A RETURN TO BASICS: IMPLEMENTING DESIGN-TO-COST

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AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC.

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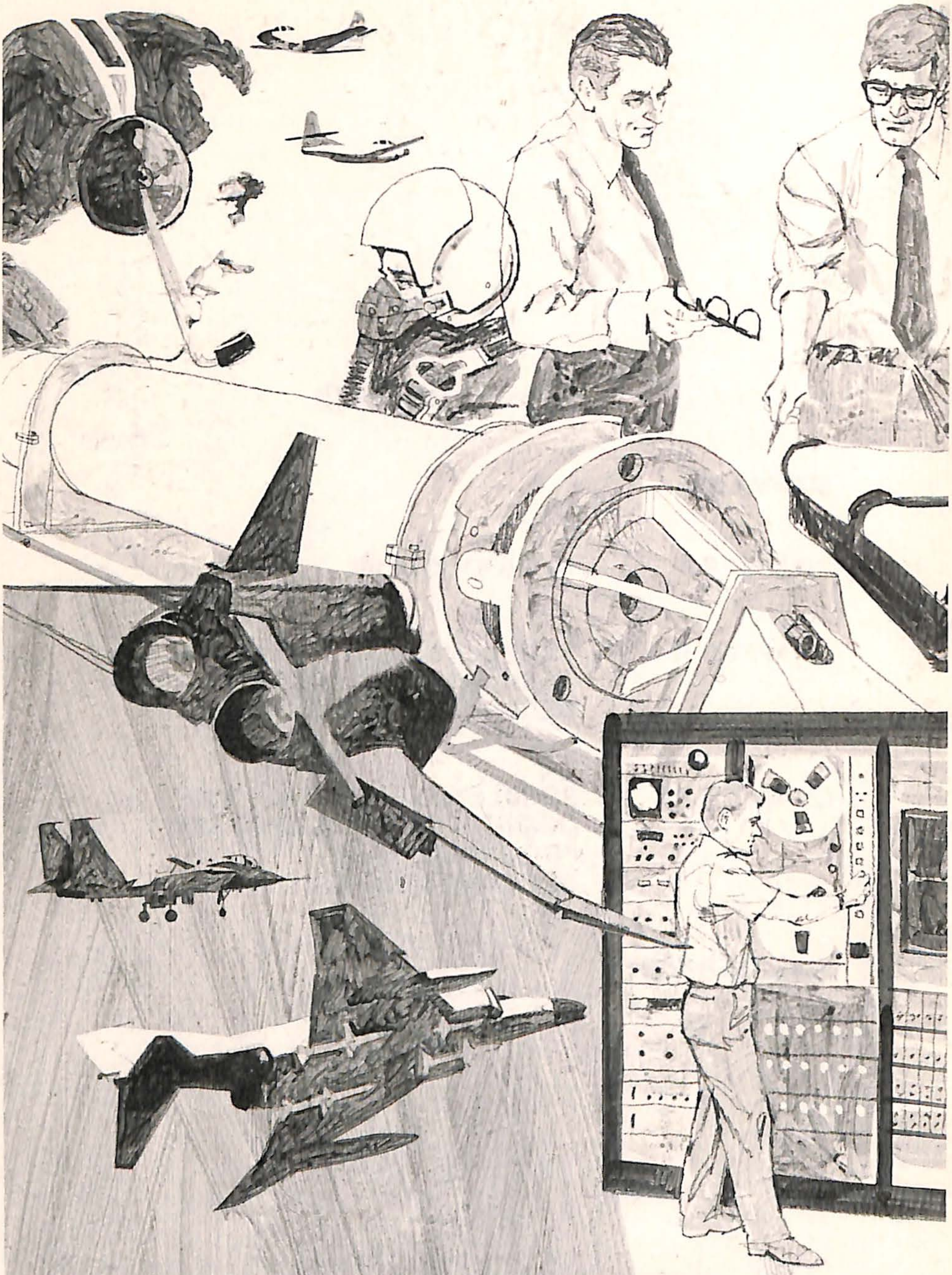

A RETURN TO BASICS: IMPLEMENTING DESIGN-TO-COST

SUMMARY

The purposes of this AIA paper are to identify anticipated problems that "Design-to-Cost" will encounter as its use increases, to suggest practical solutions, and to prevent undesired results. In short, it is intended as a constructive and useful contribution towards the successful implementation of an as yet unproven Government contracting tool.

The content is based on a review of the already abundant literature on the subject and analysis of the largely conceptual material from the perspective of industry experience. It is intentionally problem-solving in nature rather than philosophical. Brief and to the point, it assumes the reader is familiar with the nuances and complexities of DoD contracting. A bibliography is provided for those who desire elaboration or further background.

An important concern is that while Design-to-Cost has become a popular concept in DoD contracting circles, real understanding of the basics of the process, at best, is deficient. Nevertheless, its basics are both important and potentially far-reaching, as means must be found to help offset the several factors rapidly eroding DoD's purchasing dollar. The policies and principles laid down in DoD Directive 5000.1 have provided a framework for such improvements. Unless Design-to-Cost is implemented so as to assure further improvement, it will fail - perhaps as spectacularly as total package procurement.

Proper implementation is the key; the coming months will see the test. The concept will have to contend with a host of hurdles and pitfalls. Thirteen important ones are identified herein along with recommended solutions. The paper emphasizes the basic nature of certain aspects of the design and development processes, particularly tradeoffs, iteration, and flexibility. It notes that these will have to be given due and proper recognition if success is to be achieved and suggests several ways to do so.

An overall conclusion is that inadequate or inappropriate implementation is almost certain to result in the demise of yet another good idea on the defense business scene. In today's environment, neither DoD nor industry can permit such to occur.

CHAPTER I

INTRODUCTION

The term "Design-to-Cost"[1] is not only the subject of considerable attention but, by necessity, may soon become a DoD contracting way of life. The systems acquisition budget squeeze is here, is real, and from all indications, will continue. The growing problems of inflation, system sophistication, changing international postures, dollar devaluation, personnel costs and such will continue to erode sharply DoD's ability to purchase necessary defense systems. Whether or not "Design-to-Cost" becomes a significant tool to help cope with this serious problem — or just another buzz word — will be decided in the months ahead. The critical test, of course, will be in its implementation; this will determine whether what is still largely philosophy will be converted into realistic and sound practice when it finally reaches the program level, or something counter-productive.

Recognizing the growing systems acquisition problems during his recent tenure in DoD, Secretary Packard led the way toward fundamental solutions, including Design-to-Cost, in the policies and principles he laid down in DoD Directive 5000.1. The recent Commission on Government Procurement report sets forth many important recommendations. The bibliography contains a host of excellent studies, articles, policy statements, speeches and reports by both government and industry personnel. It is apparent that extensive progress has been made in describing the desired design-to-cost philosophy, and the direction of implementation is becoming clearer each day.

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1. A common definition has yet to evolve, but in general terms "Design-to-Cost" means selecting a unit cost goal and developing a product with that goal as a principal design parameter. Lengthy arguments can be raised as to whether "cost" means "fly away", "life cycle", "unit production" or some other cost, and whether "Design-to-Price" is not technically more correct. The term will be used herein in the generic sense; the establishment of a precise definition will be left to others.

Recognizing that extensive thought and consideration has gone into these many documents, AIA elected not to generate another philosophical view, but decided instead to review and analyze existing material from the perspective of industry experience. It is hoped that this process will materially contribute toward the successful implementation of both DoD 5000.1 and Design-to-Cost by highlighting potential problems and suggesting practical solutions.

The possible problems and recommendations discussed in Chapters II and III arise from consideration of a few, virtually self-evident, premises noted below.

Premise 1 – *Tradeoff studies and design iterations are intrinsic to design-to-cost.* Commercial experience shows that evolving a design to meet a stipulated cost can certainly be done. In fact, a design can often be developed to meet a cost target that at first glance seems too low. However, this is true only if enough time and funds are available in the development program to examine all avenues of tradeoffs, alternate design approaches, and occasional creative, ingenious departures from normal practice. Additionally, the program manager must have the flexibility to make changes expeditiously. The principle of continuous, practical tradeoffs among system cost, performance, and schedule is paramount for success, whether the program is in the commercial or the defense area. Thus, defense programs must be structured to allow (within the legal constraints) sufficient time, money, and flexibility to explore alternatives and to implement agreed-to changes rapidly.

Premise 2 – *Development budgets must reflect the character of design-to-cost programs.* Historically, defense programs have been oriented toward achieving a production design with a minimum number (if any) of design iterations. The very nature of design-to-cost programs, as noted in premise 1, is characterized by repeated tradeoffs and design iterations. The initial program planning and budget submissions for the development phase must allow enough time and funding to perform these iterations. Unless this is done, any resulting overrun will be seized upon by the omnipresent

critics of defense spending and used to attack the program, or even the entire design-to-cost approach.

Premise 3 – *The unit production cost target must be basically compatible with the required performance.* When a new program enters the arenas of DoD and the Congress in search of funds, attendant pressures can cause its government and industry advocates to be overly optimistic; that is, to understate funding needs and to overstate anticipated performance. It is at this point, well before DSARC I when first budget estimates are made, that seeds of trouble are often sown. Unless estimates of unit production cost and performance capability are reasonably in accord (even though the cost target should present a challenge), any design-to-cost program will eventually come to grief. The current efforts in DoD to develop better estimating methods are to be encouraged, since they should help mitigate this common problem.

Premise 4 – *Effective implementation of design-to-cost programs depends upon working level personnel in Government and industry.* In any large organization, a policy stated at a high level is subject to interpretation and sometimes subtle modification as it passes down through the ranks. Organizational inertia, an attachment to established practice, and often different sets of motivations and values frequently result in less than completely effective implementation of a well-stated policy. The phenomenon exists in Government and industry, perhaps to a somewhat lesser degree in the latter. In this respect, design-to-cost is no different from any other policy. Positive steps, including formal indoctrination programs in some areas, must be taken to ensure that the policy is understood and appropriately acted upon by all working level personnel, so that the spirit of the policy is met. If design-to-cost works, it will be because of people, not because of directives and procedures. It must not be institutionalized and become merely another "ility".

Premise 5 – *The RFP and the contract must reflect the objectives of the design-to-cost policy.* Many of the potential problems cited in the following chapters can be avoided by a properly written RFP and contract. The RFP should describe the basic military mission and should outline the acceptable areas and bounds of trade-offs, so that maximum scope is allowed for responsive proposals. Care must also be taken to see that the general terms and conditions of the contract do not contain ASPR clauses that might unduly restrict the Government and contractor program managers in performing and executing the necessary trades to meet the program objectives.

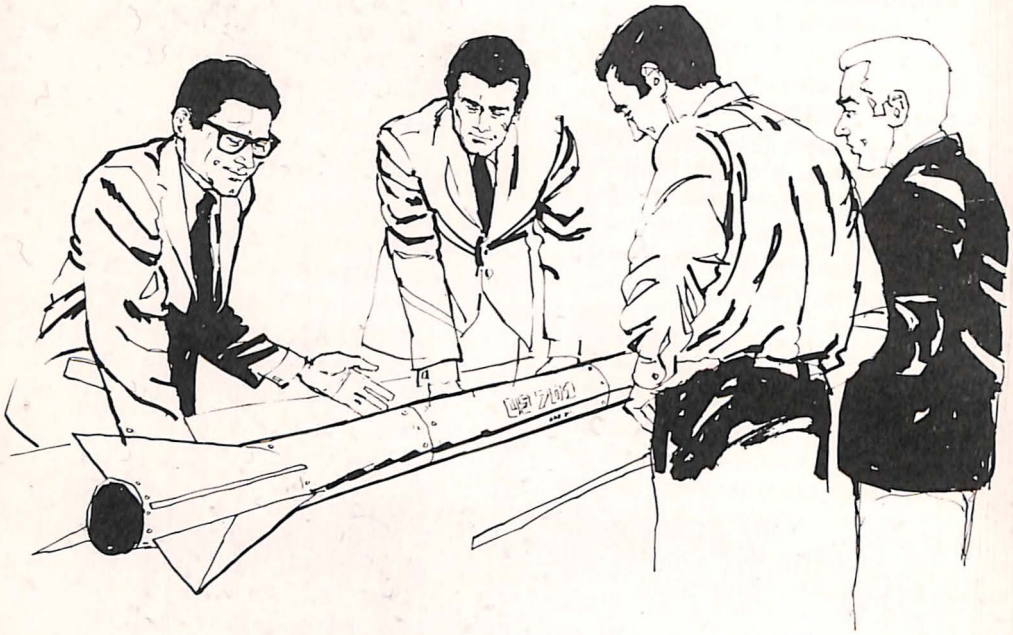
A summary of the potential problem areas identified and the recommendations for handling them is given in Table A. The problems are divided into two groups: those which are peculiar to design-to-cost programs and those which have applicability to design-to-cost and other types of programs. The line of demarcation is not sharp in all cases. Chapters II and III discuss the two groups of problems, respectively. The recommendations are offered in a spirit of cooperation, recognizing that only the best joint efforts of the Government and industry will produce the greatest benefits from the design-to-cost approach.

TABLE A

MAJOR PROBLEMS	RECOMMENDATIONS
PECULIAR TO DESIGN-TO-COST	
1. Inadequate understanding by contractors of military mission and performance priorities.	1. State in all RFP's the purpose and need for new equipment, and specify mandatory characteristics versus desirable ones.
2. Specifications used to define desired products are often too detailed and rigid in early program phases.	2. Limit initial product requirements to those performance requirements and design constraints which are mandatory, and generate increased specification detail based on trades as development evolves toward production.
3. Difficulty of maintaining management reserve.	3. Allow use of discretionary reserves for both Government and Company Program Managers in ASPR and establish limits in the Development Concept Paper.
4. Inability to implement desired tradeoffs contractually.	4. Give the Program Manager authority to authorize contractual changes consistent with the program Development Concept Paper.
5. Overly restrictive Government change control requirements in early program phases.	5. Provide Government change control of specifications to a level appropriate to the state of definition of the system.
APPLICABLE TO DESIGN-TO-COST AND OTHER PROGRAMS	
6. The procurement system often inhibits a free flow from industry of unique alternative ideas during trade studies.	6. Designate an authoritative Program Manager at the time of conceptual studies so early engagement is maintained with industry.

TABLE A (continued)

MAJOR PROBLEMS	RECOMMENDATIONS
7. Conducting a fair competition with proper recognition of tradeoffs, while eliminating cost auctions and low bids.	7. In each RFP, set ground rules of competition and evaluation that consider boundaries of trades and total program funding limitations.
8. Protection of a company's unique system approach.	8. Eliminate technical transfusion between the proposals of competing contractors prior to final contractor selection for each stage of development.
9. Government designated GFE may have a major impact on total Government cost.	9. Subject GFE items to same trade and management decisions as contractor items.
10. Inappropriate imposition of management and documentation requirements.	10. Establish management system requirements in terms of outputs and not procedures, use existing contractor management systems to the greatest extent possible, and tailor requirements to meet minimum needs of the particular phase of each program.
11. Making trade decisions between life cycle costs and unit production costs.	11. Assure that the Program Manager has the responsibility and authority for logistics, and include support objectives and total program cost planning factors in the RFP and contract.
12. Maintaining motivation for both low unit production cost and low life cycle cost where proof is many years in the future.	12. Provide incentive fee for initial production contract based upon estimated life cycle cost, and assure contractor of production for a named period upon meeting established goals.
13. Executing timely cost reduction changes during production.	13. Require prompt change proposal response with final appeal to Program Manager, after a specified period.



CHAPTER II

PROBLEMS PECULIAR TO DESIGN-TO-COST, AND RECOMMENDATIONS

Five problems have been singled out for special attention, since they are cardinal to the question of implementing the design-to-cost approach. These problems, which have such particular bearing on design-to-cost programs, are treated in this chapter.

PROBLEM 1: *Inadequate understanding by contractors of military mission and performance priorities.*

DoD Directive 5000.1 says, "System need shall be clearly stated in operational terms, with appropriate limits . . . ," yet a frequent difficulty, in industry's view, is that most RFP's do not delineate the underlying requirements or the regions within which tradeoffs are possible. To the degree that a lack of understanding exists regarding DoD's basic need for a new system, a less than optimum response will be received from industry, however hard it tries. Today this is a weak area which prevents industry from intelligently exploring the full range of options available from its knowledge, experience, and technology. This particularly compromises industry's ability to make conceptual trades of performance versus costs, since it is during the conceptual phase that the most significant trades can be achieved, if sufficient understanding is at hand.

RECOMMENDATION 1: *State in all RFP's the purpose and need for new equipment, and specify mandatory characteristics versus desirable ones.*

PROBLEM 2: *Specifications used to define desired products are often too detailed and rigid in early program phases.*

Many RFP's for development programs — despite many major studies, speeches and policies recommending just the opposite — still contain product specifications so detailed as to leave the design engineer little, if any, room to exercise his professional ability. The result is either inadequate flexibility to conduct necessary cost/performance/schedule tradeoffs or lengthy (and often unsuccessful) attempts to change the requirements, with adverse impact on cost, schedule and/or performance. DoD's inventory of technical standards and specifications exceeds 60 thousand in number, and too many are still being called out or referenced too early in the design cycle. In short, product specifications are too often too detailed, too soon. This traditional tendency, which has the effect of tieing up the designer before the design is even started, must be broken, and the level of initial specification must be elevated and the number of specification parameters reduced, if Design-to-Cost is to be made meaningful.

Some refreshing trends toward this approach are the recent RFP's for the Lightweight Fighter and the Advanced Medium STOL Transport.

RECOMMENDATION 2: *Limit initial product requirements to those performance requirements and design constraints which are mandatory, and generate increased specification detail based on trades as development evolves toward production.*

PROBLEM 3: *Difficulty of maintaining management reserve.*

DoD Directive 5000.1 states, "Schedules and funding profiles shall be structured to accommodate unforeseen problems and permit task accomplishment without unnecessary overlapping or concurrency." However, when a development contract is negotiated, the set-aside for contractor management reserves is frequently, if not usually, reduced to zero. This can be caused, for example, by the "best and final offer" type of negotiation, an audit report recommending against a management reserve, or Service funding problems.

Often the Government Program Manager is similarly deprived of a reserve because funding was not authorized or was removed for other use. If no management reserve is available to either the Government or industry program manager, many cost reduction ideas or needs which emerge only after full scale development is underway cannot be funded and the program will suffer.

In this connection, the ASPR Section XV which treats contingency should be revised to recognize the difference between contingencies and management reserves. This could be done by the addition of a sentence having the sense of the following: "The provisions of this section are not intended to apply to management reserves established in accordance with DoD Directive 5000.1."

RECOMMENDATION 3: *Allow use of discretionary reserves for both Government and Company Program Managers in ASPR and establish limits in the Development Concept Paper.*

PROBLEM 4: *Inability to implement desired tradeoffs contractually.*

In the course of full scale development, detailed analyses and tradeoff studies may reveal new paths where further significant cost savings in production units could be made. These discoveries may require further development, a change in schedule, or alternate approaches, any of which would require contractual change. The changes might be to technical requirements, program milestones, funding, or combinations of these. Frequently the program manager authorizes these changes but the contractual channels, having different schedule priorities and motivation, do not rapidly effect the change. Negotiations, when they occur, further delay contractual agreement. As a result, many "design-to-cost" opportunities are not implemented because of the need for the contractor to perform to the contract and avoid risks on innovation not contractually covered. The solution to these problems must give the same sense of urgency to contractual change actions as to program actions.

Guidance is given in DoD Directive 5000.1: "The development and production of a major defense system shall be managed by a single individual (program manager) who shall have a charter which provides sufficient authority to accomplish recognized program objectives."

RECOMMENDATION 4: *Give the Program Manager authority to authorize contractual changes consistent with the program Development Concept Paper.*

PROBLEM 5: *Overly restrictive Government change control requirements in early program phases.*

A key ingredient of design-to-cost is the use of good engineering judgment to challenge the specifications to assure that requirements are properly balanced. Excessive change control management in the early phases of full scale development hinders change of any kind. Long turnarounds on ECP requests also change the timing of incorporation of an idea from early concept, when little cost is involved, to a change in the detail design phase or even later, when change means considerable added program cost. In the early portions of full scale development, formal Government change control should exist only at the level which defines system performance requirements and essential design constraints. As the program progresses, details are developed, and testing has proven design, then specification controls at the lower levels should be invoked. This can be done because the contractor is maintaining appropriate internal change control of lower level documents during these early phases.

RECOMMENDATION 5: *Provide Government change control of specifications to a level appropriate to the state of definition of the system.*

CHAPTER III

PROBLEMS APPLICABLE TO DESIGN-TO-COST AND OTHER PROGRAMS, AND RECOMMENDATIONS

A number of problems confronting the successful implementation of design-to-cost affect other types of programs as well. In the interest of clarity, these problems and recommendations for handling them are discussed in this chapter.

PROBLEM 6: *The procurement system often inhibits a free flow from industry of unique alternative ideas during trade studies.*

A host of reasons accounts for this. For example, it is difficult for the Government to give proper consideration to the conceptual options and tradeoffs presented by industry, particularly when the practicality of new technology offered is not clear. The difficulty of securing objective decisions is often compounded by the many conflicting interests within DoD competing for limited resources, particularly when a single program authority has not been appointed. So the process today tends to sort the options, and the related contractors, in a stylized manner which emphasizes responsiveness more than uniqueness and provides too few opportunities for eliciting industry's best ideas early enough for proper consideration.

RECOMMENDATION 6: *Designate an authoritative Program Manager at the time of conceptual studies so early engagement is maintained with industry.*

PROBLEM 7: *Conducting a fair competition with proper recognition of tradeoffs, while eliminating cost auctions and low bids.*

With the increased flexibility inherent in the tradeoff process during system development, maintaining fairness and objectivity during competition will be exceedingly difficult. RFPs for development programs will have to define clearly the extent to which tradeoffs will be considered and what factors will be used in their appraisal. They will have to state what limits of cost, performance, risk and schedule will be considered acceptable. If schedule or funding considerations favor one phase of a program over others (e.g., acquisition costs more than life cycle costs), such will have to be clearly stated.

RECOMMENDATION 7: *In each RFP, set ground rules of competition and evaluation that consider boundaries of trades and total program funding limitations.*

PROBLEM 8: *Protection of a company's unique system approach.*

The question of how the Government can elicit the industry's best ideas depends not only on an environment conducive to free exchange, as noted in Problem 6, but also to an even greater degree upon the confidence that each company has that its innovative concepts will not be disclosed to its competitors. If novel or unique approaches are not zealously protected prior to and during competition, industry may withhold some of its more promising, inventive ideas, fearing a loss of competitive advantage. This means that technical transfusion will have to be abolished during active competition, in practice as well as in policy. A possible exception would be to transfer funded technology from losers to surviving competitors, but as a practical matter of maintaining confidence this should be deferred until after formal contract award.

RECOMMENDATION 8: *Eliminate technical transfusion between the proposals of competing contractors prior to final contractor selection for each stage of development.*

PROBLEM 9: *Government designated GFE may have a major impact on total Government cost.*

It is not axiomatic that the best or even cheapest course is to utilize fully developed components or off-the-shelf equipment, though such is often the case. In a design-to-cost program, however, the decision of whether or not to use GFE should be weighed just as any other design tradeoff.

RECOMMENDATION 9: *Subject GFE items to same trade and management decisions as contractor items.*

PROBLEM 10: *Inappropriate imposition of management and documentation requirements.*

The levying of extraneous management system and documentation requirements has generated a long history of excessive costs and program delays created by RFP and contract requirements and a general tendency to load everything possible aboard without due regard to need.

The basic policy direction contained in many Government defined management systems is excellent. However, too frequently the requirements do not stop at stating "what" must be done, but go on in great detail to state "how" they are to be done – and the whole, detailed package becomes a part of the contract.

The answer is to invoke effective Government control to stop the proliferation of Government-defined management systems and to "tailor" the management information requirements to fit each phase of a program. In the early phases, the required documentation should be confined to the bare essentials, to maintain maximum flexibility. As later phases are approached, appropriate management system requirements will "harden" just as design "hardens". Every effort must be made to use contractor's systems which have proven to be effective. Trimming the cost of management systems is almost as important as reducing hardware costs.

RECOMMENDATION 10: *Establish management system requirements in terms of outputs and not procedures, use existing contractor management systems to the greatest extent possible, and tailor requirements to meet minimum needs of the particular phase of each program.*

PROBLEM 11: *Making trade decisions between life cycle costs and unit production costs.*

It is in the early portions of full scale development that changes can be most readily made to affect either acquisition or life cycle costs or both. The key question is, where should the emphasis be? Acquisition cost is relatively easier to determine and represents the next and most visible investment. On the other hand, life cycle cost represents the Government's best interests in the long run, but is much more difficult to estimate and lacks hard supporting data. While far from being perfected, existing life cycle cost models can at least provide inputs for trade studies and help achieve the desired balance between ownership and acquisition costs. Ultimately, research on the interrelationships of such costs, ground rules for developing and tracing acquisition costs through the whole system growth process from concept through production, and more accurate accumulation of field maintenance costs must occur.

Until better data and models become available, we should do what we can with the present system. Contractors should be made aware of the Government's objectives and plans for operation and support, including cost planning factors. As an additional constructive step, it should be made clear that the Program Manager's sphere of authoritative action includes logistics.

RECOMMENDATION 11: *Assure that the Program Manager has the responsibility and authority for logistics, and include support objectives and total program cost planning factors in the RFP and contract.*

PROBLEM 12: *Maintaining motivation for both low unit production cost and low life cycle cost where proof is many years in the future.*

The existing contract environment works against the solution of this difficult but important problem. Production is usually conducted under some form of fixed price contract which puts a premium on reducing production costs rather than life cycle costs. Further, with few exceptions, procurements are made competitive as early as possible, and for each successive procurement. In this environment, the contractor is again motivated to minimize his current production cost. To change this situation, the fee structure for the initial production contract should have an incentive for operation and support cost, with a defined usage and support plan.

The introduction of breakout or other competitive production techniques should be withheld by policy until such time as the design, production cost, and initial operational experience have been confirmed and weighed against the program objectives. If the objectives are met, the contractor would be awarded a given period of production, and subsequent increments would be determined the same way. If the contractor fails to meet the objectives, however, the next increment could be opened to competition.

If the program goals established are reasonable, the contractor would be very strongly motivated to ensure retaining the long term production planned in the original contract. Since he would be anticipating a long term involvement, he would be motivated in his day-to-day decisions to minimize future logistics related problems.

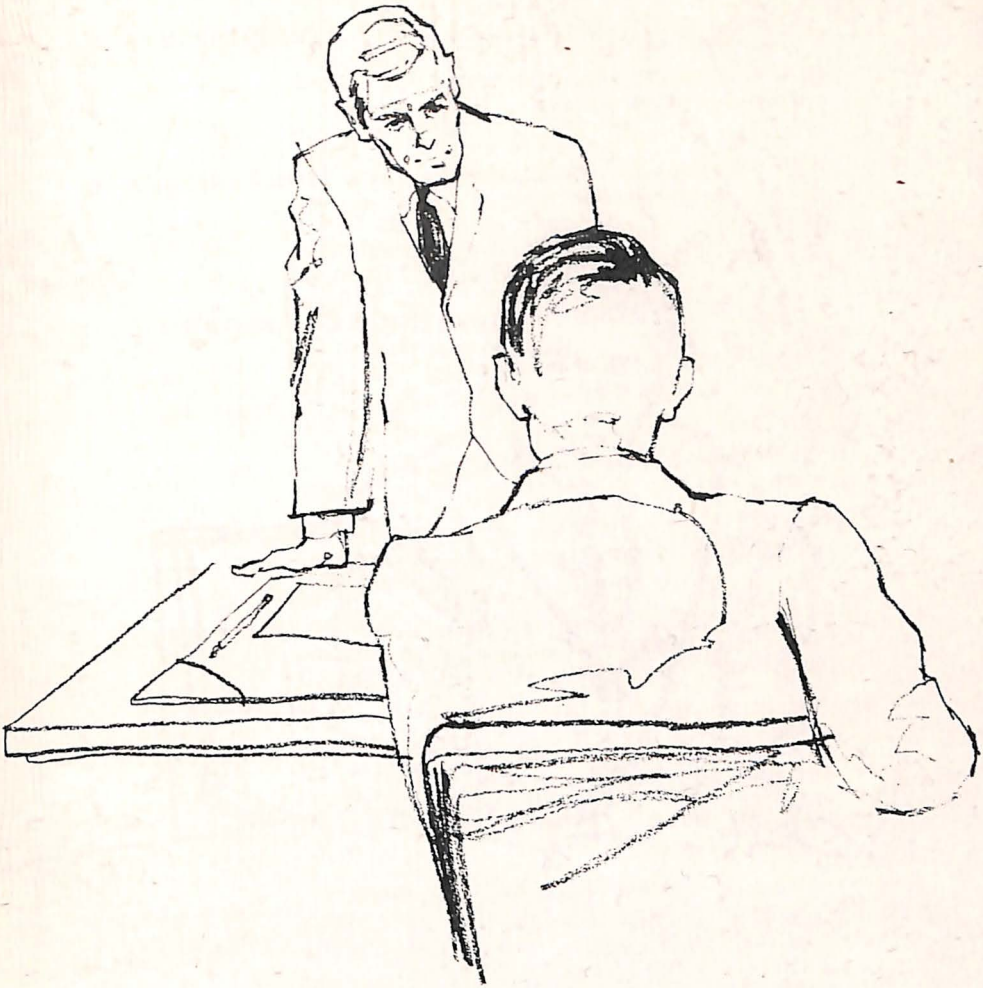
RECOMMENDATION 12: *Provide incentive fee for initial production contract based upon estimated life cycle cost, and assure contractor of production for a named period upon meeting established goals.*

PROBLEM 13: *Executing timely cost reduction changes during production.*

By the time production begins to roll, all the paper and control systems are in full force, attention has shifted from design to delivery, and a problem frequently encountered is unduly long delays in introducing changes intended to reduce cost. This is caused primarily by the requirements for coordination among many service elements, including the operational commands. In addition to the loss of potential savings which result from delays in implementation, such delays serve to discourage the contractor from vigorous submission of desirable changes.

The Program Manager's office should be assigned responsibility for, and have included in it, representatives from the various service elements pertinent to the particular program, so that the Program Manager's office has the organic capability to make decisions expeditiously on proposed changes. The operating procedures should be structured so that if a response to a proposed change is not provided within a specified period of time, the proposed change is automatically brought to the attention of the Program Manager for decision. The existing policies and procedures for handling VECP's seem to be adequate for handling this problem; they need to be funded and enthusiastically pursued by both Government and industry at all organizational levels.

RECOMMENDATION 13: *Require prompt change proposal response with final appeal to Program Manager, after a specified period.*



BIBLIOGRAPHY

AEROSPACE INDUSTRIES ASSOCIATION. *"Essential Technical Steps and Related Uncertainties in DoD Weapon Systems Development, Phase IV Final Summary Report"*, AIA, Washington, D.C., December 1970.

AMERICAN ORDNANCE ASSOCIATION. *"Cost - A Principal Consideration in Defense Weapon System Acquisition"*, Proceedings of the 4th Annual Technical Symposium, U.S. Naval Academy, AOA, Washington, D.C., October 1971.

BLUE RIBBON DEFENSE PANEL. *"Report to the President and the Secretary of Defense on the Department of Defense"*, Government Printing Office, Washington, D.C., Chapter II, Section B, pp. 67-87, July 1970.

_____. *Appendix E, "Staff Report on Major Systems Acquisition Process"*.

THE BOEING COMPANY. *"Design-to-Cost Symposium", Summary Report,* Boeing Document D1-8243, November 1972.

COMMISSION ON GOVERNMENT PROCUREMENT. *"Acquisition of Major Systems"*, GPO, Washington, D.C., Final Report, Volume 2, Part C, December 1972.

COMPTROLLER GENERAL OF THE U.S. *"Cost Growth in Major Weapon Systems"*, Report to the Committee on Armed Services, House of Representatives (B-163058), 26 March 1973.

_____. *"Acquisition of Major Weapon Systems"* (B-163058), Three Annual Reports, February 1970; 18 March 1971; 17 July 1972.

DEFENSE SCIENCE BOARD. *"Design-to-Cost, Commercial Practice vs. Department of Defense Practice"*, GPO, Washington, D.C., Report of the Task Force on Reducing Costs of Defense System Acquisition, 15 March 1973.

DEPARTMENT OF DEFENSE. *"Acquisition of Major Defense Systems"*, DoD Directive 5000.1, 13 July 1971.

_____. *"Basic Policy for System Acquisition"*, Army Regulation 1000.1, June 1972.

_____. *"Design-to-Cost Handbook"*, OSD (I&L), Draft (Unpublished as of February 1974).

_____. *"Design-to-Cost Objectives on DSARC Programs"*, OSD Memorandum signed by W.P. Clements, Jr. to the Secretaries of the Military Departments, 18 June 1973.

_____. *"Joint Design-to-Cost Guide - A Conceptual Approach for Major Weapon System Acquisition"*, 24 September 1973.

DEFENSE MANAGEMENT JOURNAL. *"Design-to-Cost"*, Various articles related to the subject, Vol. 8, No. 1, April 1972; Vol. 9, No. 2, April 1973; Vol. 9, No. 3, July 1973.

ELECTRONIC INDUSTRIES ASSOCIATION. *"Design-to-Cost Seminar"*, EIA, Washington, D.C., Proceedings and related papers, 25-26 April 1973.

_____. *"Recommendations Relating to the Implementation of Design-to-Cost"*, EIA Letter to OSD, 16 July 1973.

NATIONAL CONTRACT MANAGEMENT ASSOCIATION. *Proceedings of "Symposium on the Commission on Government Procurement" and related papers on "Acquisition of Major Systems"*, NCMA, Long Beach, California, 12-13 April 1973.

NATIONAL SECURITY INDUSTRIAL ASSOCIATION. *"Defense Acquisition Study"*, NSIA, Washington, D.C., NSIA Report, pp. 28-33, 1 July 1970.

_____. *"Major Defense Systems Acquisition, DoD/NSIA Symposium"*, Proceedings and Related Papers, 11-12 August 1971.

_____. *"Cost - A Principal System Design Parameter, NSIA Symposium"*, Proceedings and related papers, 11-12 August 1971.

_____. *"Streamlined Defense System Acquisition and Cost Saving Considerations"*, Proceedings of LOMAC/REAC Summer Meeting and related papers, 25-26 June 1973.

_____. *"Development of Major Defense Systems"*, Proposed DoD Directive 5000.X, NSIA Letter to OSD, 7 November 1973.

_____. *"Design-to-a-Price"*, NSIA Report, September 1972.

ARNOLD, JACKSON D., ADMIRAL. *"Applications of DoD Policy in the Navy Environment"*, NSIA, Washington, D.C., PROCEEDINGS OF SYMPOSIUM ON MAJOR DEFENSE SYSTEMS ACQUISITION, 11-12 August 1971.

BENNINGTON, HERBERT D. *"Address Before the American Ordnance Association"*, OSD Public Affairs News Release No. 805-72, 1 November 1972.

_____. *"Procurement Under- the Design-to-a-Cost Concept - How Do We Do It?"*, EIA, Washington, D.C., PROCEEDINGS OF DESIGN-TO-COST SEMINAR, April 1973.

BROWN, GEORGE S., GENERAL. *"Applications of DoD Policy in the Air Force Environment"*, NSIA, Washington, D.C., PROCEEDINGS OF SYMPOSIUM ON MAJOR DEFENSE SYSTEMS ACQUISITION, 11-12 August 1971.

COFFIN, ROBERT E., LT. GENERAL. *"Address Before the DMS Symposium"*, OSD Public Affairs News Release No. 110-73, 8 March 1973.

_____. *"Design-to-Cost - DoD Concepts"*, OSD Public Affairs News Release No. 361-73, Address before the National Contract Management Association, 27 July 1973.

CLARK, WILLIAM L. *"Design-to-Cost"*, EIA, Washington, D.C., PROCEEDINGS OF DESIGN-TO-COST SEMINAR, April 1973.

DURBIN, EUGENE P. *"Designing to Low Ownership Costs Requires Knowledge of Many Factors"*, DEFENSE MANAGEMENT JOURNAL, Volume 9, No. 3, July 1973.

FOSTER, JOHN S., JR. *"Defense System Development"*, NSIA, Washington, D.C., PROCEEDINGS OF SYMPOSIUM ON MAJOR DEFENSE SYSTEMS ACQUISITION, 11-12 August 1971.

_____. *"Designing Weapon Systems to a Cost"*, OSD Public Affairs News Release No. 497-72, Address before the National Contract Management Association, 6 July 1972.

_____. *"Impact of the (Cost) Problem on the Military/Industry R&D Outlook"*, NSIA, Washington, D.C., PROCEEDINGS OF SYMPOSIUM ON COST - A PRINCIPAL SYSTEM DESIGN PARAMETER, 16-17 August 1972.

_____. *"Address Before the Fort Worth Chapter Association of the U.S. Army"*, OSD Public Affairs News Release, 25 May 1972.

_____. *"Increasing Defense Electronics Productivity"*, OSD Public Affairs News Release No. 695-72, Address before the Armed Forces Communications and Electronics Association, 5 October 1972.

_____. *"DDR&E Views on Design-to-a-Cost"*, Boeing Company Document D1-8243, "DESIGN-TO-COST SYMPOSIUM", November 1972.

_____. *"Address Before the Awards Banquet, National Management Association"*, OSD Public Affairs News Release No. 155-73, 31 March 1973.

GANSLER, JACQUES S. *"The Change in DoD Electronics Acquisition"*, OSD Public Affairs News Release No. 833-72, Address before the 1972 Winter General Session of the Airlines Electronics Engineering Committee, 12 December 1972.

_____. *"Cost as a Design Parameter"*, OSD Public Affairs Release No. 67-73, Address before the AFSC Symposium on Aerospace and Electronics Systems, 13 February 1973.

_____. *"Acquisition Objectives Change From One of Sophistication to Reliability at Lower Cost"*, DEFENSE MANAGEMENT JOURNAL, Vol. 9, No. 3, July 1973.

HARR, KARL G. *Statement before the House Armed Services Committee on "How Adequate Defense can be Maintained with Lower Cost Weapon Systems"*, AIA, Washington, D.C., Administration Memorandum No. 72-26, March 1972.

HINRICHS, FRANK A., MAJOR GENERAL. *"Army Views Challenge of Design-to-Cost"*, DEFENSE MANAGEMENT JOURNAL, Vol. 9, No. 3, July 1973.

HOLLISTER, FLOYD H., COMMANDER, and SHOREY, RUSSELL R. *"Design-to-a-Cost: Concept and Application"*, DEFENSE MANAGEMENT JOURNAL, Vol. 9, No. 3, July 1973.

HOLT, PAUL W. *"Controls Begin at Home in Design-to-Cost Contracting"*, DEFENSE MANAGEMENT JOURNAL, Vol. 9, No. 2, April 1973.

KIDD, I.C., ADMIRAL. *"Happiness is Quality and Cost Effectiveness"*, DEFENSE MANAGEMENT JOURNAL, Vol. 9, No. 3, July 1973.

LANDESCO, A.A. *"Many Questions Surround Design-to-a-Cost Concept"*, DEFENSE MANAGEMENT JOURNAL, Vol. 9, No. 2, April 1973.

LOW, GEORGE M. *"Cost Cutting Suggestions"*, NSIA, Washington, D.C., PROCEEDINGS OF SYMPOSIUM ON COST - A PRINCIPAL DESIGN PARAMETER, 16-17 August 1972.

McCULLOUGH, JAMES D. *"Design-to-Cost: Problem Definition, Survey of Potential Actions and Observation on Limitation"*, IDA, Washington, D.C., Institute for Defense Analyses, Cost Analysis Group Paper P-928, Log No. HQ73-14764, January 1973.

_____. *"Design-to-Cost - Buzz Word or Viable Concept"*, IDA Paper P-928, Log No. HQ73-15304.

MILEY, HENRY A., JR., LT. GENERAL. *"Applications of DoD Policy in the Army Environment"*, NSIA, Washington, D.C., PROCEEDINGS OF SYMPOSIUM ON MAJOR DEFENSE SYSTEMS ACQUISITION, 11-12 August 1971.

MOOT, ROBERT C. *"Resource Management in Defense System Acquisition"*, NSIA, Washington, D.C., PROCEEDINGS OF SYMPOSIUM ON MAJOR DEFENSE SYSTEMS ACQUISITION, 11-12 August 1971.

PACKARD, DAVID. *"Policy Guidance on Major Weapon System Acquisition"*, OSD Memorandum to principal officials of the DoD, 28 May 1970.

_____. *"Improving R&D Management Through Prototyping"*, NSIA, Washington, D.C., PROCEEDINGS OF THE SEMINAR ON PROTOTYPING, 23 February 1972.

_____. *"Defense System Acquisition"*, NSIA, Washington, D.C., PROCEEDINGS OF THE SYMPOSIUM ON MAJOR DEFENSE SYSTEMS ACQUISITION, 11-12 August 1971.

REICH, ELI T., ADMIRAL. *"The Challenge of Cost-to-Produce"*, DEFENSE MANAGEMENT JOURNAL, Vol. 8, No. 1, April 1972.

SHIPLEY, H.E. *"Alternate Weapon System Acquisition Strategies"*, AIA Paper, Washington, D.C., Address before the Air War College, 13 December 1972.

SHILLITO, BARRY J. *"Production and Support of Defense Systems"*, NSIA, Washington, D.C., PROCEEDINGS OF SYMPOSIUM ON MAJOR DEFENSE SYSTEMS ACQUISITION.

SIMON, ALLAN D. *"Design-to-Cost"*, AIA, Washington, D.C., Address before AIA Product Support Committee, AIA Paper AO-PSC 72-29, 1 November 1972.

STEINER, J.E. *"Report of the DSB Task Force on Reducing Costs of Defense Systems Acquisition"*, Boeing Company Report, Address before the NSIA LOMAC/REAC Summer Meeting, 25-26 June 1973.

SULLIVAN, LEONARD, JR. *"Comment"*, DEFENSE MANAGEMENT JOURNAL, Vol. 9, No. 3, July 1973.

_____. *"Design-to-Cost - A Progress Report"*, Address before an AIA Meeting, Washington, D.C., February 1974.

TAYLOE, HARRY M. *"Dinner Speech - Design-to-Cost"*, EIA, Washington, D.C., PROCEEDINGS OF SEMINAR ON DESIGN-TO-COST, 25-26 April 1973.

TRIMBLE, ROBERT F., BRIG. GENERAL. *"Systems Acquisition under DoD Directive 5000.1"*, HQUSAF (Proc Policy), Address before the Federal Bar Association Western Briefing Conference on Government Contracts, 26 October 1972.

WACKER, FRED P. *"Design-to-Cost Comments"*, Testimony before the House Armed Services Committee, 29 March 1973.

WILSON, T.A. *"Design-to-Cost"*, NSIA, Washington, D.C., PROCEEDINGS OF SYMPOSIUM ON COST - A PRINCIPAL SYSTEM DESIGN PARAMETER, 16-17 August 1972.

_____. *"Reducing Costs Can Be Fun: Judgment, Flexibility Needed"*, DEFENSE MANAGEMENT JOURNAL, Vol. 9, No. 2, April 1973.

WILSON, MYRON F. *"Design-to-Cost Application in Military Environment Changing Old Ways"*, DEFENSE MANAGEMENT JOURNAL, Vol. 9, No. 3, July 1973.

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