence of sufficient technical information and the lack of guidance in setting priorities.

Future Trends

But what about the future? Will this trend continue? All indications are that the roller coaster is still picking up speed. For instance, the same controversial policy on adherence to voluntary wage and price guidelines, while applicable to contracts over \$5 million now, is expected to be applied to lower-priced contracts in the future, once there has been experience gained from the present policy.

A recent report released by the Joint House-Senate Small Business Committees charged that government policy is accounting for under-utilization of small enterprises in the nation's efforts to encourage technological innovation. The joint committee noted that P.L. 95-507 requires each agency to establish goals for the participation of small business concerns in procurement contracts over \$10,000. However, the committee warned "if the Executive Branch does not *develop* and *achieve* appropriate small business R&D targets within a reasonable time, the Committee will reopen the question of percentage standards for small business by hearings or otherwise"¹³ (emphasis added). The message is clear that

12. *Ibid.*

13. U.S. Congress Joint House-Senate Small Business Committee Report on Underutilization of Small Firms for Federal R&D, December 1978.

acquisition managers must increase their efforts to develop and achieve their small business R&D targets—or else!

Additionally, Representative Drinan has introduced HR-291 which, among other provisions, would amend Section 15 of the Small Business Act to permit the Small Business Administration to specify categories of procurements for which the agencies would be required to increase the percentage of dollar value furnished by small business concerns until the total reached 20 percent of that category. This same bill would require the head of each department or agency to "review its large systems procurements on which small businesses ordinarily cannot compete and take all feasible steps to subdivide such procurements into smaller components on which small businesses can compete and bid."¹⁴

The seriousness with which industry and some congressional leaders view the use of the federal contract to implement socio-economic policy can be seen in the recent attempt by the administration to relax restrictions in federal procurement policies that require agencies to give preference to American firms in the award of federal contracts. Immediately upon learning of this aspect of the multi-lateral trade agreement, the Chairman of the House Small Business Committee warned that the multinational treaty would be in jeopardy unless the President eliminated those changes in the Buy American Act.¹⁵ Within a matter of days, the administration announced it had renegotiated the objectionable provisions.¹⁶

Acquisition Manager's Role

Faced with these ever-increasing socio-economic requirements, the acquisition manager is squarely in the middle of a management process, the ground rules of which are changing constantly. To assume that the contracting officer will take care of these responsibilities is "passing the buck." Each acquisition manager must take the time to become conversant with our national objectives so as to assure their inclusion in his or her acquisition planning. By aggressively pursuing these objectives, the acquisition manager can materially assist in assuring their success. Additionally, by surfacing the problems and communicating the difficulties to higher level officials, there is an opportunity for change. Through training of program personnel in these socio-economic considerations, the acquisition managers can improve the efficiency and effectiveness of program operations by anticipating delays and avoiding confrontations.

14. HR-291 to Provide Additional Assistance to Small Business Concerns in Acquiring Federal Procurement Information and Contracts.

15. "U.S. Would Relax Preference to Small and Minority Firms," *Washington Post*, March 20, 1979.

16. "Set-Aside Restored by Carter," *Washington Post*, March 23, 1979.

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The future depends upon the acquisition manager assuming a larger role in the implementation of national socio-economic policy. The track record of success in technological advances indicates that the capability and determination necessary to achieve these objectives already exist.

It is time to recognize, if it has not been recognized already, that the nation is depending upon federal contracts to further its social objectives. Now is the time to take a more active part in seeing that these expectations are met. |

TABLE I
Socio-Economic Policies Affecting the Acquisition Process

PROGRAM	PURPOSE
Buy American Act*	To provide preference for domestic materials over foreign materials.
Preference for United States Manufacturers	To provide preference for domestic manufacturers in construction of <i>diplomatic and consular</i> establishments.
Preference for United States Manufacturers	To restrict U.S. Forest Service from purchasing twine manufactured from materials of foreign origin.
Preference for United States Products (Military Assistance Programs)*	To require the purchase of U.S. end products for the military assistance program.
Preference for United States Food, Clothing and Fibers (Berry Amendment)*	To restrict the Department of Defense from purchasing specified classes of commodities of foreign origin.
Officials Not to Benefit*	To prohibit members of Congress from benefiting from any government contract.
Clean Air Act of 1979	To prohibit contracting with a company convicted of criminal violation of air pollution standards.
Equal Employment Opportunity*	To prohibit discrimination in government contracting.

17. Bureau of National Affairs, Inc., *Federal Contracts Report*, Washington, D.C., February 19, 1979, pp. F-7 and F-8.

Copeland "Anti-Kickback" Act*	To prohibit kickbacks from employers on public works.
Walsh-Healy Act*	To prescribe minimum wage, hours, age, and working conditions for supply contracts.
Davis-Bacon Act*	To prescribe minimum wages, benefits, and work conditions on construction contracts in excess of \$2,000.
Service Contract Act of 1965*	To prescribe wages, fringe benefits, and work conditions for service contracts.
Contract Work Hours and Safety Standards Act*	To prescribe 8-hour day, 40-hour week, and health and safety standards for laborers and mechanics on public works.
Fair Labor Standards Act of 1938	To establish minimum wage and maximum hours standards for employees engaged in commerce or the production of goods for commerce.
Prohibition of Construction of Naval Vessels in Foreign Shipyards	To prohibit use of appropriated funds for the construction of any Navy vessel in foreign shipyards.
Acquisition of Foreign Buses	To restrict use of appropriated funds to purchase, lease, rent, or otherwise acquire foreign-manufactured buses.
Release of Product Information to Consumers	To encourage dissemination of government documents containing product information of possible use to consumers.
Prohibition of Price Differential	To prohibit use of appropriated funds for payment of price differential or contracts made to relieve economic dislocation.
Required Source for Jewel Bearings*	To preserve a mobilization base for manufacturer of jewel bearings.

Employment Openings for Veterans*	To require contracts to list available employment openings with State employment system to assist veterans in obtaining jobs.
Covenant Against Contingent Fees*	To avoid contract obtained by broker for a contingent fee.
Gratuities*	To provide government with right to terminate if gratuity is given to the government employee to obtain contract or favorable treatment.
International Balance of Payment*	To limit purchase of foreign end products and services for use abroad.
Prison-made Supplies	To require mandatory purchase of specific supplies from Federal Prison Industries, Inc.
Preference to U.S. Vessels*	To require the shipment of all military and at least half of other goods in U.S. vessels.
Care of Laboratory Animals*	To require humane treatment in use of experimental or laboratory animals.
Required Source for Aluminum Ingot*	To eliminate excess quantity of aluminum in the national stockpile.
Small Business Act*	To place fair portion of government purchases and contracts with small business concerns.
Blind-made Products	To make mandatory purchase of products made by blind and other handicapped persons.
Duty-free Entry of Canadian Supplies*	To further economic cooperation with Canada and continental defense.
Use of Excess and Near-Excess Currency*	To provide preference in award to bidders willing to be paid in excess or near-excess foreign currency.
Purchases in Communist Areas*	To prohibit acquisition of supplies from sources within Communist areas.

Nonuse of Foreign Flag Vessels Engaged in Cuban and North Vietnam Trade*	To prohibit contractor from shipping any supplies on foreign flag vessel that has called on Cuban or North Vietnamese port after specific dates.
Labor Surplus Area Concerns*	To provide preference to concerns performing in areas of concentrated unemployment or under-employment.
Economic Stabilization Act of 1970	To stabilize prices, rents, wages, salaries, dividends, and interest.
Humane Slaughter Act*	To purchase meat only from suppliers who conform to humane slaughter standards.
Miller Act*	To require contractor to provide payment and performance bonds on government construction contracts.
Convict Labor Act*	To prohibit employment on government contracts of persons imprisoned at hard labor.
Vietnam Veterans Readjustment Act	To give employment preference to disabled veterans and veterans of the Vietnam area.

*Indicates that the program has resulted in the issuance of a standard contract clause.

Increasing Emphasis on Readiness in Acquisition

Richard E. Biedenbender

Over the past 5 years, initial support investment and operating and support (O&S) costs have been of growing concern to management. Initially, this concern resulted in attempts to improve weapon system O&S cost measurement and prediction. More recently, this concern has been expanded to include a notion called "system readiness." The term is not directly associated with current and well-known readiness issues, but is intended to denote measures of merit pertinent to the peacetime availability and wartime employment of a system.

I will in this paper: discuss the sense in which readiness is becoming a major Defense Systems Acquisition Review Council (DSARC) consideration, review some analytical developments which underlie this, and discuss potential impacts on the acquisition and contractual processes.

Background

As background, it is well to note that the recent Office of the Secretary of Defense (OSD) reorganization created a DSARC chair for Manpower, Reserve Affairs, and Logistics (MRA&L). This established a DSARC advocate whose primary interests are manpower, support, and system readiness. In support of this role, several personnel spaces were established in the Directorate of Acquisition and Support within MRA&L. This directorate is, in turn, supported by the Logistics Review Division, located at the Defense Logistics Agency (DLA) as part of the DOD Product Engineering Services Office. A primary function of these two offices is the review of major programs at DSARC milestones to help formulate an MRA&L position.

Readiness Measures

Before we discuss analytics, we should define our terms. System readiness is a broad term used to describe measures of merit pertinent to the peacetime availability and wartime employment of a system. The specific measures vary by type of system. To illustrate this, consider three examples:

SYSTEM	MISSION	MEASURE
1. Navy VSTOL aircraft (singly deployed; isolated ships).	React to submarine detections.	Operational availability

Author's Note: The analyses discussed reflect the initiative and know-how of the Logistics Review Division (LRD) staff members, Mike McGrath, Larry Hubbard, John Turek, and Bill Miller. Contributions by the Office of Acquisition and Support Planning, Office of the Secretary of Defense, were critical to the issues and developments discussed.

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|--------------------------|------------------------------|--------------------------|
| 2. Army radar patrol | Maintain continuous coverage | Percent coverage per day |
| 3. Air Force EW aircraft | Escort attack aircraft | Sortie rates per day |

A major MRA&L thrust in the DSARC has been to model the probable system readiness rates to be achieved given (1) predicted or demonstrated design parameters, such as reliability and maintainability; (2) planned support resources, such as spares; and (3) pertinent logistic system measures, such as resupply time. Conceptually, this approach makes more sense than past reliance on historical planning factors and "rules of thumb."

The major difficulties with this approach involve availability of definitions and data inputs, the large size of models useful for this purpose, and the validity of the models themselves. The approach taken to resolve the first two of these is use of simplified models which permit more rapid analysis and greater use of sensitivity testing, combined with real-world data such as development test/operational test (DT/OT) results. Model validation will be addressed later.

In general, most programs can be analyzed using one or two models. The first model is a spares model which optimizes operational availability achievable for a given spares budget, given various inputs such as less than release unit (LRU) or weapon replaceable assemblies (WRA) reliability levels, average resupply time and the expected not operationally ready— maintenance (NORM) rate. If operational availability is the desired output measure, this model is sufficient for testing a wide variety of sensitivities. A second model is needed if operational availability levels or an optimized spares budget is an interim step to a wartime output measure such as sortie rate/day.

An example of the second model is a simplified simulation model which "flies" missions, given the optimized spares list. Maintenance, spares and manpower demands, and the resulting sortie rate achievable are simulated. This model can again be used to test a wide range of sensitivities. Simplification is achieved by concentrating on the key subsystem likely to affect results.

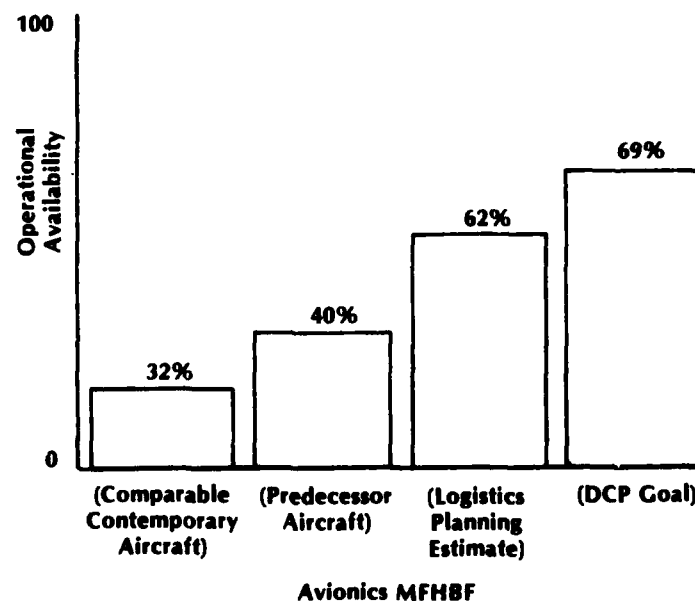
Anti-Submarine Helicopter. Our first example is a Navy helicopter deployed singly aboard destroyers and other such ships. The aircraft is supported by a "packup kit" of spares brought aboard with it. A small maintenance crew corrects deficiencies by replacement of weapon replaceable assemblies from the kit. Defective WRAs are returned ashore for repair. Because the helicopter is needed to respond to ship-detected anti-submarine warfare (ASW) threats, the probability of being available to meet a random demand for a sortie is the most pertinent measure. For a simple aircraft this is the same as operational availability.

Likely operational availability of the system can be estimated based on assumed reliability levels for each WRA, average off-ship resupply time, the budget for the packup kit, and expected NORM value. Because the helicopter in question

is an adaptation of an existing aircraft, the major area of uncertainty is the avionics suite being added. A single echelon, single hardware level of indenture spares optimization model developed by the Logistics Management Institute was modified for the analysis. The model selects the best mix of WRAs to be included in the packup kit, and estimates the maximum availability achievable for a given spares investment level. The inputs can be varied to test sensitivities. Figure 1 summarizes the expected operational availability based on the program's planned packup kit budget, a resupply time equal to that of current systems (15 days), and the assumption that the allocated NORM goal (10 percent) would be met. The figure shows that operational availability of this system is quite sensitive to avionics reliability.

By comparing these results to desired or specified availability, and making an assessment on the likely level of reliability to be achieved (this might be done using development or operational test results, adjusted for planned corrections of

FIGURE 1
Operational Availability for Given Packup Kit Budget



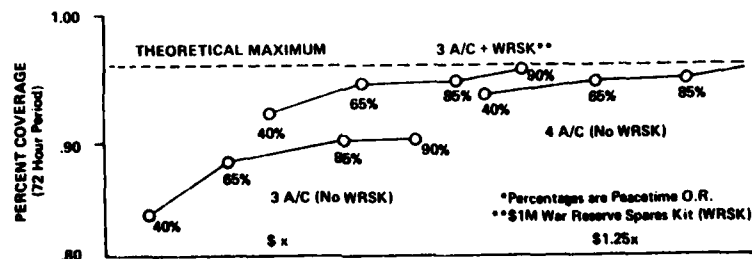
deficiencies), a judgment can be made as to whether availability is likely to be achieved or if corrective action is needed. The analysis can be varied, for example, to determine the cost of the pickup kit required to meet the availability objective, to evaluate the impact of reducing resupply time, or to measure the impact of alternative deployment concepts (e.g., two aircraft versus one per ship). The analysis is not intended to substitute an OSD estimate for a service estimate, but rather to serve as a "flag" to ensure that potentially adverse conditions are properly analyzed and addressed by the service involved.

Army Radar Patrol Aircraft. Our second example is an Army radar helicopter. The deployment plan is to locate four of these in each Army division, along with several ground stations, to receive and process the radar surveillance data. The airborne system involves modification of an existing helicopter to accommodate a radar and data link. The modified helicopters are colocated with existing helicopter units in the division. In time of combat surge, the Army desires continuous surveillance coverage (or as much as possible), i.e., one aircraft on station at all times. This is more demanding than either peacetime or sustained combat operational requirements. The appropriate readiness measure for the surge scenario is percent coverage maintained over a 72-hour period.

This situation can be analyzed by the combination of two models. The first model, as in the previous example, optimizes the spares list for peacetime operational availability, and gives the planned spares budget. This list is then fed into a simulation model which "flies" missions, simulating maintenance and spares demands, and evaluates the percent coverage achieved.

Two areas of interest are the effects of varying the number of aircraft per division, and the potential impact of utilizing a war reserve spares kit (WRSK) similar to the Air Force WRSK concept. Figure 2 illustrates the results.

FIGURE 2
Investment Cost Per Division (\$Millions, FY-79)



Because the chart is somewhat "busy," a few words of explanation are in order. The horizontal line represents investment per division while the vertical line represents percentage of surge coverage achieved. The different points for any given number of aircraft, with or without WRSK kits, represent different surge "going in" peacetime operational availability rates. The chief point of interest is the virtual equivalence in coverage of four aircraft versus three aircraft with a WRSK, and the relative costs of each. This is largely due to the fact that with no WRSK, one aircraft rapidly becomes a "hangar queen" because of cannibalization. In short, hangar queens are not a cost-effective sparing strategy. Again, other sensitivities such as mean-time-to-repair and mission duration can be evaluated to identify lucrative areas for improvement.

Another interesting analysis is the repair level decision for the radar "black boxes." Repair of boxes within the division will probably require a sophisticated test set and highly skilled personnel. A cost analysis of repair of LRUs at both division (DS) and corps (GS) level versus repair at GS level only is shown in Table I.

The analysis focuses on test equipment, spares, and personnel because these are the major costs. While GS level repair increases spare costs slightly, this is more than offset by test equipment and manpower savings. Since the skilled manpower required is likely to be in short supply at the time of deployment, the "GS-level-only" alternative looks particularly attractive. Note that initial spares can be varied to achieve the desired peacetime operational availability rate.

These analyses point out different ways in which desired readiness might be achieved at lower costs. Such alternatives should be examined in more detail during the full-scale development phase.

TABLE I
Radar Level of Repair Analysis (Cost Per Division \$M, FY-79)

Investment	Repair LRU's At DS*	Repair LRU's At GS
Test Equipment		
GS (1 Set/3 Div)	.3	.3
DS (1 Set/Div)	.9	0
Initial Spares (75% O.R.)	1.1	1.5
20 Year O&S		
Personnel (Incl. Training)		
GS	.1	.2
DS	2.0	.8
Support of Test Equip.	1.2	.3
Total	5.6	3.1

(Cost of Transportation Assumed Negligible; Replenishment Spares, Manuals, Repair of SRU's, Supply Administration, Etc., Are Equal Cost For Both Alternatives)

*10% NRTS Rate

Electronic Warfare (EW) Aircraft. A third example is the analysis of an electronic warfare aircraft that is a modification of an existing aircraft with additional EW equipment. The analysis centers around the added EW equipment, because it is the new part of the system. The remainder of the aircraft is treated as one "big" LRU. The measure of merit in this case is sorties flown per aircraft per day. This is a key measure because other aircraft may not fly if the EW aircraft is unavailable. Accordingly, an objective was set on the number of sorties flown per day in surge and sustained operations in wartime. Figure 3 shows the probable sortie rates achievable for surge conditions as a function of achieved reliability.

The dotted lines show the probable impact of failure false alarms from the built-in-test. The likely reliability can be bounded by taking test results and upgrading them for planned corrections of deficiencies. If the EW equipment is derived from existing equipment, field data on the existing system could provide an alternate bound. Management can compare the likely performance in this range with the objective and make judgments regarding needed actions. This type of analysis also may indicate promising avenues for corrective action if necessary. Figure 3 shows that improving EW reliability has limits since the EW reliability could become dominated by the reliability of the basic aircraft. Table II shows sortie rate capability as a function of variations in reliability, spares budgets, and organizational level maintenance manpower. The table illustrates that, in the example, large increases in spares investments yield little payoff unless a manpower bottleneck is eliminated, after which more spares can increase sortie rates.

FIGURE 3
Surge Sortie Generation Capability vs. Subsystem Reliability*

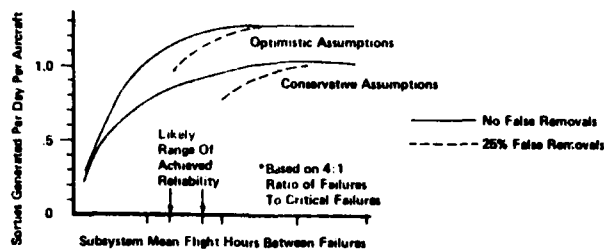


TABLE II
Sustained Sortie Generation Capability vs. Manpower and Spares (Sorties/Acft/Day)

Subsystem "O" Level Mtnc.	SPARES (INITIAL + WRSK)			Subsystem MFHBF
	\$X	\$1.25X	\$4.7X	
4 Man Maintenance Crew	.50	.52	.54	Y Hrs.
8 Man Maintenance Crew	.60	.63	.76	
4 Man Maintenance Crew	.57*	.59	.61	1.4Y Hrs.
8 Man Maintenance Crew	.64	.69	.79	

Implications

The initial results from this type of approach have been promising. Our recent experience with the use of such models on aircraft to support DSARC reviews has shown them to be valuable for assessing the impact of reliability and maintainability and manpower and support resource deficiencies in terms of system readiness so that corrective measures can be taken before the system is fielded. Application of the concept to some missiles and ground vehicles is underway.

The key issue is model validity. This is an open issue. While the models used in the examples have been validated to the degree possible, frequently against larger, more complex models, more needs to be done. In the long run, given greater stimulus in this area, one might say with confidence that better models, if needed, will be developed. In fact, OSD is already sponsoring such work. The services have a number of models, particularly in the simulation class, which can be useful in this regard.

Policy Revisions

The general thesis that support-related system readiness is a major DSARC concern, and that it should be quantitatively linked to reliability and maintainability and manpower and support, seems to be gathering significant momentum. Policy to this effect in DOD Directives 5000.1 and 5000.2 appears likely. The update of the integrated logistics support policy directive, DODD 4100.35, now undergoing formal coordination, elaborates on this. A study group to improve test and evaluation is underway.

Finally, we can speculate on the impact on contractors and contracts. If readiness becomes a major system parameter, readiness goals or objectives will become part of contracts; however, it is an operational term and thus not directly measured in factory test. Most of the impact will, therefore, involve shifts in emphasis of existing practice, rather than new requirements *per se*. Reliability and maintainability will be treated more seriously.

Incentives may shift. Support considerations will be treated more seriously, particularly in early phases. Contractor innovation of new, more effective, support concepts will be encouraged.

Summary

The "readiness" approach provides an output measure for support issues in lieu of the past management "gut feel." Assuming that this approach is solidified and adopted by the services, the long range impact will be more explicit consideration of readiness measures and related manpower and support in program management and higher level management reviews. ||

These charts were intended to accompany the paper, "Meeting the Evolving Micro Requirement," by Jerry L. Raveling, which appeared in the Summer 1979 Defense Systems Management Review. We regret the error.

FIGURE 1
System Life Cycle Process

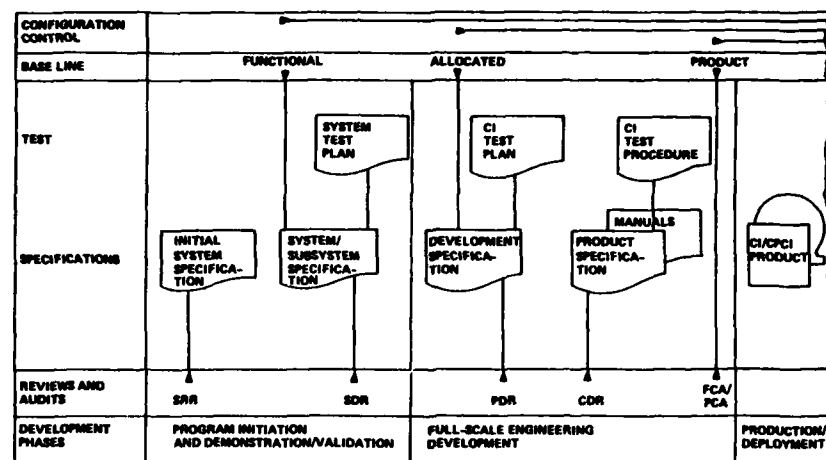


FIGURE 2
Basic CM Identification Scheme

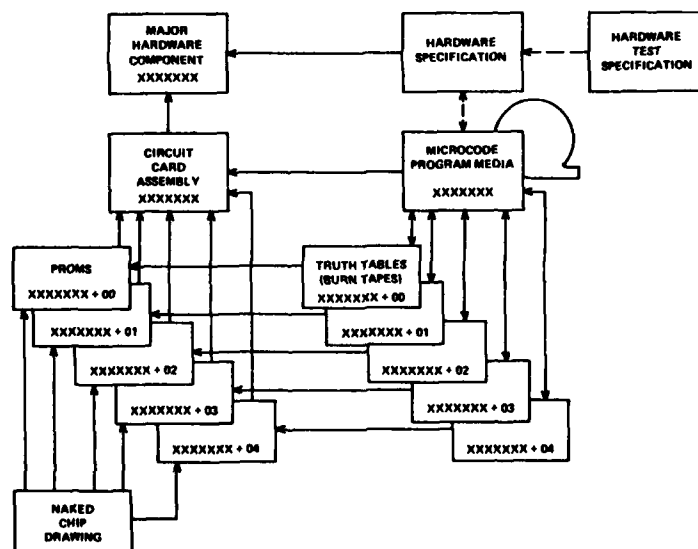


FIGURE 3
Microprogram/Firmware Software Configuration Identification

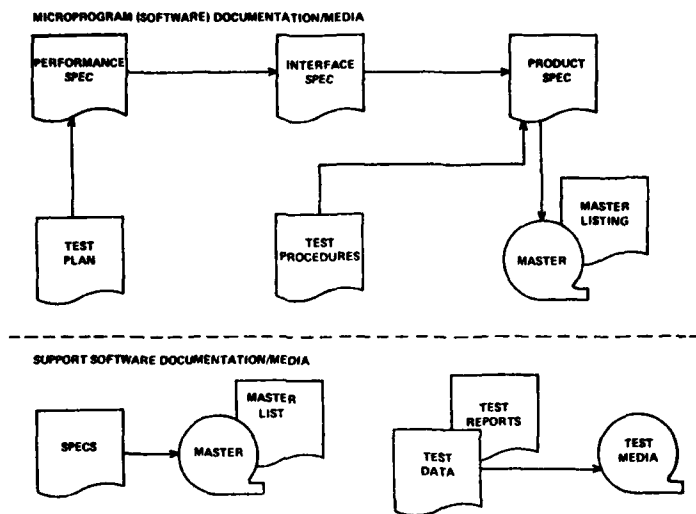


FIGURE 4
Micro Management Environment

