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On 23 and 24 February 1972 approximately 120 educators, researchers and practitioners gathered at Wright-Patterson AFB, Ohio, to discuss Department of Defense (DOD) procurement. The symposium theme was "Progress and Research."

Attendees included representatives of the DOD, Army, Navy, Air Force, NASA, Federal Republic of Germany, universities and industry. Presentations covered the following areas: PIECOST, return on investment capital, industrial preparedness, design-to-cost pricing concepts, and contract incentives.

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Proceedings

DOD Procurement Symposium: Progress and Research in the Seventies

23-24 February 1972

SCHOOL OF SYSTEMS AND LOGISTICS
AIR FORCE INSTITUTE OF TECHNOLOGY
WRIGHT–PATTERSON AFB, OHIO 45433

Editors' Remarks

On 23 and 24 February 1972, some one-hundred and twenty educators, researchers and practitioners gathered at Wright-Patterson Air Force Base, Ohio, to discuss Department of Defense (DOD) Procurement. The theme of this gathering was "Progress and Research." The idea of the symposia was to discuss new concepts, research and procurement problems which require research.

Attendees included representatives of the Department of Defense, Army, Navy, Air Force, National Aeronautics and Space Administration, the Federal Republic of Germany, universities and industry. It was our hope that in bringing together the educators, researchers and practitioners that two critical outcomes would occur -

1. the practitioners--the real world working guy--would become exposed to some of the innovative procurement ideas which may deserve implementation, and

2. the researchers and educators would identify problem areas deserving research efforts.

By publishing this proceeding we hope to disseminate the fine presentations which were made in order to help achieve our objectives. It is too early to tell if our goals will be achieved - but we remain optimistic!

Requests for additional copies of this document, or any comments thereon, should be addressed to:

Air Force Institute of Technology
School of Systems and Logistics
AFIT/SLGM
Wright-Patterson AFB, Ohio 45433

Phone:

Area Code 513, 257-4407
Autovon 78-74407/74240

THE EDITORS

DAVID N. BURT, Major, USAF
Assistant Professor of
Logistics Management
School of Systems & Logistics

LONNIE L. OSTROM, Capt, USAF
Associate Professor of
Logistics Management
School of Systems & Logistics

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MAJOR GENERAL ERNEST A. PINSON

Major General Ernest A. Pinson is Commandant of the Air Force Institute of Technology (AFIT). This position, somewhat akin to that of President of a large university, gives him the responsibility for managing a resident academic program offering degrees at the bachelor, master and doctorate levels in engineering, and master's degrees in management to Air Force officers and selected personnel from other Department of Defense activities. AFIT also administers a program through which selected officers attend colleges and universities to pursue academic degrees, as well as a program of continuing education in residence, at air bases around the world, and with selected industries. AFIT's student population averages 6,000 in residence, and over 17,000 in all programs from year to year.

General Pinson holds two earned doctorates, one in Medical Physiology from the University of Rochester and another in Physics from the University of California at Berkeley. His military career is distinguished by his activities in research and as a director of research activities. As a scientist he has insisted that the proper person to test a hypothesis is the person who originated it. Thus he has undergone explosive decompression, aircraft seat-ejection tests, has breathed deadly tritium gas, and has flown through nuclear clouds in his efforts to advance military science. He has been called the Air Force's human guinea pig.

During his career, General Pinson has supervised research activities at Los Alamos Scientific Laboratory, Cambridge Research Center, and the Special Weapons Center. Before coming to AFIT he was Commander of the Office of Aerospace Research. Among his numerous decorations and awards are the Legion of Merit with one Oak Leaf Cluster, the Distinguished Flying Cross, the Soldiers Medal, and the Air Force Commendation Medal.

WELCOMING REMARKS

TO THE

DOD PROCUREMENT SYMPOSIUM

By

Major General Ernest A. Pinson
Commandant
Air Force Institute of Technology
Air University

I would like to extend a personal welcome to the attendees of the DOD Procurement Symposium.

It is appropriate that the Air Force Institute of Technology (AFIT) host this symposium since it is our mandate to enhance the professional development of personnel in the procurement and production elements of logistics.

The location of AFIT at Wright-Patterson Air Force Base was determined by the proximity of Headquarters, Air Force Logistics Command, and the Aeronautical Systems Division of the Air Force Systems Command, two activities whose concomitant effort has a significant effect on the defense portion of the national budget.

Inherent in AFIT's discharge of its responsibility is the development of individuals assigned to procurement or production management. These individuals are charged by Federal law to guard the outflow of public funds in a most challenging atmosphere.

Here at AFIT, we have developed a faculty devoted to the advancement of procurement. We offer several levels or approaches to the education of procurement personnel:

1. Graduate instruction at the School of Systems and Logistics and the Department of Systems Management of the School of Engineering.

2. A wide range of Resident Continuing Education courses.

3. A cooperative program in production management where students do part of their work at the School of Systems and Logistics and part at manufacturing plants.

4. Seminars conducted at bases both in the United States and at bases overseas.

5. In addition, through our Civilian Institute Division, we offer education at leading civilian universities. We also have a very active Education With Industry program in which Air Force procurement and production officers receive education and experience at manufacturing plants.

I note that participation in this symposium is about evenly divided between practitioners and investigators. I find this to be an appropriate balance. Too frequently, significant research reports appear to be filed in the researcher's bookcase. Valuable and innovative ideas which have the potential of improving the procurement process are lost due to our inability to implement the ideas. The topic which will be discussed by the panel tomorrow: "How Can We Better Implement Procurement Research Findings?," will focus

on this very real problem. The coming together of the scholar and the practitioner should assist in the process of determining if procurement research is of value. Conversely, we also hope that this symposium will help to identify new problems which the practitioner has--problems which researchers may be able to help solve. We hope that during the organized program and during the opportunities for informal discussion that these objectives will be satisfied.

It is now my pleasure to introduce Brigadier General Robert F. Trimble, the Director of Procurement Policy for the United States Air Force.

BRIGADIER GENERAL ROBERT F. TRIMBLE, USAF

Brigadier General Robert F. Trimble is the Director of Procurement Policy, Deputy Chief of Staff, Systems and Logistics, Headquarters, United States Air Force. He is responsible for the development of policies and procedures relating to the procurement of major weapon systems and logistics support for the Department of the Air Force.

General Trimble graduated from the United States Military Academy at West Point, New York, in June 1945, with a Bachelor of Science Degree, Pilot Wings and a commission as a Second Lieutenant. He received a Masters Degree in Business Administration from the University of Michigan. In addition, he has attended the Air Command and Staff College and the Industrial College of the Armed Forces. General Trimble's prior procurement assignments include tours in base procurement, the B-57 project office, HQ USAFE, Ogden Air Materiel Area and as Military Assistant to the Deputy Assistant Secretary of the Air Force.

General Trimble's military decorations and awards include the Legion of Merit and the Air Force Commendation Medal with one Oak Leaf Cluster. He is a command pilot.

INTRODUCTION TO

DOD PROCUREMENT SYMPOSIUM

By

Brigadier General Robert F. Trimble
Director of Procurement Policy
Headquarters, United States Air Force

I think it is entirely proper that the educators and our research people who are innovating or are coming up with new concepts meet with the practitioners that General Pinson referred to in his opening remarks.

I hope that I can set the stage for you as I see it, regarding what we are hoping to achieve here in these two days. By way of explanation, I'll relate to an incident that occurred yesterday. On the airplane from Andrews AFB the Deputy Assistant Secretary of the Air Force for Research Laboratories sat next to me. He's a very fine gentleman. I've worked with him in a rather distant sense for the last four years and I know him to be a very logical thinker. During my discussion with him, he asked why I was coming to Dayton. I told him that I was planning to attend a Procurement Research Symposium. He replied, "Research?" "What is it that you fellas are researching? Is it scientific or is it technical? What are the procurement people really interested in?" Now I can excuse a Deputy Assistant Secretary for Laboratory Research for asking such a question. He undoubtedly was thinking as most people do about the scientific and

technical areas,but the very fact that he reacted as he did brought to my mind the paradox that we are in today.

We have arrived at a point where our scientific community has made possible highly sophisticated weapons for our military forces. Admiral Zumwalt recently stated that one of his greatest challenges is to maintain and operate the super sophisticated equipment that belongs to his Naval Forces. We know quite well that we can't pay for and buy all of the super sophisticated systems that current technology can provide. And, unfortunately, we find that our airmen, our soldiers, and our sailors, in many instances are hard pressed to maintain the equipment under operational circumstances. So we find ourselves at a technological crossroads in the defense of our country.

Since World War II we've pushed as hard as we can to increase technical advancements to stay ahead of our enemies. Now we must develop our management systems so that we can pick and choose among our super sophisticated hardware in such a way that we can optimize the use of the limited dollars that we have available. We must optimize so that we will be able to maximize the effect of our military forces.

There are many who believe that neither the United States nor Russia will enter into a nuclear war. The pattern of confrontation established during the Cuban missile crisis is a pattern which we believe will prevail in the future. So we find ourselves attempting to bring to bear credible forces that will influence the uncommitted or the developing

nations of the world. We believe that the country capable of developing a sufficiently large number of weapons that influences these people is the country that gradually will attain ascendancy in the world today. With limited dollar resources available, we are very hard pressed to buy sufficient numbers of the very complex items of equipment to carry out the foreign policy of our country. Therefore, the task as I see it, falls more plainly in the area of business management. As we maximize technology, we must also optimize on designs which will permit production of quantities sufficient to meet our world policy commitments. This means that we will not always be buying the most expensive designs. This not intended to criticize or to downgrade the importance of the people in the technical community -- rather it's intended to place an emphasis on the management of these systems in such a way that we will be able to maximize their capability. Indeed, I believe that the security of our country depends just as much on our efforts as upon the efforts of the scientists or engineers engaged in research on new engines, new weapons, new airframes, new ships or new tanks.

Getting together and considering on a research basis and on an investigating bases will enable us to acquire for the Department of Defense (DOD) systems that are of greater value to us.

I am very very pleased that the School of Systems and Logistics, under the Air Force Institute of Technology, has

taken the initiative in this particular effort by bringing together this august group leaders in this particular area.

I have the responsibility for procurement research in the Department of the Air Force. In this area, I report to Mr. LeRoy Haugh, who is with us today from the Office of the Secretary of Defense. LeRoy works for Pete Malloy who will be talking to us tomorrow night. As the Head of Procurement Research in the Department of the Air Force, I very definitely depend on the Major David Burts from the School of Systems and Logistics, and the Major Otto Martinsons from the USAF Academy, and I also depend upon those of you who are representing the civilian institutions who are engaged in this valuable work.

I am looking forward to the next two days and I am confident that out of this will come much good.

TOPIC: IMPLEMENTATION OF PIE COST

MAJOR OTTO B. MARTINSON, JR., USAF

Major Otto B. Martinson, Jr., is the Chief of the USAF Procurement Research Office located at the USAF Academy, Colorado. He is also an Associate Professor at the Academy in the Department of Economics and Management.

Major Martinson is a CPA and received his Ph.D. in Managerial Economics from George Washington University. He has conducted extensive research in the area of contract management and systems acquisition. He was awarded the Legion of Merit for his research leading to the development of the PIE COST System for evaluating contractors' indirect "overhead" cost.

IMPLEMENTATION OF PIE COST

Summary of a Presentation Given by

Major Otto B. Martinson
Chief, Procurement Research Office
USAF Academy*

by
David N. Burt
Edited by
Lonnie L. Ostrom

Background and Description

PIE COST is an acronym for the Probability of Incurring Estimated COST. The PIE COST system is concerned with the indirect element of a contractor's cost. These indirect costs are also known as overhead costs. When we are concerned with overhead, we focus on three questions:

1. How much should it be?
2. Are the costs allowable?
3. How do we allocate the costs?

In PIE COST, we concentrate on this first item--How much should it be?

To put the problem into its proper context, let's begin by looking at it in terms of total cost input or the total work in process at the manufacturing plant. When we look at indirect costs we observe that they are approximately one third of total cost input. On closer observation we realize that total cost input includes direct material costs. These material costs average 46 percent of the total cost input.

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*For a more detailed description see: Classification System For Indirect Costs of Defense Contractors in the Aircraft Industry, by Major Martinson.

When dealing with indirect or overhead costs, we should be concerned with the costs gene ..ted at the contractor's plant. (See Figure No. 1) Therefore, we exclude direct material costs. We now observe that indirect costs are approximately two-thirds of the total costs generated at the manufacturing plant. The actual range for indirect costs is 54 percent to 85 percent.

The system which we have developed focuses on what we get when we buy overhead. We take a budget view of these costs. We are budgeting tomorrow's costs. We can't do much about yesterday's costs, but we can influence tomorrow's costs. Our vehicle for doing this is our Forward Pricing Rate agreement.

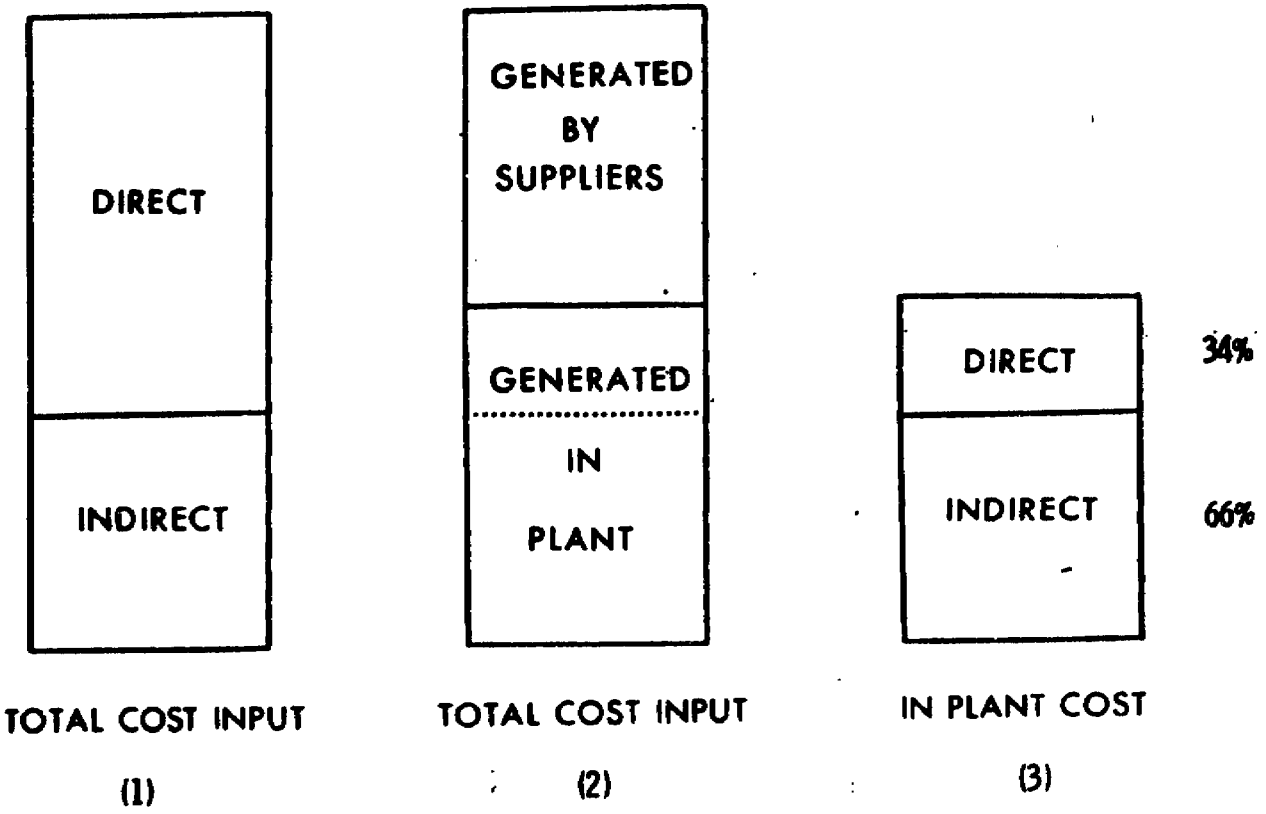
PIE COST is a statistical approach to determining a measure of acceptable cost. The system has five major phases:

1. Classification
2. Deplacing
3. Analytical
4. Forecasting
5. Recording

In the classification phase we establish the track of our cost ... the track in the past. The contractor's costs may be classified three ways:

1. Object Mode - the nature of goods and services consumed,
2. Functional Mode - the process of consuming these goods and services, and
3. Organizational Mode - who consumes the goods and services.

The mode with which we can do something from the modeling sense is the object mode. This is a type of classification



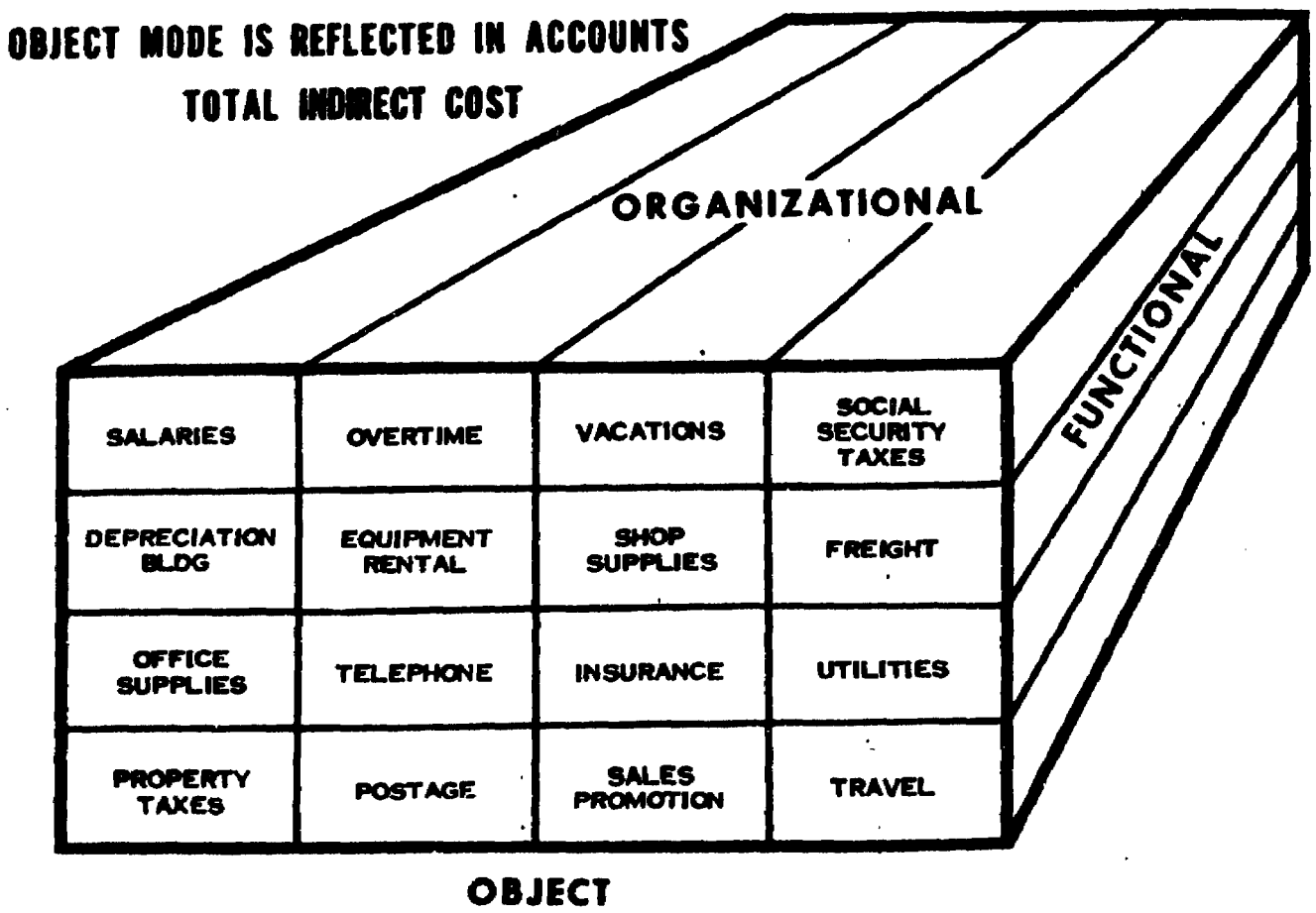
SIGNIFICANCE OF INDIRECT COST

Figure 1

of costs which deals with such basic generic things as salary, social security, taxes, supplies, telephone, automobile, postage, utilities, travel, etc. (See Figures 2 and 3) This basic classification exists everywhere the modes do not.

We have built our system around the object mode of cost increase. We have identified eleven major components. These components or major cost modes each have subelements. Our system is developed so that we can translate any contractor's cost into this classification system. On an industry wide basis we find that for every $100 spent on overhead, $37 is for labor, $16 for fringe benefits, $12 for use of plant facilities, $3 for payroll taxes, $4 for administrative costs, $1 for recruiting, $6 for plant equipment, $6 for future business, $3 for communication and travel, $10 for production related expenses, and $2 for miscellaneous. This classification system is the first step in dealing with overhead in a more specific context than in the past. With this approach, we don't impose any changes on a contractor's accounting system. This is a significant constraint which we accepted when we started this research effort.

Once we have classified the overhead cost data and stored it, we are ready to proceed to development of a predictive model. However, before development of the actual model, we must adjust or compensate for the fluctations in past and future costs due to escalation. Our historic data has inflation in it. For example, $100 would buy a given amount of overhead in 1962. The same thing cost $136 in 1969 and $144 in 1970. We can't ignore this when we are pricing weapon systems.



OBJECT MODE VIEW OF INDIRECT COSTS

Figure 2

OBJECT MODE CLASSIFICATION SYSTEM FOR INDIRECT COSTS

110 Indirect Labor
- 111 Salaries/Wages
- 112 Supplemental Allowances
- 113 Apprentice and OJT
- 114 Administrative and Supervision
- 119 Other

150 Employee Benefits
- 151 Paid Absences
- 152 Employee Insurance
- 153 Savings--Retirement Plans
- 154 Education
- 159 Other Benefits

190 Payroll Taxes
- 191 FICA
- 192 Federal and State Unemployment
- 193 Composite Payroll Taxes
- 199 Other

200 Employment
- 201 Employee Advertising
- 202 Recruitment Travel
- 203 Employee Relocation
- 204 Composite Employment
- 209 Other

300 Communication/Travel
- 301 Telephone and Telegraph
- 302 Postage
- 303 Travel
- 304 Corporate Aircraft
- 309 Other

400 Production Related
- 401 Expendable Tools and Equipment
- 402 Freight
- 403 Material Handling
- 404 Manufacturing Supplies/ Services
- 405 Product Servicing
- 406 Tool Handling
- 407 Medical Services
- 409 Other

510 Facilities--Building/Land
- 511 Depreciation and Amortization
- 512 Rentals
- 513 Maintenance
- 514 Insurance
- 515 Utilities
- 516 Property Taxes
- 517 Plant Rearrangement
- 518 Plant Security
- 519 Other

550 Facilities--Furniture/ Equipment
- 551 Depreciation and Amortization
- 552 Rentals
- 553 Maintenance
- 554 Data Processing Services
- 559 Other

600 Administrative
- 601 Office Supplies
- 602 Reproduction/Engineering Supplies
- 603 Professional Services
- 604 Contributions
- 605 Other Taxes
- 606 Dues, Memberships and Subscriptions
- 607 Conventions and Meetings
- 608 Office Services
- 609 Other

700 Future Business
- 701 Bid and Proposal
- 702 Independent Research and Development
- 703 Advertising
- 709 Other Promotions

800 Other Miscellaneous
- 801 Assessments and Transfers
- 802 Employee Awards
- 803 Corporate Allocations
- 804 Patents and Royalties
- 809 Other

gure 3

We have had a recent change in economic policy which indicates that we are not going to be experiencing the same rate of cost escalation in the future. However, some change is inevitable. In our system, we force the establishment of price indices. Once we get these indices established they will be tied into a macro-economic forecasting model which will be maintained by the Department of Economics and Management of the Air Force Academy.

Once we have adjusted for escalation; we are ready to identify the variables that drive the overhead costs. Having done that, we perform the regression analysis to merge the strenght of these activity variables in explaining the cost. Our models are relatively simple--they are in the form Y= A + BX. They are all first degree equations, yet R^2 (the coefficient of determination which measures the amount of variance of the dependent variable which is explained by the independent variable)* exceeds .8 in all cases. For most of the cost modes, R^2 exceeds .9!

What do our models tell a fellow who is about to engage the contractor in negotiations? It tells him how much 100 hours of indirect labor are going to cost (about $440). It tells him

---

*$R^2 = \frac{\text{explained variance}}{\text{total variance}}$. R^2 can range from 0 to 1. The absence of any explanation is indicated by an R^2 of 0. Complete explanation is indicated by 1.

that if the contractor wants to hire 500 people it will cost $4,126 to put them on the payroll. If the contractor wants to add plant facilities, it will cost $3.24 per square foot. So we begin to focus the negotiator on what he's buying and on what its costing us.

One of the beauties of this system is that once we have our models constructed, we can handle change in the current situation in a matter of a few minutes. Generally three to four months expire between the time when the contractor submits his proposal and when we get together at the negotiating table. Alot of things can and do change in that three to four months. Work forces can switch as much as thirty percent. Now when the contractor up dates his proposal, we contact our computer by telephone and up date our models in a few minutes! Thus, we take what has been a static situation and make it into a dynamic one. And that's what a negotiation should be. . . dynamic.

After we complete negotiations, we move to the administration phase where we track his incurrence of costs. We take the cost mode that he is supposed to achieve during the year and obtain monthly printouts on where he stands. If we note that he's running high we put him on notice that he is spending at an excessive rate and that we want to know what his plans are for correcting the situation. Thus, the Air Force personnel who are monitoring him in his plant are aware that he is

incurring excessive costs. Then he's on notice. If he trys to debate the issue, we have documented proof that we have put him on notice, and that we consider certain costs as unreasonable before the fact.

In summary, PIE COST focuses on the total incurrences of indirect costs. We deal with inflation explicity. We focus on what is driving the costs. We've got a uniform method of working the problem that we can employ across services lines.

Implementation

In order to implement the system, we have a three phase training program. We have two week resident course at Lowry AFB. We have a mobile course for our managers. We take this course right to the plant to indoctrinate our personnel there. We give the managers the language so they can appreciate the problems that their working people are having. We also put this course on at OSD and major air command level. The third phase is to help the negotiators prepare for action. We know that our negotiators are apt to be a bit uncomfortable preparing to use this new technology for the first time. We fortify their confidence by sending a team to his plant to conduct a prenegotiation simulation with him. In the simulation the negotiators can assess all the trade-offs and "What ifs" that have to be addressed. In this manner, they develop a sense of confidence in the use of this new tool.

I would like to make one closing comment related to this symposium. Things normally evolve thru four phases:

concept, test, training, and implementation. Research impacts on each of these phases. If we are going to create change, if the product of our research is going to be implementable, if were're going to impact on the system, we must take this dimension into our research. Otherwise, all we are going to do is to fill up shelves in libraries with stale old documents.

We intend to innovate through research and we intend to get research that will be implementable. The key to doing this is defining the dimensions of research. The researcher has to be concerned with the test, the researcher has got to design the training program, the researcher has got to lead in the implementation -- if it's as good as he says it is - he's got to be out front.

TOPIC:

RETURN ON INVESTED CAPITAL

COLONEL BRUCE S. BENEFIELD, USAF

Colonel Bruce S. Benefield is the Chairman of the Contract Finance Committee in the Office of the Assistant Secretary of Defense (Installations and Logistics). In this position, he is responsible for the conduct of this joint-service committee in developing uniform policies, procedures, and clauses relating to financial matters affecting government contracts.

Colonel Benefield received his education from the University of Miami, Florida, (B.S.), the Air Force Institute of Technology (M.S.), and Harvard University (Ph.D.). Prior to his present position, he held positions as Negotiator and Price Analyst; Congressional Liaison Officer; Associate Professor and Department Head of the Management Studies Department, Graduate School of Systems and Logistics, Air Force Institute of Technology; and Special Assistant in the Office of the Assistant Secretary of Defense (Installations and Logistics).

SUMMARY - RETURN ON INVESTED CAPITAL

Summary of a Presentation given by Colonel Bruce Benefield
by David N. Burt - Edited by Lonnie Ostrom

Since the time of the Revolutionary War, we have related profit under negotiated procurements to the cost of the goods or services. Until very recently, we tended to ignore the role of invested capital as a factor in developing profit objectives. The problems created by a cost-based method of profit determination, have been highlighted by both LMI and GAO. In recent years we have been seeking ways to reduce profit on capital inequities and support the national industrial base by removing the disincentive for defense contractors to invest in more efficient equipment and facilities.

In 1963, the weighted guidelines concept was introduced into the Armed Services Procurement Regulation (ASPR). Included in the weighted guidelines was a penalty of up to 2% for those companies using Government furnished equipment or facilities. This was a first halting step in the direction of considering contractor investment when determining profit. The token emphasis placed on the contractors' investment in the weighted guidelines has proven to be a very ineffective method of recognizing capital. Based on our efforts of the past five years, we have developed an approach which recognizes the capital employed by a contractor as a basic element of our profit policy. The balance of this paper will

discuss this new approach.

Capital Index

The Capital Index is designed to recognize the amount and risk aspects of capital allocated to a contract and is related to the risk inherent in the type of contract. Several steps are involved in developing a capital index for specific contracts.

Step 1: The profit/fee negotiation objective is calculated using the weighted guidelines method. The element "Source of Resources" is disregarded. Also disregarded at this point in the profit/fee determination is the "Special Profit Consideration." Capital is segregated into four categories:

1. Operating Capital
2. Land
3. Buildings
4. Equipment

Step 2: Operating capital required to perform a contract is determined based on either historical data or projected operating requirements for the individual contract. The historic method of determining rates is preferred since it is administratively simpler and produces reliable results. Allocation is usually based on the number of dollars of costs supported by a dollar of operating capital.

Step 3: Facilities Capital (land, buildings, equipment) is allocated on the same basis as depreciation. The result of the allocation is a series of rates for land, buildings, and equipment that are expressed as cents of capital per dollar of cost incurred in a particular burden center.

By multiplying the cost incurred in each profit center by the appropriate operating capital factor, the operating capital allocated to the contract can be calculated. By multiplying the appropriate overhead allocation base (for instance, direct labor dollars), by a rate for each type of capital, the facilities allocation can be determined.

Step 4: We now determine the capital turnover rate by dividing the contract total estimated costs by the total allocated capital.

Step 5: Recognizing that there are different levels of risk associated with different types of contracts, we next compute a factor called a Capital Index. This is done by using the rate of capital turnover in the type of contract as inputs to the table on the following page:

CONTRACT CAPITAL INDEX TABLE

CAPITAL TURNOVER	CAPITAL RISK LEVEL TYPE OF CONTRACT			
	CPFF	CPIF	FPI	FFP
1.2 & below	8.3	10.0	11.7	13.3
1.3	7.7	9.2	10.8	12.3
1.4	7.1	8.6	10.0	11.4
1.5	6.7	8.0	9.3	10.7
1.6	6.3	7.5	8.8	10.0
1.7	5.9	7.1	8.2	9.4
1.8	5.6	6.7	7.8	8.9
1.9	5.3	6.3	7.4	8.4
2.0	5.0	6.0	7.0	8.0
2.2	4.5	5.5	6.4	7.3
2.4	4.2	5.0	5.8	6.7
2.6	3.8	4.6	5.4	6.2
2.8	3.6	4.3	5.0	5.7
3.0	3.3	4.0	4.7	5.3
3.3	3.0	3.6	4.2	4.8
3.6	2.7	3.3	3.8	4.4
4.0	2.5	3.0	3.5	4.0
4.5	2.2	2.7	3.1	3.6
5.0	2.0	2.4	2.8	3.2
6.0	1.7	2.0	2.3	2.7
8.0	1.3	1.5	1.8	2.0
10.0	1.0	1.2	1.4	1.6
15.0	.7	.8	.9	1.1
20.0 & above	.5	.6	.7	.8

This brings us to a dilemma in assessing the importance that capital should have in determining prenegotiation profit objectives. If we develop a profit based solely on the amount of capital invested, as England and Germany have done, we introduce a bias for capital in one extreme; to base total profit on cost alone is in the other extreme. A profit based solely on capital would amount to saying "We will a guarantee profit based on whatever dollars you invest in your particular operation". This is not our objective. Our objective is to reduce the inequities in profit opportunity available and to motivate the contractor to increase the volume in his plant to increase the turnover in his investment. After considerable deliberation, the final weights have been set at 50% for capital and 50% for cost. There is a possibility that capital should receive a greater weighting than 50% but the 50-50 approach appears to be the most reasonable selection at the present time.

Total Profit Objective

Having determined our weighted guidelines profit objective, having allocated capital to this contract, and having determined the capital turnover rate and the contract type, we are now in a position to determine the total profit objective. Using the contract type and the capital turnover rate, we enter the table and extract the appropriate capital index. This index has already been adjusted to acknowledge the 50% weighting.

The next step is to add the capital index to 1/2 the weighted guidelines profit objective. The result, reflecting the 50% weighting for cost and 50% for capital, is the total profit objective.

The attachment portrays a hypothetical set of data on the contract capital employed, the Government's cost objectives, and calculations for developing the total profit objective.

Implementation

This policy change will be implemented on an optional basis in mid-September 1972 via a Defense Procurement Circular (DPC). Both Government and contractor will have options on its usage, with the final option resting with the contractor. A mandatory date for use on contracts meeting the criteria for application has not been established.

The present criteria for application are as follows:

1. The weighted guidelines are applicable,
2. The contract is a production or supply contract,
3. The estimated engineering costs are 25% or less of the estimated in-house costs, and
4. The total estimated contract cost is $3 million or more.

These criteria are subject to revision based on experience during the optional period.

Summary

By increasing the emphasis placed on the amount and allocation

of contractor capital, we hope to revise the historic incentive for contractors to increase costs in order to increase actual dollar profits. We are not going to the extreme of guaranteeing a profit where based solely on the amount of capital invested. We are balancing between these two extremes. In the process, we hope to be able to provide the motivation required to induce our supplies to increase the efficiency and reduce our costs!

DD Form III

CONTRACT CAPITAL EMPLOYED

Contractor: ABC, Inc.
Profit Center: Vehicle & Controls Divisions
Address:

RFP/Contract PIIN No:
Performance Period: 3/1/72 - 9/30/73

PROFIT CENTERS Productive Burden Centers (1)	Fiscal Years (2)	CONTRACT OVERHEAD ALLOCATION BASES (3)	ESTIMATED FACILITIES CAPITAL EMPLOYED FACTORS Land (4a)	Bldgs (4b)	Equip (4c)	AMOUNT Land (5a)	Bldgs (5b)	Equip (5c)
VEHICLE DIV								
Engineering	1972	90 DL$	.0367	.3717	.0789	3	33	7
	1973	10	.0392	.3842	.2942	-	4	3
Manufacturing	1972	60 DL$	.0363	.3710	.7183	2	22	43
	1973	540	.0394	.3831	.6189	21	207	334
CONTROLS DIV								
Engineering	1972	320 DL$	.0269	.2856	.0825	9	91	27
	1973	80	.0264	.2786	.1014	2	22	8
Manufacturing	1972	60 DL$	.0271	.2871	.6800	2	17	41
	1973	240	.0263	.2750	.5825	6	66	140

A. CONTRACT FACILITIES CAPITAL EMPLOYED		45	462	603
B. OPERATING CAPITAL EMPLOYED	Form 1 1143			
C. CAPITAL PREFERENCE WEIGHTS	ASPR 3-808.7(b) .7	.7	1.0	2.0
D. WEIGHTED CAPITAL EMPLOYED	800	32	462	1206
E. TOTAL UNWEIGHTED CAPITAL	Sum A + B	2,253		
F. TOTAL WEIGHTED CAPITAL	Sum D	2,500		
G. CONTRACT TOTAL ESTIMATED COST	DD 1547	5,000		
H. WEIGHTED CAPITAL TURNOVER RATE	G÷F	2.0	X	

WEIGHTED GUIDELINES PROFIT/FEE OBJECTIVE

INSTRUCTIONS: 1. See ASPR 3-808 for determination of assigned weight factors.
2. See ASPR 3-811 for documentation of profit objective.

1. [illegible] CONTRACT NO.	2. CONTRACTOR: ABC, Inc.	CONTRACT TYPE: FPI

3. COST INPUT TO TOTAL PERFORMANCE — ASPR 3-808.5(b)

COST CATEGORY	a. GOVERNMENT'S COST OBJECTIVE	b. ASPR 3-808 WEIGHT RANGE	c. ASSIGNED WEIGHT	d. WEIGHTED PROFIT/FEE (Col b x c)
DIRECT MATERIALS: PURCHASED PARTS	$ 100,000	1% TO 4%	2 %	$ 2,000
SUBCONTRACTED ITEMS	900,000	1% TO 5%	3 %	27,000
OTHER MATERIALS		1% TO 4%	%	
ENGR DIRECT LABOR	500,000	9% TO 15%	12 %	60,000
ENGR OVERHEAD	700,000	6% TO 9%	7 %	49,000
MFG DIRECT LABOR	900,000	5% TO 9%	7 %	63,000
MFG OVERHEAD	1,100,000	4% TO 7%	5 %	55,000
OTHER COSTS	200,000		1 %	2,000
			%	
			%	
			%	
			%	
GENERAL AND ADMINISTRATIVE	600,000	6% TO 8%	7 %	42,000
TOTAL	$ 5,000,000			$ 300,000

				PROFIT/FEE OBJECTIVE
4. COMPOSITE PROFIT/FEE ON COST INPUT TO TOTAL PERFORMANCE (Col d ÷ Col a)				6.0 %
5. COST RISK	ASPR 3-808.5(c)	0% TO 7%		3.0= %
6. PERFORMANCE	(d)	-2% TO +2%		1.0 %
7. SELECTED FACTORS	(e)	-2% TO +2%		%
8. SPECIAL PROFIT	ASPR 3-808.5	0% TO +6%		%
9. COST-BASED PROFIT/FEE OBJECTIVE (Lines 4 thru 8)				10.0 %
10. CONTRACT CAPITAL TURNOVER RATE (DD FORM 111)				2.0 %
11. CAPITAL INDEX FOR RISK LEVEL (ASPR 3-808.7(i))				7.0 %
12. CAPITAL RESOURCE FACTOR (Line 11 - 50% of Line 9)				+ 2.0 %
13. ADJUSTED PROFIT OBJECTIVE (Line 9 ± Line 12)				12.0 %

DATE	PREPARED BY (Name, Title and Office Symbol)	SIGNATURE
1 Feb 72	PROCURING CONTRACTING OFFICER	

DD FORM 1547 C-11 ATCH 2 84

TOPIC: INNOVATIONS IN INDUSTRIAL PREPAREDNESS

MR. EUGENE L. MC CUBBINS

Mr. Eugene L. McCubbins is an Industrial Specialist with the Headquarters, Naval Material Command. As Director, Production Planning Staff, Mr. McCubbins is responsible for policy and guidance to the Systems Commands on Industrial Preparedness, production and planning, "Should Cost" Industrial Reviews, and solution of special production/procurement problems affecting items in fleet operations.

Mr. McCubbins received his education at the Virginia Polytechnic Institute (Electrical Engineering) and the American University (Political Science). He has had wide experience as both a systems technician and an upper level manager. He holds several trademarks and patents and has developed production-oriented planning systems as well as an advanced procurement planning system now used by the DOD.

INNOVATIONS IN INDUSTRIAL PREPAREDNESS

Eugene L. McCubbins
Director of Production Planning
Navy Material Command

DOD Industrial Preparedness Program

Due to the broad and varied coverage of this program, I have divided the subject matter into two parts.

First, I will discuss the background that led up to the formation of the DOD Steering Group currently in the process of revising policy.

I will then discuss the part thereof that would be of most interest to you - procurement policies.

Experience over the last 32 years has verified that converting industry from peacetime to wartime objectives is a time consuming and costly task. Fortunately for the United States, the transitions that occurred during World War II, Korea and SEA were accomplished in an environment of relative security. IN-CONUS hostile action did not occur that could have destroyed facilities or interdicted the logistics of raw material necessary for manufacture of wartime hardware.

From the entrance of the United States into World War II, it took well over one year to develop an effective system of industrial controls. It took much longer to effectively mobilize industry to meet the demands of military requirements.

During the Korean Conflict buildup, World War II hardware was employed until industry could catch up with military requirements. The attitude of indiscriminately dismantling the military that existed at the end of World War II had caused intemperate closing and stripping of many industrial elements that were required to support our military forces in an hostile environment. In order to assuage a commodity hungry civilian economy after World War II, the transition to manufacture of private requirements was rapid and unplanned. Without the availability of World War II hardware, the Korean conflict would likely have ended at Pusan.

SEA buildup saw a repeat of many of the same problems that occurred during the Korean buildup. The problems were to a lesser degree; partially because of a more honest policy in laying up some of the required facilities in caretaker status following Korea; partially because of the type of conflict involved, (limited response); and partially due to the lessened impact on the civilian market-place.

In any future conflict of the scope of SEA or larger, we cannot anticipate the tranquility of complete protection from hostility, harassment, or interdiction in CONUS. This may be from within or without depending on instant political and economic conditions.

There is now general understanding among responsible government and industrial leaders that only by the continued operation of a set of government rules designed to accomplish

the conversion of a peacetime industrial base to military needs, for a contingency action or limited war, can we achieve the requirements necessary to our national security and be ready for the accelerated and changed industrial activity required.

From our experiences of World War II, Korea and Southeast Asia, the DOD has now reached the conclusion that:

1. It must plan on the basis that military requirements for a contingency action or limited war cannot rely on the normal market-place without a mobilization planning system to satisfy its needs for specialty items and engineered products and systems, which are the bulk of the requirements. Most civilian products and production capabilities are not readily convertible to military requirements, although the converse may be true,

2. The Department of Defense can rely on the normal market-place for only commodity type products in general use by the private sector and there only to a limited extent.

Therefore, to meet our future requirements for Limited War, the DOD must maintain an adequate production capacity in industry through a comprehensive and reliable Industrial Preparedness Production Planning Program complemented by an in-house capability.

Our production capacity is often taken for granted, something that is always there like natural resources. In past wars we were able to survive the months of the buildup period.

I want to reemphasize the point that present and future conditions may not allow such a grace period. We must have it recognized that retention of the industrial base, in our own country, in a ready, responsive state, is an indispensable link in the chain of events that puts a weapon system in the field.

Thus, in October 1970, the Industry Advisory Council set up a subcommittee, composed of both government and industry personnel, to look into mobilization planning. The concern was that the rapidly decreasing requirement for an active defense oriented industrial base would impair readiness both in the short and long term.

From their observation and concern, Secretary Packard on 3 November 1970, directed the Military Services and DSA, in concert with the Industry Advisory Council, to revise the DOD policy and criteria for "Mobilization Production Base Planning and Procedures." From this direction, the IAC Subcommittee on IMP was chartered with members from both government and industry. The Chairman is VADM Eli Reich, Deputy Assistant Secretary of Defense (Production Engineering and Materiel Acquisition).

The problem presented by Secretary Packard to ADM Reich that required resolution was general and covered a very large complex area in a few words:

1. Rapidly cooling defense industrial base would impair defense readiness.

2. Decline in defense-generated employment from 3.6 million employees in FY68 to 2.4 million at the close of FY 71.

3. Government owned production facilities are steadily phasing down, professional and craft skills are disappearing from the economic scene.

Therefore, the Subcommittee explored the total area of defense readiness.

The study showed that deficiencies existed in all elements of industrial preparedness. For example, it was found that (1) the military departments used inconsistent planning factors--namely, different planning periods, and different concepts of the force levels against which the planning should take place. In addition, the departments were planning for a large number of items which resulted in a lack of depth of planning in those items selected. Negotiation Exception 16 was used sparingly, if at all.

This Report was submitted in May 1971 to Secretary Packard.

In June 1971, the Secretary established a Steering Group to develop implementing directives and procedures to carry out recommendations of the Subcommittee. Target date for initial implementation is June 1972.

Within the total effort, Management Committee #2 was assigned the task of preparing implementing actions relating to ASPR revisions and required legislative authority. I believe this is the area that you may be most interested in.

In this specific category, proposed directives have been prepared on the following three subjects:

1. Purchases in the Interest of National Defense or Industrial Preparedness. Military departments have expressed the opinion that the examples in ASPR 3-216.2 fail to authorize clearly awards of contracts for current requirements for the purpose of preserving the industrial base. It has been proposed, therefore, that ASPR 3-216 be strengthened by adding authority to:

A. retain or continue any existing production base or operating lines required for IPP which are jeopardized by reduced procurements; and

B. to limit to planned producers only, competition for current procurement of selected items for which a valid agreement exists with those producers.

2. Dependency on Foreign Sources. To minimize reliance on foreign sources for items determined to be critical to major weapon systems, military services shall include appropriate designators in their planning documents which will identify the applicable portions of the weapon system, subsystem, component and material which require elimination of dependency on foreign sources. It is interesting to note

that when DOD requested the Navy to identify specific foreign made components in our weapon systems, we were unable to identify within a reasonable time beyond the first tier subcontractor, those components of foreign origin.

The bidder or offerors must then certify that the product furnished is a domestic end product comprised solely of products mined, produced or manufactured in the U.S.

3. Integration of Industrial Preparedness Requirements with Current Peacetime Procurements. To insure compliance, a clause will be incorporated in those contracts covering industrial preparedness planned items which will provide for:

A. inclusion of a line item for IPP as a deliverable requirement in contracts;

B. mandatory award evaluation conditions;

C. and rejection of bids which are non-responsive to IPP requirements. Any bid or proposal which omits an offer for such requirements will be considered non-responsive.

Regarding ASPR Coverage

A new section in ASPR has been prepared to provide broad policy and more specific and detailed guidance for procurement personnel. It will establish policy and procedures for integrating current procurement with IPP; necessity for coordination among procurement and planning personnel. It will, also set forth contractual means for implementing the program.

Now will this program, if fully implemented, affect defense procurement in the seventies?

I believe it will have a significant impact. For example, to protect the base necessary, many procurements that normally would go the IFB route during peacetime will be negotiated with the planned IPP suppliers.

Another significant aspect will be the proposed directive or integration of current requirements with industrial planning. Premiums will have to be paid; however, trade-offs can be made under the active base concept such as lower inventory levels with less material in our warehouses to become obsolescent or even obsolete.

In the long run, this may even reduce quantitative requirements, less current procurement. I would think some research in this area--for items such as conventional ordnance-- bombs, rockets, airborne missiles, gun ammunition, etc., under the active base concept would be interesting

We certainly don't pretend that all the problems will be solved by these proposed directives and ASPR coverage. We believe we have just scratched the surface.

One of our basic problems is in convincing people who are not directly involved in IPP of the importance of this program. When decisions have to be made in the award of contracts, for example, it is usually in favor of award to the low bidder in order to realize immediate dollar savings, rather than the long range view towards protection of a competitive industrial base.

ASD (I&L) memo of 25 January 1972, has emphasized the importance of IPP during the transitional period from war to peace and the need to assign a high priority to this function.

In this regard, incorporation of the new section in ASPR should give procurement people a better understanding of what the program is designed to accomplish. Procurement personnel can be one of the strong links in achieving success.

There are other currently unresolved questions. For example, where should we draw the line on premiums to retain two or more sources? Should detailed specific guidance come from OSD or should each service be authorized to determine the percent of I.O. they must have? Should the active base be authorized for only expendable ordnance? How do we assure a "CONUS" capability for detailed parts and material--such as transistors, titanium, precision ball bearings, etc. How will industry react when they finally realize that the DOD is sincere, this time, regarding IPP? Most important, where is the money coming from to support the rather substarted industry base?

These and many many more questions remain to be answered as the "New Look" at IPP begins to crystalize. Perhaps you gentlemen, may be able to provide a constructive input. I'm sure our Steering Group has not covered all the pitfalls.

The results of any research you may do on this subject would certainly be of interest to VADM Reich and the entire Steering Group.

TOPIC: DESIGNING FOR COST TO PRODUCE

MR. RAYMOND D. GILBERT

Mr. Raymond D. Gilbert is a Project Team Leader in the Department of Defense Value Engineering Services Office. In this position, he is responsible for the design and installation of factory cost systems, quality assurance systems, work simplification, staff reporting and economical analysis, operational research in production control, value engineering and marketing and product design.

Mr. Gilbert received his education at Oregon State University (B.S., Industrial Engineering) and Stanford University (M.B.A., Industrial Management). Also, he has completed the Command and Staff School of the United States Air Force and has completed additional graduate work in Industrial Management at the University of Washington.

DESIGNING FOR COST-TO-PRODUCE

Raymond D. Gilbert, P.E.
DOD Value Engineering Service Office

Introduction

Controlling cost-to-produce of defense materiel during the design phase involves disciplines beyond "designing something that will work."

This paper reviews management phenomenon through which the weapons acquisition process can be expected to balance development's concern for product performance with a discipline for achieving a targeted cost-to-produce. The theory and concept of controlling cost-to-produce during development is partially treated in the public bodies-of-knowledge relating to comptrollership, engineering and business law. However, many major corporations have evolved a complete internal managerial discipline to control cost-to-produce throughout the product's design and development. The Department of Defense is now challenged to define and execute means to bring "cost growth" into managerial control.

Comparison

The four step life cycle for commercial products is--(1) conceive idea, (2) design and develop, (3) manufacture the item, and (4) deliver to customer. Initial comparison to life cycle for military design products reveals a close analogy for each of the four steps--(1) express requirements, (2) design and develop, (3) contract for manufacturing and (4) deliver to user.

As this analogy is continued to the second level of indenture as shown in Figure 1, it reveals an exception within the military design and development activity. A contract to design and develop a commercial product is expected to specify--(1) the cost of performing the development work and (2) the cost for producing the designed item. Contracts for design and development of military products have characteristically specified vigorous control over the cost to perform the development work, but the production cost objective for the end product is seldom in the language of the development contract.[1]

This omission alters the philosophy and work disciplines for both buyer and producer of development contracts. Inclusion of a cost-to-produce parameter insures a greater contractor concern for the results of his work.

COMPARISON

COMMERCIAL PRODUCT	MILITARY PRODUCT
1. Conceive Idea	1. Express Requirements
Project sale price Research the basics	Budget cost-to-acquire Research the basics
2. Design and Develop	2. Design and Develop
Regulate cost-to-design Control future cost-to-produce	Control cost-to-design
3. Manufacturing	3. Contract for Manufacturing
Control quality Hold cost to standard	Inspect quality Audit actual costs
4. Deliver to Customer	4. Deliver to User
Instruct in use Maintain warrantee	Train in use Provide logistic support

FIGURE 1

"Stop Loss" Control

The product control exercised by one major producer of commercial and military equipment is illustrated in Figure 2. When a product concept is accepted for action it is assigned to three organizations -- (1) engineering, (2) market research and (3) manufacturing engineering. They estimate the initial product's engineering characteristics, the acceptable price for a defined portion of the market and its expected manufacturing unit cost. The integrated team's results are presented to corporate management for a decision to proceed with more investment in the concept or to stop the program.

Assuming that the return on investment continued to be favorable, a second iteration (three to 10 times greater than the first) would develop details in engineering, marketing and manufacturing engineering. Again, a top management review compares the output of the detail review against the original concept and decides whether to proceed or stop.

The third cycle of development involves preparation for a major economic commitment to facilities, subcontracts, manning and marketing the new product.

At each of these three points, the decision to proceed with a growing investment is influenced significantly by the difference between an acceptable price and the projected cost-to-produce.

In 1970, Secretary of Defense Packard initiated a similar "stop loss" system at three major milestones during a program's early life. This decision-making group is called the Defense Systems Acquisition Review Council (DSARC). Initially only the highest cost systems were subject to its three major decision points, however, the DSARC "model" can provide investment control in local project and system management.

Progress-Measuring Tools

The projected cost-to-produce for an item that is in development is usually a series of estimates and projections. As each major portion of the item is completed, its production cost can be estimated with reasonable precision. Uncompleted elements of the design are still dependent on "projection" from analogy or comparison with near-similar parts of sub-assemblies. A fundamental tool for controlling this mix of "Estimates and Projections" is found in a natural phenomenon termed the "Pareto Distribution."

Alfredo Pareto, an Italian philosopher emphasized the importance of a significant few in contrast to the insignificant many. Although Pareto emphasized the social importance of the "significant few," the phenomenon is found in nature and has been adopted to management of inventories; i.e., we see more attention to the accountability for one jet engine than for all the office supplies. This phenomenon is also expressed as the 80/20 rule. As shown in Figure 3, if all items of a system are arranged in order of decreasing unit cost, the cumulative total value of the first 20 percent of items will approximate 80 percent of the total cost of the system.

DEVELOPMENT DECISIONS & TIMING

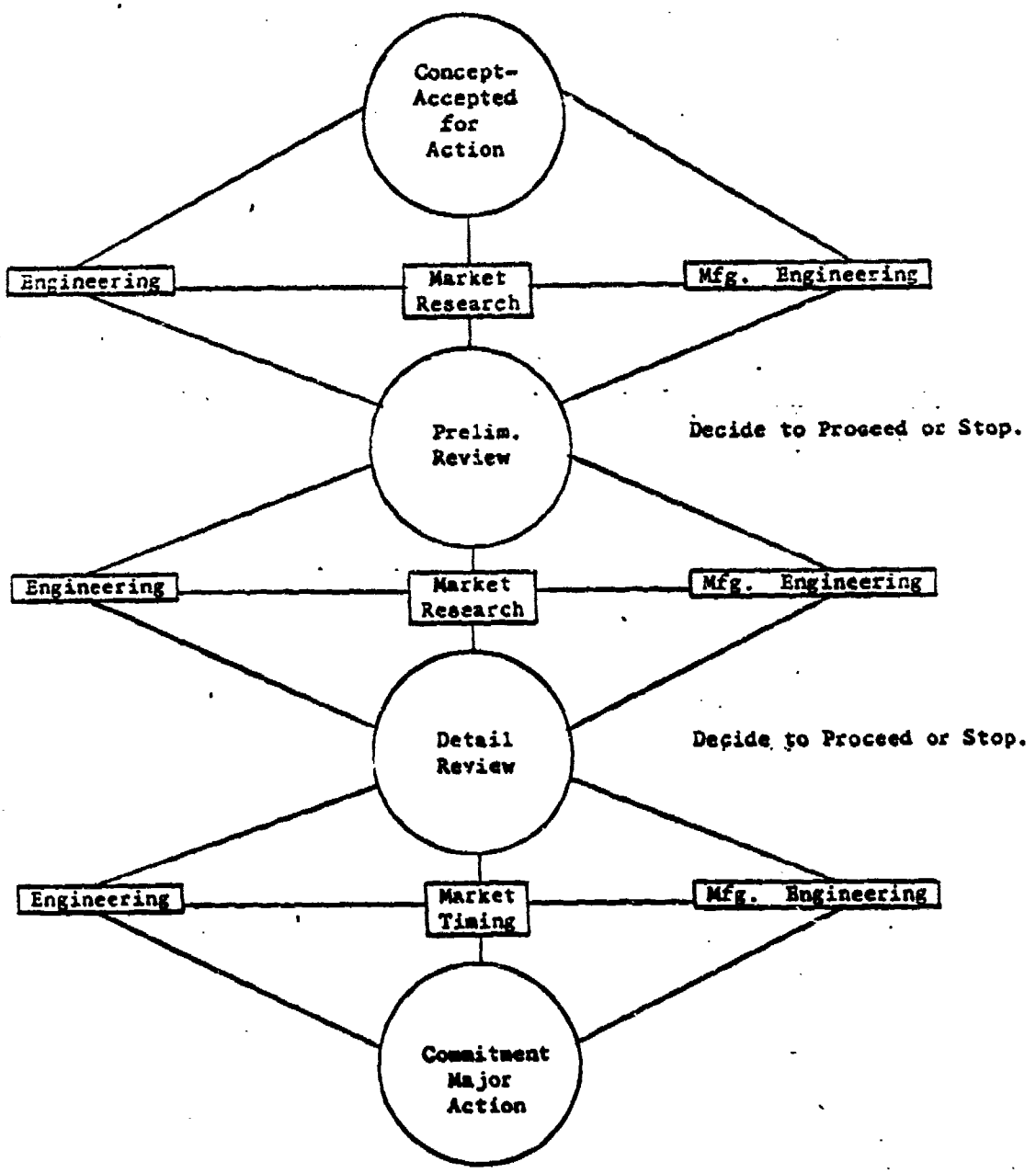


FIGURE 2

PARETO DISTRIBUTION

or 80/20 Role

"The Significant Few vs. the Insignificant Many."

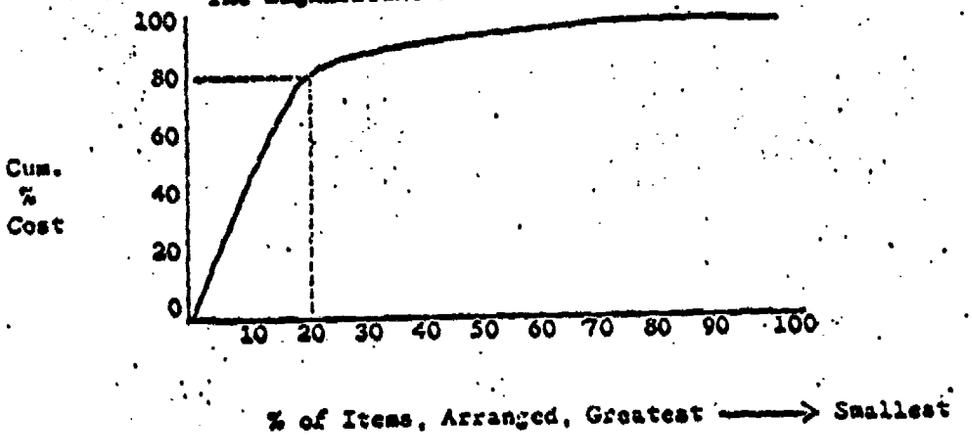


FIGURE 3

The usual frame of reference for cost in military development contracts has been the rate of funds spent in comparison to a schedule for delivery or work, i.e., delivered drawings. Characteristically, the cumulative pattern for cumulative delivery of final results is an S shape curve which normally lies to the right of the cost curve. Notice that when half the funds are spent, there are few drawings delivered. When half the drawings have been delivered to the customer, nearly all of the committed funds are consumed. When enough is known about the product's cost-to-produce to indicate need for change, the available development funds do not permit redirection of the development work.

CONTRACTOR'S CONTROL OF DEVELOPMENT COSTS

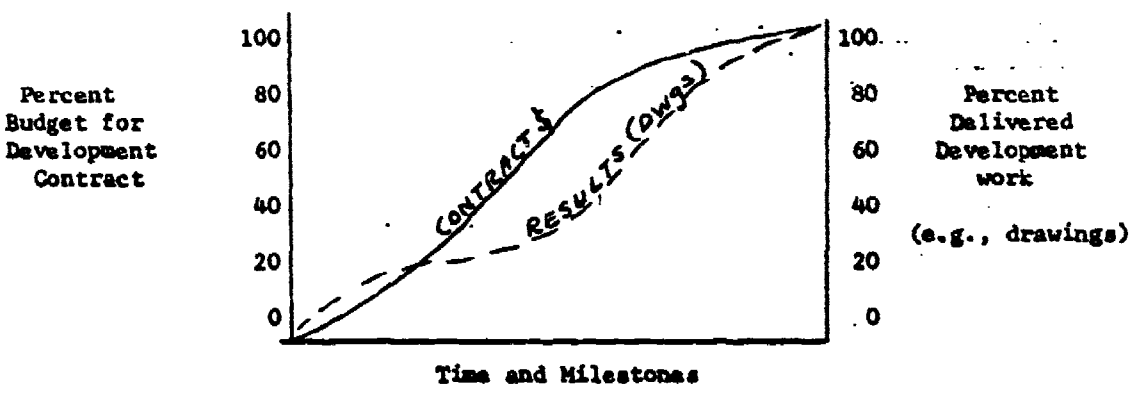


FIGURE 4

When cost-to-produce estimates are a contractual requirement, the developer and his customer will need to arrange their sequence of development to confirm the basic economics of the end product as early as the milestone for consuming the first 15 percent of the development budget. Then when his estimate of defined work approximates 65 percent of the total unit cost target, his projection can reconcile the rest of the target cost. If, that early in development, 65 percent of the estimated total unit production cost is out of proportion with the target cost-to-produce (as illustrated in Figure 5) an early redirection permits refining the original approach before "sunk" costs have consumed a major portion of the development budget. With each succeeding milestone review, cost-to-produce becomes more firm.

Program managers can expect to find their projected cost-to-produce going out of control several times during the life of a military product. Even the toy business reports the need for sustained control throughout development.

CONTROL OVER DEVELOPMENT COST AND FUTURE PRODUCTION COST

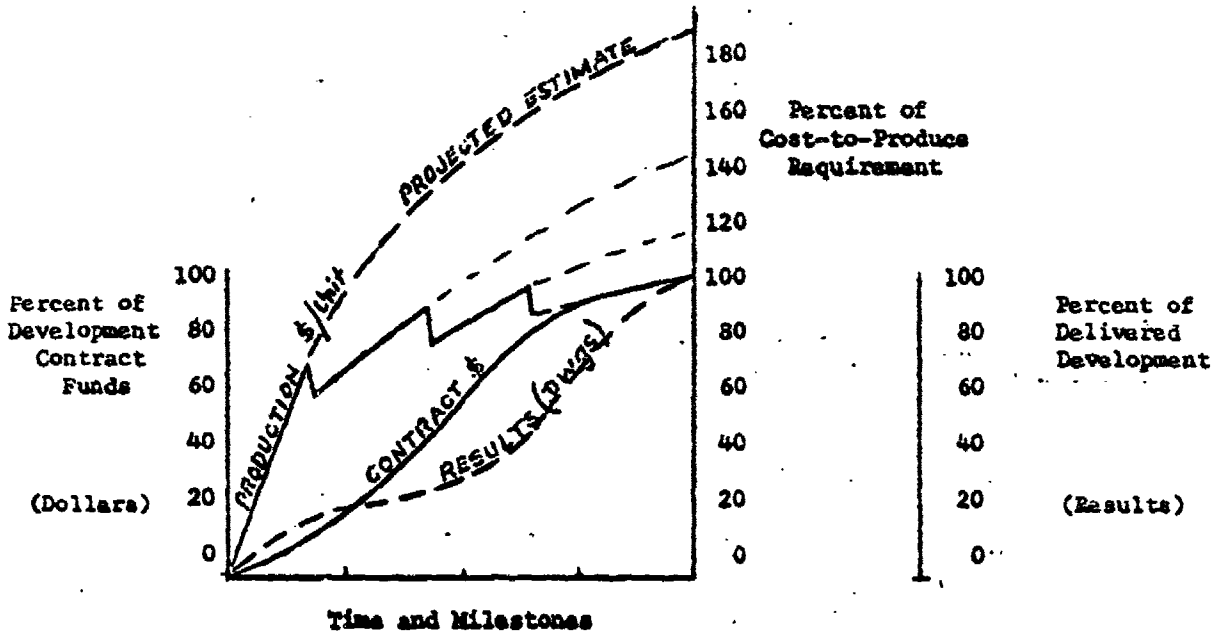


FIGURE 5

The Mattel, Incorporated, designers and manufacturers of unique toy "systems" has reported that in their experience of controlling cost-to-produce, a product's unit cost will typically exceed the assigned cost thresholds and require corrective action several times during development.

Cost Feedback

Figure 1 highlighted the need for cost-to-produce to be in the language of DoD Weapon Development contracts and Figure 5 has proposed a real-time measurement of progress toward achieving a design which meets cost-to-produce criteria. Assuming that real-time measurement is employed for development contracts having cost-to-produce requirements, Figure 6 traces the delegated flow of cost-to-produce responsibility from the general contract through its distribution of responsibility to the cost-originators. The group design leaders, by assumptions and call-outs, originate the major cost-of-production estimates as they accept responsibility for cost-to-produce. These group leaders need cost-knowledgeable manufacturing engineers and skilled procurement specialists to support their economic judgements. A responsive feedback of cost-to-produce implications for each element of each design option guides the design team toward an effective product. Within their assigned cost-to-produce targets, the responsive cost feedback of the designer's selected approach also helps assure the program manager and his customer that their assigned cost-to-produce targets will or will not be attained.

Cost Regression from Experience

The actual measurement of cost-to-produce results must be tempered with an appreciation of what happens to the average unit cost of products as their production increases. The Rand Corporation's analysis of Airframe cost established a characteristic regression curve which was termed "learning curve" because its original application deals with changes in labor cost. This regression analysis became expressed as the percent of manhours required for each subsequent doubling of the production quantity, i.e., when the first items averaged 100 hours, a typical 80 percent learning curve forecasted that the average for the second hundred would be 80 hours each, and the average for the next two hundred would be 64 hours, etc. (Major Airframe contracts were negotiated on this basis-of-cost-projection.) This type of cost regression is now plotted for the total cost of most major procurements by the Defense Contract Audit Agency.

This paper refers to the regression pattern of total unit cost as "experience curve." The experience curve for a fuze system as described on Figure 7 shows a production-cost regression rate as 77 percent. However, due to the influences of a high proportion of engineering attention, the unit cost regression rate during development will reflect a much steeper curve (57%). This steeper cost regression rate during development should discourage premature start of production. When the government's intended cost-to-produce is plotted for a future production unit and the intended experience curve passes through this point, the intersection of the development rate

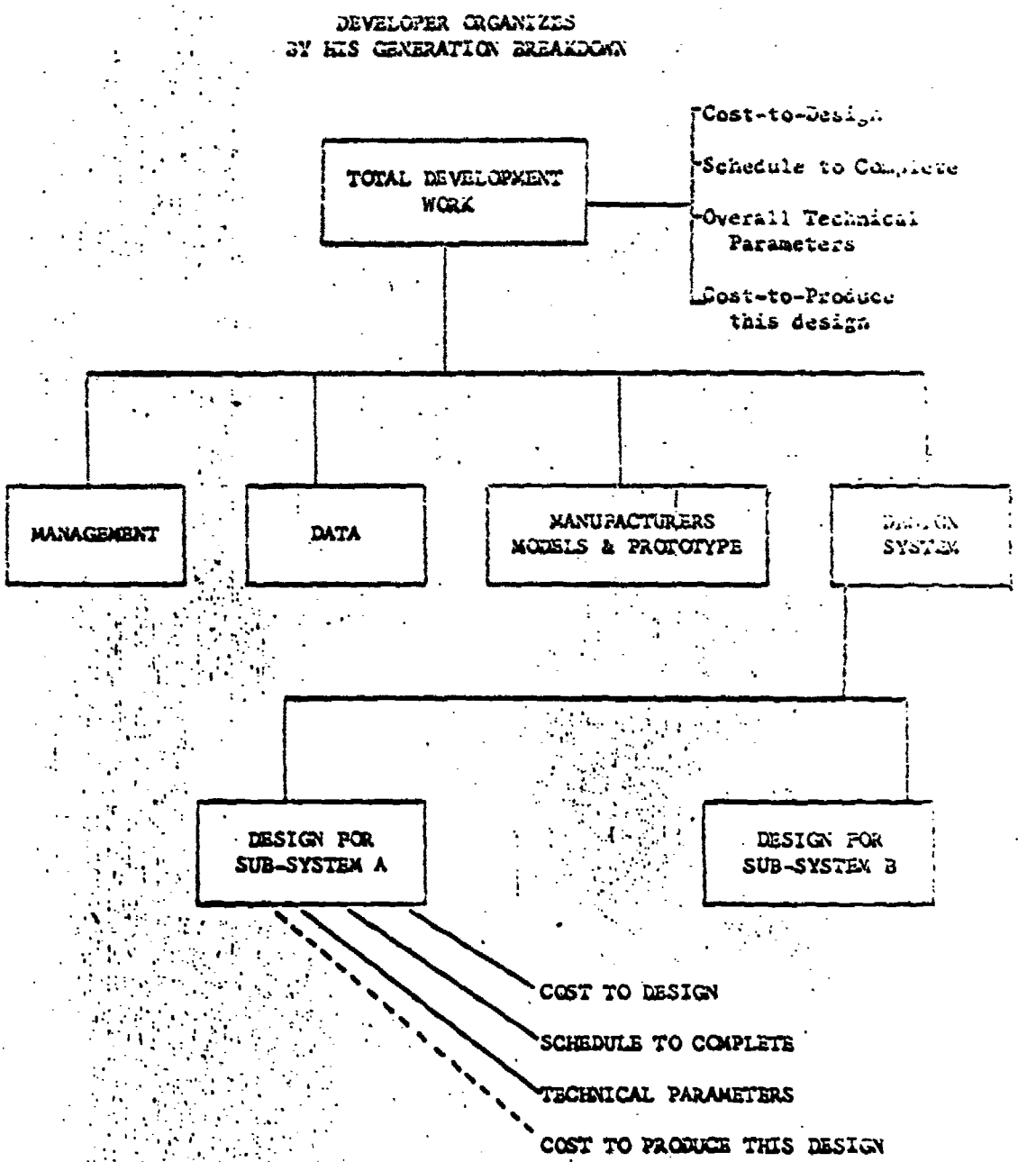

DEVELOPER ORGANIZES
BY HIS GENERATION BREAKDOWN
TOTAL DEVELOPMENT WORK
Cost-to-Design
Schedule to Complete
Overall Technical Parameters
Cost-to-Produce this design
MANAGEMENT
DATA
MANUFACTURERS MODELS & PROTOTYPE
SYSTEM
DESIGN FOR SUB-SYSTEM A
DESIGN FOR SUB-SYSTEM B
COST TO DESIGN
SCHEDULE TO COMPLETE
TECHNICAL PARAMETERS
COST TO PRODUCE THIS DESIGN

FIGURE 6

EXPERIENCE CURVES

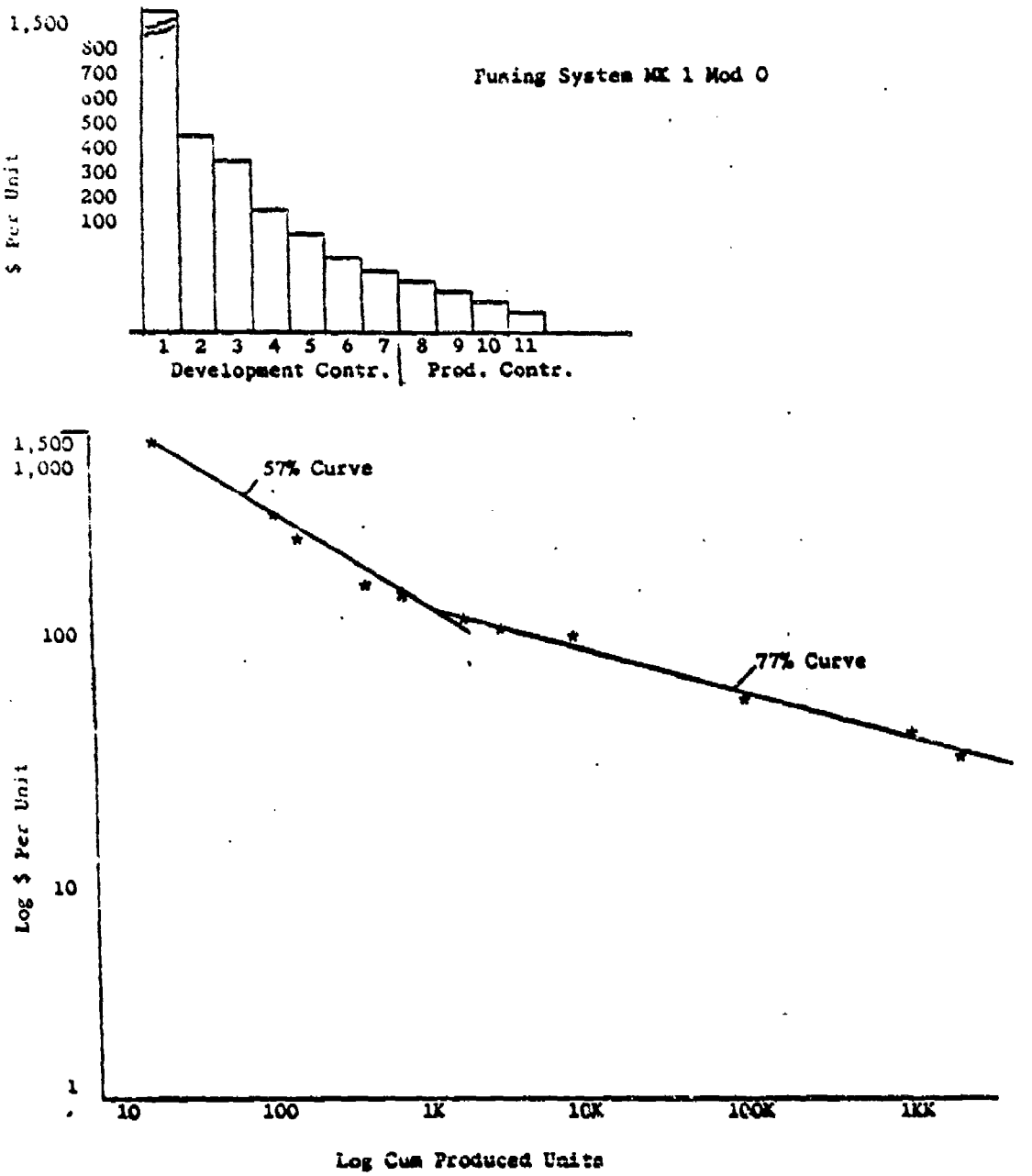


FIGURE 7

and production rate provides one more management tool to indicate an appropriate unit cost-to-produce at which the development program can be converted to a production program.

Where a cost-to-produce parameter is the basis for a contract requirement and/or a major incentive to a development contract, the lot size and its place in cumulative production describe the time when cost-to-produce is to be measured.

Until that time of measurement, cost-in-production is estimated by the developer and the estimate is adjusted or confirmed by the customer. An escalation factor permits the original government target to be adjusted in terms of original dollar value.

Visibility of Cost Decisions

A concept of cost-to-produce exercises early development control over future production cost. It uses the Pareto or 80/20 rule to highlight the production cost consequences of the decision to use a basic design approach. For management review, a display like Figure 5 superimposes the economic consequences of these early development decisions on the more usual budget-control display of the development contract cost.

The Family Tree

The government's total target price may be classified in terms of cost-to-produce by defining assumptions about overheads and profit and by utilizing the idea of Work Breakdown Structure (WBS) contained in Military Standard 881. It defines seven classes of military hardware systems by describing them in three levels of a "Family Tree." Two levels of indenture for an aircraft system, one shown on Figure 8, and three levels of ordnance WBS are superimposed onto the aircraft armament. Using this approach, agreement between the contractor and government can define common sub-elements of a system to any useful level.

Selection of the Significant Few[2] of these elements of design for detail pricing can provide meaningful assurance that the assigned cost-to-produce targets are being met. As similar elements of design are made visible to the government from other programs, their comparison becomes the basis of even better control.

Role of Ad Hoc Task Force in Controlling Cost-to-Produce

Experimental Value Engineering Task Forces have demonstrated an effective methodology for:

1. Confirming the cost-to-produce for a weapons system concept.

2. Restoring the intended cost-to-produce during an engineering development contract. The task force is initiated at least three months

See page 14 for footnotes

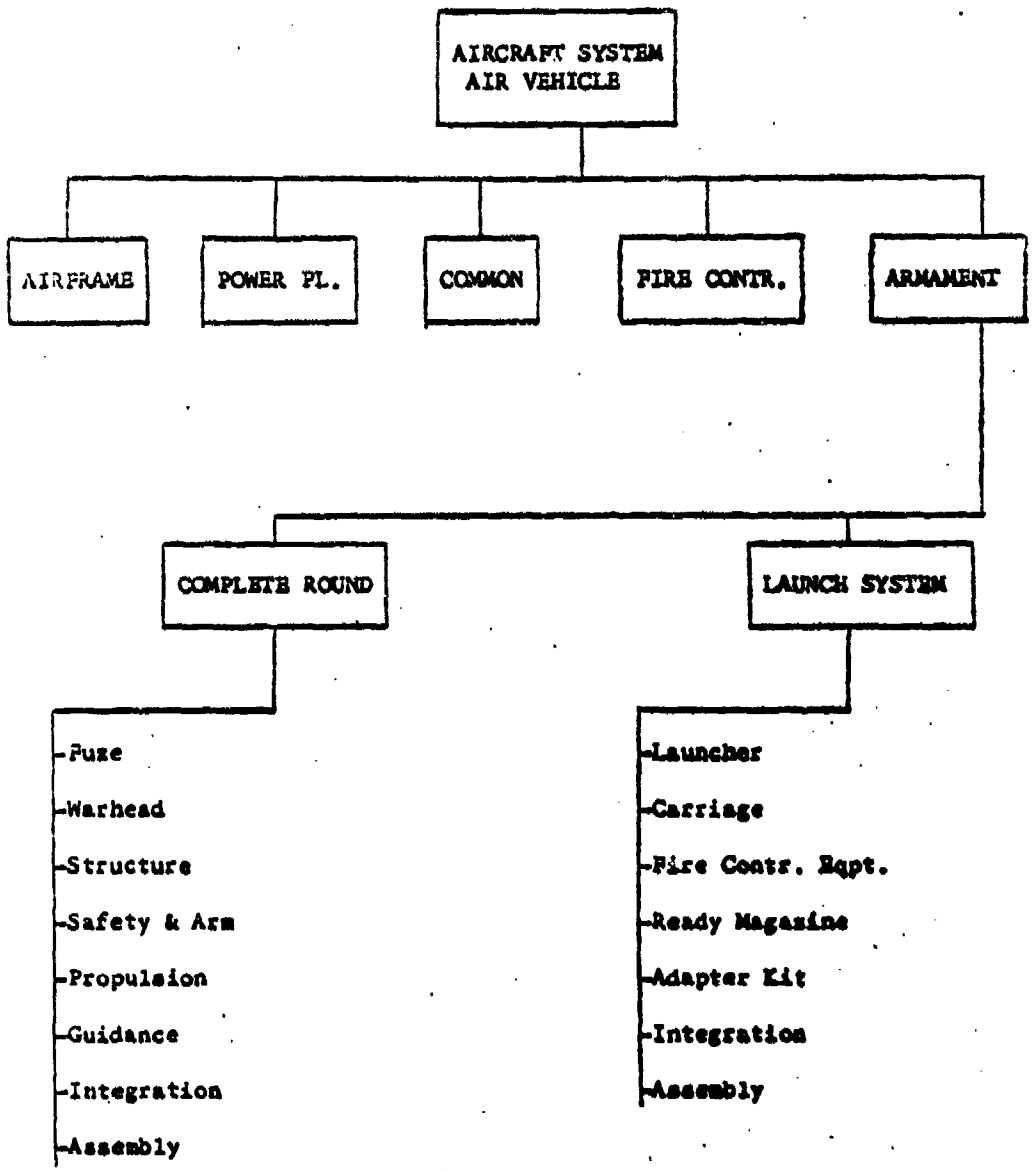

AIRCRAFT SYSTEM
AIR VEHICLE
AIRFRAME
POWER PL.
COMMON
FIRE CONTR.
ARMAMENT
COMPLETE ROUND
LAUNCH SYSTEM
-Fuze
-Warhead
-Structure
-Safety & Arm
-Propulsion
-Guidance
-Integration
-Assembly
-Launcher
-Carriage
-Fire Contr. Eqpt.
-Ready Magazine
-Adapter Kit
-Integration
-Assembly

FIGURE 8

prior to the budget allocation process to let the economic results influence priorities for investing R&D funds. The effectiveness of these Ad Hoc teams is dependent on:

a. Adequate manpower investment (60 to 150 man weeks including special talents of design engineers, production engineers, purchasing specialists, cost estimators and illustrators.

b. Visibility of manufacturing cost information for an orderly comparative evaluation with the tactical and technical requirements of intended missions.

3. Two-way communication with the Military services' decision-makers who are responsible for financial and technical requirements.

4. Active participation of individuals who will direct the implementation of task force findings with appropriate laboratories and contractors.

The limitations of an Ad Hoc task force still requires testing to confirm the Ad Hoc analysis; contract adjustments to accommodate the novel approaches which promise attainment of cost-to-produce goals and program management which continues to use cost-to-produce targets as a constraining design parameter.

Summary

Congress and the Department of Defense are committed to extraordinary measures to bring "cost growth" into control. The DoD Directive 5000.1 (Acquisition of Major Defense Systems) has placed new emphasis upon designing to a specific cost objective. The concept of controlling cost-to-produce while a product is being developed is supported with adequate industrial management disciplines which are within the public body-of-knowledge.

Footnotes

1. Recently the government program managers for very important development programs are required to prepare quarterly cost estimates of total program cost for comparison with their program cost estimated prior to development. These selected Acquisition Raports (SAR) DODI 7000.3 are provided to the Department of Defense and to Congress.

2. Program management should design their data feadback to emphasize the significant few in contrast to attempting use of a vast quantity of detailed cost data.

TOPIC: NEW CONCEPTS IN PRICING--MODULAR PRICING

MR. JAY W. CHABROW

Mr. Jay W. Chabrow is the Manager of Pricing, TRW Systems, Electronic Systems Division. Mr. Chabrow has nineteen years experience in estimating, pricing, analysis, and negotiation. He has developed data processing systems for pricing activities, conducted seminars on new pricing/estimating systems, and presented new techniques and analysis concepts to various government agencies and industry.

Mr. Chabrow is a graduate of Pennsylvania Military College. He has been associated with the Radio Corporation of America and Electronics Communication, Inc., as well as TRW Systems. He is on the Board of Directors for the National Estimating Society, Los Angeles Chapter.

J. W. Chabrow
Manager of Pricing
Electronic Systems Division
TRW Systems Group

NEW CONCEPTS IN PRICING - MODULAR PHASED PRICING SYSTEM AND OTHER TECHNIQUES

For 20 years we have been overrunning cost estimates for developing and producing defense systems. Giving proper credit - one of the major efforts the Government did make in the costing area was to change the terminology from cost overrun to "Cost Growth." Much of the overrun problem is caused by industry but much is directly attributable to government agencies. The part that comes from the Government begins with the initial Request for Proposal (RFP). You keep on writing (relative to cost data) the same old tired RFPs asking us to submit the same tired old outmoded data completely ignoring new sophisticated processes which can be utilized to substantiate and give credibility to costs contained in our proposals. This might sound like a general oversimplification of a more complex problem, but the truth of the matter is that when the Government has some good up-to-date concepts, and industry has sophisticated its method of pricing, and you still ask for audits, analyses and negotiations to be held in the manner used in 1945, you don't keep up with yourselves, and more specifically, the auditing and analysis agencies don't keep up with themselves.

Mundane as it might seem - I have the impression that like a cut, we keep trying to find a better bandage each year but we fail to find the cause of the injury. So each year we come up with stated new concepts - one year it's "PIE Cost", the next it's "Modular Phased Pricing" and next year something new; but to get implementation and acceptance of these concepts is something else. So we meet here, discuss these concepts in an academic environment, go back to our respective tasks and beat ourselves against the walls of bureaucracy and "the hierarchy of innocence." I dare say that a third of what I've heard here is probably used on one percent of all outstanding contracts.

NEW CONCEPTS IN PRICING -
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Working on 2 billion dollars worth of proposals each year gives me a pretty good idea of what concepts are utilized in the field and their degree of acceptance. Therefore, when Col. Bruce Benefield formulates the concept of additional fee percentage for invested capital within the Weighted Guidelines, I can say in absolute candor that 90% of the Procurement Agencies, Procurement Officers and their industrial counterparts find the Weighted Guidelines Techniques questionable and manipulative, and many just don't believe in the concept. Therefore, refinements to these questionable techniques can be likened to putting new tail lights on an Edsel.

Today I am here to speak about a new concept extrapolated from parametric estimating. This concept is called the Modular Phased Pricing System. We had been working on this concept for 2 years, when massive constriction befell the Aerospace Industry. During this fiscally constricted period, with attendant cutbacks, we were forced to speed up a process which would enable us to perform proposal pricing utilizing much smaller proposal teams, new methods of estimating with no loss in credibility; and with ceilings on proposal expense, allow us to bid the same quantity of proposals for less cost, or more proposals for the same cost.

When preparing "Grass Roots" estimates, personnel usually develop rationale from past experience and judgemental criteria. Our task was to live with the Scientific, Engineering, Manufacturing and Project Management personnel from all technical disciplines and extract the processes they went through during the estimating phase. Working in a parallel effort we retrieved all actual cost information and performance data on completed, and in-process projects. Detailed retrospective analyses were performed and a massive "search for truth" was begun.

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Our experience has shown that collecting raw actual data without a thorough analysis of problems, breakthroughs or other program experiences creates a misleading base for parametric estimating.

No matter what formal accounting system was utilized we discovered that job numbering, work breakdown structures (WBS) and program unique criteria were, for the most part, determined by the project manager with secondary considerations given for corporate project uniformity. Hence we attempted to create project coding similarity, reflect this in our accounting system so that similar functions and tasks had assigned identifiers. This facilitated the task of comparing actuals for tasks such as sustaining engineering, test, product assurance, etc. from project to project and insured credible comparisons.

Work breakdown structures and suborders of work were made similar and, in some cases, standardized. Additionally, we generated CERs (Cost Estimating Relationships) cost per pound, watt output, task percentages to total program cost, etc; criteria which in some form or another had been applied in the airframe or similar industries for years. During this 3 year period of collection, analysis and refining we were also refining our computer applications to be able to accept all of the aforementioned data, and programmed a quick input-output system. Given the above as a background of some representative tasks which had to be accomplished, we can now address ourselves to the steps in the Modular Phased Pricing concept which we welcome the opportunity to share with you.

The first step in the Modular Phased Pricing System is to define the proposal requirements. Examples will be : (1) Statement of Work, (2) Master Schedule, (3) Hardware List, (4) Reliability Level, (5) Power - Weight, (6) Hardware Black Box Description.

The second step is to take these requirements relating them to systems or known hardware and prepare analogous data. An extremely important process takes place at this time. Aside from parts data the most critical analysis must now be made relative to complexity factors assigned to the proposed hardware. A baseline of total systems, subsystems or boxes from past projects is established by the project engineer. A critical analysis of total cost by labor, ODC, technical and specification parameters is made and complexity variables are assigned to the current proposed systems relative to those past projects or systems. These complexity factors now become the overriding consideration of delta costing. Coupled with escalation factors, this method precludes the detail elemental generation of costs and enables the analysis to be made at a much higher and meaningful tier. Parts data in the usual grass roots estimates would be explicit discretes such as Transistors, Capacitors, etc. However, in Modular Pricing parameters are employed such as how many discretes, integrated circuits to total parts by box, dollars per drawing, and dollars per part/cost to design. The above criteria is then applied to subsystems or black boxes defined via the hardware list.

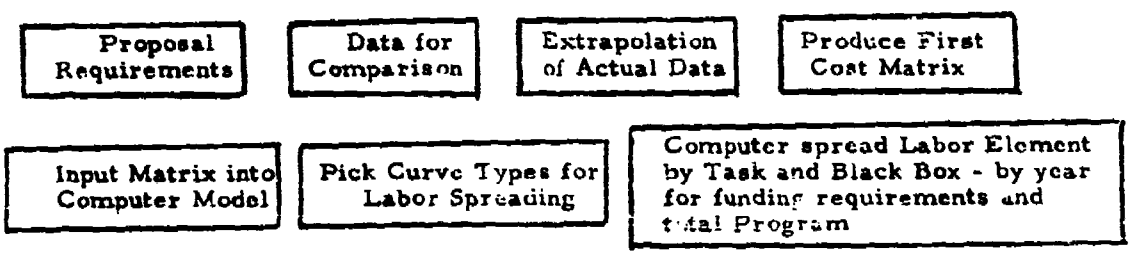
A simple matrix is then defined utilizing two (2) axes. A representative horizontal axis would include the subsystem functional costs such as Subsystem Engineering, Design, Sustaining Engineering, Manufacturing, Test, Quality Assurance, etc. A typical vertical axis on the matrix would be Tasks or Black Boxes such as Program Management, Antennas, Transmitters, Receivers, etc. From this matrix a total preliminary "strawman" cost can be postulated giving management an immediate first cost utilizing preinputted computer data of the aforementioned cost and labor experience.

The matrix is then broken down by element of labor within task, and time spread using profile tables. Selecting applicable manloading curves which have been preprogrammed in the computer process, the estimator has a choice of 16 different curves with different slopes and peaks for manloading labor, only requiring the estimator to know the task start and end date and type of curve required. Distribution and labor mix are also preprogrammed into this computer process.

After accumulating the above data and inputting into the Modular Phased Computer Program the output prints out by task - labor category, time spread, and ODC percentages making correlation to similar jobs, adjustments for reliability complexity and escalation factors. A simplification of this process would be that given a program requirement for a space program, the Modular Pricing will do the following:

Break tasks down into hardware elements.
Time-phase these elements by labor, ODC (Other Direct Costs) and percentages of the above, to total cost.
Take labor and ODC and further breakdown by labor category and ODC category.
Apply indirect costs and profit/fee and formulate total price.

The above may be done with two (2) people within 48 hours as opposed to fifty (50) people and 2 weeks worth of effort. This, of course, assumes a credible data base accumulation on comparable hardware or systems requirements.
A typical flow diagram would be:



NEW CONCEPTS IN PRICING -
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Now listen --- the days of grass roots estimating for the majority of major programs are over. Why do you keep printing RFPs asking for grass roots costing data? Why do you continue forcing us into a cumbersome, wasteful, time consuming, cost expensive and, in many instances, meaningless mode because you have not sophisticated your costing techniques and methods of analysis?

Imagine, if you will, the guidelines you impose on your auditing and analysis groups, and in turn, on us: requests for analysis of all parts of $10.00 and over ignoring either past total material costs or future unknowns; asking us to make explicit determination down to the detail part level in 1972 for design and production parts ordered in 1976 when history has shown the rapid obsolescence of parts due to advancing technology (Vacuum tubes to transistors, discretes to microelectronic - and advanced LSI techniques). However, you continue asking us to delineate each part, with its cost, in response to your clerically-written RFPs. You are forcing both Government and Industry to ignore much experience, such as the cost of unknowns and the more important items having tremendous impact on cost. Clerical questions relative to travel, detail parts, report costs, etc. have been in RFPs for 20 years and should be revamped now.

I am reminded that the famous philosopher Santana once said "Those of us who do not learn from history are condemned to repeat it."

WHEN WILL WE LEARN ?????

Sophisticate your RFPs and analysis techniques - analyze the complexity factors compared to prior projects, analyze the type of history used and how much we both determine is applicable to the present requirement. Analyze the parameters, block diagrams, and black box cost comparison - keep data yourselves and share it with us. Instead of getting volumes and volumes of paper work, why not minimal meaningful information?

The logic escapes me that with 33 billion dollars in cost growth, you have never to my knowledge sent an RFP to major industrial firms asking for a systems analysis or study of more sophisticated and better pricing methods. Design failures and technical performance failures are met with immediate requests, RFPs and Change Orders. Costs failures are met with chastising statements, bureaucratic hyperbole, changes in personnel, audit crackdowns, truth in negotiations laws, but no massive exploration of the concept of Modular Phased Pricing, - and no massive move to develop your own independent estimating capabilities. In one year, putting the money into the right firms, using more sophisticated analysis of these new systems, you too can have the data we have.

Collecting data on labor mixes with attendant rates by geographical area and overlaying your CERs and escalation factors applied to past history should get you pretty close to what the competitive cost will be from different performers in response to your anticipated RFP.

Therefore, when you state that you have an independent estimating capability developed in the Air Force and DOD I don't believe it. The reason for my statement is that this capability has not made itself apparent to your man at the negotiation table, or the agencies requesting funds, or you wouldn't have the costing/pricing problems so vividly apparent at this time.

One of the DOD directives from Mr. Packard's office requested that Agencies perform risk analyses on prospective programs and proposals. If you don't have a solid data base and a formidable estimating capability, how can you perform a risk analysis? An analogous mode would be, playing 5 card poker with 4 cards and always waiting for one of the players to "slip" you the card you need. We have the fifth card, we have the results of the risk analysis. Why not ask for this analysis to be contained in the bid or at fact finding?

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Some might argue that to include a risk analysis with its associated cost as an addendum to the proposal, would have a negative evaluation effect on the Agency and would be a foolish tactic in the competitive market place. However, wouldn't it bring to light the very causes of overrun at the RFP stage rather than during the program? Wouldn't it enable the Government to build data files on Contractors who willfully neglected to show this analysis in order to be low bidder? Wouldn't it be an opportunity for Statement of Work changes, eliminating unknowns early enough to avoid the frustration and embarrassment of a widely disparate performance, delivery or cost variance during the life of the program? Previously, you couldn't accept costs for unknowns and we couldn't put them in. History shows "they" happen and should be put in. We need your assistance to accomplish this.

Former Secretary Frosh said: "The whole point of development of such systems is to get something that we haven't got, something we have never seen and something which we don't really know can ever be produced. Unless this is taken into account very much more explicitly in the procurement of development, we are going to go on having terrible trouble and new kinds of trouble."

We still haven't learned - so what I'm asking you is this. Can you change the way you formulate your RFPs? Can you accept the cost from a contractor who says, "look - I'm going to bid a competitive cost because I want to win the competition - so I will quote you exactly what you ask for, but I want you to know that the requirements could possibly cause certain perturbations to occur. I want to respond to the RFP, but I want you to know that predicated on risk analysis No. 1 - it could cost you X additional Dollars -- predicated on risk analysis No. 2 - you could save Y Dollars - now it's up to you to look at other bidders and see if they have made similar evaluations."

If this concept is naive and sophomoric, -- what terms could be applied to the present method of formulating RFPs and the contractual process with its history of cost variance, ineptitude and public mistrust?

Change the way you audit, analyze and negotiate bids. Work closer with us out on the line. Talk to your negotiators and see if they really believe in the cost and fee parameters you have given them or if they are trying to bring a contract price in within agency funding limitations, even with the knowledge, after negotiations, that these limitations were erroneous. (Precluded by independent estimating capability and more modular phased pricing.) If these people don't have the sophistication or data they need to review these new methods of pricing (and they don't, believe me) they should get that information from us; and we welcome the opportunity to work with you. The outcome must be mutually beneficial. How about some RFPs for us to look at better ways, unique concepts for pricing, using CER techniques and modular pricing?

I am asking you to change the system, recognizing that the oracles of the world don't write RFPs and we don't profess to be the oracles of the world responding. However, jointly - sharing our information, working together narrowing the deltas of our independent estimating judgements, precluding wide cost variances, has to recast the public anathema to the military industrial complex, to one which emanates an aura of fiscal integrity and a guide for the private sector.

TOPIC: EXTRA CONTRACTUAL INCENTIVES

AND

THE AWARD FEE

DR. RAYMOND G. HUNT

Dr. Raymond G. Hunt is a Professor of Social Psychology and the Director of the Survey Research Center at the State University of New York at Buffalo.

Dr. Hunt received his Ph.D. from the University of Buffalo. For the past four years, he has been project director of a major study, granted by NASA, on extra contractual influences in government contracting.

Dr. Hunt has done extensive research in organizational relations and the social psychology of economic behavior.

EXTRA-CONTRACTUAL INCENTIVES AND THE AWARD FEE

Raymond G. Hunt
Professor of Psychology
State University of New York at Buffalo

In government contracting circles, the notion of 'extra-contractual influences" tends to have a somewhat narrow reference; typically the expression (and especially in a context of discussions of "motivational" or incentive-type contracts) is taken to mean, "those factors other than contract profit opportunities that affect contract performance."

Actually anything that affects the work encompassed by a given contract in any manner not specifically and directly traceable to the terms and provisions of that contract is an extra-contractual influence. The range and variety of extra-contractual influences is therefore obviously great and they are operative in all contractual relations (S. Macauley, '[illegible]) Moreover, the extra-contractual route seems to be an informal avenue along which organizational leaders commonly prefer to conduct their affairs.

In their classic two-volume studies of the weapons acquisition process, Merton Peck and Frederick Scherer ([illegible], 1962, focused attention on extra-contractual influences in explaining the outcomes of system procurements, emphasizing their special potency in R&D environments. Others, including the NASA-commissioned Booz, Allen, Hamilton evaluation of incentive contracting (1967), have done the same, commenting

frequently in performing R&D, extra-contractual influences account for a substantially greater proportion of the variance in project performance than do contractual varieties.

We have recently completed a four-year long analysis of extra-contractual influences in government contracting under a grant from NASA.[1] In it we undertook to review various aspects of procurement policy and practice seen against a backdrop of organizational motivation and the circumstances of R&D project performance. That review led us to numerous conclusions, only certain ones of which are the subjects of this paper.

In general, we suggested that it seems appropriate to move toward R&D contracting formats which define, embody and require a certain kind of relationship between procuring agency and contractor organization. This relationship can be broadly conceptualized as interdependent rather than adversary: it should be cooperative and open; it should have two-way channels of communication with feedback available and frequently utilized at all interface levels, for it can be argued that the structure of relations between two parties is the ingredient essential for motivation, not the routine imposition of economic rewards and penalties.

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[1]Grant No. NGR 33-015-061. We are also grateful to the Department of Defense for its assistance in furthering our research. Principal reports of this research were issued in July 1970, March 1971, and December 1971.

The approach to R&D procurement advocated here will encompass and demand new knowledge and new policy directions; among other things, our proposal is to replace, or at least supplement, strict economic motivation with a more global, qualitative attempt to galvanize organizations. A decreasing emphasis on complex multiple-incentive formats and a concomitant rise in recognition of the inescapable subjective, judgemental aspects of management and administration seems clearly in order, if one is to become capable of handling effectively not just one but several dimensions of an organization's motivations. In capsule, then, what we recommend is a managerial instead of a mechanical approach to procurement and R&D project management.

Extracontractual Motivations

Although placing predominant emphasis on profit maximization, federal procurement policy statements repeatedly make reference to the importance of non-profit, extra-contractual motivations in the determination of contractor performance. For example, in discussing the basic principles of incentive contracting, the 1969 joint DOD/NASA Incentive Contracting Guide states:

> "In stressing the profitmaking aspects of a company's existence, however, there is no intention to discount the importance of extra-contractual incentives, such as to (i) gain future business, (ii) increase profits on other contracts being performed at the same time (by absorbing a portion of the fixed overhead expense which otherwise would be absorbed by other fixed price or incentive type contracts and thereby increasing the profit margin under those other contracts, (iii) contribute to

> and improve the nation's international reputation, (iv) gain prestige and goodwill, (v) retain and maintain an engineering and/or production capability, and (vi) excel for the sake of excellence. These factors should be considered prior to making awards, and when possible while structuring the incentive sharing provisions, because, with any particular contractor, these factors may outweigh the short term profit incentives. Particular attention should be paid to the absorption of overhead expense, which might be a primary incentive. This can often be quantified to some degree prior to award." (p. 2).

With regard to the empirical weighting of extra-contractual motivations, however, the government "at the present time (does) not have the means to quantify the extra-contractual influences, but the identification of some influences can certainly add such adjective weightings as 'strong' or 'weak.' (The Government) can also review the performers when (they) consider corporate behavior and individual behavior." (NASA/DOD Incentive Contracting Guide, 1969, p. 252). Measures of the presence and strength of extra-contractual motivations are thus presently defined, if they are, in terms of the intuitions and subjective evaluations of government personnel. These assessments are unreliable, since no formal set of decision rules or criteria for their application exist. Further, there is no model for predicting the specific effects of these motivations on contractor behavior; although it is demonstrable and generally agreed that non-profit tendencies have effects on performance, what and how strong these influences are is indeterminate and probably will remain so at least with regard to particular cases.

With no reliable means of explicity determining and employing non-profit motivations, any attempt to structure the automatic contract incentive plan to encourage action choices (trade-offs) which are beneficial to the government's interests must arbitrarily assign monetary values to these motivations or ignore them completely.[2] The net effect of these difficulties is to encourage a situation in which recognition of the behavioral consequences of non-profit motivations is more apparent than real.

General Conclusions

The NASA/DOD incentive model can best be summarized as a set of unvalidated assumptions about the manner in which the relationship between a single organizational motive (short-run profit maximization) and a multi-dimensional outcome (performance, cost, time of delivery) can be mediated

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[2]We have, of course, discussed the general matter of extra-contractual motivations and influences on performance at great length in our March 1971 Report; with regard to the specific point under discussion here a brief quotation from another article may aid clarity: "...it should be possible to translate profit units into other units and conversely, an operation that would allow statement of any motivation in terms of dollar equivalents. However, the 'exchange rates' would have to include suitable situational constants. Thus, even leaving aside measurement problems, a quite complex calculus would be needed" (Hunt, 1969, p. 9). Obviously such a calculus is not available.

through the effects of a particular vehicle (contractual incentives) or an intervening process (managerial trade-off decisions). The most pertinent criticism of this model is that it oversimplifies the number, type and linkage of the variables which determine contract outcomes. In particular, it fails to incorporate in any systematic fashion the effects of non-profit motivations and contractor perceptions of performance and reward contingencies.

To motivate contractors, incentives must fulfill the following conditions:

1. Judgements about the efficiency of organizational performance must be based on observations of actual project behavior. This behavior should be evaluated with respect to a clearly defined, mutually understood set of criteria which may be adjusted if project conditions change so that they always reflect the current priorities of the government agency.

2. Performance criteria must be flexible enough to allow for contingencies over which the contractor has no control (e.g., unforeseen technical difficulties, failure of the government or a subcontractor to perform as anticipated).

3. The reward system must be attuned to the fact that organizations, as well as the subsystems and individuals which comprise them have multiple goals. The nature and priorities of these goals will vary across organizations and within the same organization over time.

4. The reward system must also recognize that any decision has multiple consequences at a given level of organization structure. A company (subsystem, individual) will not be motivated to engage in behavior which leads to short-term reward (e.g., profit) if it decreases the probability of acquiring other, equally or more attractive rewards (e.g., more government contracts) in the future.

Our research, together with the other existing literature, indicates that, for the most part, none of these conditions is effectively met by any current form of incentive contract. CPIF and FPI contracts are directed to contract

outcomes and make meaningful allowance for [illegible] contingencies. Award-fee contracts [illegible] these problems (cf. Egan, 1967), however, [illegible] array of problems unique to themselves.

Dilemmas and Award Fee Contracting

Fixed Price vs Cost Reimbursement

For some considerable time, the prescriptions of federal procurement policy have been at war with the practical realities of research and development program and project management. In conflict have been, on the one side, ideologically-based aspirations for maintaining a market-like, arms-length buyer-seller relationship between the government and its private industrial suppliers -- i.e., market relationship approximating the one envisaged in certain classical economic theories -- and, on the other side, the non-market-like and, we might add, politically risky requirements for cost-sharing, cooperation and organizational interpenetration essential to large-scale contracted system development.

Fixed Price/Cost Reimbursement Dilemma. Somewhat simplified, the ideological-operational conflict [illegible] in the procurement area is the [illegible] competition between what we can, for convenience, call the [illegible] and the "cost-plus" principle [illegible] of contracting virtues and the [illegible] hence, plenty of [illegible]

and great is the effort spent trying to establish conditions that will make reasonable the application of FFP contracts. Admittedly, there are ways that the fixed price contract is administratively simpler and more convenient than any other. But there are other ways or times when its use is impractical and patently unreasonable.

Practical exigencies, therefore, have compelled various practices not fully harmonious with the "fixed price doctrine." Preeminent among these, of course, are procurements involving government underwriting of a contractor's costs of performance, and then allowing the contractor some "profit" as well. It should be recognized, however, that while "cost plus practices" may contrast most sharply with the "fixed price doctrine," virtually any deviation from an FFP contract departs in some measure from it. Thus any species of negotiated contract transgresses the boundaries, even if only slightly[3] -- and that, of course, is why such strong preferences exist for using open, advertised competitive fixed price procurements "whenever possible."

If not in quite the same terms as used here, nevertheless the same kind of conflict was vividly highlighted by Leonard Marks, then Assistant Secretary of the Air Force (Financial Management), in his remarks about "Industry Versus DOD Control of Programs and the Impact on Management Prerogatives" before

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[3]Because the doctrine includes the assumption of a free market within which pricing decisions are made.

a September, 1967, National Security Industrial Association (NSIA) Procurement Symposium. Marks began by commenting on the theme of the program, which featured the dilemma set by DOD imposed "management systems" and the incompatible government objectives for them: "Visibility" and "disengagement." He then went on to emphasize the circumstantial need for government visibility relative to contractor operations, saying: "Most industry spokesmen refer to disengagement as if it should mean essentially leaving the contractor alone because of the increased number of fixed-price contracts. Fixed-price contracts or not if they are let non-competitively, or if they are subject to a multitude of changes with significant resource implications, the Air Force must participate in these important decisions and must be fully aware of the resource implications of the contractor's action."

But, of course, "leaving the contractor alone" is basic to the "fixed-price doctrine." However, what Marks makes evident is that real implementation of such a doctrine in present day R&D operational environments is infeasible.

In another Symposium, concerned with "risk," at the Federal Bar Association meetings in 1969, Robert C. Gusman of Aerojet General, articulated another facet of the same basic issue, but from a different vantage point and with quite different references. On the one hand, he maintained that, on balance, the federal government has been, in its actions, "anti-profit." At the same time, however, as we have repeatedly done, he noted the government's premise that

profit is the "elemental business motive" and should be related to performance. From these beginnings, Busman proceeded to describe the non-market character of government procurement and the facts of government-contractor R&D interdependence, ending with the observation that we "... have a contract system in which significant economic decisions are left to administrative determination."

Expressions of sentiments similar to these are commonplace among government and contractor people alike. At the same time, however, aspirations toward finding ways of actualizing the "fixed price doctrine" are no less commonplace. Such developments as total package procurement and efforts to shift greater risk and/or to "require" heavier capital investments by contractors by themselves attest to that. But quite apart from such manifestations, we have found it not at all difficult to elicit supportive commentary from government procurement officials and from industry spokesmen, too. Sometimes these values are expressed as preferences for an adversary relation between contractor and sponsor. Sometimes they become manifest as desired for "disengagement" or results-oriented evaluations. And sometimes they take the form of urgings for precise work

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[4]Detailed discussion of the non-market character of major government system procurement may be found in Peck and Scherer (1962), especially Ch.3. Peck and Scherer also provide a comprehensive treatment of the "unique environment of uncertainty" in R&D contracting (cf. Ch. 2).

statements as pre-conditions for incentive contracts -- in which case, of course, one probably does not need an incentive contract, but can rest content with fixed price formats.

Doubtless the steam behind the "fixed price doctrine" is fueled from several sources: concepts about the American economy and fears of "creeping socialism." Congressional pressures (cf. Proxmire, 1970) based in skepticism[5] about incentive-type contracts and the political dangers of anything other than arms-length government-industry relations, and hopes that fixed price arrangements will solve many vexing procedural and management problems (costing, source selection, contract management, etc.) simply by making them go away.

Now no one would deny that competition can affect prices and even induce efficiencies (cf. Scherer, 1964; Subcommittee on Economy in Government, 1969), but no one could deny either that it can result in buy-ins, unrealistic bidding, etc. And certainly no one would doubt the general desirability of clear work statements, terms of association and what not. Nor can there be any dispute about the need for honesty and its many correlates in business operations. Things become problematic,

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[5]We have before and will again suggest that such skepticism is justified. Unfortunately, however, much of it, expressed by such sources as Senator Proxmire, is grounded on the wrong premises.

however, when ideological preferences or dispositions lead to distortions of reality or misguided efforts to fabricate a version of reality that suits preferences rather than actuality. There very well may be good reasons for maintaining a contract system of procurement (cf. Hunt, 1969) but that system needs to be sensibly adapted to what it is that is being procured and not just express bare bones ideological desires for a distant simpler world.

To restate the argument: Much of what passes for federal procurement policy and practice amounts either to elaborate attempts to transform myths into realities (as, for instance, in connection with views of contractor organizations as monolithic profit maximizers) or efforts to manage the system into some approximation to a market environment with the kind of price competition envisaged by classical capitalist economics.[6]

One can find much discussion of the need in R&D procurement for stimulating competition, transferring greater risk to the contractor, and free markets. But, in fact, what

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[6]The point bears emphasis that we are not advocating a laissez faire approach to procurement. On the contrary, what we endorse is active, disciplined management that recognizes that in the end decision is a matter of judgement, but that makes full use of methods available for informing those judgements (cf. Hitch, 1965). What we dissent from are efforts to falsify the environment of decision.

is almost universally being called for is some kind of "engineered" competition in context of a carefully moderated, risk-controlled operating environment. For one thing, the practice of compensating contractors for "risk" (quite aside from how it may be measured) when made a universal matter of policy (as, for instance, in Weighted Guidelines or investment incentives) does not reward the assumption of risk, it eliminates risk (cf. Bain, 1968; cf. also Dean, 1951, on the related fallacy of equating risk to uncertainty).

For another thing, "engineering" competition leads inevitably to maintaining competition which leads inevitably to maintaining competitors by direct or indirect subsidy. Major system procurements are not conducted in a market environment and the costs of entry and exit (Meyerson, 1967) into major system R&D fields is simply too great for it ever to become one.

Therefore, it may be concluded that large parts of federal procurement policy and practice are fundamentally unreal and this has lead to a plethora of contracting "gimmicks" intended to simulate a price competitive market environment. Some of these are terribly elaborate (e.g., TPP, contract trade-off models, etc.) and almost all of them are very expensive.

Despite these efforts and "innovations" the inexorable demands of R&D reality have compelled deviations from the "fixed price doctrine" to the "cost-plus-practice." However, these deviations have been reluctant at best and have been

constrained by indispositions to go all the way (i.e., to CPFF) if that could somehow be avoided. Enter the incentive contract.

As is well known, the FPI and CPIF contract formats were developed as alternates to FFP contracts on the one end and CPFF contracts on the other. The idea was to provide a wider range of alternatives, not so much, we can surmise, to FFP contracts, but to CPFF types. These alternatives, then, would obviate the necessity of going "all the way" to CPFF, if for some reason an FFP contract just couldn't be used.[7]

Given such a rationale for the incentive contract, it should hardly be surprising to find that, in effect, most critiques of incentives are couched in terms that blame them for not working as FFP contracts. Examples could be multiplied, but one will suffice. In a speech before the 1967 George Washington University/Federal Bar Association Institute on Government Contracts, the former Deputy Administrator of NASA, Robert C. Seamans, Jr., stated that one cannot have a "meaningful incentive contract...until very clear and precise understandings as to the objectives of the assigned task have been reached." But, if that is true (and we believe

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[7]As Nash (1963) has put it: "The only difference between the incentive contract and the firm fixed price contract is that in the use of the incentive contract the contractor takes a smaller share of the total cost responsibility" (p. 3). See also Scherer (1964, Ch. 6).

it is), why would one refrain from a fixed price contract and when would one ever choose to write an incentive contract (i.e., FPI or CPIF)? Doubtless the answer to that lies in risk aversion tendencies.

The point of this discussion is that despite appearances and official statements to the contrary, there really are basically only two effective contract alternatives in the government's armamentarium: FFP and CPFF. And, as we hinted earlier, the choice between them really leads to a policy confrontation with the question: why have a contract system of R&D procurement?

Assuming there are reasons to support such a system, as we have said we think there are, and assuming, too, that contracting for R&D simply will not bend to fixed price methods,[8] and granting that there may be some problems, at least with the administration of CPFF contracts, one is led to scan the field for genuine alternatives. On that count the Cost Plus Award Fee (CPAF) contract warrants consideration.

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[8]Even under phased procurements or total package methods, no matter how extensive their definition phases, arrangements still have to be made for contracting research and development, i.e., for contracting under uncertainty. Hence, total package approaches, for example, only change the terms of contracting, not the conditions of performance.

We might add parenthetically that under such procedures as TPP, there must be introduced tremendous, even overwhelming, temptations to buy-in if the motivations of firms are misunderstood--huge contracts mean huge sales volume and that may be a potent inducement to unrealistic (hyper-optimistic) pricing, which could lead to chaotic procurement if the process is rooted in strict assumptions about profit maximizing.

Award Fee Contracting

The CPAF contract has been described in many sources including the 1967 NASA Cost Plus Award Fee Contracting Guide.

The NASA Guide discusses the distinguishing characteristics of award fee methodologies relative to other types and suggests ways in which award fee provisions can be combined with other incentive systems. Unfortunately, the Guide fails to do justice to what is authentically novel about them.

The Award Fee Concept. In the first place, there is no reason why applications of award fee concepts must be restricted to cost reimbursement types of contracts. The distinctive feature of award fee methods is to be found in the nature of those methods, not in their being embedded in a cost-type contract.

In the second place, the Guide conveys the impression that the award fee contract is chiefly an alternative to incentive-type contracts. In a sense, of course, this is true, but the more appropriate comparison alternative is to the CPFF contract, not the CPIF one. That is to say, for example, the CPAF contract may and should be regarded as an alternative to CPFF contracts; it should be regarded as an alternative to CPIF contracts only in the same sense that the CPFF contract is an alternative to FFP types.

Thirdly, the NASA Guide locates CPAF contracts to a position on a supposed continuum of contract species running from FFP at one pole through, in sequence, FPI, CPIF, CPAF, and, finally, CPFF at the other pole. We have suggested

that actually this "continuum" is more like a two-category field, each defined principally by the conditions under which its constituents are applicable; one category includes FFP, FPI and CPIF contract varieties, the other includes CPFF and CPAF. Thus we propose that the CPAF contract be regarded as a universal alternative to CPFF, suitable for application in any context where CPFF might be used. Indeed, regardless of the history of their development, it is possible to perceive CPFF contracts as special cases of more general CPAF varieties -- in the general case, fee is variable: in the special case, it is fixed. Now a fixed fee may be preferred (say for simplicity's sake) at some times or in some situations, but that is no embarrassment to the proposition stated.[9]

The Novelty of Award Fee. To return now to the essential novelty of the award fee concept: because it does not rely mainly on cost-based fee setting or fixed fee in advance of performance, it comes closer to fulfilling the principle that profits should be earned, not awarded in advance. In that sense, it resembles an FFP contract. The award fee contract is also the one contract type that does not require satisfaction of a host of dubious assumptions in order for it to be successfully employed in R&D. This does not mean there are

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[9]A top-ranking NASA procurement official commented to us, for instance, that difficulty sometimes existed in preventing conversion of CPAF to CPFF at higher fees in order to reduce administrative burdens.

no difficulties with CPAF contracting -- there are, and we shall talk about some presently. But to quickly recapitulate the most dubious, if implicit, assumptions made by most other contract types available for R&D procurements, they are: (1) that contractor motivation is monolithically monetary; (2) that R&D performance is conducted in static rather than dynamic environments; (3) that organizational top management can exert full and complete control over detailed working-level operations; (4) that contracts can be written that will control decision processes over a project's life; (5) that contract formulas can be teamed with mechanical management systems in such fashion as to make contracts and projects virtually self-administering; and (6) that line personnel are closely and continuously in touch with the specifics of contract terms and provisions.

As regards the first of these assumptions, it is true that CPAF contracts provide for payments of fee for performance. However, it is not true that they depend on the primacy of profit motivation, which, in addition to everything else that can be said about it, is simply not a valid assumption to explain either how businessmen do or should act -- for one thing it's too difficult to do, and for another it's insufficiently moral (cf. Anthony, 1960). We have elsewhere pointed out that fees received may have many significancies and can relate to various motive systems. And, in any event, fee paid has <u>information</u> value as to judged quality of performance, and everything that goes with it. Indeed, it is

most impressive to witness the managerial concern, attention and effort elicited by even small fluctuations of award fee ratings.[10]

Some Further Observations on the Environment of R&D Contracting. There are certain basic features of the R&D contracting environment at which we already have hinted and which in any event are widely acknowledged. For present purposes, we shall simply reassert them as fact and let it go at that.

First, R&D procurement, in the major systems areas, is conducted in a non-market environment (ci. Johnson, 1967; also Peck and Scherer, 1964).

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[10]Moreover, it is our contention that we are not dealing here with "profit" in any genuine economic sense, but rather with management fees. These fees are quite reasonably allowed to fluctuate with the scope and complexity of the management task. The Weighted Guidelines are one relatively detailed way of estimating that and of arriving at an equitable payment. Cost-based fee determinations are, of course, the basic, and on the fact of it, a sensible way of indexing the magnitude of the management task. It is, of course, fraught with problems (cf. Johnson, 1967), as is well known, for the contractor quite naturally will be interested in manipulating the indexes of project scope by manipulating costs, so as to benefit himself -- but in ways that may be unknown or even unimagined by government negotiators. The latter then tends to work from the convenient -- but sometimes disastrously wrong -- assumption that the contractor always wants to inflate costs so as to maximize fees. So-called "should cost" methods are, therefore, desirable efforts to obtain sounder cost estimates and better indicators of project scope. However, since these methods necessarily depend on some measure of "market" experience, as well as careful analysis of contractor operations, cost-based fee setting will continue to pose problems in R&D. Developing highly capable government cost estimating teams for major operations would, however, be a step in the right direction.

Second, there are no contracting panaceas, no substitutes for active management. Secretary Malloy, for one, made that point emphatically at a 1969 National Bar Association symposium.

Third, company top management cannot exert the kind of detailed operational control envisaged by contractual arrangements that provide only or mainly for interfacing at top management levels (cf. our July, 1970 and March, 1971 Reports). Multiple interfacing with frequent exchange across those interfaces is a fact of R&D life.

Fourth, contracting for R&D requires a high degree of cooperation between contractor and agency for successful project operation. Competition may have important impacts on pricing, etc., but it is not clear that competition is the most suitable way to procure R&D (cf. Charles, 1971; also Scherer, 1964). Nor is it clear that an adversary relationship is conducive to effective R&D performance (cf. Howard, 1967; Alexander, 1969).[11]

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[11]Apart from the justification for exercising judgement in selecting an R&D contractor, there is extensive evidence that a competitive atmosphere may degrade the quality of problem-solving and decision-making and that adversaries are unlikely to share information freely with one another (cf., e.g., Costello and Zalkind, 1963; David, 1969; Lindzey and Aronson, 1968).

It was remarked to us with great regularity by a number of differently situated observers of the procurement scene how inevitably intertwined were the fates of companies and of government program/project managers. Both are concerned with program success and each depends on the other to achieve it. Moreover, all indications are that dollars tend in practice to be a weak influence upon R&D operations; what counts most is program success. There are also many indications that contractors do indeed "shoot for targets." What is interesting then is why they miss them so often.

In this connection, it has been suggested (by Nash and Cibinic[12]) that the major theoretical function of the incentive contract is to control costs arising from the informal relationship between the contractor and the contract manager that is undisciplined by the CPFF contract. There is, however, an implicit gentlemen's agreement prevalent that a contract is (and must be) modifiable. Contract specifications are primarily negotiable points of reference. This, obviously, explains the high rates of contract change observed under certain contractual arrangements. For instance, under CPIF there seems to be more formal change than under CPFF, where change tends to be informal. Under CPFF, then, change shows up as overrun, thereby introducing artifact into direct CPFF-CPIF comparisons. In any event, frequent change grossly attenuates any disciplinary virtue that incentive contracts might have in theory.

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[12]Personal communication.

Furthermore, with regard to the achievement of or compliance with contract specs, a principle of judgement or "reasonable interpretation" applies.[13] Also, contract targets often are renegotiated at the end in order to align them with actual performance (just as schedule or other incentives sometimes are negotiated after the event). Under such conditions, it is hard to perceive the force of arguments against going CPFF -- or against trying a managerial type of contract, CPAF.

Some Strengths and Weaknesses of Award Fee Methods. One government official characterized CPAF contracts to us as a "lazy man's incentive."[14] From the limited perspective of contract

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[13]For example, a NASA "Apollo Policy Statement" began with the proposition: "One of the most significant possibilities for controlling cost and maintaining schedules...is the reasonable -- I'm tempted to say rational -- interpretation of requirements, particularly specifications and quality control documentation and procedures." The Statement goes on to mention "essential requirements," "convenient requirements," "general requirements," and acknowledges the vagueness of such ideas, concluding with the observation "...that the NASA has an open mind on the interpretation of requirements or procedures which the contractors feel are restricting their performance..." Along the way to this conclusion the Statement stresses the importance of "an open technical communication channel from subcontractor to the prime and from the prime to NASA," and encourages "the use of engineering disposition 'on-the-spot' engineering orders, waivers of unimportant non-compliances," etc.

[14]Ironically, incentive contracts have been similarly characterized by at least one Congressional Committee (cf. Moore, 1967, p. 219).

people who may enjoy constructing elaborately intricate incentive formulas, this may be true. The award fee contract is (or should be) structurally simpler than most incentive types, certainly more so than the multiple incentive varieties with complex trade-off matrixes which now, fortunately, have fallen into growing disuse. Indeed, such simplicity is a major point in favor of CPAF. However, from the standpoint of management, an award fee contract is (or should be) much more demanding to administer -- especially in the ways it requires involvement of line managers.[15]

This difference in perspective is not a minor matter. Together with the widely evident uneasiness with the "subjectivity," and the unilateral nature of CPAF evaluation, it tends to precipitate attempts at functional conversion of CPAF toward CPIF forms (cf. Nash, 1963, pp. 106-111), conversion that only vitiates the fundamental value of CPAF.

With regard to the matter of "subjectivity" in CPAF evaluations, it is of interest that our examinations of various methods for evaluating performance -- methods having nothing to do with CPAF -- have revealed strong tendencies

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[15]We did, however, come on one contracts manager in a comparatively small company that had just received its first incentive contract. He was enchanted by the challenge it presented as compared with FFP or CPFF and with the new importance of his position that came from his being the only one around the place who understood the contract (or at least who was thought to).

for intra-organizational methods to rely chiefly on subjective (if often multi-dimensional) schemes; even more striking, the AFSC's implementation of the DOD Contractor Performance Evaluation program operated very much after the fashion of an award fee method (without fee determination, of course, or the same kind of working-level interaction, buth then it was strictly an evaluation, not a management device), and, as it strove for simplicity in its operations, it moved toward judgemental formats.

Furthermore, once an incentive contract is structured, it may work "objectively," but structuring it in the first place typically requires heavy doses of "subjectivity." The whole objectivity-subjectivity argument beclouds basic issues that have to do chiefly with the clarity of specifications and criteria for evaluation together with the modes by which evaluation is to be performed. To some extent it is a semantic issue resolvable by construing conventional incentives schemes, after the fashion of Scherer (1964), as "automatic" or "mechanical" means for assigning fees and award fee methods as "judgemental" means for doing the same thing.

Basically, the virtue of CPAF lies in its consonance with the joint government-contractor performance system that typifies major system R&D. In this context, it is worth noting that in an R&D performance system, abilities of a contractor are inputs to satisfaction of government needs construed as outputs. Only the government can decide when and whether its needs have been satisfied. To be sure, needs should be stated

as well as possible in advance because, for one thing, determination of contractor abilities must be in relation to them. Also the "rules of the game" should be made clear. But, from then on what counts is government feedback as to how well its needs are being met. The award fee approach requires and facilitates cooperative attitudes and high levels of communication across a multiplicity of interfaces and, in theory at least, is capable of operationally satisfying all the conditions pertinent to effective R&D procurement. It is an arrangement that is also consistent with the idea that contracting for R&D involves two separate parties -- it leaves to the contractor, just as it does to the government organization, the task of motivating its own personnel.

CPAF advantages over CPFF arrangements are associated mainly with the CPFF contract's weaker and less reliable inherent demand for active management and high levels of communication. However, conditions may arise where the advantages from CPAF are offset by its greater costs of administration.

The administrative demands from award fee contracting can be heavy. The requirements for documentation that discipline its operations can be burdensome and are frequent sources of complaint. Furthermore, circumstances may develop in which a contractor's performance reaches a level of development where further improvement is unlikely or of little value; or the circumstances of performance may become stabilized and capable of detailed specification. To persist in unmodified

award fee procedures under such conditions (or on very small contracts) converts a useful methodology into an onerous ritual. Moreover, it exposes the entire method to unjustified criticism.

Award Fee as a Management Approach. In fact, if the award fee contract is to serve as a meaningful management tool (and not just as a passive reference for judging outcomes), the contract cannot be divorced from its associated modes of administration. Indeed, it is these that really count. Award fee is best regarded as a method of management, not as a contract type.

We have suggested elsewhere that there are certain questionable aspects to "management by objectives" and it seems anyway that interorganizational project management can hardly avoid an interest in procedure. At least that seems true, if one is to be serious about the government's management role.

For these reasons, we suspect that the orientations of current government policy, as exemplified in the NASA award fee Guide, overstress the importance of outcome-based evaluation.

This, of course, is not meant to be construed as a recommendation that anyone avoid output appraisal or downgrade the importance of goal-setting in planning and management (for an important review of strategic planning, see Chandler, 1962).

It is simply a plea for a balanced approach to that task. Improving communication, for instance, requires attention to the communication process, not just noting whether or how often A told B the time of day.

A Booz, Allen, Hamilton investigation was probably the most extensive survey of award fee contracting. In general, it, too, reported favorably on the method and described it as a commonly preferable alternative to CPFF. The study noted variation in modes of structuring and administering award fee contracts and indicated that the effectiveness of award fee arrangements as ways of gauging and influencing contractor performance would vary with the evaluative criteria used and the methods by which evaluation was conducted. However, no systematic comparative analyses were performed that could assist choice from among the great variety of possible criteria or methods. To our knowledge such basic studies still have not been done despite the observation made by the Booz, Allen, Hamilton report that meaningful cost effectiveness measurements could not be made on award fee contracts until experience had been accumulated with suitable evaluation processes and criteria.[16]

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[16]Furthermore, the general literature on wage and management incentives is univocal on the point that the effectiveness of such incentives stands or falls on the methods of performance evaluation used (among other things, of course). Andrews (1965), for instance, commented in his summing-up of the Ann Arbor Managerial Compensation seminars that "perhaps the key to getting incentive value out of the incentive dollar lies hidden behind a screen of inadequate appraisal of managerial performance" (p. 4). (See also Haire, et al, 1963; Opsahl and Dunnette, 1966).

With respect to evaluati criteria and processes, the Booz, Allen survey also generated commentary on problems involved with the integration of inputs and judgements from a large number of different evaluators and across a wide range of events. The study produced recommendations for increased quantitative measurement wherever possible.

Since the Booz, Allen and Hamilton study, reported in 1967, there has apparently been no further commissioned research, investigation or other kind of study of any scope done on award fee contracting (although the current Commission on Government Procurement will do btless have something to say on the subject). However, there is now an obvious need for a systematic comparative study of award fee contracting and administrative practices relative to their differential effects on a program/project performance.

Our own studies[17], have led us naturally, if unsystematically, to inquiries into processes and problems of award fee contracting. From analyses of organizational motivations and and the circumstances of R&D procurement, we were led to the judgement that the CPAF arrangement had great promise, but required further study.

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[17]Including work done under NGR 33-061-015, supplemented by investigations by R. G. Hunt, incidental to analyses of contract consolidation, conducted while acting as Resident Research Associate at the Manned Spacecraft Center in Houston, Texas during the summer of 1971.

Weighting Performance Events in Award Fee Evaluation. A major indeterminacy in the whole award fee process has to do with how the weights are developed according to which final evaluative scores are produced along various performance dimensions.[18] At present this seems to be arbitrary, hit-or-miss, intuitive and largely a matter of guesswork. In any event, it appears as a highly uncertain area, but one that lies near the base of the whole evaluation and management system. Related to it is a question of whether or not to inform contractors of the task weights that have been assigned to work. Practices vary on this score.

We would, therefore, strongly recommend careful analysis of the bases and processes used in arriving at specific task weightings in the evaluation process and investigation of ways of rationalizing the process so as to make more sensitive and precise the entire award fee evaluation. And, since the award fee method is intended to enhance communication across interfaces and to directly affect performance, the advisability of informing contractors of task weightings should be studies.

Related to this large matter of determining weights is a chronic problem in the award fee practice. An example can perhaps express it best: One technical manager has developed for himself a computational formula from which he calculates a weighted change score for each task; these scores then are

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[18] Incentive structures are not exempt from this problem either.

summed across all tasks. On the face of it, this seems a sound procedure; unfortunately in practice, because of the large number of tasks and the simplistically arbitrary derivation of weights, it is all but impossible for the overall grade given the contractor to vary from one evaluation period to another.

Also focusing attention on the matter of weights is a tendency (of uncertain magnitude) for changes in performance to get "washed out" as contracts increase in size -- the sheer number of "events" seems to have the effect of simply making grading less sensitive.

We have noted, too, a tendency for gradings to become somewhat stereotyped (partly because of inability to relate grades and performance closely). For one thing, grading tends to be "anchored" by preceeding grades. We interpret this as a baseline problem -- an evaluator's need to have some standard of reference -- which is still unresolved in the award fee process. Regarding it, too, practices vary: sometimes the last score is deliberately selected as a baseline; sometimes an "imaginary average contractor;" sometimes an "imaginary excellent contractor." Comparative study of these different methods (and perhaps others as well) should be undertaken in order to determine whether effective standard baselines can be identified.

Scaling Judgements. While we are on these psychometric points, we should introduce some evaluative observations: to our knowledge there has never been a study designed to identify usable scale values (measurement units) for making ratings of contractor

performance; there has never been even an elementary attempt at determining the validity of award fee grades; there has not even been an effort at appraising the reliability of the grades. Such assessments are fundamental and should be undertaken without delay.

Award Fee Administrative Burden. We mentioned above that award fee methods carry an administrative burden. By one estimate, on one sizeable support services contract, annual award fee administrative costs ran to about $50,000. There plainly are points in the life of a program when cost-benefit assessments of CPAF contracting must be undertaken. When contractor performance has become asymptotic or, in a well established contract relationship, when it has got to the point where only the "good people" are left, CPAF may no longer be cost effective and transition to an alternative contract format (CPFF or FFP) or to a different mode of CPAF administration may be indicated.[19] Distinctions need to be drawn between the development and the maintenance stages of an operation, and ways of structuring the associated relations should be studied in relation to the kind of work being contracted.

It has been suggested, for instance, that when a contractor has demonstrated "excellence," fee could be broken into "smaller pots" and given to him routinely unless he has a documentable

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[19]We have found indications that contractors may tend to treat CPAF contracts almost as if they are CPFF after they are well established and fees stabilize.

problem. In other words, a shift to a penalty system might be appropriate at maintenance phases. Certainly it would be simpler to monitor and cheaper to administer. Moreover, there are indications that, at these stages, contractors anyway tend to orient mainly toward drops in grade; these drops act as "flags" to management. They focus attention on problem areas when these can sensibly be expected to be relatively few in the overall flow of contract performance. The administrative method then becomes analogous to "management by exception."[20]

Such a procedure would have a further virtue: it would make it possible, in fact, for a contractor to earn 100% fee. Many award fee arrangements are in a sense, fraudulent on that score. They arrange fee payments in relation to performance grades in the form of an initially positively and finally negatively accelerated curve, e.g.:

[20]Use of such a method, of course, presupposes the existence of well-oiled management information and performance control systems so that excessive reliance on simple "interpersonal confidence" is avoided.

Such a curve structures things such that the magnitudes of reward decrease at points where incremental effort necessary to achieve improvement in performance increases. In reality, the S-shaped curve for payoffs reflects the government's utility function relative to changes in contractor performance; it has little to do with what it takes to motivate better performance. For that, a steadily positively accelerating curve would be suitable; but such a curve would be irrational from the standpoint of government preferences -- which are really not of a maximizing nature -- and so the study of effective relationship structuring that will align utilities of high levels of performance requires serious analysis.

The main purpose of this rather lengthy discourse has been to illuminate what we regard as the virtues and promises of award fee approaches to structuring motivationally complex and dynamic interorganizational R&D undertakings. We have also tried to air some of the problematic aspects of those approaches, but would conclude with the idea that, in any case, resolution of those problems is necessary to the promotion of effective R&D procurement and program performance.

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TOPIC: THE VALUE OF A GOOD DESIGN TEAM

PROFESSOR ALBERT SHAPERO

Professor Albert Shapero is a Professor of Management at the University of Texas, Austin, Texas. He has a B.S. in Mechanical Engineering and a M.S. in Industrial Engineering from the University of California at Berkeley.

Professor Shapero's expertise in the fields of management and procurement is firmly established. Until December 1966, he was the Director of the Technology Management Division at the Stanford Research Institute. He has served as expert witness on scientific manpower before the Employment and Manpower Subcommittee of the Senate Labor and Public Welfare Committee. He has also testified on the impact of R&D expenditures before the Government Research Subcommittee of the Senate Committee on Government Operations. Professor Shapero has been a member of the panel on the Impact of Federal R&D Programs for the House and of the Joint Government Research Subcommittee of the Senate.

THE VALUE OF A GOOD DESIGN TEAM

Albert Shapero
Professor of Management,
The University of Texas

The development of complex systems requires the collaborative and creative efforts of professional specialists drawn from a variety of disciplines and background. The ability to transform a group of such specialists into a "team," as differentiated from a co-located collection of individual efforts, can mean the difference between highly effective performance and mediocrity. Thus, procurement practices that operate in the direction of developing and maintaining competent teams add to the ability of Department of Defense (DOD) to get more research and development (R&D) per dollar.

In the mid 1960's the author took part in a small study of the French aircraft industry in which we made a comparison of a French and an American program that were simultaneously developing aircraft, essentially comparable in form, fit and function and destined to compete with each other in the market place. As rather self-satisfied American aerospacers we were startled to find that the French were using significantly less engineering manhours to achieve the same thing. To be more specific, a careful comparison of projected engineering manhours to first flight for the same functions

showed the French projecting something less than 150,000 manhours as compared to a U.S. projection of more than 960,000 manhours. When all the functions that U.S. practice includes and which French practice does not include, such as spares analysis, PERT, maintainability, reliability, zero-defects and value engineering were included, U.S. engineering effort climbed to well over 1.8 million manhours.

The French aircraft is in the market place today. When Israel's users of the aircraft were asked what they thought of it, they answered simply, "It shoots down MIG 21's!" Though the foregoing example is from a particularly competent French company it is not far from the norm for European practice.

For example, one French helicopter was developed by six engineers and 14 draftsmen. For one European fighter project the entire materials and structure section consisted of five engineers. Since the laws of physics are the same in Los Angeles and in Paris and since no one has claimed any genetic differences between the U.S. and Europe the question is -- why the great difference in the resources required for weapons systems development? There are many factors that go into an answer to the question: (1) differences in the training and prestige given to engineers in the respective countries, (2) differences in the way engineers are educated, (3) differences in the way the engineers learn to use analytic techniques, (4) differences in social mobility, and (5) differences in the role of government employees. One of the

results of all of these differences is the existence of recognized design teams in Europe. These teams are identified with both their failures and their accomplishments. The chief designer of a given aircraft in France is identified with his aircraft. I would ask you, "Can you name the designer of the Minuteman II? of the Titan III? of the F-102?" However, if I were to ask you about the Sidewinder missile, the U-2 aircraft or the Agena-D, many if not all of you, would mention John McLean and Kelley Johnson. Here again, we have cases in which there are well known, successful designs, identified with given design teams. Even a man's name can be identified with these successful systems design.

A critical difference between the French and U.S. examples and the general U.S. experience is that all of these very successful designs were carried on outside the normal U.S. defense procurement system.

We will now briefly identify the characteristics typifing a "good" team. Then we will discuss how our procurement practices affect these characteristics and suggest some ways for improvement. What are the characteristics of a good design team? First, in each of the successful U.S. design teams mentioned above we find "valid communications," what Bennis and Shepard describe as "a level at which the members understand what they are doing, resolve internal conflicts, mobilize their resources, make intelligent decisions, identify and accept group goals, establish and maintain effective leadership, engage in meaningful exchange

of ideas, and develop methods for achieving and testing understanding ...."[1]

The organizations are small enough for face-to-face communications. They are below the threshold where documentation, memos and coordinating meetings dominate. Of course, we can also see some of the relationships between costs and team size. To achieve the conditions necessary for valid communication requires capable individuals and a particularly capable management. However, time is also required, the time to learn to interact with others in the design team, to gain a common communications code, to establish the interpersonal, non-destructively competitive interactions that allow all of the energy and dynamic effort of the individuals to go into the development effort instead of the organizational relationships.

The effect of time together on a team has been noted by the studies of air crews in which it was found that performance is a direct function of the time a team works together. Some idea of the time required is provided by Pelz and Andrews in their studies of productivity vs group age in research groups. Their studies suggest that it takes about five years to reach a particular peak of creative output, and then production declines unless new efforts occur or new information inputs enter the system.

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[1]Crook, Robert B., "Communication and Group Structure," Journal of Communication, September, 1961.

John McLean of the Sidewinder once proposed a development system in which two groups would be funded to do a given development, but one team funded at 10% of the dollars of the other team. He wrote that he would prefer to always be on the 10% team--personally so would I. Our procurement practices affect our ability to achieve good teams by the way proposals are evaluated, by a focus on project optimization and by an overemphasis on project control mechanisms. In evaluating proposals there is no recognition given to the value of a given design team. As has been often stated, the primary emphasis is on costs. Furthermore, where value is placed on experience, it is attributed to the corporate entity rather than to the men who have actually done the work. Essentially it is assumed that some corporate entity in Delaware is the producer of a design. I remember visiting a major aerospace company that was working on the second-generation version of a missile that it had developed. When I asked to talk to someone who had worked on the earlier version there was a long, thoughtful pause, and then the project leader asked his subordinate, "Didn't old Harry work on Missile A?" Under current procurement practices a company shows its technical capability for a particular project by a high density of degrees per square head per dollar in its proposal. This tends to displace the older, experienced and sometimes more effective engineer and tends to increase the proportion of scientists (non designers) to engineers. This also tends to increase the

emphasis on university measures of competence as differentiated from design oriented measures.

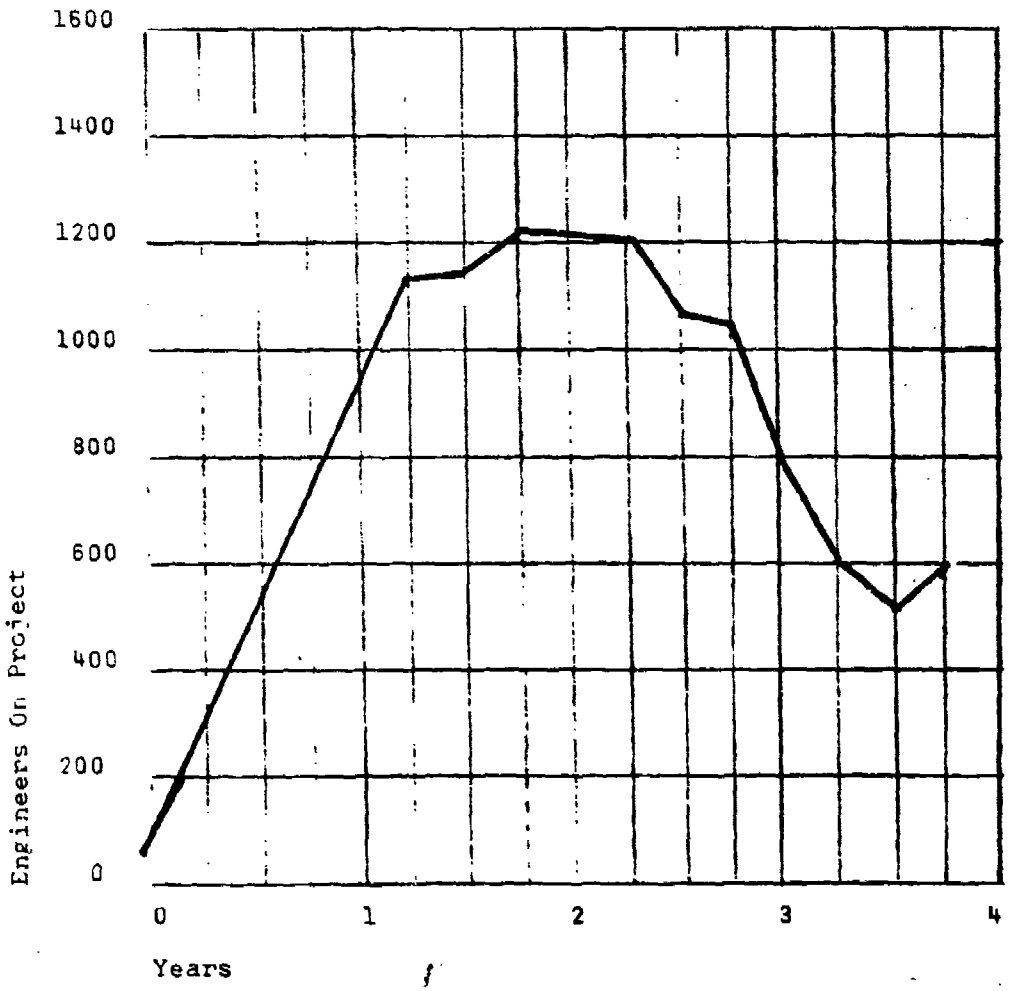
Our current procurement practice is project oriented, thus emphasizing a particular form of sub-optimization to the detriment of all subsequent projects. A project officer (and his company equivalent) are constrained to be particularly single-minded in pursuit of their immediate project goals. One result of this orientation is the practice of attracting needed manpower from other projects by offers of increased pay. At one time, aircraft companies had a stated policy of not offering more than a 10% increase in salary to a desired man. This policy was easily overcome. I remember receiving a 10% increase when moving from one company to another. I got the other 18% as a special raise in the second month. The exclusive project orientation has acted as a ratchet on the salary structure of the aerospace industry. Aerospace salaries far outstripped those of other industries resulting in less subsequent R&D per defense dollar. Will today's slowdown in the industry change the process that has been described? It is doubtful. Our current orientation will bring the process into action the minute we begin a new funding program.

Our current procurement practices incorporate a very large number of attempts to control the R&D process through a variety of required managerial and reporting techniques.

The large number and variety of attempts at control are the result of an ever present justification process in the U.S. governmental system. No responsible government official in our procurement system would or could make a decision to proceed with even a very minor change in design without an elaborately documented justification effort. In France, the equivalent government official and a designer would argue on a change, say for the bolts in a given strut, at the drafting board. The decision to proceed would be oral--without any delay or documentation. Can you visualize the equivalent process in the United States? What are some of the operational results of our procurement practices? For one thing, there is a tremendous project-piston effect; running project manpower levels up and down like a roller-coaster. (See Figure 1 and Table 1). The effects of these variations on the formation or destruction of competent teams are devastating. The manhour costs of our requirement for extensive documentation and the application of a large number of specific managerial techniques have been indicated above. Furthermore, the rate of failure on R&D projects has not been significantly lower despite all of our efforts at control. In a recent study we investigated the possibility that higher levels of control were associated with higher levels of technical performance. The findings depicted in Table 2 show that there is no statistically significant difference resulting from the level of control.

TYPICAL REQUIREMENTS FOR ENGINEERING PERSONNEL

ON A MAJOR MISSILE DEVELOPMENT PROGRAM



SOURCE: A. Shapero et al, An Exploratory Study of the Structure and Dynamics of the R&D Industry, 1964, Stanford Research Institute

Figure 1

TURNOVER RATES FOR THREE DEFENSE R&D COMPANIES, BY NUMBER OF YEARS FROM COMPANY ACTIVATION
(Percent)

Years From Activation	Company A[a] All Employees	Company B[a] All Employees	Company B[a] All Engineering Division Employees	Company C[a] All Salaried Employees
1	9%	not available		34%
2	44	29%	21%	25
3	29	29	20	33
4	22	22	18	25
5	19	18	17	21
6	19	17	19	20

a. Company sequence has been deliberately changed for purposes of anonymity.

SOURCE: (Same as for Figure 1)

Table 1

TECHNICAL PERFORMANCE FAILURES AND THE LEVEL OF MANAGERIAL CONTROL

	Avg Technical Performance Failures/ Project		Low Level of Control	High Level of Control
High Performance	0.50			X (1967)
	0.60		X (1957)	
	0.64		X (1954)	
	0.86		X (1956)	
	1.00		X (1955)	
	1.00		X (1950)	
	1.13		X (1951)	
	1.25			X (1965)
	1.33	Median Tie	X (1959)	
	1.33			X (1964)
	1.54			X (1963)
	2.00		X (1958)	
	3.17			X (1961)
	3.33			X (1960)
	3.50			X (1962)
Low Performance	3.75		X (1952)	
	5.67		X (1953)	

Mann-Whitney $U = 26$, Not significant at 0.05 level.

SOURCE: E. Gerloff, The Management of Government R&D Projects: The Effects of the Contractual Requirement to Use Specific Management Techniques, Unpublish Ph.D. Dissertation, The University of Texas, 1971.

Table 2

What might be done to improve the situation? We need to take steps to:

1. Place a higher value on successful design teams.

2. Remove contractual and procedural pressures that lead to the use of massive numbers of people on R&D projects.

We must make efforts to encourage organizations to maintain and develop good design teams. I hasten to add that I do not believe that we can obtain the desired kinds of teams by instituting a new procedure demanding that organizations show (by means of documentation) that they are using the "proper" means for developing and maintaining teams. We might start a program for gradual, steady and definite disengagement from the mass of entangling documentation and management requirements that are presently required of the contractors. Again, let me hasten to add that I do not mean the substitution of "better" documentation and techniques for inadequate ones--I do mean the elimination of the requirements. Disengagement might be accomplished by the formation of an experimental Systems Project Office (SPO) in which small (politically insensitive) projects might be managed, and which would be devoted to observing and/or measuring the effects of removal of given requirements such as the Cost Schedule Control System Criteria from contracts. Such an experimental SPO might also be used as a proving grounds for any proposed documentation or management techniques; the slogan might be "No new requirement until it has been tested!"

We also might consider the overall effects of funding several projects requiring the same kinds of skills at the same time.

There are no formulae available for instant application to the problem of maintaining effective and efficient design capabilities. However, there are many indications of things that might be done to improve our present effort by a considerable amount through efforts to develop and maintain design "teams."

TOPIC: UNIFIED LOGISTICS--AN

UNHOLY ALLIANCE?

LT COLONEL GRAHAM W. RIDER

Lt Colonel Graham W. Rider is a member of the faculty of the Air Force Institute of Technology, assigned to the Graduate Education Division of the School of Systems and Logistics, Air Force Institute of Technology.

The major portion of his Air Force career has been spent in Avionics Maintenance in Aerospace Defense Command. His assignments have been at squadron, air division and major air command level. He was an advisor on aircraft armament and electronics maintenance to the Imperial Iranian Air Force from 1960 to 1962. From 1962 to 1965 he was assigned to HQ ADC to develop personnel training plans and policies for avionics maintenance.

Lt Colonel Rider holds a Bachelor of Science in Engineering from the United States Military Academy (1952), a Master of Science in LAgistics Management (With Distinction) from the Air Force Institute of Technology (1966), and a Doctor of Business Administration in Management from Arizona State University (1970). His thesis and his dissertation were based upon research in the concept of logistics, and he has written and published a number of articles on conceptual applications of logistics, and on research in logistics education.

Lt Colonel Rider is Head of the Department of Management Studies, is an Associate Professor of Logistics Management and teaches the Logistics Policy course in the Graduate Logistics Management Program.

UNIFIED LOGISTICS--AN UNHOLY ALLIANCE?

By

Graham W. Rider*
Lieutenant Colonel, USAF, D.B.A.
Head, Department of Management Studies
Associate Professor of Logistics Management
Graduate Logistics Management Division
School of Systems and Logistics
Air Force Institute of Technology
Wright-Patterson Air Force Base, Ohio 45433

* The views expressed herein are those of the author and do not necessarily represent the views of the Air University, the United States Air Force, or the Department of Defense.

Whether or not an alliance is unholy is, I suppose, a function of how those who must coexist with it see it. Most of our military leaders, and a good number of civilians too, have viewed a unified military service--the so-called "purple-suit" force--as unholy. Apparently, they have not held such a horror of the unification of logistics because it has proceeded at a measured pace for the past fifteen years. Though not yet complete, a very significant amount of logistics unification has occurred while conquering what I choose to regard as only minimal resistance. Perhaps instinctively some of our leadership is coming to the realization that they have been very neatly outflanked--that service unification may very well come about as a result of logistics unification.

What is presented in the following paragraphs is a step-by-step description of how logistics has been integrated, and how the process of full unification will be accomplished in the coming decade. These are my thoughts, of course, and they are based upon my research so I must accept full blame for any faults found. Truly, I have tried to remain impartial and unbiased; to be neither pro- nor anti-unification. My single purpose is to tell you, logically, what is happening to our organization for defense.

Unification, a la Logistics

Lets take a few moments to review the events that have led up to our present situation. Most of you are familiar with these events as a series of organizational changes that relocated decision--making authority within the Department of Defense, and you have probably viewed them as they impacted upon the operational missions of the services. I suggest that we might profit by viewing them as they have impacted upon the logistics missions of the services.

The major changes to the National Security Act of 1947 that occurred in 1949 and 1953 were intended primarily to strengthen the administrative position of the Secretary of Defense. We can pass over those events for the most part because their impact upon logistics was no greater than on any other military function. Two, however, are important. In 1953 the Munitions Board and the Defense Supply Management Agency were abolished and their functions were absorbed by a newly appointed Assistant Secretary of Supply and Logistics. Let me say here, parenthetically, that I am not sure whether the choice of title was deliberate or not, but it certainly created a confusion about the function of logistics that we have yet to resolve. The O'Mahoney Amendment to the Defense Appropriations Act gave the Secretary of Defense full financial control of logistics--a responsibility delegated, of course, to the new Assistant Secretary. The second important event of 1953 was the Defense Cataloging and

Standardization Act--the management tool needed by the new Assistant Secretary in exercising his financial responsibility.

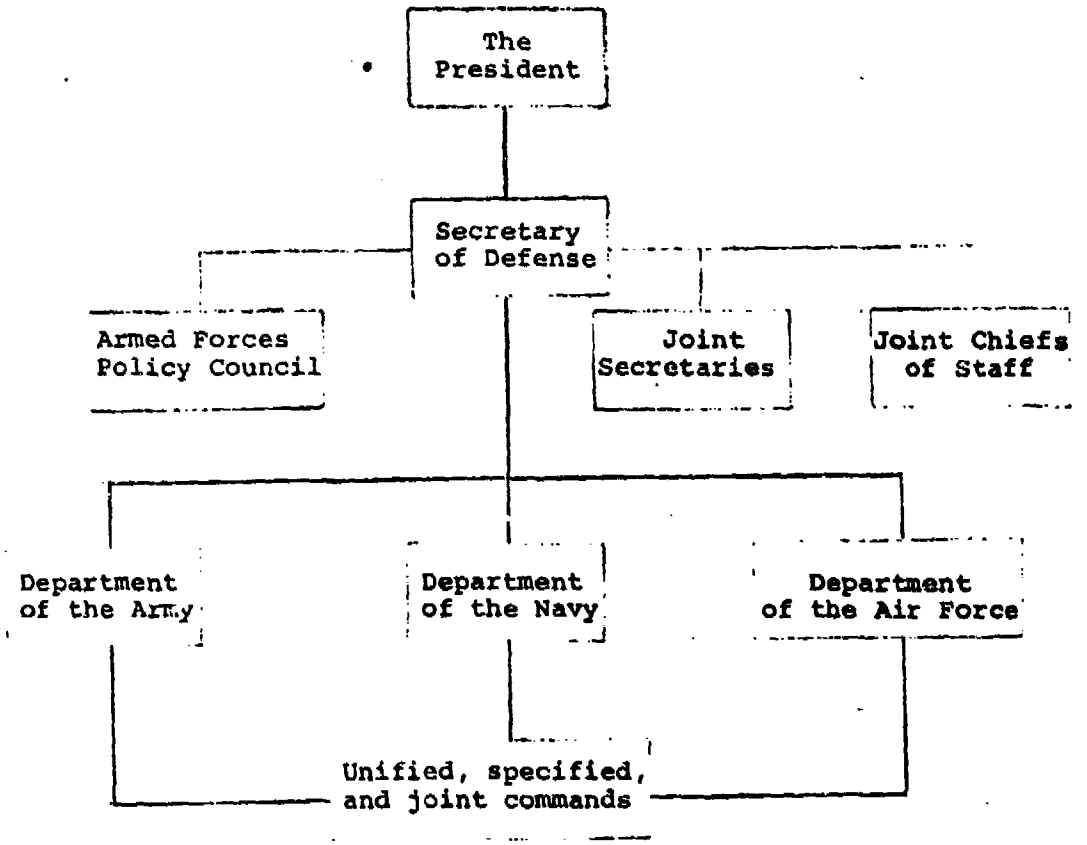
In 1955, the Second Hoover Commission submitted its report with its primary recommendation that a single Defense Supply and Services Agency be established. This idea was not new. It had appeared in bills submitted to Congress following World War I, and was included in the 1943 Collins Plan which was the first of the series of proposals that led to the National Security Act of 1947. However, this time the conditions for the ultimate creation of such an agency were much more favorable. But no immediate adoption of the Hoover proposals was made. Instead, the military departments proposed a compromise, and in late 1955 Secretary of Defense Wilson announced the Single Management and Inter-service Supply Support Plan for common--use commodities and transportation services. Under the plan, one military department was designated by the Secretary of Defense to be responsible for the wholesale supply of a category of common--use items or for provision of a transportation service for all of the departments. This became known as the Single Manager Plan.

Unfortunately, the compromise did not work out too well. Perhaps it was too much of a change from tradition or service doctrine. At any rate, charges were soon made that only the parent service of the single manager got good support, and general dissatisfaction with the system at the working level began to make itself felt up through the chain of command. What most of us do not know, however, is that the Secretary of Defense initiated a Logistics Systems Study Project in 1957 which reported in 1958 that the Single Manager Plan was an effective management technique. In the following year, the same group recommended that the next logical step would be the creation of an Armed Forces Supply Support Center--the same recommendation made three years earlier by the Second Hoover Commission.

In another significant 1958 event, the Rockefeller Panel Report recommended that the power of the Secretary of Defense be strengthened. This recommendation, falling in line as it did with those made previously, resulted in the Defense Reorganization Act of 1958 which required the Secretary of Defense to provide for the carrying out of any supply or service activity common to more than one military department by a single agency or such other organizational entity as he deemed appropriate. This responsibility he delegated to the Assistant Secretary for Supply and Logistics and created, under the latter's management, the Armed Forces Supply Support Center. Through this agency he continued to control the Single manager plan, and he added single managerships in the following year, 1959.

At this point, it is essential that we see how the Congress and the Executive Department viewed the defense organization. Remember that the 1958 Act was designed to increase the effectiveness of the unified and specified commands. The size of the Joint Staff was increased as was the authority of the Chairman of the Joint Chiefs of Staff. The chain of operational command that used to go to the service chiefs was restructured to go from the President to the Secretary of Defense to the unified and specified commands. The chain of command for support activities ran through the Secretary of Defense and the departmental Secretaries to the Service Chiefs. Figure 1 shows the defense organization before and after the passage of the Defense Reorganization Act of 1958.

Before



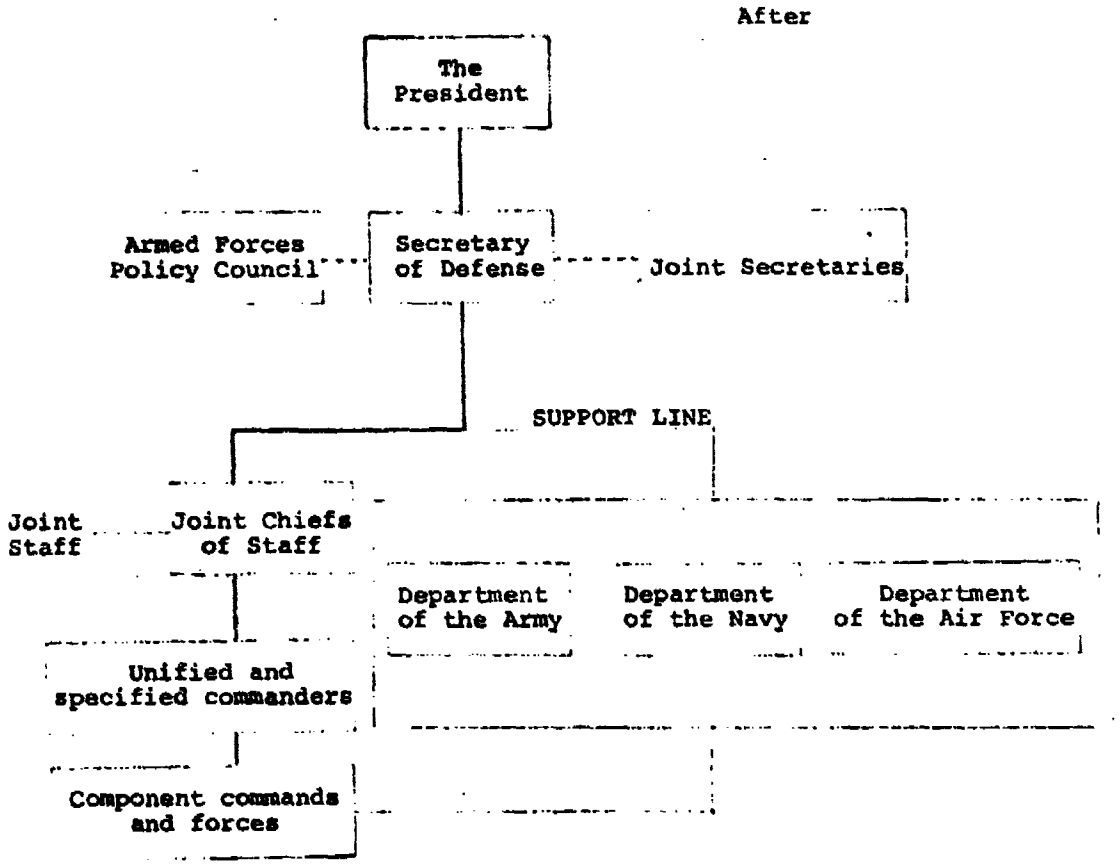


FIGURE 1

The line titled Support in the "After" organization was referred to during hearings before Congress and later within the Office of the Secretary of Defense as the "logistics chain of command." I feel certain that, right or wrong, our civilian managers really viewed defense organization as depicted by Figure 2. This is significant because it shows two separate and distinct chains of command--one for operations and another for logistics.

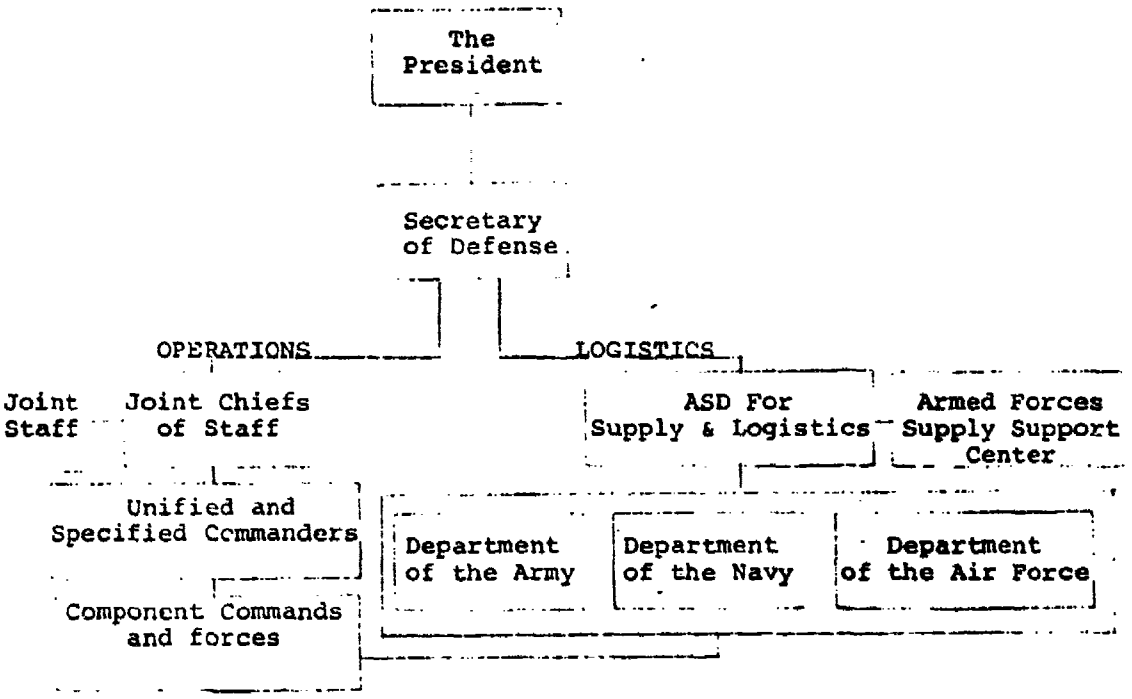


FIGURE 2

The decade of the 60's has been called the Defense Supply Agency Era. Established in 1961, it absorbed the Armed Forces Supply Support Center, the single managerships, and now provides a great number of the tools and techniques of supply management to the military departments. Study after study made during the decade resulted in the transfer of more and more wholesale supply management responsibility to the Agency.

In his reorganization of the Assistant Secretaryships in 1961, Secretary McNamara combined Supply and Logistics with Properties and Installations to create a new office of Installations and Logistics. Though this move increased the power and prestige of the Assistant Secretary from a management viewpoint, it did little to resolve the confusion surrounding logistics from a semantic viewpoint.

As a final note on this background study, lets look at the striking similarity between the recommendations made by two commissions--one at the beginning of the decade and one at the end. In 1960, then President-elect Kennedy asked Senator Symington to head a committee to study the defense establishment. The report, delivered late in the year, recommended sweeping organizational changes in the Department of Defense including abolition of the three military departments and the creation of three unified commands: a Strategic Command, a Tactical Command, and a Defense Command. The report dealt primarily with the operational aspects of the Department. At the end of the decade, the Fitzhugh Report also recommended sweeping changes in organization; among them the creation of a Strategic Command, a Tactical Command, and a Unified Logistics Command. It almost seems that the reports of commissions, panels, and study groups are tied together by a single thread of managerial and organizational thinking. Even though a full decade of magnificent improvement in the management of defense has transpired, we are still hearing proposals that would improve the efficiency and economy of our performance.

How Do We Stand Today?

Below the Office of the Secretary of Defense in our organizational chart, the three departments are charged with the logistics processes of determining requirements, acquisition and maintenance of weapon systems and their associated materiel. The fourth logistics process, distribution, has been split with a major portion of this responsibility assigned to the Defense Supply Agency. In fact, a recent study done by graduate students at the School of Systems and Logistics, AFIT, revealed that on 31 March 1970 the Defense Supply Agency, the General Services Administration, and the US Army Tank Automotive Command shared among themselves management responsibility for 50.6 percent or 2,033,156 of 4,019,105 supply items in the Federal Catalog System. The three are Single Managers or, in the new jargon, Integrated Material Managers. Defense Supply Agency is by far the largest.

The old single management concept for common-use items has come a long, long way. And it shall continue to grow. For example, the General Accounting Office has been studying how we manage munitions. Concurrently, two more graduate logistics management program students simulated current administrative practices in munitions management in comparison with those of an hypothesized single manager. Their findings strongly support the contention that significant administrative improvements in munitions management can be achieved through single management.

In transportation, single management is the organizational pattern. Management of transportation rests with the Assistant Secretary for Installations and Logistics--for example, he controls MILSTAMP, the Military Standard Transportation and Movement Procedures. Significantly, much discussion has occurred during the past year regarding further organizational unification of the modes of transportation under a single manager.

The services retain a large amount of control over the function of procurement or, if you will, acquisition. Yet not one has escaped scathing public criticism of late about its ability to manage this function, and each is conscientiously engaged in a search for better procurement management. Significantly, a Commission on Government Procurement, established by Congress, is currently studying this logistics function in considerable detail.

Where the function of maintenance is concerned, separate service responsibility has not been seriously threatened by the concept of single management. Interestingly enough, criteria for the assignment of items or activities to a single manager are rather vague. This is especially true of the maintenance of supply items. All that we have are these criteria taken from the Defense Reorganization Act of 1958:

1. The supply or service activity must be common to more than one Military Department.

2. Assignment of responsibility for the activity must be advantageous to the government.

On the other hand, retention of item supply management and maintenance by the military departments is determined through the use of ten explicit criteria contained in DODI 4140.26, Item Management Coding of Items in Federal Supply Classes Assigned to the Defense Supply Agency. Two of these criteria, (1) that the item is a Weapon System Consumable, and (2) that the item is a Reparable, enable the military departments to retain nearly ninety percent of the supply items not single managed. The other eight criteria account for the remaining ten percent retained by the military departments. The prime reason that the military departments can keep items from being single managed is that they and they alone have a technical capability for maintenance. Significantly, the recent DOD Communications Materiel Study and the F/RF-4 Recoverable Item Service Test were direct challenges to that jealously guarded service maintenance capability.

Turning last in this analysis of our present status to management processes, we find that which is generally accepted as a primary management task has been absorbed by the Assistant Secretary for Installations and Logistics. I speak of planning. First came the Blueprint in 1969; then the Logistics System Policy Committee chaired by the Assistant Secretary; then the LOGPLAN and the LOGPLAN Mechanism; and early this year twenty-one logistics system objectives. This chain of events is directed toward developing a Logistics System Plan which will rank within the Department of Defense as a management tool equal to the Joint Strategic Objectives Plan. It will be controlled from within the Office of the Assistant Secretary of Defense for Installations and Logistics.

As I said earlier, our civilian managers see two chains of command--one operational and the other logistical. I regard what has been presented herein as substantial evidence of that fact.

Where Are We Going?

Certainly, political and economic factors have played a significant role in the developing unification of logistics. And certainly they will play a similar role in future developments. Though I have chosen to ignore these factors in this study, let me say that I regard them as limiting factors--limiting only in the sense of how they will affect the speed with which logistics unification is achieved. Even so, I confidently predict that by 1980 logistics will be unified.

Whether transportation or procurement will be the first to go is difficult to say because both are ripe. In the new organization, transportation will be separately established with system managers responsible for the throughput of materiel from origin to destination. Intermodal shipping and control, and the use of improved packaging and handling techniques will most assuredly be available.

Procurement within the Department of Defense will be split somewhat in the way the Air Force currently handles this function. Procurement for the research and development of new technology and for the acquisition of new weapon systems will be separately organized. All other procurement will be a function of supply.

When the two item coding criteria that allow the services to retain a technical capability for maintenance are eliminated, all supply and maintenance functions in the Department of Defense will be combined. The fact that the military departments have this technical capability at present and the Defense Supply Agency does not shall be resolved through a simple transfer of the people and the facilities that make up that technical capability. Yes it will happen, because to the efficiency expert duplication in maintenance activities is just as bad as duplication in supply. These, I believe, are the points of view and the logical actions that must inevitably occur to any civilian manager who will serve in the top posts of the Department of Defense. These must also occur inevitably to those who will advise the managers. Remember that some Second Hoover Commission recommendations were implemented three years later in the Defense Reorganization Act of 1958, and that others were implemented by Secretary McNamara about six years later. Remember that the Symington Committee recommendations, though shelved in 1960, reappeared in essence in the Fitzhugh Committee report of 1970. Remember that only one year has passed since that last report was submitted.

Our organization in 1980 will probably be as depicted in Figure 3.

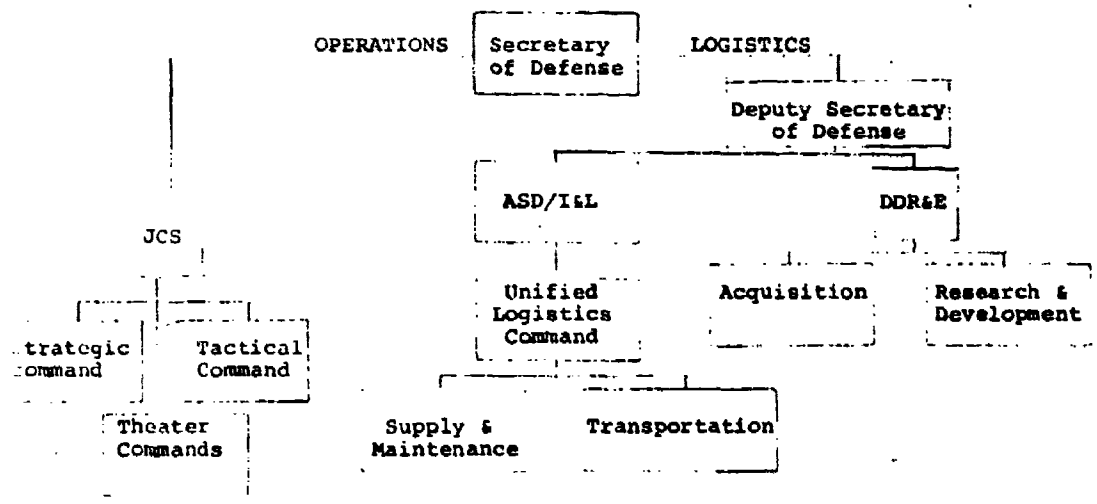


FIGURE 3

Of course, a number of activities such as Personnel and Civil Engineering have been left out purposefully so as not to confuse the impact of what is predicted for logistics.

An Unholy Alliance?

Perhaps, or perhaps not. Our understanding of the nature of war is that it consists of the three fundamental elements of strategy, tactics, and logistics. These are so interrelated that they are inseparable in any form or level of intensity of war. Improper management of any of the three should cause a commander to lose his war. Our doctrine and those of our sister services preach this unforgivable lesson. Certainly then, the commander responsible for fighting a war must have delegated to him full control of all three functions of war.

In the predicted organization, the Secretary of Defense has such full control because below him the chain of command is split into operations and logistics. Full and complete defense decision authority will rest in his office. Of course, in wartime he can assign strategic, tactical, and logistics forces to theater commanders and delegate corresponding authority and responsibility. Nonetheless this is his authority and responsibility--the organization makes him the senior commander of the military force. His decisions in peacetime will determine the nature, structure, and equipment of the fighting force even more explicitly than they do now. To him, the alliance should not appear unholy.

But will it appear unholy to the military professional, or will it not? Each of us must answer this question: Will complete unification of logistics, with its resulting impact upon traditional service organization, improve or degrade our ability to defend this nation?

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TOPIC: ARMY PROCUREMENT RESEARCH

DR. ROY L. SCHOOLING

Dr. Roy L. Schooling is the Director of the Procurement Research Office at the United States Army Logistics Management Center (ALMC), Fort Lee, Virginia. His practical experience in the field of Government procurement has been extensive. He began as a Purchasing Agent for the Oklahoma City Air Materiel Area (OCAMA), USAF, and quickly advanced to Member and then Vice Chairman of the Procurement Committee at the OCAMA. His subsequent positions have been as Chairman, Procurement Committee, Air Force Office of Scientific Research; Director, Procurement Research Office, ALMC; and Dean, Institute of Logistics Research, ALMC.

Dr. Schooling received his education at the Oklahoma City University (B.S., Business; L.L.B., Law; and L.L.M., Law).

ARMY PROCUREMENT RESEARCH

Dr. Roy L. Schooling
Director of Procurement Research
Army Logistics Management Center

Because of their direct relationship, it would be impractical to discuss Army Procurement Research without a brief preliminary discussion of the Army Procurement Research Office. It is there, in fact, that all organized procurement research for the Department of the Army is now conducted.

During the latter part of his administration, Secretary of Defense Clark Clifford voiced recognition of a need within the Department of Defense for a Procurement Research Laboratory. Prompted by this, and by the further recognition that the Army had no single activity charged with the responsibility for seeking methods of improving the procurement process, Lt General Woolwine, then the Army Materiel Command's Director of Procurement and Production, initiated action in late 1968 to establish such an activity at the Army Logistics Management Center (ALMC), Fort Lee, Virginia.

As originally conceived, the activity was to have had a 26-man staff. Following the inevitable manpower and budget struggles that seem to be an inherent part of any such endeavor, formation of a 20-man Army Procurement Research Office was authorized in early 1969. After having successfully defended against subsequent attempts to cut the original authorization roughly in half, full staffing was finally achieved in July 1970. To that original staff has since been added an industrial engineer, filling a skill requirement not originally identified. (Slide 1 On)

SLIDE #1

PROCUREMENT RESEARCH OFFICE

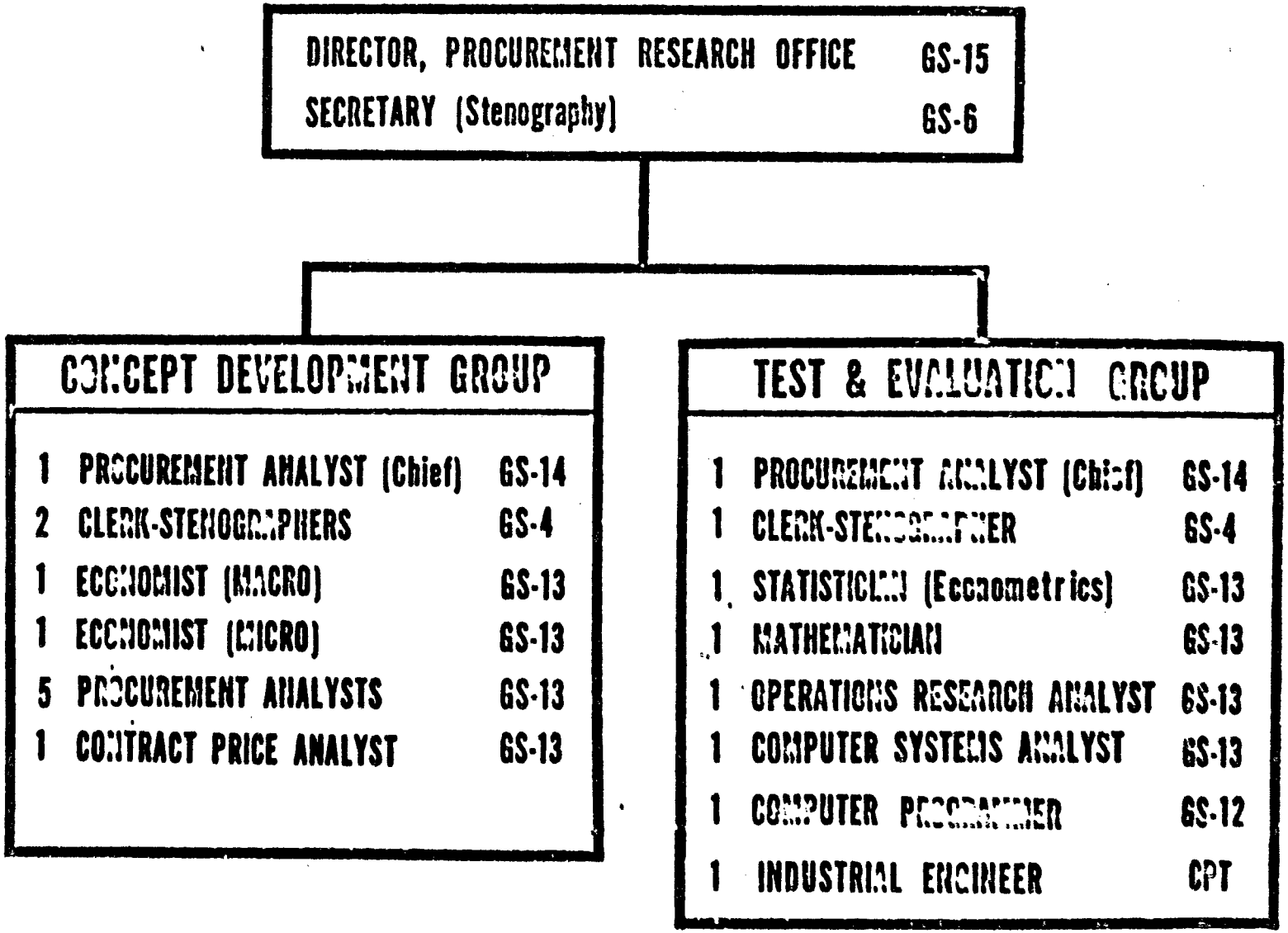
BASIC MISSIONS	DEVELOP AND TEST IMPROVED PROCUREMENT TECHNIQUES PROVIDE CONSULTATION SERVICES ON EMERGING PROCUREMENT PROBLEMS
STAFF	17 PROFESSIONALS → 9 PROCUREMENT SPECIALISTS → 8 SCIENTIFIC SPECIALISTS
METHOD OF OPERATION	TEAM CONCEPT: PROJECT OFFICER ASSISTED BY PROCUREMENT AND SCIENTIFIC SPECIALISTS

THE BASIC MISSIONS OF THE OFFICE ARE TO CONDUCT RESEARCH LEADING TO THE EVOLUTION OF MORE EFFECTIVE TECHNIQUES FOR MILITARY PROCUREMENT AND PROCUREMENT MANAGEMENT, AND TO PROVIDE CONSULTANT SERVICES TO ARMY PROCURING ACTIVITIES WITHIN ITS AREAS OF COMPETENCE. THE RESEARCH MISSION CONSISTS PRIMARILY OF PERFORMING RESEARCH STUDIES ON CURRENT AND EMERGING PROBLEM AREAS IN ARMY PROCUREMENT. THE ULTIMATE GOAL OF MOST OF OUR RESEARCH STUDIES IS TO FIRST DEVELOP, AND THEN TEST, IMPROVED PROCUREMENT TECHNIQUES FOR HANDLING THE PROBLEMS WE NOW FACE AND ANTICIPATE FOR THE FUTURE. SOME STUDIES ARE CONDUCTED TO IMPROVE OUR UNDERSTANDING OF PROBLEMS SO THAT WE WILL BE IN A BETTER POSITION TO CHOOSE OR DEVELOP THE APPROPRIATE PROCUREMENT METHODS. THE CONSULTANT MISSIONS ARE TO ASSIST IN THE IMPLEMENTATION OF OUR INNOVATIONS ADOPTED BY THE ARMY MATERIEL COMMAND AND TO AID PROCURING ACTIVITIES IN THE SOLUTION OF PECULIAR PROBLEMS ON CURRENT PROCUREMENTS. TO ACCOMPLISH THESE MISSIONS WE ARE STAFFED WITH A MIXTURE OF PROCUREMENT AND TECHNICAL SPECIALISTS. EACH MAJOR RESEARCH PROJECT IS HEADED BY A PROJECT OFFICER, NORMALLY A PROCUREMENT ANALYST, WHO IS ASSISTED BY ONE OR MORE RESEARCH ANALYSTS. THE TALENT MIX IS DICTATED BY THE DEMANDS OF EACH PROJECT.

(SLIDE 1 OFF - SLIDE 2 ON)

SLIDE #2

ARMY PROCUREMENT RESEARCH OFFICE



THE PROCUREMENT RESEARCH OFFICE IS ORGANIZED ON THE PREMISE THAT NEW AND IMPROVED CONCEPTS SHOULD BE DEVELOPED BY FUNCTIONALLY EXPERIENCED PEOPLE AND TESTED BY RIGOROUSLY TRAINED, QUANTITATIVELY ORIENTED SPECIALISTS. IN STAFFING THE OFFICE WE HAVE ATTEMPTED TO AVAIL OURSELVES OF PEOPLE SKILLED IN EVERY AREA LIKELY TO HAVE FAVORABLE IMPACTS ON THE SOLUTION OF PROCUREMENT PROBLEMS. THE TEAM APPROACH IS THE PREVAILING MODE OF OPERATION. PROCUREMENT ANALYSTS, ECONOMISTS, AND THOSE WITH OTHER SPECIALIZED SKILLS COLLABORATE IN AN ATTEMPT TO VIEW ALL FACETS OF THE PROCUREMENT PROBLEMS ENCOUNTERED.

(SLIDE 2 OFF - SLIDE 3 ON)

SLIDE #3

PRO PERSONNEL PROFILE

PROFESSIONALLY EXPERIENCED AND TRAINED GROUP

EXPERIENCE: 9 PROCUREMENT SPECIALISTS - 10 YEARS
8 TECHNICAL SPECIALISTS - 8 YEARS

EDUCATION: ALL HAVE DEGREES; 15/17 HAVE AT LEAST 1 ADVANCED DEGREE.

AGE: $\bar{X}$ = 35

SOURCE:

AIR FORCE	- 5	NASA	- 1
ARMY	- 4	UNIVERSITIES	- 2
NAVY	- 2	INDUSTRY	- 3

PHYSICALLY MOBILE AND FLEXIBLE

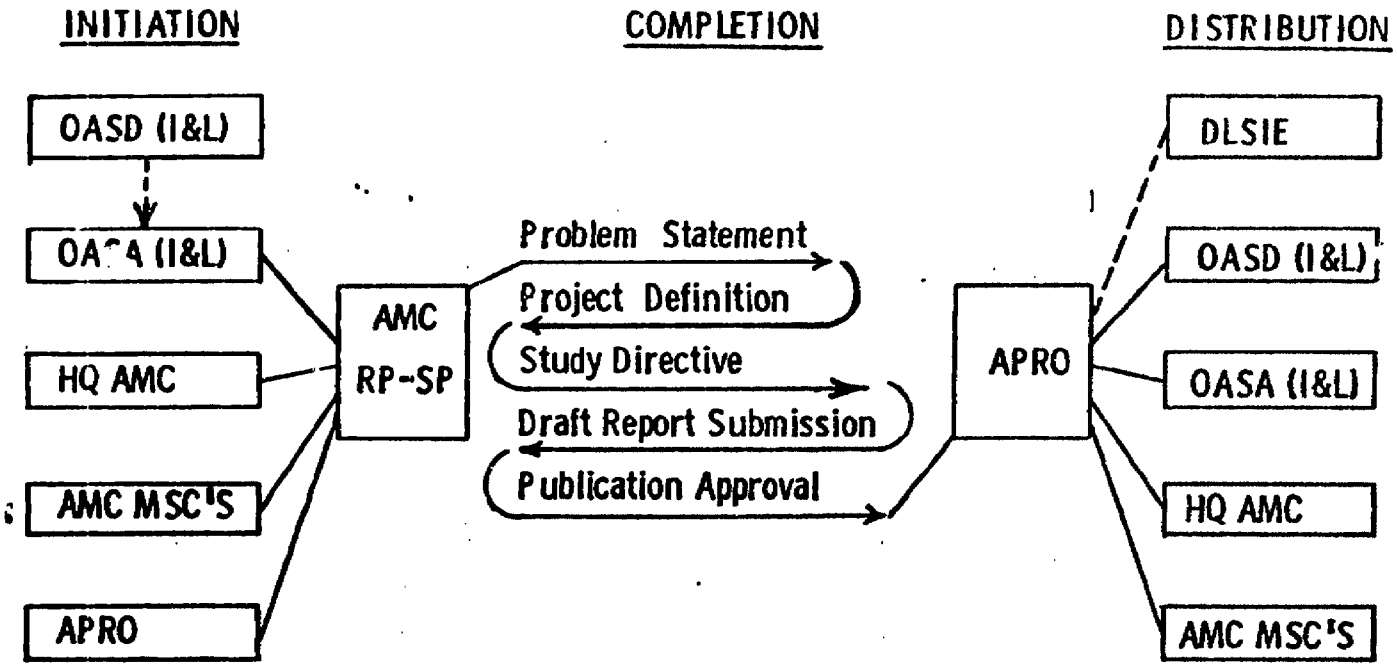
THIS BRIEF PROFILE OF THE PROFESSIONAL STAFF SHOWS ITS GENERAL COMPLEXION. WHILE OUR ONE PRINCIPAL RECRUITING CRITERION HAS BEEN TO ATTRACT AND SELECT THE MOST HIGHLY SKILLED AND HIGHLY MOTIVATED PEOPLE OBTAINABLE, IT MAY BE DISCERNED FROM THIS PROFILE THAT WE HAVE ASSEMBLED A GROUP OF REMARKABLY YOUNG AND WELL EDUCATED PEOPLE POSSESSING A GREAT DEPTH AND DIVERSITY OF EXPERIENCE.

(SLIDE 3 OFF)

THAT, IN BRIEF, IS THE ARMY'S ORGANIZATION FOR THE CONDUCT OF PROCUREMENT RESEARCH. NOW, JUST A FEW WORDS ABOUT HOW OUR RESEARCH PROJECTS ARE GENERATED AND REFINED.

(SLIDE 4 ON)

RESEARCH STUDY FLOW



SLIDE #4

STUDY PROJECTS HAVE BEEN INITIATED BY THE OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY (I&L), ARMY MATERIEL COMMAND HEADQUARTERS AND ITS MAJOR SUBORDINATE COMMANDS, AND THE ARMY PROCUREMENT RESEARCH OFFICE, ITSELF. WHILE, IN THEORY, PROJECTS COULD COME THROUGH CHANNELS FROM THE DEPARTMENT OF DEFENSE, NONE HAVE COME TO US BY THAT ROUTE. THE ARMY MATERIEL COMMAND'S MAJOR SUBORDINATE COMMANDS PROVIDE OUR GREATEST POTENTIAL SOURCE OF MEANINGFUL PROCUREMENT RESEARCH STUDIES. IT IS THERE OUR PROBLEMS ARISE, THE DATA ARE GENERATED, AND THE HANDS-ON EXPERIENCE EXISTS.

IN SELECTING PROJECTS FROM OUR COMMODITY COMMANDS, WE ATTEMPT TO CONCENTRATE OUR ENERGIES ON PROBLEMS WHICH ARE NOT ONLY REPETITIVE, BUT ARE ALSO COMMON TO SEVERAL COMMANDS. WE STRIVE TO MAXIMIZE THE BENEFITS OF OUR LIMITED RESEARCH RESOURCES BY AVOIDING PROBLEMS PECULIAR TO A SINGLE COMMAND OR PROCUREMENT ACTIVITY.

THE INITIAL PROBLEM STATEMENTS ARE EITHER PREPARED OR APPROVED BY THE PROCUREMENT POLICY DIVISION OF AMC'S REQUIREMENTS AND PROCUREMENT DIRECTORATE, AS THE ONLY ACTIVITY AUTHORIZED TO TASK THE ARMY PROCUREMENT RESEARCH OFFICE. THAT OFFICE THEN DIRECTS THE APRO TO DEFINE A STUDY PROJECT. IN PROJECT DEFINITION, WE FIRST CONFIRM THE EXISTANCE OF A PROBLEM, PROPOSE

SLIDE #5

ARMY PROCUREMENT RESEARCH OFFICE

PUBLICATIONS

PROJECT NO.	TITLE	PUBLICATION DATE	NO. OF PAGES
001	SHOULD COST ANALYSIS GUIDE	NOV 1970	243
002	EFFECTIVENESS OF CONTRACT INCENTIVES	AUG 1970	48
004	PRIORITIES ASSISTANCE PROCEDURE	OCT 1970	121
005	TRANSMISSION OF PROCUREMENT TECHNICAL REQUIREMENTS	JUN 1971	173
006	LIFE CYCLE COSTING	MAR 1970	99
007	COST GROWTH I	MAR 1971	39
	COST GROWTH II	JUN 1971	41
008	SHOULD COST TEAM: SIZE & COMP	FEB 1971	44
101	SC REFERENCE BIBLIOGRAPHY	MAR 1971	22
102	PHASE-OUT PLAN FOR GOV'T OWNED FACILITIES	JUN 1971	70
103	CONTRACTOR MANAGEMENT IMP PROG	APR 1971	29
	SHOULD COST LESSONS LEARNED	NOV 1970	39
	SHOULD COST IN R&D I	MAR 1971	51
	SHOULD COST IN R&D II		22

THE DIRECTION AND SCOPE OF THE WORK, AND ESTIMATE THE TIME AND OTHER RESOURCES REQUIRED FOR STUDY COMPLETION.

WITH THE APPROVAL OF OUR DETAILED STUDY PLAN, THE PROJECT IS ASSIGNED FOR FULL-SCALE RESEARCH. UPON COMPLETION OF THE RESEARCH PROJECT, A DRAFT REPORT IS SUBMITTED FOR REVIEW AND PUBLICATION APPROVAL.

ABSTRACTS OF OUR ON-GOING AND COMPLETED STUDIES ARE INCLUDED IN THE AMC AND ARMY LOGISTICS STUDY PROGRAM CATALOG AND IN THE DEFENSE LOGISTICS SYSTEMS INFORMATION EXCHANGE (DLSIE) ANNUAL DEFENSE LOGISTICS BIBLIOGRAPHY. INITIAL DISTRIBUTION OF COMPLETED STUDY REPORTS IS MADE TO ALL DIRECTLY INTERESTED ACTIVITIES.

(SLIDE 4 OFF - SLIDE 5 ON)

THIS SLIDE REPRESENTS OUR PUBLISHED REPORTS TO DATE. SINCE SOME OF OUR RESEARCH PROJECTS ARE OPEN-ENDED, EACH PUBLISHED REPORT DOES NOT NECESSARILY REPRESENT A COMPLETED PROJECT. NOT SHOWN HERE ARE THREE ADDITIONAL REPORTS AWAITING AMC PUBLICATION APPROVAL, TWO UNDERGOING INTERNAL REVIEW PRIOR TO SUBMISSION TO AMC, AND ANOTHER TWO NEARING COMPLETION OF INITIAL DRAFTS.

(SLIDE 5 OFF - SLIDE 6 ON)

SLIDE #6

PROCUREMENT RESEARCH OFFICE

FY 1972 STUDY PROGRAM

NUMBER	TITLE
007	PRODUCTION COST GROWTH
103	SHOULD COST CENTER
104	DESIGN AND DEVELOPMENT OF A STANDARD AMC AUTOMATED BIDDERS LIST
105	MILESTONE CONTRACTING VARIATIONS
201	AN ANALYSIS OF THE ARMY'S CPE PROGRAM
202	LESSONS LEARNED FROM SENIOR PROCUREMENT REVIEW BOARD ACTIONS
203	IMPROVED METHODS FOR PROPOSAL EVALUATION AND SOURCE SELECTION
204	TECHNICAL DATA PACKAGE IMPROVEMENT
205	LIMITATIONS ON SMALL PURCHASES
206	BIDDERS MAILING LIST

THIS SLIDE DEPICTS OUR CURRENT FISCAL YEAR STUDY PROGRAM. TO PROVIDE YOU WITH SOME INSIGHT TO OUR RESEARCH EFFORTS, I HAVE SELECTED FOUR OF THESE PROJECTS FOR FURTHER DISCUSSION: COST GROWTH, SHOULD COST, CONTRACTOR PERFORMANCE EVALUATION, AND PROPOSAL EVALUATION.

(SLIDE 6 OFF - SLIDE 7 ON)

SLIDE #7

STUDY: COST GROWTH

OBJECTIVE: IDENTIFY AND ANALYZE THE MAJOR CAUSES OF COST GROWTH; AND ASSESS THE RELATIVE MAGNITUDE OF THEIR INFLUENCE.

LET US FIRST ADDRESS OUR COST GROWTH STUDY. ALL OF YOU ARE AWARE OF THE SIGNIFICANCE OF CONTRACT COST GROWTH IN OUR PROCUREMENT PROGRAM. WE HAVE AN OPEN-ENDED RESEARCH PROJECT STUDYING THE FACTORS CAUSING COST GROWTH AND ATTEMPTING TO FIND WAYS OF CONTROLLING THESE FACTORS. SO FAR, WE HAVE PUBLISHED TWO REPORTS AND ARE ABOUT TO RELEASE A THIRD. IN THE FIRST TWO REPORTS, WE EXAMINED SOME OF THE MAJOR AREAS AND CAUSES OF COST GROWTH. IN OUR NEXT REPORT, WE HOPE TO ESTABLISH MORE PRECISELY THE REASONS BEHIND CONTROLLABLE COST GROWTH AND POINT THE WAY TO BRINGING IT UNDER CONTROL.

(SLIDE 7 OFF - SLIDE 8 ON)

SLIDE #8

COST GROWTH DEFINITIONS

INITIAL TARGET COST: (C_i)

ADJUSTED TARGET COST: (C_a)

C_i + Modifications

FINAL COST: (C_f)

Actual Cost; C_a + Overruns

SECRETARY PACKARD'S DEFINITIONS

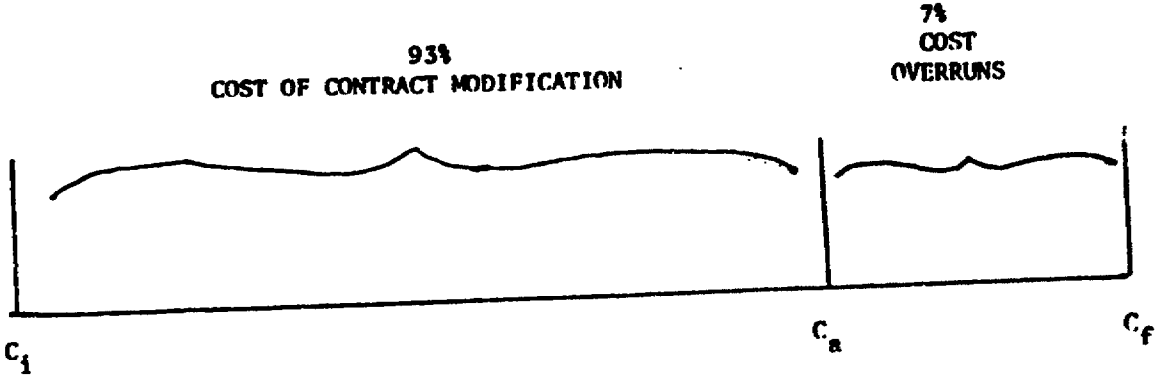
Cost Growth: $C_f - C_i$ (Net Increase)

Overruns: $C_f - C_a$

HERE WE SEE THE DEFINITIONS USED IN THE STUDY. THEY CONFORM TO SECRETARY PACKARD'S DEFINITIONS. ONE OF THE FIRST THINGS WE SOUGHT TO DETERMINE WAS HOW LARGE COST OVERRUN WAS AS AN INCREMENT OF COST GROWTH. IN OUR STATISTICAL ANALYSIS OF 740 MAJOR CONTRACTS, WE FOUND THIS INCREMENT TO BE RELATIVELY SMALL.

(SLIDE 8 OFF - SLIDE 9 ON)

SLIDE #9



C_i = INITIAL NEGOTIATED COST

C_a = ADJUSTED TARGET COST

C_f = FINAL COST OF THE CONTRACT

AS MAY BE SEEN, 93% OF TOTAL COST GROWTH WAS ATTRIBUTABLE TO CAUSES OTHER THAN COST OVERRUN. ON OUR SUBSEQUENT SAMPLES OVERRUN COMPRISED EVEN LESS OF THE TOTAL.

SOME ADDITIONAL FINDINGS OF OUR INITIAL COST GROWTH RESEARCH ARE SHOWN ON THE NEXT TWO SLIDES.

(SLIDE 9 OFF - SLIDE 10 ON)

SLIDE #10

FINDINGS

1. TOTAL COST GROWTH, CONTRACT MODIFICATIONS, OVERRUNS: SIGNIFICANTLY DIFFERENT FOR R&D AND PRODUCTION.

2. TOTAL COST GROWTH, CONTRACT MODIFICATIONS FOR PRODUCTION: SIGNIFICANT DIFFERENCE BETWEEN CONTRACT TYPES AND BETWEEN COMMODITY CLASSES.

3. OVERRUNS FOR PRODUCTION: SIGNIFICANT DIFFERENCE BETWEEN COMMODITY CLASSES, AND BETWEEN INDIVIDUAL CONTRACTORS.

THE DIFFERENCES ALLUDED TO HERE WERE FOUND TO BE STATISTICALLY SIGNIFICANT WHEN THE AVERAGES FOR THE KINDS OF CONTRACTS CITED WERE SUBJECTED TO A BATTERY OF SIGNIFICANCE TESTS.

(SLIDE 10 OFF - SLIDE 11 ON)

FINDINGS

AVERAGE COST GROWTH AS A PERCENTAGE OF COST: AGGREGATE SAMPLE AND BY TYPE OF WORK.

CLASSIFICATION	NO. OF CONTRACTS	AVERAGE COST GROWTH $\frac{C_f - C_i}{C_i}$	AVERAGE OVERRUN $\frac{C_f - C_a}{C_a}$
AGGREGATE SAMPLE	740	157%	6%
R&D	236	261%	13%
PRODUCTION	504	108%	3%

SLIDE #11

AN EXAMPLE OF ONE OF THE MANY COMPARISONS MADE IN THE FIRST COST GROWTH REPORT IS SHOWN HERE. THE RESULTS ARE WHAT MOST OF US WOULD EXPECT, BUT IT WAS FELT NECESSARY TO DEMONSTRATE THIS, ESPECIALLY BEFORE PROCEEDING TO A SEARCH FOR CAUSES.

(SLIDE 11 OFF)

THE MOST RECENTLY COMPLETED PART OF OUR COST GROWTH WORK DEALS WITH THE ASSESSMENT OF THE EFFECTS OF CONTRACT DURATION, DOLLAR SIZE, INFLATION AND TECHNOLOGY LEVEL ON COST GROWTH.

WE HAVE FOUND THAT ALL THESE FACTORS EXERT A SIGNIFICANT INFLUENCE ON COST GROWTH, THOUGH NOT ALL IN EITHER THE SAME DEGREE OR DIRECTION. FOR EXAMPLE, WE HAVE BEEN ABLE TO ESTABLISH THAT WHILE COST GROWTH IS INFLUENCED POSITIVELY BY CONTRACT DURATION, THE RATE OF GROWTH GOES DOWN AS CONTRACT SIZE INCREASES. WE ALSO FOUND THAT, WHILE INFLATION DOES CAUSE A CONTRACT TO GROW, ITS EFFECT HAS BEEN NO GREATER THAN ON THE ECONOMY IN GENERAL.

OUR CURRENT RESEARCH EFFORT IN COST GROWTH INVOLVES AN ATTEMPT TO FIND THE KINDS OF, AND REASONS FOR, CONTRACT MODIFICATIONS WHICH CONTRIBUTE TO THE 93+% OF COST GROWTH NOT ATTRIBUTABLE TO OVERRUN. WE HAVE CAREFULLY EXAMINED ABOUT 300 MAJOR ARMY CONTRACTS IN THIS ANALYSIS. WHILE THE STUDY IS NOT YET COMPLETE, WE HOPE THAT THIS RESEARCH EFFORT WILL DO TWO THINGS: FIRST, IDENTIFY THAT PART OF COST GROWTH BEYOND PROCUREMENT MANAGEMENT CONTROL - INFLATION, QUANTITY INCREASES, ETC, THEREBY IMPROVING CREDIBILITY AND AIDING IN THE ISOLATION OF PROBLEM AREAS AND SECOND, IDENTIFY THE KINDS OF

MODIFICATIONS CAUSING GROWTH SO THAT WE CAN BETTER ANTICIPATE, ASSESS, AND CONTROL THEIR IMPACT.

ONE OF OUR BEST-KNOWN PROJECTS IS THE "SHOULD COST CENTER." THIS IS A COMBINATION RESEARCH-CONSULTANT-OPERATIONAL SUPPORT PROJECT. OVERALL, THE PROJECT REQUIRES:

FIRST - CONDUCTING RESEARCH STUDIES ON THE USE AND EXPANSION OF SHOULD COST TECHNIQUES.

SECOND - PROVIDING CONSULTANT SERVICES ON AN "AS REQUIRED" BASIS TO ASSIST FIELD TEAMS IN PLANNING THEIR ANALYSES AND IN COPING WITH SPECIFIC PROBLEMS WHICH ARISE DURING THEIR STUDIES.

THIRD - SERVING AS A GENERAL FOCAL POINT ON ALL MATTERS CONCERNING SHOULD COST WITH SPECIAL ATTENTION DIRECTED TOWARDS REVIEWING REPORTS ON COMPLETED STUDIES AND ON MAINTAINING AN "OPEN LINE" WITH THE OTHER SERVICES REGARDING THEIR SHOULD COST EFFORTS, SO AS TO ACHIEVE THE FULL BENEFIT OF "LESSONS LEARNED."

FOURTH - MAINTAINING THE SHOULD COST ANALYSIS GUIDE TO KEEP IT CURRENT AND REFLECT THE KNOWLEDGE GAINED FROM SHOULD COST STUDIES CONDUCTED TO DATE.

FIFTH - MAINTAINING A BIBLIOGRAPHY AND LIBRARY OF REFERENCE MATERIAL FOR USE BY SHOULD COST TEAMS, SHOULD COST COORDINATORS AND TRAINING PERSONNEL. AND

SIXTH - ASSISTING THE ARMY LOGISTICS MANAGEMENT CENTER IN CONDUCTING SHOULD COST TRAINING WORKSHOPS.

(SLIDE 12 ON)

SLIDE #12

SHOULD COST CENTER

FUNCTIONS

CONDUCT RESEARCH STUDIES

PROVIDE CONSULTANT SERVICES TO GOVERNMENT TEAMS

REVIEW COMPLETED STUDIES FOR LESSONS LEARNED AND TO OBSERVE TRENDS IN ANALYSES

KEEP SHOULD COST GUIDE, AMCP 715-7, CURRENT

MAINTAIN BIBLIOGRAPHY AND LIBRARY OF REFERENCE MATERIAL

SUPPORT TRAINING SESSIONS

RECENT SHOULD COST-RELATED RESEARCH EFFORTS HAVE INCLUDED STUDIES OF THE FEASIBILITY OF APPLYING SHOULD COST TO R&D PROCUREMENTS, THE CONTRACTUAL STRUCTURING OF MANAGEMENT IMPROVEMENT PROGRAMS TO OVERCOME EXISTING INEFFICIENT AND UNECONOMICAL CONTRACTOR PRACTICES, THE SIZE AND COMPOSITION OF SHOULD COST TEAMS, AND THE SELECTION, MOTIVATION AND TRAINING OF SHOULD COST TEAM MEMBERS. ADDITIONALLY, WE HAVE ISSUED A SUMMARY REPORT ON "LESSONS LEARNED," REVISED THE SHOULD COST ANALYSIS GUIDE (DA PAMPHLET 715-7) AND DEVELOPED A BIBLIOGRAPHY OF SHOULD COST REFERENCE MATERIAL.

(SLIDE 13 ON)

SLIDE #13

PRO STUDIES ON SHOULD COST

APPLICATION OF SHOULD COST CONCEPTS TO R&D PROCUREMENTS

CONTRACTOR MANAGEMENT IMPROVEMENT PROGRAMS

SHOULD COST TEAM: SIZE AND COMPOSITION

SELECTION CRITERIA FOR SHOULD COST TEAM MEMBERS (IN PROGRESS)

TEAM MOTIVATION

UTILIZATION OF WORKSHOP ATTENDEES ON SHOULD COST TEAMS

LESSONS LEARNED

SHOULD COST ANALYSIS GUIDE

OUR CONSULTING EFFORTS HAVE BEEN PRIMARILY ASSOCIATED WITH ASSISTING IN THE PLANNING PHASE OF INDIVIDUAL SHOULD COST STUDIES AND IN EVALUATING CONTRACTOR'S USAGE OF COMPUTERS AND RELATED ADP EQUIPMENT. ONE OF OUR STAFF IS, HOWEVER, CURRENTLY PROVIDING FULL-TIME CONSULTANT SERVICES TO A TEAM EFFORT. WE EXPECT TO BE PROVIDING INCREASINGLY MORE ASSISTANCE IN THE DEVELOPMENT AND CONTRACTUAL STRUCTURING OF MANAGEMENT IMPROVEMENT PROGRAMS.

BECAUSE IMPLEMENTATION OF MANAGEMENT IMPROVEMENT PROGRAMS MUST BE TAILORED TO THE SPECIFIC CONTRACTUAL SITUATIONS AND CONTRACTOR'S OPERATIONS, OUR PARTICIPATION IN THIS AREA MAY BE CONSIDERED A FORM OF OPERATIONAL SUPPORT. WE HAVE ALSO PROVIDED OPERATIONAL SUPPORT THROUGH OUR PERIODIC VISITS TO SHOULD COST COORDINATORS AT THE COMMODITY COMMANDS AND OUR SUPPORT OF THE SHOULD COST WORKSHOP. IN THE EDUCATIONAL AREA, WE HAVE ALSO COMPILED A LISTING OF REFERENCE MATERIALS ON SHOULD COST FOR DISSEMINATION TO STUDENTS ATTENDING THE SENIOR SERVICE SCHOOLS.

(SLIDE 14 ON)

SLIDE #14

CONSULTANT SERVICES

PLANNING

PROBLEM-SOLVING

MANAGEMENT IMPROVEMENT PROGRAMS (MIP'S)

SKILLS AVAILABLE

- PRICING
- INDUSTRIAL ENGINEERING
- PROCUREMENT
- CONTRACT LAW
- MANAGEMENT SYSTEMS ANALYSIS
- MATHEMATICS
- STATISTICS AND STATISTICAL TECHNIQUES
- COMPUTER APPLICATIONS
- ECONOMICS

SLIDE 15 STATES THE MAJOR AREAS COVERED BY OUR STUDY OF THE CONTRACTOR PERFORMANCE EVALUATION PROGRAM. THE STUDY WAS UNDERTAKEN IN RESPONSE TO A REQUEST FROM THE OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY (I&L). AS WE ALL KNOW, THE MAJOR PORTION OF THE DOD CPE PROGRAM HAS BEEN DISCONTINUED. THE ONLY REMAINING PORTION OF THE PROGRAM IS THAT COVERING SMALL DEVELOPMENT CONTRACTS EVALUATED ON DD FORM 1683. AGAIN, THE PROGRAMS FOR MAJOR DEVELOPMENT CONTRACTS AND FOR SUPPLY CONTRACTS HAVE BEEN CANCELLED.

SLIDE #15

TITLE: ANALYSIS OF ARMY'S CONTRACTOR PERFORMANCE EVALUATION (CPE) PROGRAM

TASK: CPE DATA'S VALUE IN COST GROWTH ANALYSIS

IMPACT OF CPE PROGRAM CANCELLATION

REASONS FOR CANCELLATION

LESSONS LEARNED

CURRENT METHODS USED AND THEIR EFFECTIVENESS

CONCLUSIONS/RECOMMENDATIONS

SLIDE 16 INDICATES OUR STUDY APPROACH. OUR EMPHASIS IS DIRECTED TOWARD INTERVIEWS, SINCE WE FEEL THAT TALKING WITH INFORMED PEOPLE, ESPECIALLY THOSE IN THE FIELD, WILL GIVE US THE TRUEST PICTURE OF THE PROBLEM. WE ARE IN THE MIDST OF THE DATA ANALYSIS STAGE. WE PLAN TO COMPLETE OUR DRAFT REPORT DURING THIS QUARTER.

SLIDE #16

STUDY APPROACH

STUDY OF LITERATURE

EVALUATION OF CPE DATA BANK

ANALYSIS OF POLICIES, TASK GROUP FINDINGS, ETC.

INTERVIEWS:

PROGRAM ADMINISTRATORS
DATA COLLECTORS
DATA USERS

STATUS

REPORT WRITING

COMPLETION DATE

3Q 72

ALTHOUGH WE ARE NOT FINISHED ANALYZING THE DATA, WE DO HAVE A FEW PRELIMINARY FINDINGS.

1. IN GENERAL, THE CPE DATA DOES NOT LEND ITSELF READILY TO THE STUDYING OF COST GROWTH. THE DATA IS NOT SUFFICIENTLY DETAILED: IT IS PRETTY MUCH OUTDATED: MUCH OF IT IS CLASSIFIED.

2. THE IMPACT OF THE PROGRAM'S CANCELLATION IS VERY SLIGHT. CPE DATA HAS NOT BEEN USED TO ANY GREAT EXTENT IN THE ARMY'S FORMAL SOURCE SELECTION PROCESS (WE HAVE HAD LESS THAN A DOZEN SUCH ACTIONS IN THE LAST 4 YEARS): THERE WAS LITTLE, IF ANY, USE MADE OF CPE DATA IN THE DETERMINATION OF A CONTRACTOR'S RESPONSIBILITY (THE PCO USUALLY RELIED ON DATA OTHER THAN THAT CONTAINED IN THE CPE DATA BANK) AND THE RE-NEGOTIATION BOARD RARELY FOUND CPE DATA OF VALUE FOR RE-NEGOTIATION PURPOSES.

3. METHODS CURRENTLY EMPLOYED BY THE ARMY'S COMMODITY COMMANDS APPEAR GENERALLY ADEQUATE FOR DETERMINING CONTRACTOR'S RESPONSIBILITY.

SEE SLIDE #17

SLIDE #17

PRELIMINARY FINDINGS:

CPE DATA OF MINOR VALUE IN COST GROWTH STUDY

IMPACT OF CANCELLATION NEGLIGIBLE

CURRENT METHODS APPEAR GENERALLY ADEQUATE

ONE OF OUR NEWEST RESEARCH PROJECTS IS ON PROPOSAL EVALUATION METHODS. THE EVALUATION OF CONTRACTOR PROPOSALS IN NEGOTIATED PROCUREMENTS RANGES FROM RELATIVELY SIMPLE COMPETITIVE PRICE ANALYSES TO HIGHLY COMPLEX SOURCE SELECTION PROCEDURES. FOR THOSE PROCUREMENTS FOR WHICH THE AWARD DECISION IS TO BE MADE SOLELY ON THE BASIS OF PRICE COMPETITION BETWEEN RESPONSIBLE, RESPONSIVE CONTRACTORS, FULLY DEVELOPED SPECIFICATIONS AND THE PRUDENT APPLICATION OF ASPR PRICE ANALYSIS TECHNIQUES ARE NORMALLY SUFFICIENT TO ASSURE AWARD TO THE CONTRACTOR WHOSE PROPOSAL BEST MEETS THE MINIMUM NEEDS OF THE GOVERNMENT. FOR THOSE FEW PROCUREMENTS QUALIFYING FOR FORMAL SOURCE SELECTION PROCEDURES, THE COMPREHENSIVE ACTIONS REQUIRED SHOULD NORMALLY ASSURE AN AWARD TO THE CONTRACTOR WHOSE PROPOSAL BEST MEETS THE NEEDS OF THE GOVERNMENT. BETWEEN THESE EXTREMES, THERE ARE PROCUREMENT SITUATIONS WHICH CANNOT BE DETERMINED ON THE BASIS OF PRICE ALONE, BUT AT THE SAME TIME DO NOT QUALIFY FOR FORMAL SOURCE SELECTION TREATMENT. THERE DOES NOT EXIST A UNIFORM BODY OF POLICY, GUIDANCE, OR METHODOLOGY FOR USE BY THE ARMY COMMODITY COMMANDS IN HANDLING PROCUREMENTS FOR THESE MID-RANGE SITUATIONS. IT IS TO THIS SET OF PROCUREMENTS, WHERE AWARD IS TO BE MADE ON THE BASIS OF MULTIPLE EVALUATION

FACTORS, WITHOUT FORMAL SOURCE SELECTION. THE THIS STUDY IS DIRECTED

WE HAVE COMPLETED THE PROJECT DEFINITION PHASE OF THIS RESEARCH PROJECT, AND WILL COMMENCE FULL-FLEDGED RESEARCH, INCLUDING MODEL DEVELOPMENT AND DATA COLLECTION, AS SOON AS RESEARCHERS BECOME AVAILABLE FROM OTHER PROJECTS. THE INITIAL OBJECTIVES OF THE STUDY ARE SHOWN ON THE NEXT SLIDE.

(SEE SLIDE #15)

SLIDE #18

PROPOSAL EVALUATION METHODS

PURPOSE: INVESTIGATE THE NEED FOR AND DEVELOP AS REQUIRED SYSTEMATIC PROCEDURES FOR THE EVALUATION OF CONTRACTOR PROPOSALS IN COMPETITIVE PROCUREMENTS WHERE:

1. PRICE ALONE WILL NOT BE THE AWARD DETERMINATE, AND
2. THE PROCUREMENT IS BELOW THE THRESHOLD FOR FORMAL SOURCE SELECTION PROCEDURES

WE HOPE THAT THE RESEARCH AND DEVELOPMENT EFFORT WILL ENABLE US TO:

FIRST - ASSESS PROPOSAL EVALUATION TECHNIQUES CURRENTLY IN USE AND DETERMINE THEIR APPLICABILITY TO THE KINDS OF PROCUREMENTS BEING STUDIED HERE.

SECOND - DEVELOP PROCEDURES FOR CONSTRUCTING EVALUATION FACTORS AND CRITERIA WHICH ARE PERTINENT, CREDIBLE, ECONOMICAL, SIMPLE, AND VERIFIABLE.

THIRD - DEVELOP GUIDANCE FOR THE CONDUCT OF EVALUATIONS, INCLUDING ORGANIZATION, FUNCTIONS, RESOURCES, AND TIME.

FOURTH - DEVELOP METHODS OF RELATING THE EVALUATION PROCESS TO AWARD, INCLUDING REQUIREMENTS FOR CLOSE CORRESPONDENCE BETWEEN THE EVALUATION CRITERIA AND THE RFP, AND

FIFTH - DETERMINE THE RANGE OF APPLICATION OF EXISTING AND DEVELOPED METHODOLOGIES TO VARIOUS PROCUREMENT SITUATIONS WITHIN THE SET DEFINED IN THE STATEMENT OF THE PROBLEM ABOVE.

(SEE SLIDE #19)

SLIDE #19

PROPOSAL EVALUATION METHODS

OBJECTIVES:

1. EVALUATE CURRENT METHODS
2. DEVELOP EVALUATION FACTORS
3. DEVELOP EVALUATION PROCEDURES
4. DEVELOP PROCEDURES FOR RELATING EVALUATION PROCESS TO RFP
5. DETERMINE RANGE OF APPLICABILITY TO TECHNIQUES DEVELOPED

AS YOU ARE AWARE, I HAVE BEEN DISCUSSING ARMY PROCUREMENT RESEARCH PROJECTS. IT MUST BE EVIDENT, HOWEVER, THAT MANY OF THE PROBLEM AREAS WE HAVE ADDRESSED AND ARE NOW ADDRESSING ARE CERTAINLY NOT PECULIAR TO THE DEPARTMENT OF THE ARMY.

OUR STUDIES HAVE, IN FACT, ALREADY TAKEN US INEVITABLY INTO AIR FORCE AND NAVY ACTIVITIES ON NUMEROUS OCCASIONS. WE HOPE TO CONTINUE ENJOYING THE SAME WARM WELCOMES FROM OUR SISTER SERVICES WE HAVE BEEN ACCORDED IN THE PAST. IN RETURN, WE WILL CONTINUE TO FREELY DIVULGE THE RESULTS OF OUR INVESTIGATIONS.

AT THE RISK OF SOUNDING TRITE, THERE ARE PLENTY OF PROCUREMENT PROBLEMS TO GO AROUND. WE CAN ILL-AFFORD THE LUXURY OF DUPLICATING THE PROBLEM-SOLVING EFFORTS OF OTHERS. ONE WAY TO AVOID SUCH DUPLICATION IS FOR EACH SERVICE TO BE MADE, AND KEPT, AWARE OF THE OTHERS' ACTIVITIES. THIS MEETING PROMISES TO BE A GREAT STRIDE IN THAT DIRECTION. I LOOK FORWARD TO HEARING FROM THE ARMY'S COUNTERPARTS. THANK YOU.

TOPIC: NAVY PROCUREMENT RESEARCH

DR. MELVIN B. KLINE

Dr. Melvin B. Kline is a member of the faculty of the Naval Post Graduate School, Monterey, California. As a professor in the Department of Operations Research and Administrative Sciences, he is responsible for the development of its new Systems Acquisition Management curriculum.

Dr. Kline received his education from the City College of New York (B.S. in Physics), the Stevens Institute of Technology (M.S. in E.E.), and the University of California at Los Angeles (M. Engg. and Ph.D. in Engineering). He has worked as Project Manager for a study program for the Navy and has held the position of Lecturer at UCLA as well as instructor at UCLA.

RESEARCH IN PROCUREMENT AND PROCUREMENT EDUCATION AT THE NAVAL POSTGRADUATE SCHOOL

Melvin B. Kline
Professor of Management
Department of Operations Research
and Administrative Sciences

I am pleased to have been invited to participate in this symposium and to describe to you some of the research which is going on at the Naval Postgraduate School with respect to procurement and related areas. The research which we take on is limited to long-time as opposed to crisis or firedrill research. We do not undertake specific day-to-day operating problems. The research effort arises from discussions held with various Navy activities during which these activities suggest certain areas of interest in which they would like to have a long-term research solution. Members of our faculty also initiate discussions and proposals to prospective sponsors based on ideas generated by them in their areas of interest.

Procurement research at the Naval Postgraduate School is, at this stage of development, primarily exploratory in nature. Faculty and student work in this area supports, to some extent, the instruction in related subjects. Public service contributions are also taking place through faculty involvement in current procurement inquiries. For example, we have actively participated in support of the Congressional Commission on Government Procurement. Two members of our

faculty are part-time members of two of the commission's study groups--Cost and Pricing and Major System Acquisition. Specific problems of interest to the commission have been explored by students in term papers under faculty supervision.

Such papers are of help to the student to deepen his understanding of selected procurement problems, policies, and techniques. They are, on a selected basis, passed on to the study groups of the commission as background studies. Conversely, the experience with the commission is useful to enrich the courses at the Naval Postgraduate School (even though no specific materials are released by the commission at this time).

Among the papers which have been prepared are the following:

1. A "Should Cost" Concept for Procurement of R&D.
2. Requirements Contracting as an Improved Method of Handling Small Volume Purchases.
3. Planning Strategy for Contract Negotiation.

Some case material development is taking place to test and refine defense industry procurement cases used for instructional purposes at the Naval Postgraduate School. Some of these case materials are listed with the Intercollegiate Case Clearing House at Harvard University. At this point, the listing for this year includes a three-part procurement case, and one inventory management case.

The first of these is titled "The Silver Wing Aircraft Company." Part A concerns planning for follow-on procurement; Part B concerns planning and coordination of in-plant activities associated with the follow-on procurement; and Part C is concerned with materials cost analysis. The second case, Quality Fabricators, deals with the inventory management problem.

Several additional cases are under development. One of these, Monarch Manufacturing Company, is in final editing and deals with negotiation strategy - analysis of existing leverage factors. The others under development, presently untitled, deal with runway extension at an airfield - a case in construction procurement, and maintenance and repair versus replacement decisions.

Another effort at the Naval Postgraduate School is consultation for various Naval activities in areas related to procurement and acquisition management. One of these involves analysis of how the program management offices of the Navy and other DOD components are organized. Specifically, during the past year the Navy has designated two project offices within Navy laboratories. We are currently assisting one of these laboratories with respect to how they should organize their project management office, and in particular with regard to the carrying out of the procurement function.

Recent developments, such as the issuance of Defense Procurement Circulars 94 and 96 and the recommendations of the Industry Advisory Council (Fox Report) concerning profit computation and payment frequency, stand to improve the equity of profit measures by incorporating a weighting factor for return on capital investment. The whole gamut of considerations, such as escalation recovery, subcontractor payment, financial risk assessments, must be weighed and balanced against the new profit guidelines. The application of these factors further complicates the tasks of the project manager and contracting officer.

Under faculty supervision, several students are performing thesis research in the area of contract financing. In particular, their research will concern the financial impact of the interrelationships of progress payments, escalation, and return on capital investment as it applies to the defense shipbuilding industry. In the area of progress payments, they are investigating the applicability of an Air Force developed contract financing model to shipbuilding in conjunction with the Office of the Comptroller-Navy. In the area of return on investment, they are looking into the application of the work of Colonel Bruce Benefield from OASD (I&L). In the area of escalation, they are reviewing the most recent ASPR subcommittee study on escalation and how the shipbuilding escalation provision will relate to progress payments and return on investment.

In a related area of research, a member of the faculty is conducting a cost-benefit audit of a new inventory control system recently introduced at one of the Naval Air Rework Facilities. This audit is intended to measure whether introduction of the new system will result in increased benefits, decreased costs, or a combination of both. If the result is successful, the new system will be implemented at the other Naval Air Rework Facilities.

Another one of our faculty is engaged in research to develop mathematical functions relating industrial engineering methods of cost estimation (production function) to the accounting method of cost estimation (cost function).

Another activity at the Naval Postgraduate School, related to procurement, which I would like to describe to you is our recently instituted Systems Acquisition Management curriculum. The objective of this curriculum is to provide selected Naval officers with an advanced education in the fundamental concepts, methodology, and analytical techniques required for the life-cycle management of the planning and acquisition of defense systems. The students enroll in a six-quarter curriculum leading to the degree of Master of Science in Management, with a specialty in Systems Acquisition.

In addition to the typical management and related courses, the curriculum is system life cycle oriented. It emphasizes the "real world" through the use of case studies,

problem-sovling exercises, and seminars presented by experienced project managers and project management personnel from government and industry. The courses in the curriculum are integrated in the last three quarters through the use of a group thesis in which the students participate in a simulated project environment, solving a systems acquisition problem starting from conceptual studies and proceeding through system definition, development, and into production.

To assist us in bringing the real world into the classroom, a cooperative arrangement has been made with the Naval Material Command for an interchange of project personnel and our faculty. Currently, a contracting officer from the Naval Ship Systems Command is spending a year at the Postgraduate School and one of our faculty is about to spend six months in Washington, part of the time in a project office.

As part of this curriculum, the contracting officer on leave from NAVSHIPS has developed a new two-quarter sequence in procurement. The first course deals with procurement planning and negotiation, and the second one covers contract administration. He is currently teaching, on a pilot basis, the first course and will teach the second course next quarter.

I would like to tell you about an interesting new development currently going on in the first procurement course. The instructor has made an arrangement with one of the Navy's contractors to have them respond to an RFP with a proposal and then to conduct a mock negotiation. The students in the

class have been organized as a project office with each student playing different roles, sometimes more than one. For example, one of the students has been designated as the project manager, another as the contracting officer, another as technical director, and still another as logistics manager, and so on. Other roles called in at times include the Chief of Naval Material, the Chief of Naval Operations, one of the Naval Systems Commanders, and the OPNAV Program Coordinator. The students started out with a General Operational Requirement (GOR) and a Specific Operational Requirement (SOR). They developed and examined a number of laternative proposed approaches and prepared a Technical Development Plan (TDP), and an Advanced Procurement Plan (APP). They held role-playing conferences with submission of these documents to appropriate levels for approval, including the preparation of a Request for Authorization to Negotiate (RAN) and a Determination and Findings (D&F). They prepared a Development Concept Paper (DCP) and held a DSARC meeting with faculty members playing the various DOD roles.

The students are currently preparing the RFP for submission to the contractor. The contractor will respond to the RFP by suitably modifying an old proposal for a similar system. Then the negotiation will be conducted. I can report to you that the students are highly motivated and are putting in a significant number of hours on this game which is carried on in addition to the regular course lectures.

We hope to be able to continue this role-playing exercise next quarter during the contract administration phase in which problems such as engineering change proposals, changes in requirements, schedule delays, and other perturbing forces will come into play.

We are currently adapting the Defense Management Simulation exercise used at the Industrial College of the Armed Forces to our computer and hope to make use of it next quarter. We are also beginning to adapt the System X exercise used by the Defense Systems Management School at Fort Belvoir for use as the first of the group thesis problems. System X contains 30 individual life-cycle oriented exercises, approximately half of which use the computer. We hope to modify and embellish it with additional detail since we have more time in our curriculum to do so. For example, we shall investigate the possibility of expanding the System X exercise by the inclusion of the procurement exercise we are currently doing.

The Naval Ship Systems Command is currently experimenting with a ship acquisition management simulation model. This model traces the events which occur during ship construction in a shipyard. These are structured into a critical path network. The effect on ship construction schedule and the resultant cost of varying certain events in time or effort can be predicted including sensitivity analysis.

This model is currently being tested on two of the new ship construction programs. We hope to be able to use this model as an instruction tool in the Systems Acquisition Management curriculum.

In summary, as I indicated at the beginning of this paper, our procurement research efforts are at an early stage. All of the above mentioned items have been started during the past year. We hope to be able to report further progress and results of our research at some later symposium.

TOPIC: AIR FORCE PROCUREMENT RESEARCH

MAJOR DAVID N. BURT, USAF

Major David N. Burt is an Assistant Professor of Logistics Management assigned to the Graduate Education Division of the School of Systems and Logistics, Air Force Institute of Technology (AFIT). At AFIT, he is Course Director of the Procurement and Acquisition Management Course in the Graduate Logistics Management Program.

Major Burt received his education from the University of Colorado (B.A., Economics--cum laude), the University of Michigan (M.S., Industrial Administration), and Stanford University (Ph.D.). He has had eight years experience in government procurement from base to major command level. Two of his recently published articles are "Effect of the Number of Competitors on Cost" in The Journal of Purchasing and "How to Select and Compensate Your Next Architect-Engineer" in the Michigan Business Review.

PROCUREMENT AND ACQUISITION RESEARCH BY THE AIR FORCE INSTITUTE OF TECHNOLOGY

David N. Burt, Major, USAF
Assistant Professor of Logistics Management
School of Systems and Logistics

Our review of procurement and acquisition research conducted by the Air Force Institute of Technology will be in three parts: (1) faculty research, (2) thesis research, and (3) term papers.

Faculty Research

Several members of the AFIT faculty have accomplished their doctoral research in the area of procurement or acquisition. Here are three recent efforts:

1. Lt Colonel David Belden analyzed how well cost incentives worked across the broad spectrum of government contractors in his Ph.D. dissertation entitled: Defense Procurement Outcomes in the Incentive Contracting Environment, Stanford University, 1963.

2. Major Anthony F. Czajkowski developed a technique for selecting system and subsystem reliability and maintainability design goals in his dissertation, Reliability and Maintainability Analysis, University of Southern California, 1971.

3. Major David N. Burt analyzed the likely impact on cost, time and quality of alternative approaches to purchasing building construction in his dissertation, An Analysis of Alternative Methods of Purchasing Building Construction, Stanford University, 1971.

Thesis Research

At AFIT we have two resident programs which place emphasis on procurement and acquisition management at the masters level:

the Systems Management program within the School of Engineering and the Logistics Management program of the School of Systems and Logistics.

The following masters degree theses were completed by students in the Systems Management program:

1. An Examination of Recent Defense Contract Outcomes in the Incentive Environment. This thesis examines the actual contract outcomes of nearly 3,000 recent Air Force, Army, and Navy CPFF, CPIF, and FPI contracts. It concentrates on an examination of the results of using cost sharing provisions. The overall conclusion is that, in general, contractual incentives have not motivated contractors toward achieving increased control of their resources.

2. The Weapon System Acquisition Process: Systems Engineering, Technical Uncertainty and Development Strategy. This thesis offers a model of how to select development strategies and establish system life cycle boundaries. It concentrates on the relationships between systems engineering, identification of technical uncertainty, risk assessment and formulation of the strategy to reduce the technical uncertainties.

3. Role Definition in the Decision-Making Process of Weapon System Acquisition. The paper examines the role definitions in the various government groups involved. It observes that confusion exists as to the decision level within the organizations concerned, especially in the SPO, where decision-making authority is not commensurate with responsibility. It concludes that cost over-runs can be lessened by improving the role definition.

4. History and Analysis of the C-5A Program: An Application of the Total Package Procurement Concept. This work traces the development of the total package procurement concept and analyzes its application in the C-5A program. Using information from both written sources and interviews within the SPO, the study concludes that most of the problems of the C-5A program were not attributable to the total package procurement concept.

5. A Study of System Interfacing: A Case Description and Analysis of the AGM 69A/FB-111A Interface. This report gives a general background in the area of interfacing, including the types and areas of interfacing, and the types of problems encountered. The use of a case study of the interface between the AGM 69A and the FB-111A is made to illustrate problems and solutions for improvement of interface between components of weapons systems.

6. The Use of Escalation Clauses to Deal With Abnormal Fluctuations in the Economy. This paper investigates the current contract provisions (escalation clauses) for adjusting contract price and analyzes the various elements that should be considered and contained in them. A review of the clause used in the C-5A program is presented. It is concluded that present escalation agreements are inadequate and guidelines are suggested for construction of improved clauses.

7. Application of Progress Curves to Ballistic Missile Production Costs. This paper studies the curves in their various forms and illustrates the limitations of available data. Other considerations covered include possible alternative models, statistical limitations, locations of lot mid-points and the effects of engineering changes.

8. The Role of the Air Force Plant Representative Office in the Weapon System Acquisition Process. This treatise is concerned with the AFPRO's role in its relationships with the SPO. It concludes that most SPO personnel do not have a working understanding of the AFPRO role and are reluctant to delegate responsibility to the AFPRO. The paper also examines the distinct and the overlapping functions of both offices.

9. A Comparative Analysis of Systems Management Concepts Applied by Aerospace Companies to Their Commercial and Military Program. An investigation was made as to how the contractors are applying these concepts to both military and civilian programs. It was concluded that the aerospace industry is adopting a systems management approach to large commercial programs as well as military projects.

10. A Cost Function Based on Learning Theory. This paper attempts to integrate learning theory and economic theory. It uses an economic model and formulates a cost function with costs of production as a function of total volume of output and length of the time horizon of production. A calculus and a dynamic programming approach are used. Both approaches look upon time first as a discrete and then as a continuous variable.

11. An Analysis of First Unit Labor Costs for Fixed-Wing Aircraft. This paper examines the parameters for seven aircraft to find a method for estimating. Non-linear functions of weight and time were valid for estimates within 4% of actual values observed.

12. A Dual Industry Analysis to Give Perspective to Aerospace Defense Industry Profits. This paper examines and describes the operating environment of the Aerospace Defense Industry. It considers the aggregate industry profit levels achieved within this particular environment. To give added perspective to the study, a parallel examination of the public utility industry is accomplished.

Within the Graduate Logistics program we have two levels of procurement and acquisition research: theses and term papers.

Recently completed theses include:

1. An Analysis of the Relationships Between Individual Traits and Job Performance of Air Force Procurement Officers Assigned to the Aeronautical Systems Division. The authors ask: Is it possible to estimate the future performance of an individual on the basis of available information at the time of selection? The researchers developed their own rating systems to avoid problems with the halo effect present in effectiveness ratings. As a result of this effort, it was determined that relationships between an officer's performance and certain items of his biographical data such as type of degree, undergraduate major field of study, etc., can be statistically significant. The result of this effort indicate that a longetudinal study of personnel entering the procurement field has the potential of identifying performance predictors.

2. A Comparative Study of the Functional Relationship Between the Air Force Plant Representative Office and the System Program Office in Defense System Acquisition. The authors found that several steps have been taken to improve the understanding and coordination of interrelated System Program Office (SPO) - Air Force Plant Representative Office (AFPRO) functions, but significant problems still exist. Conclusions: (1) In general, the SPO-AFPRO functional relationship is sufficiently defined for successful program operations. (2) The memorandum of agreement should be an evolutionary document with chapters being added as the Program progresses. (3) Face-to-face contact between SPO and AFPRO functional counterparts is a definite prerequisite to effective program progression. (4) The SPO-AFPRO co-location principle warrants further research and evaluation.

3. The Economics of Managing Special Tooling and Special Test Equipment. The decision on when to dispose of special tooling and special test equipment obtained in conjunction with production of a defense system influences the net proceeds from disposal and the cost of managing the tooling and equipment. If we dispose on completion of the production, we receive approximately 10% of the acquisition cost of the items. However, we run the risk that we will have to pay for new equipment when we order spare and replacement material for the defense system and its subsystems. The authors obtained prices on material and equipment purchased for the F-100 and F-105 on a dual bid basis. Under this procedure, suppliers were requested to offer two prices for each item: One with GF tooling and test equipment and one without government furnished tooling and test equipment. The results showed a significant savings with GF tooling and test equipment. The authors then developed a model to allow the managers of tooling and test equipment to determine when to dispose of these items.

At the present, we have ten theses efforts in progress in the procurement and acquisition area:

1. Integrated Logistics Support Planning During the Conceptual Phase of the Air Force System Acquisition Process - The Interrelationship Between the Logistician and the Feasibility Study Contractor.

2. Inspecting and Receiving Contractor Data to Insure Proper Procurement of Future Spares and Replacement Items.

3. A Study of the F-15 Contract Structure and Its Contribution to Effective Program Management.

4. Department of Defense Control of Subcontractor Quality Control Programs.

5. An Overview of the Provisioning Process.

6. An Analysis of One-Step and Two-Step Advertising As Applied to the Acquisition of Family Housing.

7. A Study to Determine the Feasibility of Establishing 'Should Cost' as a Permanent AFPRO Function.

8. A Review and Analysis of Program Office Managers' Background and Training, Regarding Personnel as a Subsystem.

9. An Analysis of the Feasibility of Using Category II Test Results to Improve Provisioning Estimates.

10. A Study to Provide Criteria for the Establishment of a Base Level Procurement Management Information Control System.

In our course in Procurement and Acquisition Management we require the student to prepare a term paper dealing with procurement or acquisition management. Following are examples of recently completed term papers:

1. "Would Centralization of Material Management and Central Procurement for AFLC Result in Improved and More Economical Logistics Support?"

2. "Value Engineering"

3. "An Analysis of the Time Required for Procurement of a Class IV Modification Kit"

4. "Systems Management: An Investigation of Role Conflict Between Program Managers and Procuring Contracting Officers"

5. "Must DOD Funded Basic Research be DOD Oriented?"

6. "A Brief Evaluation of Air Force Concentration on a Supplier's Production Process in Lieu of End Item Inspection"

7. "Determination of How Information is Acquired, Stored, and Transmitted to the Support AMA on the Ultimate Manufacturer of Components of a Major System"

8. "Time Constraints on DCAA: Impact of Cost Allowability"

TOPIC:

STATUS OF DOD PROCUREMENT RESEARCH

JOHN M. MALLOY

Mr. John M. Malloy assumed his present position in the Office of the Secretary of Defense in April 1965. He is responsible for determining policy for and ensuring effective implementation of the purchasing program of the Department of Defense.

Mr. Malloy retired from the U.S. Navy in July 1963 with the rank of Captain after 22 years service. During his service in the Navy, Mr. Malloy had a variety of assignments in the procurement field including command of the Navy Purchasing Office in Washington, D.C. and Los Angeles, California. He was Chairman of the Armed Services Procurement Regulations Committee in the Office of the Secretary of Defense from 1958 to 1961.

Prior to being appointed Deputy Assistant Secretary of Defense for Procurement, Mr. Malloy was employed by North American Aviation, Inc., El Segundo, California.

Mr. Malloy graduated from Boston College in 1940 and Harvard Graduate School of Business Administration in 1947.

DOD PROCUREMENT IN THE SEVENTIES:

PROGRESS AND RESEARCH

J. M. Malloy
Deputy Assistant Secretary of Defense
(Procurement)

I am grateful for the opportunity to be here with you, to wind up your two days of what I have been assured were very fruitful discussions. The general theme of your symposium, "Procurement in the 70s: Progress and Research" -- and the specific subjects on your program, winding up with the subject of procurement research, are all very timely. I am well aware of the problems and challenges that procurement faces in the decade ahead. The idea of procurement research has been one which I have pushed for several years. I am convinced that a good program of procurement research will provide the answers to many of the challenges facing procurement.

Tonight, I would like to recap briefly some of the growing pains of procurement research in the Department of Defense, leading up to our present approach and then try to look down the road to some of the problems that are either upon us or just around the corner, that we may solve through procurement research.

The first step toward formal or structured procurement research was taken at the Defense Procurement Pricing Conference held in Hershey, Pennsylvania, in November 1967. Panels were formed to concentrate on various subjects. One of the

problems that Panel Three defined was:

> How can advanced business methods and techniques be evaluated and implemented on a uniform basis so as to progressively and effectively improve the pricing function?

From deliberations on this topic, the idea of a DOD Procurement Research Laboratory was conceived.

The Hershey Conference recommendation was in considerable detail, and envisioned a fairly good sized operation--a full time in house staff of approximately 40 people. The Center (at that time it was referred to as a Business Methods Research Center) would have conducted some wholesale level training (as opposed to operating level or "retail" training) in order to bridge the gap between policy makers and field operations; and it would have conducted studies, as a sort of in-house think tank.

There was further agreement on the concept of procurement research in February 1968 at the follow-up conference of top executives to review the Hershey proceedings. The recommendation for a Procurement Research Laboratory (the new name for the Business Methods Reserach Center) was considered among the ten most significant recommendations coming out of the Hershey Conference, and was chosen for further discussion at the top executive meeting.

On January 15, 1969, Secretary of Defense Clark Clifford, in his prepared statement regarding the 1970 Defense Budget and Defense Program proposed that a procurement research laboratory be established. Later, Chairman Chet Holifield of the

Committee on Government Operations submitted a report to the Speaker of the House of Representatives on December 10, 1970, which stated:

> "The rationale for Mr. Clifford's proposal, we surmise, is based on the consideration that so much of procurement research today is done essentially on a fast-reaction basis, in response to immediate problems, with short-term results. Innovations or improvements which do come about are not necessarily brought to the attention of other procuring activities. Similarly, improvements which may be developed in industry or in the academic world may be missed. Even where innovations see the light of day, there may be long delays before they are exploited by the Defense Department's many procuring activities or agencies. A procurement research laboratory in our opinion would:
>
> Identify and exploit new and significant business methods;
>
> Develop, test, and innovate procurement methods on a systematic and centralized basis;
>
> Effect coordination of such efforts within the Department of Defense;
>
> Test or simulate the impact of major new policies and procedures on government activities and industry prior to their issuance;
>
> And provide an in-house consulting and training capability to hasten the exploitation of significant developments."

Now, four years after the DOD top executive review of the Hershey Conference, we still don't have the kind of organization that was first proposed. Nor does it look as if we are likely to achieve that kind of formalized organization in the foreseeable future. As with any new program or idea, there are many hurdles and turns in the road between the acceptance of the concept and setting the actual program into operation.

This is particularly true of a program that requires additional funds and the full time commitment of scarce talented manpower. It is difficult to convince those who must put up those resources that the returns will be worth the investment.

So being selected as one of the more important Hershey recommendations, and getting the sympathetic ear of DOD top procurement officials and even Congressional support was not enough to guarantee a smooth path for the Procurement Research Laboratory idea.

The sentiment of the DOD group in February 1968 was captured by one Service official who stated that he understood the idea, thought it was a sound one, but questioned the ability of the Department to staff such a project. It was felt that "in-house" staffing would require, as he put it, "our good people" if the effort was to be successful. The statement "We are confronted with an order of priorities," seemed to reveal that while they were in favor of <u>someone</u> doing procurement research, if it would mean a sacrifice of current "doers" and specialists, it just would not be done. Much discussion surrounded this observation, with considerable time devoted to the proposition that other organizations be given the mission.

Several possible other organizations were discussed during the February meeting:

Logistics Management Institute
Rand Corporation
U.S. Air Force Academy
Industrial College of the Armed Forces
U.S. Air Force Institute of Technology

The tenor of the gathering was illustrated by Secretary Morris, when the time came to turn to the next subject on the agenda, by saying "...let's go back down to earth."

Later discussions with representatives of the military departments to solidify plans for a procurement research laboratory left them anything but solidified. The direction was clearly "go" but the responsibilities, were unclear. None of the services were willing to take on the job as Executive Agent for DOD. Both Army and Navy objected to establishment of a new organization. They suggested variously that LMI, the ASPR Committee, or OASD (I&L) could do the job. Personnel shortages and lack of funds were cited as reasons. The Air Force concurred in the concept and the idea of a new organization. It suggested the establishment of an Advisory Council and a Working Group, but expressed reservations over the limited manpower available to meet commitments. Secretary Morris discussed the proposal with Secretary Packard who endorsed the idea, and a decision was made to develop the research capability within LMI, as opposed to creating a new in house organization. When Mr. Shillito assumed the post of Assistant Secretary of Defense (I&L) in February 1969, he issued a memorandum to the Services, DDR&E, and ASD (Comptroller) proposing a plan to establish a "Special Research Capability

into the Procurement and Acquisition Process." His plan was for LMI to hire three to ten new project directors and to rotate defense personnel on a detail basis to perform the work under supervision of these LMI project personnel. He suggested that the addressees meet to discuss the plans and that the effort become operational by July 1, 1969.

LMI, as I am sure most of you already know, was set up in the early 1960s as a problem solving research kind of organization. DOD has no "think tank" comparable to those of the services. Neither did it have the quantity and quality of people available at OSD level to research many of the problems confronting it. One of the problems of giving this procurement research task to LMI was that it would have entailed some redirection of LMI as well as some restructuring of the original procurement research laboratory concept. Most of LMI's efforts was devoted to performing discrete tasks assigned to it by OSD or one of the military departments. It was not a "think factory" in the usual sense. This assignment would have made it one for this part of its effort, and at the same time would have resulted in a far less ambitious program than the original proponents at the Hershey Conference envisioned.

Other forces were at work which acted to forestall any specific action. One element in the situation was that DDR&E had some reservations about what was meant by "acquisition" as substituted for "procurement."

Secondly, the services had voiced their concern during the February 1968 meeting that qualified people were in short supply. These feelings were reinforced later in the year by memorandums in response to an inquiry from ASD (I&L). Such statements as:

> "... inappropriate due to current environment of fiscal and personnel stringencies."

"Manpower limited--can't commit any now"

seemed to sum up the problem preventing establishment of a PRL. The services could not be expected to push for establishment of a laboratory if they would be responsible to staff it.

Finally, the House Appropriations Committee chose this time to swing the axe at LMI and to insist upon contract reductions. The Committee recommended a reduction to about one-half the prior year's contract activity-- but settled for approximately a 10 percent reduction. LMI would need between $500,000 to $1,000,000 additional funds if they were to take on the establishment and operation of the laboratory. Needless to say, this killed the LMI approach.

Thus, the balance of 1969 and most of 1970 was a period of stagnation insofar as a formal Procurement Research Laboratory was concerned. Rather quitely, the Army proceeded to establish a "procurement research capability" at the Army Logistics Management Center, Fort Lee, Virginia. In early 1971, ASD (I&L) asked the Army to consider assuming executive managership of the activity for DOD. The Army responded that the capability it had established was designed to improve communications and problem solving within Army, and as such was

not geared to a DOD-wide operation. The Army recommended that each service establish a similar capability. This alternative was posed to Navy, Air Force, and DSA in July 1971. The Navy response indicated that it was establishing a procurement research type of capability at the Post Graduate School in Monterey, which it felt was geared to the Navy's needs. The Air Force objected to a formal laboratory or Center type of organization, and pointed to various research efforts at the Air Force Academy, here at AFIT, and within procurement staffs as its answer to its research needs. DSA favored the concept of a single DOD activity, in order to avoid duplication. In October 1971, Mr. Shillito advised all the departments that this function should be performed within the departments for the time being. However, he established a DOD Procurement Research Coordination Committee chaired by a member of my staff, to provide the capability for sharing information across departmental lines.

In retrospect, it appears that we have arrived indirectly at a point that we found almost impossible to reach directly. At least we are several rungs up the ladder. Whether individual effort by the services will fill the entire need originally envisioned for a formal Procurement Research Laboratory, remains to be seen. I think it is significant though, that we have identified procurement research capabilities which are going operations, and I like to think that their birth and growth has been nurtured, in part at least by our efforts to establish a DOD capability. For the foreseeable future, we want to capitalize on these service capabilities. We will use the DOD

Coordinating Committee as a means of keeping the communication channel open, avoiding unnecessary duplication, exchanging ideas and results, and perhaps assigning a particular problem on occasion to the agency best equipped to tackle it.

What Do We Look for in Procurement Research

Throughout all the discussions regarding the need for more efficiency and quality in procurement, there never seemed to be any argument about the fact that solutions would be found by research. Turning first, therefore, to a definition of this thing which was the only point of agreement in all discussions, we find:

> Research is a systematic approach which aims to define and to solve problems already known; or to explore areas projected into the unknown where problems have not become sufficiently crystallized to be defined. The approach is essentially that of the scientific method.

This simple definition underwrites the answer to the general concern for better procurement. Surely, the Defense Department managers who spend government monies are cognizant of a whole host of unique problems. They are provided with a formidable rule book designed to solve these problems in the Armed Services Procurement Regulation (ASPR). Why, then, one must ask, would these managers believe that it would be wise to spend a million dollars or more to research procurement problems? The answer apparently lies in the realization that the technology of virtually every other aspect of the Defense Department has undergone intensive research and has been updated as a result. Yet basic procurement methods have not undergone any significant changes since World War II.

Similarly, little organized effort is devoted to anticipating problems, and, through systematic research, devising meaningful answers that can be applied so as to effect lasting improvements. Most of the new procedures which have entered the ASPR System since its origination in 1948, have been reactionary procedures resulting directly from adverse criticism or from the need to solve an existing problem.

I feel fairly certain that the disciplines of operations research must be employed if Procurement Research is to accomplish any significant improvement in procurement operations. It is both an experimental science as well as an observational effort. People faced with complex problems seldom possess the ability to comprehend the many interacting factors required to solve them by other than consideration of a fraction of the alternatives available. Formal analysis serves to make the decision-maker aware of the right things in making a decision even though it may not be able to tell him precisely and specifically the thing to do.

Let us turn to the problems of procurement which need study. Would that I could come forth with an identification of all the problems that plague procurement and start a search for workable solutions! Just such an identification would be half the way or more toward solution. Ask anyone familiar with Defense procurement what the major problem is and immediately you would hear such familiar statements as:

"The type of contract we use."
"Specifications are not firm."
"Captive industry problems."
"Too many layers of supervision."
"Not enough concentration of authority."
"Too many changes."
"Inadequately qualified people."
"Policies too rigid."
"Insufficient guidance."
"Funding too late."
"No technical help."
"Too much competition."
"Laws are too vague."
"Not enough legal backing for actions."
"Training inadequate."

I submit that these are only symptoms and not causes. Each statement could probably be traced back to a "horror stody" that is remembered, without much thought as to how a change would affect the thousands of cases that are not remembered. Many of the symptoms are contradictions, yet indeed describe the same "horror case" reflecting the point of view of the person expressing his opinion--the procurement officer, the contractor, the auditor, the engineer, the General Accounting Office representative, a Congressman, a Senator, a private citizen or a newspaperman.

The Hershey Pricing Conference Panel which first recommended that the PRL be established compiled an impressive list of what were considered to be basic problems. Panel suggestions included:

1. Analyze the adequacy of defense profits and develop ways of utilizing the profit motive in the procurement process to motivate constructors toward greater industry investment and improved performance.

2. Develop an analytical model for estimating and predicting the amount of contractor overhead costs for use by contracting officers in pricing contractors' proposals.

3. Examine the contract change order process to develop improved methods of pricing and controlling changes.

4. Examine the risks imposed on contractors by the contractual method employed.

5. Examine the application of automated data processing techniques to:

a. Simulate the impact of proposed new major policy innovations on government and contractor activities.

b. Analyze contractor proposals in connection with prospective pricing of noncompetitive procurements.

c. Provide field level response for such things as capability of contractors, past performance, and cost and pricing histories on past contracts.

6. Examine the effectiveness of the data packages for reprocurement purposes in terms of possible changes in data policies to conform to industrial practices.

7. Examine in detail the elements of effort which in aggregate represent procurement and administrative leadtime with the objective of achieving major reductions.

8. Examine the impact of program and fiscal policies on procurement costs and the degree to which they contribute to placing cost type contracts and other types of open ended contractual arrangements.

Surely this is not an exhaustive list. But just think about one item--changes. Who sits here tonight feeling comfortable about prevailing techniques for pricing out changes? I, for one, feel pretty nervous and I would love to see some good original work down here.

It would be untrue to say that nothing in the way of research has been accomplished merely because the PRL was not formally established. Some outstanding examples have been discussed here in the past two days. The research leading to the PIECOST Concept is exactly what was envisioned by one of the items in the list I just mentioned. We now have some identified resources which can undertake at least some of what was contemplated by a central DOD Procurement Research Laboratory.

CONCLUSIONS

I am convinced that Procurement Research, if it is to be successful, must accomplish the following:

1. Avoid time-constrained, manual-producing operations, tuned more to output rather than to objective investigations.

2. Seek people who have the capability and interest to pursue the question at hand; encourage them to take the question to the "laboratory," staffed as it should be with experts who can aid in quantification, implication and manipulation; then insist that they carry the results into the real world for proof, by furnishing supervision of implementation.

3. Adopt policies to permit abandonment of projects which show no promise, with reassignment of personnel without a stigma of failure.

4. Measure the results of the Research itself by "tries" rather than "successes."

5. Scrutinize current procurement methods and develop possible measurement techniques for them first, rather than assume that untested new methods will be better than old methods.

6. Energize a technique of publicizing procurement successes and breakthroughs to educate procurement mangers, contractors and citizens on the complexities and problems in spending their tax dollars wisely.

Change is the inevitable future of any management activity, and procurement is no exception. The fact that change will occur should be recognized by management and the direction of that change carefully planned and executed. This will require management at all levels within DOD to realize the challenge and complexity of future change so as to guide them in the skillful execution of procurement. Procurement Research will be a great help in this respect by identifying and defining real problems and supplying real courses of action. But these new courses of action may very well be revolutionary and little understood by the managers who must authorize the final actions. There must be a realization that clear-cut objectives are needed if creative goals are to be achieved. Few objectives in procurement today are truly goals that the individual buyer

can accommodate with the constraints placed upon him. They resemble "motherhood" pronoucements followed by eloquent excuses as to why circumstances would not permit their achievement. More frequently than not, when the goals are achieved, immediate suspicion is registered that reports are rigged, that the manager didn't understand the problem, or the activity should be phased out because the job has become too easy.

Procurement Research promises an avenue for truly understanding and improving the government procurement process for everyone. Management must have matured to want it--must mature even more to accept and use it. I believe this will come about. The Army's PRO shows a promising avenue for continuity and intensive investigation. This combined with the less formal approaches of the other Departments should go a long way toward solving some of our long-standing problems.

The Procurement Research project has suffered to date because it is trying to create something new. I believe that the DOD procurement complex has the talent to do meaningful research.

There must be some central control for such an effort, since its mission is to serve the whole of DOD. The scattered and scarce talent must be encouraged to come forward. I look to the Procurement Research Coordinating Committee to provide a means, as it were, to assemble the scattered imagination and talent to the service and betterment of all.