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USAF MILITARY PERSONNEL COSTING:
PROBLEMS AND APPROACHES

By

H. Anthony Baran

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August 1977
Final Report for Period June 1973 – December 1976

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This is the second of two technical reports covering research undertaken in support of the objectives of Air Force Request for Personnel Research (RPR 72-7): to develop standardized costing techniques and standard cost data for Air Force military personnel. Reference: AFHRL-TR-74-106, AD-A013 171, *Air Force Human Resources Laboratory Military Personnel Costing Conference*.

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This report attempts to identify the most pressing Air Force military personnel costing problems and to specify the prerequisite needs of Air Force cost analysts in order to solve them. A survey was made to identify costing approaches and techniques to satisfy the needs. These were then examined to assess their utility in developing standardized costing techniques and standard cost parameters for Air Force military personnel. The examination revealed ways in which planned application restricts the choice of methods, and the existence of widespread disagreements concerning basic definitions and objectives.

A requirement does exist for the development of additional tools and techniques to improve the accuracy and comparability of personnel cost estimates within the Air Force. However, the Air Force appears to possess the

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essentials of an effective capability to resolve most of its military personnel costing problems. What is most lacking is a set of universally recognized standards for the collection and analysis of cost data such that individual user requirements are served, while maintaining the integrity of a standardized process.

The accounting approach, using the investment quantification method, seems best to meet the majority of USAF military personnel costing requirements. It is one of nine possible combinations of costing approach and technique cited which constitute the generic basis of most of those available for USAF implementation. Use of this approach would require a close examination of the possible ways to combine and structure cost elements in order to meet the dual objective of conforming to individual user requirements while achieving the benefits of standardization. The establishment of standard cost element structure tables for generic rather than specific applications should also be considered. These tables should be accompanied by standard definitions of cost elements and clear guidelines for the allocation of individual requirements into generic categories. Rigid guidelines should also be established which provide for the case wherein an individual user has a requirement to "fine tune" the cost estimate to achieve greater specificity.

USAF military personnel should be costed more in terms of the weapon systems they support. Rules should be developed to categorize them on the basis of whether they provide direct or indirect support, and personnel cost data defined which reflect personnel support requirements imposed by weapon system design and support plans. One possible approach is to develop functional relationships between personnel cost and the characteristics of weapon system design and support plans which drive personnel requirements.

USAF should avoid personnel costing methodology which balances investment against returns and be less hesitant to use relative as opposed to absolute cost estimates. Billet or job cost estimates may, in most instances, be substituted for the less easily obtained and more tenuous calculation of personnel life cycle cost. All personnel cost data packages should be accompanied by a means of quickly determining the consequences of their use in terms of comprehensiveness, accuracy, reliability, and underlying assumptions governing their applicability and the conduct of data collection pursuant to their development.

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SUMMARY

Problem

The need for the accurate cost assessment of Air Force military personnel has increased rapidly over the years. The general heightening of this need is reflected by the increasing number of uses to which military personnel cost data are being put in all phases of U.S. Department of Defense activity. Unfortunately, it is also reflected by a proliferation of dissimilar costing methodologies which often produce disparate results. There is a real and immediate need for standardization as well as accuracy in the costing of military personnel both within and across the Armed Forces. Standard cost parameters must be defined and standardized costing techniques must be established. Several years ago, the Navy was nominated by the Secretary of Defense as the lead service in this activity. However, the products which it developed are not sufficiently applicable to Air Force personnel to meet Air Force military personnel costing requirements. It, therefore, remains for the Air Force to establish standard cost parameters and standardized costing techniques for military personnel costing which fulfill its own requirements, yet retain the highest possible degree of compatibility with those of the other Armed Forces.

The objectives of this effort were to identify and examine outstanding problem areas within Air Force military personnel costing and to then ascertain what existent techniques and approaches would be most appropriate to their resolution.

Approach

In order to maintain the scope of the objectives and keep the effort to manageable proportions, military personnel costing problems were examined in terms of the types of personnel costing situations which give rise to them. This was done in an attempt to ascertain whether there existed a basis of commonality by means of which actions could be defined which addressed the broad spectrum of service-wide needs without becoming bogged down in the specifics of individual requirements. In this way, the extreme magnitude and diversification of military applications for personnel cost data and their attendant difficulties were rendered tractable. Prescriptions, aimed at the underlying causes of general problem areas, could then be made in a building block fashion to determine solutions to individual problems on a categorical rather than piecemeal basis.

In line with the above reasoning, a personnel costing conference was held which was comprised of representatives of various Air Force and Navy organizations involved in either the computation or use of personnel cost data (13). The objectives of the conference were to:

1. Explore and summarize the various existent concepts and practices of military personnel costing.
2. Identify the users of military personnel cost data and their present and projected uses for it.
3. Ascertain what has already been accomplished by others that would or could be adapted to satisfy the requirements identified.
4. Summarize the most pressing difficulties in military personnel costing.

The findings were supplemented by a review of military personnel costing literature, in order to transform Air Force problems into clearer statements of specific needs prerequisite to the alleviation of problem situations affecting the Air Force as a whole. A survey was then conducted of current personnel costing research and practices within both the military and industry to determine what techniques/approaches presently are available to satisfy the needs of Air Force personnel cost analysts. A screening process was applied to determine the applicability of each toward improving Air Force military personnel costing capability and functional effectiveness. The clear picture of basic needs and available means to satisfy them which was afforded by this research approach formed the basis for recommending steps which might be taken to improve Air Force military personnel costing.

Results and Conclusions

A requirement exists for the development of additional means to improve the accuracy and comparability of personnel cost estimates within the Air Force. However, it addresses policy and planning more than costing technology improvement. Significant improvements seem well within the reach of Air Force personnel cost analysts because the Air Force currently possesses the basic tools and capabilities

necessary to resolve most of its costing requirements, with little need for a major augumentation of technical capability. A major source of costing difficulty is the lack of universally recognized standards for the collection and analysis of cost data in such a way that individual requirements are served while maintaining the integrity of a standardized process.

Three basic approaches to personnel costing were determined to be acting as common denominators of the majority of variations to be found either in the military or industry. They are the Economic Approach, the Accounting Approach, and the Alternative Investment Approach. A similar determination was made with respect to the majority of existent personnel costing techniques. The three which form the basis of the many which are available are the Key Man Insurance Technique, the Causal-Intervening Variable Technique, and the Investment Quantification Technique. Each of these may be used to varying degrees within each of the three basic approaches to personnel costing cited earlier. The determinants of their use, as well as those of the basic approaches, do not appear to stem from differences in personnel utilization or differences in cost data availability across personnel types. Instead, the relevant factor which seems to predispose the cost analyst to a particular combination of approach/technique is the way in which the cost of personnel is defined. This conclusion is important to any attempt to improve Air Force costing capability because policy regarding personnel cost definition imposes severe restrictions on costing accuracy and reproducibility, as a function of the choice of methodology. Full recognition of this fact radically narrows the choice of methodology available to Air Force cost analysis, if current policy regarding the necessity of cost estimate reproducibility and objectivity is to remain unchanged.

While the concept of balancing a cost with a return on investment is extremely appealing from several standpoints, it does not appear to be a viable direction to take in attaching a dollar figure to military personnel. There are too many negative aspects arising from either a requirement for subjective analysis or probabilistic forecasting of personnel actions. The Accounting Approach, using the Investment Quantification Technique, seems best to meet the majority of USAF military personnel costing requirements. Use of this approach would require a close examination of the possible ways to combine and structure cost elements in order to meet the dual objective of conforming to individual user requirements while achieving the benefits of standardization. The establishment of standard cost element structure tables for generic rather than specific applications should also be considered. These tables should be accompanied by standard definitions of cost elements and clear guidelines for the allocation of individual requirements into generic categories. Rigid guidelines should also be established which provide for the case wherein an individual user has a requirement to "fine tune" the cost estimate to achieve greater specificity.

One of the major prerequisites to a substantial enhancement of Air Force military personnel costing capability which demands consideration is the establishment of clear and unambiguous means to define and mandate procedures, authenticate and implement data collection requirements, and adjudicate questions concerning cost apportionment. In addition, USAF military personnel should be costed more in terms of the weapon systems they support (79). Rules should be developed to categorize them on the basis of whether they provide direct or indirect support, and personnel cost data defined which reflect personnel support requirements imposed by weapon system design and support plans. One possible approach is to develop functional relationships between personnel cost and the characteristics of weapon system design and support plans which drive personnel requirements.

Billet or job cost estimates may, in most instances, be substituted for the less easily obtained and more tenuous calculation of personnel life cycle cost. Similarly, relative cost estimation can and should be used more often by USAF instead of absolute cost estimation. In all cases, cost data packages should be accompanied by a means of quickly determining the consequences of their use in terms of comprehensiveness, accuracy, reliability, and underlying assumptions governing their applicability and the conduct of data collection pursuant to their development.

PREFACE

This report contains the results of an effort to ascertain what available methodology, in the area of human resource cost assessment, is applicable to the satisfaction of Air Force military personnel costing requirements, and what requirements remain for the development of new methodology. Both military and civilian research have been taken into consideration. This is the second technical report covering research conducted in support of Air Force Request for Personnel Research (RPR 72-7) and technical need (TN-AFSC/AFHRL 0505-74-01) to develop standardized costing techniques and standard cost data for Air Force military personnel.

The first report (AFHRL-TR-74-106, *Air Force Human Resources Laboratory Military Personnel Costing Conference*) contains the proceedings of the subject conference. The conference was convened 2 and 3 May 1973 in order to obtain a compendium of expert opinions regarding the present and projected military personnel costing needs of the Air Force. Representatives from various organizations within Air Force Headquarters, Tactical Air Command, Air Force Systems Command, Air Force Logistics Command, Air Training Command, and the United States Navy Personnel Research Laboratory comprised the membership.

This report was prepared as part of an in-house work unit. The work is documented under account number 11240306, Development of Air Force Military Personnel Costing Techniques for Use in Weapons System Analysis. This work unit represents a portion of project 1124, Human Resources in Aerospace System Development and operations. When this report was initiated, Major Duncan L. Dieterly was Project Scientist. Dr. Ross L. Morgan served in that capacity for the completion of the report. The work unit scientist is Mr. H. Anthony Baran.

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TABLE OF CONTENTS

		Page
I.	Introduction	7
II.	Personnel Costing Techniques Available for USAF Implementation	9
	Civilian Sources	10
	The Economic Approach	11
	The Accounting Approach	12
	The Alternative Investment Approach	12
	Basic Techniques Within the Approaches	13
	Military Sources	16
	The Perception of Cost	16
	What is Being Accomplished	17
	Weaknesses in Specific Costing Areas	19
	On-the-Job Training (OJT)	20
	Medical Benefits	20
	Retirement	20
	Billet Costing	21
	Summary	21
III.	USAF Military Personnel Costing Problems	22
	Causes of Difficulty	23
	Problems of Calculation	24
	Problems of Standardization	25
	Problems of Implementation	27
	Summary	28
IV.	Prerequisites of Problem Resolution	29
	Cost Data Applications	29
	The Cost Analyst's Needs	30
	The Underlying Issues	31
	Summary	32
V.	Applicability of Available Methodology to USAF Military Personnel Costing Problems	33
	The Role of Perception of Personnel	33
	Determining Applicability	35
	Evaluation of Available Methodology	37
	Summary	39
VI.	Conclusions and Recommended Actions to Improve USAF Military Personnel Costing Capability	40
	Utility of Civilian Methodology	40
	Directions Toward Improvement	42
	Summary of Recommendations	45
	References	46

LIST OF TABLES

Table		Page
1	Summary of Civilian Personnel Costing	14
2	Summary of Differential Features of the Methodology	15
3	Comparison Table of Air Force and Civilian Personnel Costing	22

USAF MILITARY PERSONNEL COSTING: PROBLEMS AND APPROACHES

I. INTRODUCTION

The Air Force, along with the other Armed Forces, has in recent years been confronted by a number of hard economic realities which severely impact its methods of acquiring and maintaining an adequate defense force. Economic considerations affect almost every facet of military operations. The significance of their impact is demonstrated by the fact that cost constraints have led, not only to the reconfiguration of operational procedure but, also, to the establishment of operational priorities which embody long term consequences in terms of national defense capability.

The Air Force, in particular, has been forced to face an ever increasing necessity to evaluate its efficiency, not only in terms of operational capability but also, in terms of the cost to achieve it. The spiraling costs associated with the rapid technical obsolescence endemic to modern defense systems have never lacked recognition by those concerned with acquiring an adequate defense posture at minimum cost. What has, however, been becoming increasingly clear is the fact that the cost of acquiring updated weapon systems is progressively becoming overshadowed by the cost of procuring and sustaining the technically qualified personnel required to operate and maintain them (103). This and other recent economic developments have combined to produce a stringent requirement for the precise cost estimation of the human resource requirements of weapon systems. Furthermore, any process of estimation which is to be accurate and repeatable must be based upon known relationships and quantitative baselines. Thus, the cost estimation of weapon system human resources requirements dictates a corollary requirement for the standardization of methods and data bases.

Historically, the Armed Forces have been more concerned with the costs associated with hardware development and acquisition than with those stemming from the need to acquire and sustain a cadre of personnel for the purposes of weapon system operation and maintenance. A viable, if not totally valid, assumption which supported this emphasis on hardware costing was that military manpower could be regarded as a commodity easily acquired and relatively inexpensive to sustain. The systems acquisition posture which this assumption precipitated was not conducive to research into the accurate prediction of weapon system human resource requirements, much less the detailed cost of personnel. It contributed heavily to the present gap between the Armed Forces' ability to assess the cost of human as opposed to hardware resources.

Several years ago, recognition was accorded to the significance of the fact that weapon system ownership is an organic process requiring the expenditure of resources on a continuing basis. Known as life cycle costing, the concept of cost accounting on the basis of aggregate resource consumption throughout a system's entire life expectancy or period of utilization (71) began to receive attention. Initial applications of this approach to costing, even though methodology was not fully developed, indicated that weapon system ownership cost represented a sum considerably larger than the initial acquisition investment. Also indicated was the fact that personnel costs could be shown to consititute an awesome expenditure.

Although life cycle cost analysis held much promise in terms of its potential usefulness as a tool for performing detailed cost impact trade-off analyses for both weapon systems and personnel planning, real impetus for its further development and implementation was lacking. Due to the manner in which Congressional systems acquisition appropriations were enacted, the primary cost estimates which appeared to critically impact Congressional approval were those which addressed the acquisition phase of a weapon system's life cycle (100). Little or no real incentive was provided to the Armed Forces to develop methodology to accurately assess total system support costs. The cost of trained military personnel, essential to the operation and maintenance of the weapon system, remained an imprecise cost factor "tacked" onto the acquisition cost estimate. Naturally, there were other reasons involved; some attributable to the sheer difficulty of effecting accurate and comprehensive personnel cost estimates. However, the primary obstacle to their accomplishment can be traced to a way of doing business which obstensibly did not impose a pressing requirement for detailed personnel costing.

A somewhat analogous situation existed within industry. The economic climate simply did not support the treatment of human resources as a capital investment. Personnel considerations played more of a logistics than an economic role in managerial decision and policy making (85). When personnel costs were considered for planning purposes, estimates were usually confined to summations of ongoing cost incurrences attributable to salary and benefits paid by the company (43).

The situation described previously has changed dramatically (35). Modern economic conditions have fostered more comprehensive thinking, on the part of both the Armed Forces and industry, concerning personnel cost accounting and its importance to the conduct of their respective operations (61). A combination of rising costs, limited availability of and increased competition for resources, and a growing assertiveness on the part of budget controlling authorities in their demand for accurate and comprehensive cost estimation has forcefully imposed a requirement that personnel cost estimation be afforded consideration equal to that of hardware (34).

A review of the published literature on the subject supports the conclusion that useful methodology to perform personnel costing analysis is available and documented (80). The major problems confronting the military user lie, not in the development of new methodology but, in the proper adaptation and implementation of existent methodology to fulfill highly diversified requirements. Extensive research has been accomplished on the development of means to quantify personnel related items of expenditure which were previously unaccountable (70, 96, 25, 42, 49, 38). Advances have been made in record keeping procedures such that retrieval is more easily accomplished (32). In addition and perhaps of greatest significance, is the fact that increasing amounts of personnel cost data are available to cost analysts, even if in less than desirable forms. The recognition of the magnitude and relative importance of personnel costs has led to the more comprehensive recording of personnel cost data.

Given that adequate costing tools are available, it seems reasonable to question the apparent difficulty experienced by military personnel cost analysts. A major military personnel costing problem area concerns the repeatability of cost analyses and the comparability of results. However, this is not a true cost accounting problem but one which is created by the size and multi-faceted nature of the Military Establishment. It stems from the highly diversified interests and responsibilities within the military and the restricted access by each organization to cost data generated by other organizations. The present situation is that individual organizations within each of the Armed Forces use the cost data available to them to input to costing models which reflect their particular interests or responsibilities. Their goal is to produce cost assessments for their internal use. Disregarding the accuracy of these personalized cost analyses for their initial intended use, the real problem arises when higher level organizations attempt to aggregate individual assessments to calculate a more comprehensive cost figure for a different purpose. Sooner or later someone begins to wonder if anything was omitted or included more than once. Of course, a central costing authority could undertake the prodigious effort to calculate an inclusive cost figure from scratch as requirements arose. However, this would be a tremendous burden and would defeat what should be a primary objective of military personnel costing activity: the development of mutually exclusive cost sub-totals which can be aggregated at will in any fashion (13). The most apparent means to resolve this situation is to standardize all costing methodology and cost data parameters.

At this point it seems reasonable to question why this seemingly tenable problem area has not as yet been resolved. A fact not often recognized is that cost notation, in a fashion very similar to that of value notation, is an ascribed property of an object or service. It is not intrinsic to that with which it is associated but, is subjectively defined and assigned on the basis of derived relationships which hold meaning for the individual performing the cost analysis. (Reference is made to individual costing goals, bases for data inclusion, and the propensity to create costing definitions which are restricted in terms of their potential for broader utility.) In short, cost is defined and personnel are costed on the basis of how they are perceived. An example of this kind of situation is found when comparisons are made between the costing concepts of Air Training Command (ATC), Air Force Logistics Command (AFLC), and industry. Whereas ATC costs to a function (training), AFLC costs to an individual item to include personnel as a support requirement. Industry costs primarily to some measure of human performance potential. Each perception has a bearing on the final result. Costing compatibility suffers because different views concerning costing requirements usually

result in the establishment of individualized definitions, procedures and methodologies. Although not necessarily mutually exclusive, these are, more often than not, sufficiently different across potential users to severely degrade their usefulness outside of their original costing milieu.

The many seemingly very different definitions of cost and the many diverse applications for cost data reflect differing opinions concerning cost pertinence to the responsibility of the individual cost analyst. They do not represent varied approaches to the quantification of the same variable but, rather, attempts to quantify different variables which were defined on the basis of individually perceived needs. The notation of dollar cost, unlike that of dollar value, is highly amenable to objective evaluation. As such, one might reasonably expect a considerable degree of exactitude to be inherent in its calculation. However, the degree of objectivity and consequent exactitude which can be brought to bear in any individual case is limited by the discrete applicability of the dollar cost data available for use in the analysis. Considerable evidence points to the conclusion that no costing method available today possesses the capability to produce results which can serve all USAF costing purposes equally well; hence, the proliferation of individual costing practices, definitions, and tools which mark present day personnel costing activities.

It may be that the standardization of personnel costing techniques and cost data parameters will impose its own set of limitations on costing accuracy which may offset any advantages gained in increasing the comparability of dollar cost assessments. However, an examination of the overall military personnel costing situation leads to the conclusion, the above supposition not withstanding, that USAF military personnel costing requirements can be sufficiently partitioned to permit the establishment of a select set of costing standards which will not unduly restrict the accuracy of individual computations. The Navy, in its military personnel costing work, has followed this line of reasoning and developed workable procedures. Their absolute accuracy for varying purposes is open to question but, their contribution to the resolution of major personnel costing problems is undeniable. One of the major findings of both this research and that of the Navy which is of considerable significance is the fact that, while there are many equally good approaches which might be taken to effect the standardization of military personnel costing (5), the decision for implementation entails far more than the evaluation of costing techniques or cost data formats. It extends to the consideration of entirely new ways of doing business and allocating costing authority. Recognizing this fact, an attempt has been made in this report to view personnel costing within the military from a broad perspective which encompasses costing organization and policy, as well as procedure. This is necessary to the formulation of categorical costing prescription of relevance to the entire gamut of Air Force personnel costing needs.

II. PERSONNEL COSTING TECHNIQUES AVAILABLE FOR USAF IMPLEMENTATION

This section presents the results of a review of both military and civilian theory and practice in the costing of personnel. The review was undertaken in an attempt to gauge the current state-of-the-art in this activity. Coverage was not limited to personnel costing programs already implemented. It also drew upon the academic and consulting communities for theoretical concepts under development. While the primary purpose of the effort was to ascertain what might be available which could be used to improve Air Force military personnel costing, of equal importance was the accomplishment of a learning process. This would provide a broad background knowledge of personnel costing information which could be brought to bear on the causational problems which underlie many of the difficulties experienced by the Air Force in costing its personnel.

Explanation is in order for the way in which the review was undertaken and will now be reported. There is an unwieldy host of applications for personnel cost data within the Air Force, not to mention the other Armed Forces or industry. While these may be categorized (and to some extent are, later in the report), they are too numerous to be dealt with individually. It was also felt that doing so would serve no meaningful purpose at this time. In order to derive indicants of fruitful avenues leading to solutions of overall Air Force personnel costing problems, groundwork must be laid for effecting comparisons capable of yielding generalizable relationships. These are what is needed to establish a basis for recommending the adoption of costing practices by the Air Force.

Most personnel costing activity is directed at some kind of trade-off. This is true whether it is carried out within industry or the military. These trade-offs invariably involve operational

effectiveness, equipment, personnel, or some combination thereof. The range of decisions incorporating personnel cost as a factor extends from policy establishment at command levels, involving total force complement, to lower echelon evaluations of behavior or design. They can be detailed ad infinitum, along with the methods they employ, without revealing certain important factors which determine the appropriateness of a particular method to a particular costing purpose.

Even a cursory examination of civilian and military personnel costing practices will make manifestly clear the fact that each operates under a different set of percepts concerning people and their organizational roles. While the purposes of each may appear to be similar, they are not. Different precepts and circumstances are at work which subtly color their respective costing objectives and, thereby, the costing procedures employed. (To some extent, the above is also true across Armed Forces, as well as across the private and military sectors of the economy). In order to determine generalizable relationships capable of linking purpose to appropriate procedure, costing theory and practice must be examined in a fashion which goes beyond specific application to generalizable aspects of costing procedure capable of being linked to common denominators of purpose.

The following description of civilian and military personnel costing practices and theory has been structured according to the above rationale. Emphasis is accorded to the "why," as well as the "how" of current activity. It reflects a distillation of costing goals and fundamental avenues in use to attain them rather than a listing of personnel cost applications and specific procedures. One can readily observe that, although the paths of civilian and military personnel costing are divergent, each is marked by significant achievements. It is equally clear however that, while there are lessons which each can learn from the other, there are no free and ready answers available from one to immediately solve the problems of the other.

Civilian Sources

There are three basic approaches to personnel costing to be found within civilian personnel costing activities. They are: (a) the Economic Approach, (b) the Accounting Approach, and (c) the Alternative Investment Approach. The Economic Approach states that the value of an asset is related to the discounted net future revenues produced by the asset; i.e., the present worth of the asset's expected service. The Accounting Approach states that the book value of an asset is determined by its historical cost, adjusted in a manner consistent with agreed upon rules for depreciation. The Alternative Investment Approach states that the value of an asset may be calculated in terms of the value, which could be realized if all investments in the asset were applied to an alternative investment or purpose.

Within the three basic approaches there are three basic techniques for ascribing cost or value. They are: (a) the Key Man Insurance Technique, (b) the Causal-Intervening Variable Technique, and (c) the Investment Quantification Technique. The Key Man Insurance Technique consists of appraising: (a) the present value of earnings lost by the company as a result of the loss of the resource, (b) the cost of the outside replacement, and (c) the loss of profits attributable to the loss of the managerial efforts of the resource. As the name implies, this is a technique which was developed by the insurance industry. The Causal-Intervening Variable Technique appraises the internal state and health of the organization of which the human resource is a part. Included are variables such as: loyalties, attitudes, motivation, performance, goals, perception of organizational members, and the collective capacity for effective interaction, communication, and decision making. The Investment Quantification Technique addresses itself to the assessment of all expenditures made to acquire the resource and bring it to its operational performance level. It considers cost associated with such things as: recruiting and acquisition, formal training, familiarization and on-the-job training, experience, and resource development.

The diversification of specific procedures which one envisions, when considering the multitude of applications for personnel costing, is not to be found at the two levels of methodology described previously (approach and technique). It is to be found within the next lower level which deals with the procedures by means of which cost elements and data elements are aggregated and manipulated. This is the area wherein the cost analyst has the opportunity to exercise a good deal of prerogative in choosing specific procedures to fulfill the requirements of his assignment within the limits imposed by the data with which he must work. An analogy may be drawn between the three levels of methodology within civilian personnel costing and the three major aspects of the conduct of a research study: (a) defining the objectives, (b) selecting the variables to be examined, and (c) choosing the statistical analysis procedure to

manipulate the variables. It is at the third level of personnel costing methodology that the cost analyst faces the questions of what costs to include, what factors to incorporate in the calculations, and what formats to use for the presentation of results.

The three basic approaches, which together comprise the highest level of personnel costing methodology, may be undertaken on the basis of value, dollar cost, or some combination of both. The consensus of opinion within the civilian economy seems to be that investment expenditure does not completely equate to the contribution which human resources make to the organization of which they are a part. For this reason, almost all of the effort expended by civilian researchers has been directed toward the development of means to assess human resource value in terms of variables which can, in turn, be related to monetary notation. Indeed, it is found that two of the three techniques which form the basis for the repertoire of the second level of personnel costing methodology are addressed to value rather than monetary notation. Of the three, only the Investment Quantification Technique deals directly with dollar cost. Two of the three basic approaches themselves, although seemingly dealing directly with dollar notation in terms of investment and return, are really doing so in name only. The Economic Approach and the Alternative Investment Approach both rely upon the intermediate variable of productivity and often highly subjective methods to extrapolate dollar cost from it. Only the Accounting Approach directly addresses the task of placing a dollar cost on human resources. The following paragraphs will examine more closely the basic human resource accounting approaches and the basic techniques employed within them.

Most assuredly, there exist more than three approaches and three techniques for personnel costing within industry. Those described represent the core from which are drawn innumerable variations and combinations of personnel costing practices. Probably the most important question which must be answered before any attempts are made to apply civilian personnel costing methodology to Air Force personnel is: "Do we want to include value assessment as a military personnel cost component?" If the answer is "no," then civilian personnel costing technology has little to offer to military personnel cost analysts other than that which is already available to them.

The Economic Approach

The Economic Approach is really an approach to an analysis of the value of personnel rather than an analysis of their cost. It is predicated upon a principle which states that an individual's worth to an organization should be conceptualized and measured as the present worth of his expected services, less the costs incurred by the organization in acquiring, developing, maintaining, and utilizing his services over the time span of his career. In actuality, this assessment reflects more than that which is solely attributable to the individual. Results are confounded by factors which are a consequence of the internal state of the organization. More precisely, the sum total of an individual's expected future service to an organization is not only a product of his own efforts. It is affected by the propensity of the organization to either facilitate or hinder the realization of his full potential. Difficulties within this approach are not confined to the confounding of variables. They include: the derivation of an assessment of individual contributions in group activities, the forecasting of prices associated with the individual's future services, the forecasting of the service mix within the organization, and the selection of an appropriate discount rate. It should be remembered that several of these difficulties constitute problems which are currently being addressed within the Air Force with negligible success.

Within the Economic Approach there exist several ways to interpret the current worth or value of personnel assets when establishing the baseline from which to project their future value. Three of them represent the entire spectrum of possible interpretations. The first considers the current value of an asset in terms of the outlay costs which were expended to acquire it and bring it to its current state. These costs are the monetary outlays which were actually made to obtain, maintain, and develop the asset. The second considers the current value of an asset in terms of the replacement costs which the organization will be obliged to incur in order to replace it, in the event that its services are lost to the organization. This interpretation of present value provides a more realistic estimate, since it takes into account the realities of changing market values and fluctuations in the cost of living and the economy as a whole. It does, however, entail an added difficulty, in that it must include judgemental assumptions concerning the availability of specific

types of personnel at a given time. The third considers the current value of an asset in terms of the present rate at which profit, directly attributable to the asset, is accruing to the organization. Clearly, each of these interpretations of an asset's present value are differentially suitable across personnel types. Not surprisingly, organizations are often found to base their calculations of an asset's present worth on combinations of the aforementioned interpretations, as well as combinations of the three basic techniques for costing it.

The Accounting Approach

The Accounting Approach attempts to eliminate value judgements by assessing known dollar costs of actions taken by the organization in behalf and as a direct result of personnel. Its interpretation of the current value of a personnel asset is the total of the organization's expenditures which can be directly traced to it. The procedures within this approach are very similar to those used in developing a subset of the calculations involved in the Economic Approach. The major difference between it and either the Economic or the Alternative Investment Approach is that it is solely based on historical data. In its simplest form, no attempts are made to project the cost consequences of personnel actions or individual productivity. In its more complex forms, it attempts to take into account the past efforts of the individual in behalf of the organization. In doing so, intermediate variables are identified which can be used to convert the efforts of the individual into monetary notation. Thus, organizational expenses can be offset by organizational gains which accrue from the same source. Unlike the Economic Approach, little or no effort is made to interpret value in terms of future expectancy. Statistical projections are encountered but, they are usually employed in predicting trends within the factors which account for personnel expenditures, as opposed to the prediction of individual performance or the future revenues attributable to the individual.

Although the calculation of future costs attributable to personnel are avoided in this approach, the interpretations of worth and its measure may be categorically represented by two of those found in the description of the Economic Approach. These are: (a) the current monetary worth of an individual in terms of what the organization has invested in him to-date, and (b) an individual's monetary worth in terms of what it would cost the organization to replace him. Included in both of the above are costs associated with: recruiting, acquisition, formal and informal training, familiarization with organization function and policy, on-the-job training, and the enhancement of capability beyond the requirements of the present position held by the individual, for the purposes of advancement at some future date. This approach also embodies accounting techniques which are addressed to monetary investment, as well as to strict cost accounting. Within it, one finds the application of concepts such as amortization and investment obsolescence. The defining of rules by means of which to apply such concepts may be thought of as the lowest level of methodology within this approach to personnel costing. It is at that level where subjectivity tends to replace objectivity and the individual cost analyst is free to pursue his own goals. This is perhaps the weakest aspect of the approach. Of the three, the accounting approach is the only one which avoids value notation and intermediate variables in favor of the use of personnel factors which can be directly expressed in monetary notation. The inherent objectivity of this notation can easily be weakened, however, by a failure to properly consider the basic differences between man and machine when applying concepts which assume a fixed deterioration over time in the quality of human resources.

The Alternative Investment Approach

The Alternative Investment Approach is based on the premise that human resources, either as individuals or a group, might be of increased value to the organization if they were to be applied to a purpose other than their current assignment. A corollary of this premise is that the revenue invested in a particular type of personnel might produce a greater return if it were invested in some other type of personnel or in an entirely different way. This idea stems from what economists call the concept of opportunity cost. They define it as being the difference between the return on a present investment and that from an alternative investment with the highest possible yield. Simply stated, it is the potential value which is lost by not applying a resource to the most profitable alternative use foregone because of its present application.

One of the numerous difficulties in carrying out this approach is deciding upon the most lucrative alternative utilization of personnel. The procedures which it entails are extremely subjective. They involve, not only the projection of individual proficiency across jobs but also, the assessment of investment returns on an individual

basis without the support of historical data. These and other difficulties combine to make this approach unattractive to most personnel cost analysts, with the exception of those engaged in the performance of man versus machine trade-offs. However, when human performance parameters can be clearly defined and directly associated with cost and profit, this approach is tenable.

In the majority of cases, the accurate prediction of future contributions and costs in both current and alternative applications of an asset is extremely difficult. Selection of the Alternative Investment Approach necessitates a high degree of dependence upon the use of trend analysis. Actually, the comparison of trends within the variables that define the current and alternative investment constitutes a second mode in which this approach can be applied. Although a departure from the ideal, wherein absolute costs may be compared, the comparison of trends and relative variations in the growth and decline of potential alternative investment returns may afford useful information in guiding future investments in a particular asset. However, severe limitations would be imposed upon the ability of the analyst to extrapolate from his findings the kind of generalizations which would be most useful in guiding the establishment of organizational policy. The Alternative Investment Approach makes use of the same three interpretations of human resource monetary worth and its measure, as does the economic approach. It is, in fact, an expansion of the economic approach to include completely hypothetical situations. Like the economic approach, it can be utilized in two ways: to justify or assess the advisability or past expenditures of resources; and to guide the future expenditure of resources.

Basic Techniques Within the Approaches

Earlier in this section, three basic techniques for ascribing cost were briefly described. They are: (a) the Key Man Insurance Technique, (b) the Causal-Intervening Variable Technique, and (c) the Investment Quantification Technique. All three of them may be applied within any of the three basic approaches to personnel costing which have been discussed. Within each of them are numerous alternatives for defining and imputing cost accruing actions of an organization on the part of its individual members, and cost assessable benefits to the organization attributable to its individual members.

The Key Man Insurance Technique, as its name implies, was developed by the insurance industry. It is primarily designed to quantify the worth of an individual to an organization in terms of what it would mean to the organization if the services of that person were to be lost to it. It employs a straightforward calculation of the cost to replace the individual and a summation of the dollar value of the individual's past service to the organization. The latter figure, positing certain specified business trends, is used to project revenue which the employee may reasonably be expected to accrue to the organization as a direct result of his actions. The former figure is used as a balance against the employee's expected value to the organization in order to achieve a figure which reflects his current net value. Details of this technique are essentially described within the Economic Approach Discussion. The point to be made is that this technique is of real use only under circumstances where the products of an individual's efforts can be accurately quantified. In the case of the insurance industry, the products of the individual can be directly translated into the dollar value of sales; at least for the position of sales representative which is by far the most common job category in that industry. The evaluation of managerial personnel becomes more involved because the products of managerial talent are less readily demonstrable and therefore less quantifiable.

The Causal-Intervening Variable Technique attempts to do more than associate a quantitative value estimate with personnel. It also is capable of providing information to guide the formation of organizational policy to maximize the value of personnel to the organization (42). Using principles of social psychology, it attempts to relate personnel and organization characteristics to personnel behavior; and that, in turn, to the products of the personnel in behalf of the organization (64, 65). These products are then expressed in terms of whatever quantitative criterion measure is desirable; e.g., sales, production count, dollar returns. Clearly, it is a technique more adapted to prediction and control than historical documentation.

Causal variables are defined in two categories: (a) managerial behavior, and (b) organizational structure. Artifacts of these, such as goal emphasis, work facilitation, reward system, and subordinate-manager communication, are said to cause changes in those things defined as intervening variables. Intervening variables are defined as such things as:

perception of organizational and personal goals, openness in communication, motivation, decision making. They are thought to affect end-result variables. These are defined as: health, job satisfaction, productivity, and financial performance. The mechanism of control or optimization is the manipulation of those independent causal variables that can be purposively changed by the organization and which determine the course of development within it. The principal drawback to the use of this technique is that the quantification of such relationships is exceedingly more difficult than their identification.

The Investment Quantification Technique is almost self-explanatory. Its implementation consists of little more than the straightforward aggregation of all expenses which an organization has incurred in order to bring its members to their present state within the organization. It does not attempt to balance past expenditures against future returns on the investment, nor does it involve the use of special accounting procedures to facilitate the making of a value judgement concerning the benefit or loss due to the investment. Its primary applications are in the calculation of personnel replacement cost and in the calculation of historical expenditures. These are accomplished exclusive of any consideration of possible secondary effects to the organization as a result of the loss of the personnel. Given that accurate records of direct expenditure are available, the main difficulty involved in the use of this technique lies in the apportioning of expenditures which are incurred on other than an individual basis, or as an indirect consequence of the personnel.

The foregoing review of the trends in personnel costing within the civilian sector of the economy is not exhaustive. Additional approaches and technqiues do exist. However, they represent combinations and mutations of those described. Even they themselves are not mutually exclusive. Table 1 reviews the six basic personnel costing approaches and techniques, and highlights their primary applications and costing objectives. Table 2 summarizes some of the characteristic features which differentiate them.

Table 1. **Summary of Civilian Personnel Costing**

Basic Approaches to Personnel Costing
Economic Approach – establishes net value of difference between investment and returns.
Primary Use: to analyze value rather than cost of personnel in terms of a comparison of investment to returns.
Accounting Approach – establishes gross value in terms of investment cost
Primary Use: to assess dollar cost of organizational actions in behalf of the individual
Alternative Investment Approach – establishes net value in terms of comparative yield on investment
Primary Use: to assess the yield of an investment in personnel in terms of a comparison with alternatives
Basic Techniques for Ascribing Cost or Value (Useable in any approach listed)
Key Man Insurance Technique – appraises net value in terms of loss to organization if individual were to be removed.
Primary Use: when organizational product can be tied to the efforts of an individual
Causal-Intervening Variable Technique – appraises the internal state and health of the organization attributable to the individual in terms of variables which link it to the presence of the individual
Primary Use: when organizational product cannot be tied to the efforts of an individual
Investment Quantification Technique – appraises the gross value of an individual in terms of the acquisition, transformation, and sustenance costs expended on his behalf
Primary Use: when organizational product cannot be tied to the efforts of an individual and/or the individual's contribution to the organizational effort cannot be directly quantified in terms of cost compatible variables.

Table 2. **Summary of Differential Features of the Methodology**

	Accounting Approach	Economic Approach	Alternative Investment Approach
Investment Quantification Technique	Quantifies recorded investment expenditures. Does not consider returns or alternatives. No requirements for projections of personnel productivity, behavior, or career progression. Very objective.	Quantifies net worth by balancing investment expenditure with dollar notation of returns. Requires productivity and career projections, and means to translate investimate benefit into dollar notation. Subjective and difficult to validate, depending upon product of personnel.	Quantifies difference between investments either in terms of expenditure or net worth. See Accounting Approach and Economic Approach cells of this row for features of each choice. Requires detailed knowledge of investment alternative.
Key Man Insurance Technique (Almost a limited subset of the investment quantification technique.)	Similar to above cell but, addresses the quantification of recorded investment expenditures for an individual rather than a personnel type or group. Requires record keeping on an individual basis.	Similar to above cell but, addresses the quantification of the net worth of an individual rather than a personnel type or group. Requires record keeping on an individual basis.	Similar to above cell but, addresses the quantification of differences between investments in individuals rather than personnel types or groups. Requires record keeping on an individual basis.
Causal-Intervening Variable Technique	Similar to above cells. Uses additional variables, requiring subjective measurement, which are difficult to link to investment cost; e.g., personal adaptability. Usually applied to managerial personnel. Very subjective and difficult to validate.	Similar to above cells, but includes subjectively measured variables related to group dynamics and individual behavior. Attempts to tie net worth to attributes other than direct productivity; e.g., leadership qualities. Very subjective and difficult to validate.	Similar to above cells but, is much more subjective and difficult to validate because it employs additional variables requiring subjective measurement concerning both the actual and alternative investment.

Note. — Difficulty of Implementation increases from left to right and top to bottom of matrix.

Military Sources

Personnel costing in the military is decidedly different from that in the civilian sector of the economy. This is due, in part, to the manner in which the military views the role of human resources in its activities. It also reflects the restrictions imposed by the conduct of "business" on an extremely dynamic basis with the obligation to accommodate conditions which are often totally incompatible with accurate cost assessment at the individual level (6, 15). Because the military operates in an environment wherein a short to medium term flow of personnel is the norm rather than the exception, cost incurrence has been accepted on the basis of averages. This was necessitated by requirements of capacity extension and contingency preparedness not to be found in industry. The unique size, scope of operational responsibility, and flexible response requirements which characterize the military have also contributed to the adoption of personnel costing methodology which appears relatively unsophisticated when compared to that which industry either has or is attempting to implement. However, a strong need is now being felt to capture some of the costing nuances afforded by the more individual oriented costing procedures of the civilian economy.

The Perception of Cost

Historically, military personnel have been treated as a consumable resource rather than as the object of an investment possessing the potential to produce dividends. This outlook is evolving into one which incorporates greater concern for the advantages to be gained by applying a more sophisticated set of economic guidelines for investment procedures concerning human resources (48). Recent monetary constraints have precipitated a need for means to evaluate the relative merits of military personnel investments. However, its fulfillment has been blocked because the employment of investment guidelines based on economic considerations are dependent upon a more thorough knowledge of the behavioral aspects of human performance than is currently available with respect to military personnel.

Although military personnel are, indeed, a consumable item in terms of their constant flow through the service, their characteristics and potential are not as easily identified and quantified as are those of other consumables. Unlike inanimate objects, they possess an extremely variable potential to produce returns or benefit for any monetary expenditure made in their behalf. Furthermore, the degree of benefit or monetary return is quite often more an artifact of the characteristics of individual personnel than of any economic circumstances surrounding the investment. This variability and the difficulty involved in defining economic benefit to be derived from personnel investments, not to mention the problem of accurately projecting and quantifying it, have led to an almost total avoidance by military personnel cost analysts of techniques entailing considerations of economic worth (17, 18, 80, 99). The desire exists within the military to make use of personnel costing methodology which can directly provide indices of personnel cost effectiveness. However, the problems entailed in accurate investment cost attribution, long term human performance prediction, and the quantification of investment returns have combined to hinder its development.

A review of the military personnel costing practices currently in use reveals little more than various adaptations of what has been described previously as the accounting approach to personnel costing (17, 41, 62, 18, 96). The concept of economic value seems to be, with one exception which will be described, assiduously avoided. What is taken into account, for the most part, are those costs which can be directly attributed to the acquisition, training, and sustenance of military personnel (7, 8, 10, 16, 26, 27, 28, 29, 31, 97, 99). The variability encountered when examining the many procedures currently in use does not stem from the application of different approaches to personnel costing, as is the case in civilian personnel costing activities. It is more a result of differing costing objectives than of dissimilar costing concepts. The origin of methods used for individual purposes can invariably be traced to the investment quantification technique described in the civilian personnel costing subsection. Differences in the performance of calculations can be ascribed to data availability and individual viewpoints concerning: the definition of individual cost elements and the decision of which among them to include in a particular calculation.

Military personnel costing activity, across the Armed Forces, is conducted along two fundamental lines of thought: (a) the costing of the man, and (b) the costing of the job which the man performs. Until recently, it centered upon the individual. This was true even though most analysts recognized the fact that, within the

military, the costing of personnel on an individual basis has, with few exceptions, little or no value. Its primary utility lies in its usefulness in providing a means to assess large scale alternatives regarding systems and total force policy. Impetus for the costing of individuals appears to have stemmed from certain high burner cost items; such as the training of pilots. Pressure increased to expand that relatively successful task to other personnel types to include many more cost items than training. When this was attempted, it became increasingly apparent that many of the expenditures made by the service in behalf of its members either could not be accurately quantified or could not be objectively attributed to specific individuals. The result was the acceptance of so-called cost planning factors for personnel types. These are comprised of primary costs averaged across personnel and represent, at best, gross approximation of what is actually spent on personnel. The size and complexity of each service and the relatively low visibility of individual productivity, as compared to that within private industry, served to prohibit the use of economic methodology to assess the effectiveness of personnel cost investments.

Attempts to approach the costing of personnel by examining the costs associated with the job they perform clearly provide inroads toward eliminating many of the vagaries associated with the prediction of individual patterns of behavior and career progression. What they substituted were clearly defined patterns of mean career progression and a basic list of averaged costs which may be directly associated with each career plateau. Naturally, some highly restrictive assumptions were made (17, 30). This is probably the most radical departure from the concept of the economic value analysis of individual performance to be found in the military. Yet, it seems to provide a useable tool in the performance of economic trade-offs involving personnel. It also represents how far apart some military thinking is from that of industry concerning the costing of personnel.

Within these two lines of thought, there are five basic types of personnel cost aggregations: (a) acquisition cost, (b) training cost, (c) sustenance cost, (d) separation cost, and (e) life cycle cost. The primary reason for these breakouts is the desire within the military to assess costs, wherever possible, on the basis of weapon systems or specific force capability. The compilation of acquisition costs is a relatively straightforward procedure. It consists of summating all expenditures made to recruit and induct the person into the service. The compilation of training costs is the summation of all expenditures made to transform the inductee from his inception state to his present state of being or performance capability. It sometimes includes the cost of providing him with experience which is of no immediate use to the service but, is necessary to prepare him to progress to a more advanced state (76). The compilation of sustenance cost is quite similar. It consists of summating those costs attributable to the maintenance of an individual in his current state of capacity. The compilation of costs associated with an individual's separation from the service is the summation of all administrative costs and post retirement benefits which the service may be obliged to render. The life cycle costing of personnel summates all cost attributable to them throughout their tenure of service. It appears, on the surface, to be a like procedure, with the exception that it is intended to encompass a larger temporal baseline. This is not the case because numerous costs must be included which are not easily apportioned to an individual. In addition, the need arises to make a large number of assumptions concerning long term expected career progression.

What is Being Accomplished

This summary adequately represents the bulk of the personnel costing objectives within the military. There exists an enormous number of sub- and multiple-category cost aggregations being performed throughout the Armed Forces, but the five cost categories cited subsume most of the cost factors to be found in the majority of existent military personnel cost calculations. Whereas, industry often records expenditures on an individual basis in a way which allows the cost data attributable to a specific person to be retrieved, the military costs on the basis of averages. Certain costs within industry are, of necessity, compiled on a similar basis, but those occasions are infrequent enough to allow these characteristics of personnel costing to be cited as a point of distinction between industry and the military. Another point of distinction lies in the assessment of acquisition cost. It is a practice within industry to take into account the impact of the economic environment from which the new personnel are drawn, when computing the cost of acquiring them for the purpose of replacement cost estimation. This is seldom the case in military personnel costing activities except for the estimation of recruiting costs wherein

demographic factors and employment opportunities in the civilian job market are sometimes taken into consideration (67). Even so, when acquisition costs are summated, that portion which is included to account for recruitment expenditures is usually the result of an averaging process. In those instances wherein the economic environment is taken into consideration, the procedures generally consist of merely applying a weighting factor to the average dollar cost estimate for initial procurement.

If comparisons were drawn between the existant personnel costing capabilities which each of the Armed Forces has at its disposal, the Navy should be considered superior. This is partly due to the fact that the Navy was at one time directed to develop personnel costing methodology which could serve the requirements of the Armed Forces as a whole. A second factor is its emphasis on a policy of using personnel cost trade-offs as a means to justify hardware design. As it turned out, the level of cross-service utility expected to characterize the results of its efforts was not realized. The results contained no innovative approaches to personnel costing nor techniques of increased power to resolve problems in cost projection. Rather than a concerted effort to develop new technology which would enable military personnel costing to be conducted at a higher level of sophistication across the services, the Navy's personnel costing research appears to have been geared to an in-depth application of the Accounting Approach to produce extensive cost data particularistic to Navy operations. The results, through disappointing from an interservice viewpoint, are nevertheless substantial in terms of the resultant development of standard Navy personnel cost parameters, the institution of standard cost element aggregations, and procedures for their utilization. Of interest is the fact that the costing capability advantage which the Navy possesses is mainly the result of making decisions concerning costing standards and taking a firm stand regarding their implementation.

What the Navy has accomplished may be examined within three broad headings: (a) determining, defining, and describing the cost elements to be included in personnel cost analysis; (b) evaluating the means for aggregating the required cost data input; and (c) developing specialized outputs to meet user requirements. The major results of these efforts are computerized models which generate personnel cost both on the basis of the personnel in question and that of the job which they perform. The latter, known as manpower billet costing, is weapon system oriented. As such, it is extremely useful in terms of the analysis of weapon system life cycle cost.

The Navy's manpower billet cost model provides the cost per year for all operational billets in the Navy, except flag billets and those for paygrade E-1 (30). The manpower costs are computed from initial procurement to the end of retirement. This is accomplished on an investment "net" cost basis for selected time intervals throughout the entire temporal baseline defined as a career length. Costs attributable to nonoperational status are included on an amortized basis. Hence, training and acquisition cost decrement in significance as one increments along the career timeline. "Net" costing, in this case refers not to a balancing of expenditure to returns but, a balancing of productive to nonproductive time. No measure of productivity is entailed in the calculations. Nonproductive time is defined as time in training or otherwise absent from operational duty. Cost element aggregations are based on average as a function of manpower designation and paygrade. Career progression is plotted on the basis of average times to advancement and a normalized pipeline flow through the manpower system such that one person retires at the end of the twenty-five year temporal baseline chosen for naval careers. Retirement cost is developed on the basis of life expectancy, following the average retirement age, and a fixed percentage of base pay. No distinction is made across manpower designations for retirement cost purposes. In effect, that which is calculated amounts to an average yearly operating cost for a billet based upon an average life cycle cost expenditure to keep that billet occupied.

Markovian probability chains are the basis for the many averaging assumptions contained within the model. They also constitute the point of greatest instability, likely to introduce error in the calculation in the event of changes in the flow of personnel through the system. Many overhead expenditures attributable to personnel are not included in these billet costs due to insufficient data and less than ideal record keeping practices. The Navy, however, has done much to improve the effectiveness of cost models which utilize cost element averages by instituting record keeping procedures more closely attuned to the input requirements of their costing models. As averages become more associated with continuously finer personnel breakdowns, they become increasingly more representative of the individual personnel.

The second major area of personnel cost model development within the Navy focuses on the personnel rather than on the job they perform. A significant product is the Training Time and Cost Model. It is used to generate data on enlisted man training times and costs for use as inputs in determining pro day eligibility (24, 25). These data provide average times and costs invested in enlisted personnel from initial procurement through appropriate basic and specialized training. A model is presently under development which will parallel the manpower billet cost model, but will be based upon personnel categories rather than assignments. It is to be the central mechanism for personnel cost standardization within the Navy. Its development will include data reporting systems to update its associated data banks, the designation of standard methods for cost allocation, and a plan for system implementation throughout the Navy.

Another area wherein the Navy has expended effort in personnel costing, is the determination of manpower cost implications associated with changes in reenlistment rates (56, 57, 58). Their method treats the service influx, career progression, and exodus of Navy personnel as a pipeline flow, the characteristics of which are determined by stochastic processes. Reenlistment, at the various career progression levels, is valued in terms of the cost avoidance it permits by negating the need to acquire new recruits to maintain a desired number of personnel within the pipeline. Markovian probability chains are calculated to indicate the probabilities associated with each reenlistment point within a career pipeline. The major applications of this methodology are to establish appropriate reenlistment bonus rates and to perform numerous cost trade-offs involving military personnel retention. Two observations were made concerning it. They are: (a) the need to make numerous averaging assumptions concerning such things as costs attributable to increases in the number of dependents which the man may acquire, and (b) it provides a desirable capability to perform economic benefit analysis without the need to address the subject of individual productivity.

Like those of the Navy, the military personnel costing methods currently in use within the Air Force and the Army closely adhere to the accounting approach to cost analysis (11, 47, 62, 92, 95, 99). However, the costing research products available to Army and Air Force personnel analysts are far fewer in number and less directed to specific applications. In general, the Army and Air Force personnel cost analysts have at their disposal two basic tools prepared by a central costing authority within each service, using data provided by various organizations within each service. There are: (a) operating cost handbooks (11, 68) which contain both fixed and variable costs associated with functions such as training and entitlements such as basic pay and allowances, and (b) planning cost handbooks (99) which contain aggregate costs associated with the annual operating cost of a specific personnel type or classification.

Army and Air Force personnel costing are grouped together in this report because their personnel costing capabilities are almost identical. It is at a level considerably less detailed than that of the Navy in terms of its directness toward the fulfillment of specific costing requirements. The way in which cost aggregations are presented does not constitute a viable basis for effecting personnel costing standardization throughout each service because too much is left to the individual interpretation of the user. The Air Force has made some progress recently in providing the users of the Air Force cost and planning factors with a first order breakdown of the cost categories which are included in their annual operating cost factors for Air Force personnel classifications (99). However, they still consist, to a large extent, of aggregations of sub-calculations. These are produced by numerous organizations using costing aggregation rules and cost term definitions which reflect highly disparate methods as well as objectives (47, 84, 95). Without the benefit of standardized costing procedures or standard cost parameters, their validity and propriety are subject to question for all but the most nondemanding applications. Of particular concern are personnel support costs and costs associated with maintaining a support facility under conditions of variable utilization. Although numerous costs such as direct pay, allowances, training, and certain fringe benefits are included, many costs related to the support of personnel, including retirement benefits, are either excluded or included in such a way that the appropriateness of their attribution is suspect.

Weaknesses in Specific Costing Areas

The major weaknesses of existent military personnel costing capability particularly within the Army and the Air Force, are in the assessment and attribution of costs associated with on-the-job training, medical benefits, retirement benefits, and

billet costing. They, as well as the Navy, also lack the capability to perform personnel life cycle cost analysis. These areas, wherein research is currently being conducted (4, 38, 49, 69, 90, 91, 101), are prime targets for the application of efforts to clarify and standardize record keeping. One of the largest impediments to costing accuracy is the lack of appropriate record keeping from which to gather cost data. This is particularly true of Army cost data reporting.

On-the-Job Training (OJT)

A number of attempts have been made to estimate the cost of on-the-job training for military personnel. However, none has demonstrated broad range applicability, nor has any gained wide acceptance. The reason is that they either are too simplistic or are too dependent upon survey data as opposed to actuarial data. None reviewed has gone beyond the first-level journeyman stage of proficiency. In fact, one such study by Arzigian (4) further reduced its specificity, as well as coverage, by collapsing the personnel categories into four major classifications. Most of the studies, because of difficulties in the collection of accurate data in sufficient quantity, have confined their applications to the average or typical trainee.

Although recent studies have been addressed to more specific applications involving individual trainees (90, 91), their results are not sufficiently sensitive to pick up the wide cost variations due to individual differences in potential across trainees. These differences are important because on-the-job training does not operate on a fixed time schedule as does classroom training. Hence, the costs involved are more directly associated with the individual's progress than with training load or course length. Those few studies which do incorporate techniques which consider individual potential have been confined to a limited number of personnel categories. They require additional application to the remaining list of personnel categories prior to general acceptance. One particular approach which appears to offer promise is that of relating personnel attributes to the cost to train.

Medical Benefits

Medical benefits to active duty military personnel, retirees, and dependents continue to be a source of consternation to personnel cost analysts within all the services. It is impossible to generate comprehensive medical benefit costs on an individual basis. This is almost solely due to the way in which record keeping authority is delegated and mandated throughout each service. There is a lack of record keeping in several key areas of cost incurrence (95). Studies within each service have indicated that the following are the chief impediments to accurate medical cost analysis: (a) lack of centralized accounting systems, (b) existence of numerous management and funding agencies, (c) lack of proper cost breakdowns by individual funding authorities, (d) inadequate amortization programs, and (e) lack of sufficient detail in medical training program cost records. It is possible with much effort, to calculate the approximate total of most of the cost elements of the medical benefits provided by each service and to then generate a per capita assessment. However, under present circumstances of data availability, results would be confined to gross factors which would be neither accurate nor comprehensive. It is clear that a revamping of the medical benefits data collection and reporting systems is the only other alternative.

Retirement

Retirement benefits constitute another costing gap within the military. If and when they are included in military personnel costs, they are calculated in one of two ways: (a) on the basis of the current year's retirement budget divided by the number of expected retirees during the year, and (b) an averaged yearly military pension calculation multiplied by an average post retirement life expectancy, factored by inflation and cost of living multipliers (15). Neither of these methods yields more than a very gross result.

The first method is one of expediency, resulting from the fact that military retirement is paid by the Department of Defense and not by the individual services. Funding for this item which is included in the current budget is the result of past policies (15, 98). The effect of present policies is only reflected in outyear budgets. Unlike industry, the military is not faced with the need to pay as they go for retirement claims of the future. Thus, there has been little emphasis on gaining an accurate picture until recently when it was indicated that the situation may be reversed in the near future.

The second method, although capable of being interated for each rank, is incapable of capturing the many ancillary costs associated with retirement due to the existence of a host of factors which can alter the size of the retirement benefits to be paid. An alternative method has been

proposed by personnel within the RAND Corporation and the Navy (15). It is to determine the probability that an individual of a certain rank will retire, his remaining life expectancy at that time and the probable salary (including inflation factors) that will serve as the basis for determining his retirement benefits. Obtaining a total retirement obligation (by multiplying the factors and then summing them over a chosen time span) will yield a figure which can be averaged across all types of personnel as a unit or be maintained in tabular form as an average for each personnel type.

Billet Costing

Neither the Army nor the Air Force presently have at their disposal comprehensive personnel costs associated with a job or billet. They both have addressed their efforts toward assessing the costs associated with personnel types rather than the job positions which they occupy. The results have been confined essentially to operating cost assessments. These do not reflect the sum total of expenditures made by each service as a result of personnel over their period of affiliation, nor are they as comprehensive as a billet cost estimate. Much lip service has been paid to a concept known as personnel life cycle costing and to the idea that the personnel cost factors provide a sizeable component of it. Advocates of its employment in the costing of military personnel maintain that a dollar figure which represents the sum total of all expenditures incurred by the service as a result of having the individual at its disposal for the entire period of affiliation is one of the most useful common denominators of personnel in the performance of cost trade-offs. Such may be the case, especially for trade-offs in support of total force planning. However, no cost factor manual, costing procedure, or modeling mechanism exists today which can generate the comprehensive cost figure which the concept holds to be achievable. The main reason is due to the extreme variability encountered when one tries to enumerate the many factors which enter into the careers of individual personnel within the Armed Forces. Identifying the cost components is difficult, but an even more difficult aspect of personnel life cycle costing is establishing adequate rules for the correct apportionment of costs to individual personnel. This is probably the strongest reason for costing billets as opposed to individuals. However, the concept is yet to be accepted within the Army and Air Force.

Numerous personnel life cycle cost models exist within all the Armed Forces. They range from highly detailed simulation analyses to the summing of acquisition cost and average sustaining costs projected, on a discounted basis, across an average service tenure. A true life cycle cost estimate must take into account that people flow through the services like a stream. Although there are certain constant factors which determine the flow characteristics, numerous dynamic circumstances can and often do effect drastic changes. For example, there are many personnel costs, such as those arising from training, medical care, exchange and commissary facilities, and recreation services whose magnitude is dependent upon such dynamic factors as flow rate or capacity for expansion. They must be apportioned on a per capita basis but, the baseline for a per capita apportionment is changing over time. Current practice is to either assume a fixed capacity requirement and generate a fixed capacity per capita cost assessment, or to base per capita cost on an average flow rate of personnel through the facility. In order to be of real utility, a life cycle cost calculation which includes such subcalculations must not be static; i.e., representing the life cycle cost at only one discrete point in time under one discrete set of circumstances. These may or may not reflect current reality. Accurate life cycle costing for personnel appears to require a family or set of cost parameter estimates, based on data inputs regarding system functioning, the applicability of each being closely defined. However, the value of such a series of estimates is not without drawbacks. It seems likely that extreme confusion to the user might result when attempting to determine the applicability of each to his particular problem. This could conceivably precipitate misapplication, yielding costing errors of greater magnitude than those inherent in the costing of a billet.

Summary

An attempt has been made in this section to capture the major costing trends within the military. The single greatest factor which seems to restrict military personnel costing to the assessment of gross averages is the lack of an accurate means to apportion costs to individual personnel. It has been shown that record keeping within the military constitutes a major stumbling block to the development of uniform procedures for cost apportionment. Solutions to the costing problems created by personnel flow and indirect versus direct cost attribution have been created, in the form of methods to cost a job rather then the

person who occupies the job slot. Whether this procedure begs the question of what constitutes the total cost to the government of having the services of an individual at its disposal is still open to debate. The fact remains that billet costing offers effective means to sidestep some of the cost apportionment problems.

Perhaps the question of singular importance to the Air Force is whether a real and justifiable requirement exists for determining the absolute cost of personnel. It appears that the majority of costing requirements could be met by the comparative analysis of relative costs. Evidence of this is to be found in many of the procedures, developed and implemented by the Navy, which capture enough of the critical cost items to yield useful costing results. Furthermore, most of the pressure for absolute cost comes from total force planning and budgetary analysts and can often be shown to be based more on desire than necessity. Whereas the justification of costing procedure should be based on need, perhaps the answer to the absolute versus relative cost question is dependent upon the answer to the question of whether military expenditures should be justified on the basis of need or on the basis of absolute cost.

Table 3 is provided to afford a summary of the basic differences between civilian and military personnel costing practices.

Table 3. **Comparison Table of Air Force and Civilian Personnel Costing**

Civilian Personnel Costing	Air Force Personnel Costing
Often entails the concept of value in addition to cost.	Restricted to objective dollar cost notation.
Often predicated upon an analysis of human behavior and individual personality traits.	Restricted to trend analysis of group behavior; e.g., reenlistment rate or average tenure.
Often employs the concept of net as opposed to gross cost, involving the measurement of returns as a counterbalance on investment.	Restricted to gross cost estimation without regard to realized or potential return on investment.
Type of Approach employed: (a) Economic, (b) Accounting, (c) Alternative Investment	Type of Approach employed: Accounting
Type of Techniques employed: (a) "Key Man" Insurance, (b) Causal-Intervening Variable, (c) Investment Quantification	Type of Techniques employed: Investment Quantification
Often can objectively quantify the benefits to the organization stemming from individual personnel.	Restricted to subjective or at best quasi-objective quantification of benefits to the Service from individual action affecting pipeline flow of personnel; e.g., reenlistment rate.
Often maintains a central costing activity which promotes commonality in: cost term definitions, cost element aggregation, and pertinent data collection.	Existence of central costing activity of restricted authority and responsibility, serving in the role of an assimilator rather than a coordinator of costing activities operating elsewhere.
Often can objectively trace expenditures to individual personnel on the basis of individual cost records from data of acquisition.	Restricted to the use of cost records compiled on the basis of gross expenditures which can only be traced to individual personnel on the basis of cost apportionment by averages. An exception is sustenance cost.

III. USAF MILITARY PERSONNEL COSTING PROBLEMS

Human resource accounting is fairly new to both industry and the military. Although both have been engaged for a long time in assessing costs attributable to personnel, only recently have they attempted to fully exploit the potential benefits of treating people as capital investments (74, 81, 82, 83, 104). Each has developed methodology which can be applied to the costing problems of the other but, differences exist between the two which make the task of costing

military personnel decidedly different and more complex than that of costing civilian personnel.

The majority of difficulties experienced by the Air Force in computing costs attributable to its individual members are not due to a lack of available costings means. Rather, they often stem from the surfeit of possible approaches to the task and a lack of coordinated effort in the defining of objectives. Each approach to personnel costing is dependent upon the accepted definition of the problem and the selection of policy regarding such things as cost apportionment. If these do not accurately reflect the requirements of the costing situation, the choice of approach will be inadequate. It was concluded on the basis of an examination of the historic course of the development of existent personnel costing technology that the probability of success in any application is more closely related to the proper establishment of goals than to the methods chosen to attain them.

Military personnel costing within the Air Force must address three types of problems: (a) cost calculation, (b) standardization, and (c) implementation. Although each contains individual problems which are distinct, the generation of completely satisfactory solutions to problems within each category is dependent upon the coordinated solution of those within each of the others. This section begins with an examination of some of the major reasons why difficulty is experienced in the costing of USAF military personnel. Following this, an attempt is made to organize and describe specific problems in a way which will guide the establishment of USAF personnel costing objectives leading to their coordinated resolution. This is done because Air Force success in fulfilling its total personnel costing requirements appears to hinge upon the realistic definition of overall costing objectives. A realistic evaluation of costing means can only be conducted on the basis of their ability to promote the attainment of specified costing objectives. It follows that Air Force success may depend equally as much on the precise identification of existent fundamental problems, to properly select objectives, as on the evaluation of possible means to effect their resolution.

Causes of Difficulty

A number of factors distinguish military from civilian personnel costing activity. Five of them are particularly germane because they constitute the major causes of difficulty in the costing of Air Force military personnel. The first stems from the comprehensive support which the Air Force renders to its members. It, as well as the other Armed Forces, provides for a substantial portion of the total welfare of its constituents in addition to their livelihood. This support includes services ranging from medical care to the provision of legal counselling. In order to provide support of this magnitude, organizations and facilities must be maintained on a continuing basis regardless of utilization rates. This situation greatly complicates efforts to determine the actual individual accountability for the costs associated with these services. It is a fairly straightforward task to calculate an aggregate operating cost figure but, quite another thing to accurately apportion that cost to individual service members. Apart from the difficulty of establishing a reasonable basis for cost apportionment, several important policy issues are involved which will be discussed later.

A second cause of difficulty in calculating the cost of Air Force military personnel stems from the independence accorded to the various Commands within the Air Force in the conduct of their costing activities. The present Air Force cost accounting system tends to compartmentalize costing efforts. It is structured such that individual costing activities are allowed to independently pursue their own goals, with less than adequate consideration for the Air Force costing goal of accountability at all levels of costing indenture. Activities which attempt to compile higher order calculations are often faced with the task of aggregating component cost estimates which were not compiled with this task in mind, and which are often mathematically incompatible.

The third and fourth major causes of difficulty are the failure of existent generalizable cost models to generate outputs specifically attuned to individual user requirements, and adequate record keeping. There is no dearth of cost models in the Air Force today (36, 37, 80, 99). However, most of the models in use are overly general and do not accurately reflect the requirements of individual users (13, 18). They appear to either incorporate too many, too few, or the wrong mix of cost data elements for specific applications. The attempts of individual cost data users to overcome these inadequacies have resulted in a proliferation of locally modified versions, the results of which are very often incomparable. Of additional concern, is the fact that the cost figures generated by these customized models are often impossible to aggregate because they sometimes include either

the same cost elements or elements which are confounded by the inclusion of costs which are either nonspecific or nonpertinent. Local cost data record keeping is often performed on a similar basis; i.e., solely in accordance with the interests of the individual using organization. With the exception of certain record keeping facilities which feed data into costing facilities within the same organization, it appears that personnel cost data are collected and recorded in ways which do not reflect a proper consideration for the full gamut of their possible utilization.

The fifth major cause of difficulty in calculating the cost of Air Force military personnel arises from less than adequate total system planning for the regulation of personnel cost data collection, record keeping, and computational analysis activity. This conclusion is based upon an examination of the system, cost products and inadequacies reported by product users. Existing regulations for the collection of Air Force military personnel cost data could be improved if each were geared to a total system concept based on the generation of products of the widest attainable utility as determined by the functional structuring of total system user requirements. There is a central authority for the computational analysis of personnel cost data in the Air Force. However, its work is dependent upon the assembly and assimilation of personnel cost data from other costing activities and cost data collection facilities over which it has little or no coordinating control. A common result of this situation is that the orgzanizational goals and responsibilities of these cost data sources sometimes preclude or impede the development of personnel cost data optimally suited to purposes other than their own.

These are some of the roots of the inadequacies to be found within Air Force personnel costing as it is presently being conducted. What follows is an enumeration of specific problems which require immediate attention. They are presented in three groups. The first is comprised of problems concerning the actual calculation of Air Force military personnel costs.

Problems of Calculation

The most basic problem of calculation is an inordinately large number of personnel costing requirements specified as being necessary. This dilutes the capability for the production of comparable cost assessments because it fosters the use of individualized costing procedures. While valid needs for varied cost element aggregations to meet singular requirements do exist, a large number of requirements seen as being mutually exclusive are, in reality, only marginally independent. Their reduction is critical in stemming the proliferation of individual costing procedures.

A second problem of calculation, closely tied to the one described previously, is the lack of common cost term definitions. Numerous organizations possess a need for similar personnel cost data. However, their uses for it reflect different organizational requirements which may or may not be mutually exclusive. As a consequence, large variations are to be found in their functional definitions of cost related terms. This leads to wholesale disagreement with regard to the structuring of cost element components in major cost item calculations. These differences are not just semantic. They are an artifact of the existence of basic differences in how each organization views the roles which personnel play in the activities that comprise the fulfillment of its mission objectives. An example of this situation is the multiplicity of criteria for the categorization of indirect and direct operational support personnel.

A third problem of calculation is a need for improved accuracy and a higher degree of computational inclusiveness in the assessment of indirect costs. Just as the acquisition cost of a weapon system represents merely the "tip of the iceberg" with respect to total life cycle system cost, so are the pay expenditures for personnel (68), with respect to their total cost to the Air Force. Specific examples of sources of additional cost include: non-monetary benefits accrued to service personnel and their dependents, on-the-job training costs, expenditures induced by maintenance errors, and cost implications of personnel turnover rates and tenure in the service (58). Dealing with these concerns is actually a two-pronged problem. It involves not only assessing costs but, also determining specific accountability across personnel categories.

A fourth problem of calculation is the need for improved ways to take into account the existence and instability over time of an impressive array of cost related variables concerning people. These range from the prediction of total service life to the prediction of the progression and utilization of personnel throughout their individual careers (71, 94). Specific items of concern include such things as shifts in career field, changes in retirement benefits, actual manpower utilization rates,

reenlistment rates, average service tenure across Air Force specialty code (AFSC) categories, and secondary training requirements (41). These variables combine to produce an effect which tends to limit personnel costing to the generation of short term point estimates. While it is true that certain personnel costing requirements such as those for sustenance, training, and short-term budgetary cost estimates can be satisfied by these, long-range projections require cost estimates generated on the basis of data which are functionally derived in terms of the behavior of other variables. One of the reasons why the Air Force defines many of its cost calculations as "cost factors" rather than "cost assessments" is that the distributions over time of a number of the variables whch affect cost are characterized by a variance too great for an acceptable long-term point estimate projection. The "cost factors" which can be generated provide a relatively narrow basis for the long-term projection of actual costs, due to the deletion of relevant variables whose distributions presently cannot be adequately described.

If realism is to be achieved in military personnel costing, ways must be found to either circumvent the uncertainties created by the continual state of flux within the personnel force structure or to more adequately define the effects which it produces on the cost of personnel. A requirement exists for the further development of factors and formulae to relate certain personnel actions to the long-term monetary expenditures which they precipitate. Current averaging techniques do not adequately capture the effect of their combined interaction on cost.

A fifth problem of calculation is the lack of an officially accepted method to categorize personnel on the basis of whether they constitute either a direct or indirect support to weapon systems (12, 79, 88). This is not so much a problem of assessing the cost of personnel as it is one of allocating personnel costs to a particular expense category. It is included because it bears upon one of the primary uses to which personnel cost data are put; namely, the estimation of weapon system life cycle cost. The high degree of functional integration of the labor products of Air Force personnel does not support the facile development of direct/indirect support classification techniques which are readily discernible and easy to apply. Hence, methods which depend upon subjective interpretation have been used by individual cost analysts as a substitute for the objective techniques necessary to the conduct of an accurate cost analysis.

A sixth problem of calculation is a lack of standardization. This ranges from the lack of standard personnel cost parameters to the lack of standardized procedures to aggregate personnel cost data elements for common applications. Without standardization there can be no comparability among cost estimates, nor any assurance that the proper cost data will be collected in sufficient quantity or formatted appropriately. A major source of error in personnel costing is the selection of the most appropriate method of cost data element aggregation to fulfill a specific costing requirement. The reason is not due to any lack of skill on the part of the cost analyst, but to the fact that he must presently select from available aggregations. A much better alternative would be to select a cost data element aggregation structure most appropriate to one's needs and then compute a result using standard cost data elements. To be totally effective, standardization of Air Force military personnel costing must be comprehensive. It must extend from the process of data collection to the decision making process undertaken in determining its proper use.

The foregoing are the primary problems which affect the computational analysis of Air Force military personnel costs. The list sets forth the basic inadequacies within the Air Force system with which cost analysts are forced to deal. The last problem within it provides an introduction to the next categorical grouping of problems. These represent a breakout of major problems whose cause is a lack of standardization. By pinpointing areas wherein increased standardization would be beneficial, a more precise description of the potential impact of a standardization program within the Air Force is provided.

Problems of Standardization

The most pressing problem of standardization facing the Air Force is the need for increased specificity and compatibility in its cost estimates. Without a definite service-wide agreement concerning the composition of aggregate cost data element structures for specific purposes, there can be no firm basis for the comparison of cost estimates. Neither can there be any real assurance that cost estimates possess the same degree of accuracy. What is required is a common knowledge of what specific cost elements are contained in each estimate and how they are manipulated. This should be coupled with a convenient means to

either add or subtract cost elements to bring individual estimates in line with each other. A second problem of standardization is caused by the lack of uniform definitions for the many costing terms used in military personnel cost analysis. The costing terms referred to are not confined to those associated with analytical procedure. They include the descriptive terms created by individual cost analysts to denote the cost element composition of minor cost element aggregations which enter into more comprehensive cost estimates. These invariably reflect the particularistic interest and costing capabilities of performing analysts.

The impact of costing interest on the definition of terms is easily understood. The impact of individual costing capability is less obvious, in that it is more an artifact of an organization's ability to acquire the most appropriate data for its purposes than the expertise of its analysts (86, 87, 88). More specifically, the computation of certain cost items, such as the cost of medical benefits attributable to an individual, involve not only a subjective judgement concerning what cost elements to include (1, 84, 95). It also necessitates the extrapolation of cost element values from cost data which are confounded by the inclusion of irrelevant cost items. Regardless of the degree of expertise exhibited by the cost analyst in carrying out the process of extrapolation, there is a high probability that, even though cost terms may appear to be similarly defined, they may be accorded dissimilar values by different analysts because they really are not the same. Common definitions of costing terms must be developed, along with specifications which clearly designate the cost data upon which each is based.

A third problem of standardization involves the collection and formatting of personnel cost data. In order to establish a uniform personnel costing system, planning must extend to decisions involving the collection of raw data. The present data collection operations within the Air Force do not adequately serve the established requirements. Cost data records currently appear more to reflect the needs of the performing organization. As a consequence, their utility to other organizations is limited. This situation involves inadequacies in the dissemination of data, as well as in its collection. Quite often the access of one organization to another's "data" is restricted to processed cost reports which do not include the data upon which they were based. Too often a request for personnel cost data is met by a corresponsive request for information concerning its intended use. What is alluded to is not the existence of different data but, different aggregations of cost data bearing the same nomenclature. There is a definite requirement to establish a comprehensive list of personnel cost data elements to be used as common denominators for all military personnel cost calculations within the Air Force. Standard cost data formats must also be established to: (a) specify standard cost data element aggregations which can be incorporated into more comprehensive personnel cost calculations, and (b) in the case of standard cost element data which are not to be aggregated, specify exactly what is presented to include the particulars of how the cost figures were obtained.

The desirability of attaining complete military personnel costing compatibility on an inter-sevice basis has been expressed by numerous costing authorities within the Department of Defense (78). However, very strong cases have been made which indicate that complete compatibility will be extremely difficult, if not impossible to achieve. This is due to fundamental dissimilarities in the categorization of military personnel within the services and organizational differences which preclude one-to-one comparisons. Concrete evidence of this are the relatively new costing procedures implemented by the Navy. They were well thought out and serve the purposes of the Navy quite well. However, most of them could not be incorporated into Air Force operations in their present form, nor would it in some instances be desirable. It might be useful to mention here that inter-service utilization was a prime goal of the Navy's personnel cost development effort (7). Although it appears doubtful that personnel costing standardization can be achieved on an inter-service basis, cost data elements can be defined such that they may be used as a basis for comparing higher order personnel cost computations performed by different services. This could be accomplished by factoring out cost data elements which are not common to the cost aggregations of the services whose computations are being compared.

A fourth problem of standardization is the need for the establishment of clear guidelines for use by cost analysts in the decision process of cost allocation. This requirement is closely associated with the need for greater adaptability within cost models to achieve specific relevancy across users. It is improbable that any single model could be created which would entirely satisfy the many diverse personnel costing requirements throughout

the Air Force. This implies that it is likely that cost models will either be developed or modified on a continuing basis as new costing requirements arise.

It will be almost impossible to fulfill all existent requirements with a standard library of cost models, much less those arising from future changes in Air Force policy or operations. However, the existence of clearly defined guidelines for cost allocation would, in effect, standardize the process of model development. This would be instrumental in reducing the probability that continued model development by individual cost analysts would defeat previous accomplishments in service-wide standardization. In addition, it is eminently more practical and farsighted to approach the task of standardizing cost models by standardizing the model development procedures than to attempt to impose a static solution on a dynamic problem.

A fifth problem of standardization arises from the extremely large number of different requirements for Air Force military personnel cost data. One of the major impediments to the establishment of standardized procedures and standardized cost data within the Air Force is the fact that its personnel cost data requirements have not been systematically examined as a group and categorized on the basis of commonality. There are too many apparent divergencies of interest to attempt standardization on a piecemeal basis, yet, it would be naive to assume that a valid approach to standardization could be developed without fully considering the basic needs of each organization upon which it would be imposed. Personnel costing standardization cannot be achieved and should not be attempted until the total Air Force-wide personnel costing requirements are evaluated.

The foregoing are the primary Air Force military personnel costing problems which are related to the need for personnel costing standardization. The third category of problems which follows contains those problems which are related to the implementation of personnel costing procedures to resolve the problems of the first and second categories. Many of the numerous operational problems involved in attaining a high degree of personnel costing standardization within an organization as large as the Air Force are closely interdependent. As one examines this goal, it becomes increasingly clear that this close interdependence constitutes the chief impediment to its realization. The transition from current personnel costing practices to a uniform costing system will generate a requirement for total system planning, operational cooperation, and a concerted effort within the Air Force. The problems listed in the following category reveal the extent of what is implied by the concept of standardizing military personnel costing parameters and procedures, and the criticality of a comprehensive approach to its application within the Air Force.

Problems of Implementation

Each of the Armed Forces has at its disposal an extremely powerful tool. It is the capability to undertake an immediate and concerted action, once that action has been decided upon. The major problems of implementation involve both operational and policy considerations. Their substance is the need to resolve numerous questions concerning regulation, authority, and responsibility within the Air Force costing community. Operational considerations will be addressed first.

Standardization, by definition, requires the imposition of definitive regulations which specify procedure, allocate authority, and designate responsibility. The development of such regulations as will be required to implement a comprehensive standardization program for military personnel costing, Air Force wide, must involve a coordinated effort by all of the major Commands. While it is possible that the performance of personnel costing may be undertaken by a single organization, the planning and establishment of operational procedures must be a joint effort. One of the major problems of implementation, in terms of operational considerations, will arise from the conduct of this effort. There is a need for the establishment of a high-level mediation authority with the responsibility to validate costing requirements, evaluate the possible means of their fulfillment, and initiate action to implement whatever is decided upon (13). Without a highly visible and readily accessible means to transform a good idea into a productive activity, little more than lip service can be paid to the realization of comprehensive solutions.

A second major problem of implementation, in terms of organizational considerations, stems from the possible need to reorganize costing organizations, as well as operational procedures. As an example, one might consider the consequences of the fact that the Air Force-wide standardization of personnel costing might very likely require

increased organizational ties across commands. More specifically, the situation might occur wherein an organization within one command would be functionally responsible to that command and managerially responsible to another. This might be the case if a particular command were to be made responsible for the regulatory management of personnel costing within the Air Force and were given authority to mandate support from other commands.

The second category of implementation problems are of a subjective nature. They are categorized as such because they are not amenable to solutions capable of being objectively demonstrated as being most correct. For the most part, they entail policy decisions which, though not solely based upon criteria exclusive to personnel costing, have the potential to greatly impact its conduct and results. Some examples of questions underlying these policy decisions are as follows.

Whenever the topic of military personnel costing is discussed, the subject of standardization usually enters into the conversation. Invariably, this leads to a debate concerning the question of the degree of standardization necessary to effect a personnel costing program which is maximally effective and minimally disruptive to the conduct of military operations. This concern is ancillary to that for the establishment of procedures which are adequate to totally fulfill the Air Force's military personnel costing requirements but, is increasing in importance. This is due to the fact that the costing of personnel itself involves sizeable expenditures of effort and money. There are cost trade-offs to be made between procedural sufficiency and implementation expenditure. A concrete example of this is the changes in record keeping and data collection which might be a consequence of the implementation of standardized personnel costing procedures. One only has to reference the cost involved in making minor changes to the Air Force 66-1 Maintenance Data Collection System procedures to appreciate the cost impact of altering an existent Air Force-wide system.

A second question concerns the possible effects of the dynamic character of the Air Force personnel structure and its policy concerning personnel utilization. Technological advances in automated testing, job performance aids, and low-cost throw-away module development, as well as favorable experience in reliability improvement procedures and warrantee procurements, increase the likelihood that dramatic changes will continue to occur in the Air Force personnel picture. Such changes could result in decreases in the accuracy and/or utility of any personnel costing program selected for implementation without due consideration of the consequences of future changes in the manpower system itself. An offshoot of this question is the concern for the accurate determination of the degree of standardization required on an inter-service level to insure the comparability, if not the compatibility, of military personnel cost estimates across services. Both the present and future personnel situations must be carefully considered before any uniform personnel costing program is decided upon.

A third question concerns the policy which should underly the apportionment of on-going operational costs. For example, should base operating costs be imputed to personnel (6, 54, 55)? If so, a standard procedure should be established (102). There are good reasons for answering this question either way. However, until the answer is decided upon and a standard procedure established for performing the cost computations, no standard personnel cost parameters can be implemented which include any part of the sizeable costs associated with the operation of base facilities.

A fourth question which must be resolved prior to the implementation of a standardized personnel costing program involves a policy decision concerning how the Air Force wants to view its personnel. Military personnel can be perceived as individuals, or as entities which occupy positions or duty slots, as does the Navy which emphasizes the costing of a billet rather than a person progressing through the ranks. They can also be perceived as a support component of a particular weapon system. The point is that the way in which personnel are perceived bears significantly on the selection of the most appropriate procedures to assess their cost. In all probability, there will be requirements to cost personnel on the basis of several perceptions of their service roles. In any case, the question of objectives in this matter will have to be addressed before any standardized personnel costing program can be implemented.

Summary

An attempt has been made to describe a representative sample of the kinds of problems currently being encountered in the costing of Air Force military personnel. Clearly, it has been demonstrated that solutions to problems very often create additional problems. Throughout the section, emphasis has been placed on the absolute necessity of defining Air Force military personnel

costing objectives in terms of service-wide requirements. Approaching the requirements of individual organizations on a piecemeal basis will not result in enduring solutions. It will not provide foundation for the establishment of a personnel costing program possessing the degree of comprehensiveness and flexibility which is absolutely necessary to make it worthwhile in terms of the cost and effort required to implement it.

Three kinds of military personnel cost related problems have been described, along with some of the factors which combine to increase the difficulty of their resolution. They are different but, highly interdependent. One cannot address the problems related to computation without acting upon those related to standardization, if one hopes to achieve solutions of merit to the entire service. Similarly, one cannot define a workable personnel costing program without addressing the problems associated with its implementation. The Air Force requirements for military personnel costing are of a dynamic nature. They relate to constant flux within a host of variables ranging from personnel policy to force structure authorizations. Whereas these variables interact to alter requirements, the objectives of personnel costing activity to fulfill these requirements must reflect a careful consideration of the causational antecedents of the requirements themselves.

The following section will deal with the specifics of what needs to be done in order to provide Air Force cost analysts with the tools which they require to deal with the kinds of problems described in this section.

IV. PREREQUISITES OF PROBLEM RESOLUTION

This section addresses the task of specifying the prerequisite needs of Air Force cost analysts in order to resolve the Air Force military personnel costing problems described in section three. It will serve as a baseline for defining appropriate actions to meet these needs.

Cost Data Applications

The majority of personnel cost data applications throughout the Air Force can be collapsed into three categories. These are: (a) engineering design trade-offs, (b) system support trade-offs, and (c) budgetary/planning. The first two may each, in turn, be dichotomized on the basis of whether the personnel in question constitute a direct support of operational equipment. The underlying premise is that, for the categories of engineering design trade-offs and system support trade-offs, all personnel either provide direct support to hardware or indirect support to those personnel who do.

Category of engineering design trade-offs usually entails the projection of future manpower costs to be used in conjunction with other parameters in the comparative evaluation of alternative designs on the basis of the personnel requirements which they would generate. In such decisions costs, based on detailed difference between requirements for skilled performance, numbers of personnel, and specific maintenance specialties, are used in design selection. Within this category, certain costs, such as basic pay entitlements, would either be deemphasized or omitted in favor of costs incurred by items such as training. Emphasis is accorded to those personnel cost data which can be used as discriminants of system design.

Within the second category, system support trade-offs, the main interest is in those costs attributable to the quantity and quality of personnel required for a given trade-off option. As in the first category, cost items derived from budget and overhead are of lesser concern than those which bear directly on the personnel requirements of system support. This category may be thought of as a subset of the first in that both address the cost assessment of the manpower requirements of alternative systems or subsystems. The primary point of differentiation is that the former is oriented to the selection of systems, while the latter is oriented toward optimizing system operation and support in terms of cost.

The third category, manpower budget and planning, may or may not be based upon an affiliation of personnel and systems. It is nebulous in that it contains a full range of costing objectives which can require the incorporation of any combination of a broad variety of Air Force personnel costs in its calculations. It is aimed at the establishment of personnel related policy and is not limited to weapon systems. Costs; such as hospitalization, transportation, discipline, quarters, retirement, separation, and turnover are often included. The challenge in this area is not merely totalling such current costs but, in predicting their changes over time. In this respect, it shares a common goal of the other two categories. However, for the most part, costs within it are of the overhead variety as opposed to

the detailed system specific costs usually addressed within the other two categories of personnel cost data application.

The Cost Analyst's Needs

Logically, one should be able to derive the Air Force cost analyst's needs by tracing a description of the job to be done to the tools which it requires. The previously described categorization of cost data uses should help in this task. However, even a classification scheme which can reduce the levels of cost data utilization commonality to three, does not provide a workable basis for determining the specific needs of the individual analyst. Ideally, this should be accomplished on the basis of: an enumeration of the cost data applications within each category; the specification of the exact data element composition of the calculation most pertinent to each; and an analysis to determine the most appropriate data presentation formats. However, this is not feasible at this time. A reasonable alternative is to conduct a top-down analysis of Air Force personnel costing requirements. The preceding categorization provides a start. The next step is to identify fundamental questions which are a part of every cost analysis and, thereby, cut across categories. This should reveal basic requirements which must be met in order for the analyst to proceed to the resolution of specific costing problems regardless of application category. An examination of these basic requirements should provide direction in the specification of actions which might be taken to generally ease any analysis of cost. The following are five basic questions which cost analysts must resolve in the course of their work. They will be examined to determine the underlying issues of the Air Force system which inhibit their facile resolution.

The first question is: "To what purpose will the analysis be put?" The answer is perhaps the primary determinant of the manner in which it will be conducted and, consequently, the accuracy of the results. A reasonable answer would include the accuracy requirement and information concerning any comparisons into which the results are likely to be incorporated. Knowledge of the required accuracy would tend to insure a properly scoped effort. Knowledge of plans to effect comparisons would enable the analyst to take steps to insure a proper basis for comparison. Such steps might include the eschewal of available cost element aggregations in favor of raw data. They might also include the provision of additional supporting documentation to facilitate the checking of cost term or data item comparability by the product user.

The second question is: "What cost elements should be included in the computation?" Presently there are two main factors which govern the accuracy of the cost analyst's product: his individual experience and the amount of pertinent data at his disposal. In this instance, pertinence refers to appropriate formatting to indicate composition as well as data item relevancy. Individual experience presently must be heavily relied upon to determine, not only the data most appropriate but also, the merits of available preprocessed data. This is due to the current lack of uniformity in cost term definition and methodology for raw data aggregation within the Air Force. The analyst is faced with a "patchwork quilt" of preprocessed data aggregations, often in formats which defy a determination of their true nature.

The third question consists of two parts: (a) "What data are available, and (b) where can they be obtained?" Once the cost data requirements of a particular computation are decided upon, a problem exists in determining whether they can be fulfilled. Clearly, the work of the cost analyst would be greatly expedited by some means to quickly determine the availability of a particular type of cost data. Such means should also include source references and a description of the procedure for its acquisition. Their realization, if accomplished in a comprehensive manner, would necessitate the establishment of standard personnel cost data elements and standardized data packages.

The fourth question is: "How should cost data be preprocessed or aggregated to best serve the majority of higher level costing requirements?" Perhaps, under present conditions within the Air Force, it might be more appropriately worded: "How can a determination be made whether available cost data aggregations are appropriate for inclusion as preprocessed subcomputations in the overall personnel cost calculation?" Lacking a verification of the exact costing procedure undertaken to produce them, the analyst must either accept them on faith or perform the tedious task of evaluating aggregations which he himself has not compiled. A ready means to review the content and packaging for all preprocessed data would enable him to make selections of maximum relevance to his particular effort and avoid the introduction of unjustified error.

The fifth question is: "What is the most appropriate format for the presentation of the results of the analysis?" To achieve maximum utility, they must be presented in such a way that they can easily be interpreted and coordinated with other factors which may be brought into consideration. This requires that the cost analyst be aware of all other cost consideration which are to be evaluated in conjunction with his results. The case may be that the incorporation of alternative forms of the same data might result in a product of decidedly different utility to the ultimate user. For a cost analysis to be completely responsive to initiating requirements, there must be a means of communication such that both the user and the cost analyst are aware of what is desirable and what is available. Such communication suggests the development of a taxomony of cost data, costing procedures, and cost data formats. One of the major complaints of cost data users is that products are not specific enough to their individual needs. This complaint is predicated upon considerations of both the relevance of cost data included and incompatibilities between intended use and product format.

The Underlying Issues

The five basic questions described in the preceding paragraphs indicate a general need for an increased interaction between the analyst and the costing product user. Under present conditions, the analyst is not afforded sufficient information concerning the cost data, procedures, and formats of which he might reasonably be expected to make use. This problem is compounded by the fact that he often is unable to verify the accuracy and composition of those of which he is aware. The result has been the proliferation of individually developed costing procedures and cost data aggregations leading to products which certainly are not interchangeable and, in all probability, are not even comparable. This situation can be at least partially resolved by the implementation of a costing standardization program. However, the direction and extent of its application must be well planned if it is to be effective in affording cost analysts the tools necessary to serve the requirements of their individual organizations in ways which serve those of the entire Air Force. This will require an examination of how organizational roles interact with the production of cost data products and their integration into higher order calculations.

One particularly critical area in need of increased attention is the imputation of personnel costs. The Air Force Cost and Economic Analysis Division of the Comptroller's Office provides the standard average personnel costs which are entered into the majority of Air Force accounting, financing, and budgetary calculations. If one were to ask them how to impute costs obtained from their products; e.g., Air Force Cost and Planning Factors Manual, AFM 173-10 (99) across systems, they would probably answer that this is up to the individual cost analyst. He is the one who best knows his own requirements and so should be capable of performing this task. The manual in question is purposely set up that way. Its compilers want it to be open-ended. The theory of an individual being the best judge of his own requirements is logical. However, reliance upon it has contributed to the problem of too many individual cost analysts working toward similar costing goals, each using a different method predicated upon individual ideas concerning the apportionment and inclusion of cost data elements. These ideas are founded upon individual interpretations of inadequately specified product application. This underscores the necessity of determining the extent to which Air Force-wide personnel costing requirements can be subgrouped within the three categories previously cited, and the extent to which cost apportionment procedures can be regulated on that basis. This undertaking implies that a decision need be made concerning the degree of flexibility required and the limits of practicality for implementation.

A second area in need of increased attention is that of data collection and processing documentation. Good costing practice demands thorough documentation and uniformity in cost term definition. Present circumstances are not conducive to either. Documentation of costing procedure must be thorough enough to provide individual cost analysts the means to assess the applicability of cost data. Until recently, even the cost factors provided by the Air Force Cost and Economic Analysis Division fell short of meeting this criterion. Explanation was provided which told what basic cost data elements were included in the calculation of the annual cost of an airman by rank, but none was provided concerning those excluded. This made it very difficult for the user to assess its comprehensiveness or to accurately determine the degree to which the cost factor provided might have been misleading for a given

application. Furthermore, although it was made clear that the cost factor was based upon an aggregation of the direct on-going expense of keeping the personnel on active duty, the costs were listed in terms of rank and not by Air Force specialty code (AFSC) or skill level (2). This kind of cost averaging can be very misleading, particularly when the costing product involves personnel whose potential to incur cost is extensively affected by variables not directly related to rank.

While similar criticism may often be directed at the listing of costs by AFSC and skill level, the issuance of a revised edition (AFM 173-10), which did so, greatly improved the manual's utility. However, it did not completely eliminate this type of problem. Although cost term definitions are provided, the individual cost analyst is still faced with a considerable task when he attempts to insure the applicability of that data to his individual requirements. To do this, he would have to trace the aggregated data back to their sources and evaluate cost term definitions. Costing areas, such as personnel training, which are an aggregated input to the cost factor calculation, may prove to be extremely difficult. One reason is that organizational perspective or role often determines their inclusiveness. For example, the total cost figure for training may not include the cost of training facilities. When they are included, they can often be based on very different methods of cost apportionment. Some examples are: (a) apportionment of training facility operating cost on the basis of yearly operating cost divided by the number of trainees that year (73), (b) apportionment of the training facility cost by normalizing the cost of yearly operation over a number of years and dividing it by a normalized training load for those years, and (c) the exclusion of fixed facilities from the apportionment of training facility operating cost. In addition, it is not unusual for the cost of some training hardware to be omitted from the total cost of training because its purchase was accomplished with money from the budget of another command as part of the acquisition price of a new weapon system.

The foregoing illustrates the fact that even the products of what can be considered to be a central and unbiased costing authority within the Air Force are subject to contamination by organizational parochialism. Under these circumstances, perhaps the most effective initial step to achieve a program of standardization which serves total Air Force requirements is to reject the concept that each organization or cost analyst should be responsible for his own costing problems. The open-endedness in standard cost data presentations should certainly be avoided and changes made to relieve individual cost analysts, at least, of the responsibility for making independent decisions concerning cost inclusion and cost apportionment.

Caution must not be waived in the pursuit of personnel costing uniformity. Standardization creates its own problems in addition to solving others; for example, in the assignment of nondirect costs of personnel. Examples of these costs are those arising from the so-called nonmonetary benefits (33) rendered to military personnel, such as commissaries or hospital care for dependents. There is a danger that, if such costs are too scrupulously imputed to personnel, figures will be generated which do not reflect, or perhaps overstate, personnel associated expenditures. This caution also extends to situations involving the imputation to personnel of costs associated with the maintenance or establishment of fixed facilities. Uniformity must be achieved but, the individual cost analyst needs clearly defined ways in which he can take into account the relative softness of certain data items. He needs ways in which he can, within his own calculations, reduce costing incongruities arising from differences in the accuracy of certain cost data items. These must be provided while staying within the limits of a minimum standardization necessary to maintain the propriety of his results for inclusion in higher order personnel cost computations.

Summary

This section has described some of the basic needs of Air Force personnel cost analysts in order to produce cost calculations which can meet both their requirements and those of the Air Force as a whole. The individual needs of personnel cost analysts engaged in problems of such diversity as is to be found within the Air Force are almost totally dependent upon their delegated responsibilities. These, in turn, are determined by the degree of standardization incorporated in whatever Air Force-wide personnel costing program is in effect.

In order to be effective in consolidating the varied personnel costing practices which exist today within the Air Force, any significant attempt to fulfill its overall objectives will necessitate a major revamping of policy and

procedure. For this reason, a requirement exists to look at fundamental issues of use in defining the viewpoint of the cost analyst. Any costing program selected for future implementation must be based on a knowledge of its implications to the individual analyst. Thus an attempt was made to identify general capabilities which must be provided to him, regardless of the specifics of a particular costing program. Any attempt to list the absolute needs of cost analysts engaged in specific activities, under present conditions, would beg the question of prime importance. That is the specification of needs to be met by a standardized costing program. This is a basic prerequisite to its definition and scoping.

V. APPLICABILITY OF AVAILABLE METHODOLOGY TO USAF MILITARY PERSONNEL COSTING PROBLEMS

This section provides the results of an examination of personnel costing methodology to determine its applicability for use in solving Air Force military personnel costing problems. The methodology described in section two was examined in the light of a set of basic acceptance criteria generated by the designation of fundamental needs reported in section four. It was also viewed in terms of how its utility is affected by the user's perception of personnel.

The Role of Perception of Personnel

Costing practices may be based on a number of costing approaches. They and the techniques which they employ are based on definitions of cost which are, in turn, dependent on the way in which the object to be costed is perceived. These definitions may be strictly in terms of cost defined as a monetary expenditure, or a cost which takes into account either a return on investment or a derived relationship between monetary expenditure and some definition of value. The approaches and techniques for personnel cost assessment currently used in industry and the military reflect differing perceptions of both the utility and the products of their respective personnel (14, 39, 41, 50, 51, 52, 62). They also relect differing operational definitions of cost and are, in fact, selected on that basis (3, 9, 21, 22, 77, 93).

Among the civilian sources surveyed, the definition of personnel cost appears to subsume something more than a dollar cost expenditure and is strongly influenced by the products of the organization to which the personnel are affiliated (44, 46, 53, 59, 60). In general, it may be said that organizations whose product is a service tend to place a more inclusive value on their personnel than those whose product is a tangible item. Their choice of personnel costing methodology, however, often includes that which addresses personnel cost in terms of factors which cannot be directly related to either the product of the individual or that of the organization (64, 65). This may be a consequence of the fact that the specific contributions of members of a service oriented organization are less easily quantified than those of one which is product oriented. In the latter, the efforts of individuals can often be measured in terms of a product output and costed accordingly. This is particularly true if they perform tasks which can be described in detail. In a service oriented organization, the contribution of the individual is often ill-defined. This is due to the fact that, although his duties can be accurately described, cost benefit ascribed to his performance must be based on some relationship between it and the organization's potential to render its product service. Such a relationship is not easily defined (74).

The military, on the other hand, adheres to a very narrow definition of personnel cost and is more inclined than industry to assess personnel cost on a collective rather than individual basis (71, 84, 97). It also tends more to avoid the concept of return on investment. Although essentially a service-oriented organization, it acts as if it were a producer of tangible products by begging the question of the necessity to include anything other than a dollar cost notation in the calculation of personnel cost. This is the result of its perception of the role of its personnel and, consequently, its choice of cost definition.

Four major definitions of cost were identified as being used by either industry or the military. They are operating cost, replacement cost, investment cost, and career total cost. Each is indicative of a different perception of the role of human resources and is differentially suited to address particular personnel costing questions. Of significance to the Air Force is the fact that, although it presently limits its investigations to

operating and investment personnel costs, there are valid reasons for the inclusion of all four in meeting newly expanded requirements. Within industry, a similar requirement exists, but has not been adequately addressed as yet either. While attempts are currently underway to generate integrated personnel costing plans for industry as a whole, there is little presently available from that sector of the economy from which the military can draw in the way of an integrated costing plan which encompasses methodology for all four types of cost definition.

Through management conferences and a central pooling of human resources data, individual companies are attempting to find ways to get at what they consider to be the real heart of personnel cost assessment (89). Through the establishment of research activities jointly sponsored by industry; such as the Human Resource Accounting Program at the Graduate School of Business Administration, University of Michigan, concerted attempts are being made to define appropriate human resource accounting metrics and standardized means by which they can be translated into dollar cost. Efforts are not directed toward the development of techniques to merely compute personnel related expenditures. They are also seeking means to assess their relevance to good business practices by developing procedures which also lend insight to the solution of the underlying problem which gives rise to the need for personnel cost assessment: the problem of how to achieve maximum cost effectiveness in the use of human resources (19, 20, 23, 45, 76). This is also a primary objective of personnel costing within the Air Force. If it is to be accomplished, such things as the performance impact of investments in training, recruiting, etc., and the personnel characteristics associated with service tenure should be reflected in personnel cost calculations. This is necessary to provide planners with adequate feedback concerning the comprehensive effects of human resource investments (63).

During the course of the review of personnel costing practices, what might be considered to be a general role or guideline for the costing treatment of human resources was clearly in evidence. It is that the similar treatment of human and inanimate resources has distinct limitations in the field of cost accounting. Three facts can be shown to substantiate this, and thus, provide a reason for caution in the acceptance of certain civilian costing procedures by the Air Force. They are as follows. Unlike hardware: (a) no two humans are alike, (b) the value of human capital appreciates rather than depreciates along certain parameters, and (c) the resources required to transform human performance capability from one level to another are not always capable of being projected adequately enough to establish functional relationships, except on a broad statistical basis. Fact number one indicates the need to emphasize the valuation of intrinsic as well as extrinsic qualities. It also precludes the acceptance of overly simplified assumptions regarding replacement value. Fact number two introduces the need to take into consideration a greatly increased number of factors when attempting to incorporate, into the monetary evaluation of human resources, the rule of capital depletion and depreciation allowance established for the measurement of inanimate resources. Fact number three tends to introduce error in the quantification of the amount of human resources required, their performance expectancy, their true effectiveness, and the resources required to induce capability transformations to desired specifications.

All of the above emphasize the need for a critical examination of the similarities and differences between the civilian and military labor manpower pools, as well as between human and inanimate resources, when evaluating costing procedure for Air Force use. Applicability and transferability criteria for the adoption of civilian personnel costing techniques by USAF should include both parameters of restriction: inanimate versus human resources and civilian versus military personnel resources. The three facts described above are the main reasons why industry is placing considerable emphasis on the inclusion of value estimation techniques, which balance returns with investment, in its human resource accounting procedures. However, despite this apparently valid reasoning and the fact that a certain degree of success has been achieved, human resource value estimation has not been sufficiently demonstrated as being necessary to the Air Force.

Another caution must be observed when civilian personnel costing practices are adopted by the military. Evidence indicates that both industry and the military strive to maximize cost effectiveness. However, there are substantial dissimilarities between their respective interpretation of this as a personnel costing goal. These are subtly reflected in the techniques they now use. The possibilities

for costing distortions are great when techniques are removed from the context of the situation for which they were originally developed. An example of a source from which cost distortion could conceivably arise, is the misapplication by the military of certain capital investment techniques used by industry. Although a valid analogy may be drawn between personnel and capital investment hardware or facilities, there are well defined limits beyond which it does not extend. If carried beyond them, the basis for their use is transformed from personnel cost calculation to personnel cost manipulation. However, the limitations imposed by the dissimilar nature of hardware and human resources may not entirely preclude, for Air Force purposes, the use of similar costing techniques for both. This is particularly true if they are: (a) intended for and adequately serve well defined requirements which are limited in scope, and (b) proper recognition is accorded to the limitations of the techniques themselves.

Despite what has been said, instances may occur when military cost analysts may feel a need to include some factor which cannot be directly expressed by a dollar notation. Such instances can be dealt with on an individual basis. However, it must be remembered that the product of the military is a potential to deliver a service, the measure of which is highly subjective. In addition, examination of on-going research in the field of value assessment indicates that the capability of an organization to *effectively implement a human* resource accounting system, which takes "value" into account, is proportionately related to the ease with which it can measure the relationship between its personnel and the tangible products of their efforts on its behalf. If the "value" of the organization's product cannot be objectively measured, it is highly unlikely that the "value" of the individual's contribution can be measured in terms other than those which describe his acquisition, training, and sustainment. Thus there is a firm basis for the contention that military personnel "value" analysis may well be an exercise in futility.

Determining Applicability

The most elegant technique is only as good as the data which support it. If sufficient data of the required accuracy are unavailable, or if the steps necessary to generate them disrupt the conduct of Air Force operations, a particularly desirable costing procedure may be of little practical value. There are many reasons why some of those used in industry might be appealing to the Air Force. There are also numerous reasons for doubting the feasibility of their implementation in a military environment. Cost managerial structure is one example of the many differences between industry and the military which might inhibit the successful adoption of many civilian personnel costing practices to military use.

It is almost universally true within industry that most of the functions associated with cost, such as accounting, funding, record keeping, and budget control, are highly centralized; often being accomplished by a single department. This constitutes a distinct advantage in the employment of human resource accounting procedures requiring the calculation and subsequent comparison of returns to investments, notwithstanding that gained through the use of a single set of cost term definitions and computation rules. Current Air Force costing practices leave much to be desired in terms of the centralization of costing activity, and even more in terms of the purposiveness, centralization, and coordination of cost data collection. There is no single cost data collection organization with complete authority to impose data collection requirements on other organizations. Likewise, there is no single costing authority possessing the capability to collect and assimilate raw cost data from all organizations which incur personnel cost expenses. The highest existent personnel costing authority within the Air Force is supplied with and must base its calculations, for the most part, on previously aggregated cost figures (11). In addition, personnel cost record keeping is conducted on a basis which permits wide variation in the degree of exactitude and comprehensiveness which can be expected to result from it. It may be, therefore, safely concluded that the acceptance of any personnel costing approach or technique for Air Force use must be predicated upon either the existence of a data collection and processing capability sufficient to permit its effective use, or concomitant plans to bring one into being.

The specific applicability of a costing approach or technique to Air Force requirements is another consideration. It can be viewed in terms of those of either the cost analyst or the ultimate cost product user. In either instance, two factors are particularly critical. They are: (a) the type and quantity of the data required to use it, and (b) the merits of the costing policy which will govern its use.

The first factor is somewhat flexible in that data collection efforts may be extended. However, the nature of the costing objective may not justify it because the cost of revamping or supplementing a data collection system can result in expenditures which may more than offset those avoided or reduced by the implementation of the costing methodology which the data are to support. The extent to which the Air Force is willing to go to collect and process whatever data might be necessary to effect optimal personnel costing procedures must be determined. However, the means to evaluate that decision in terms of cost effectiveness are not available because there is little definitive information available concerning the cost involved in the conduct of present personnel costing procedures, not to mention the cost of implementing new ones. Despite this present deficiency, it is obvious that a proper criterion measure for the applicability of a given costing methodology to Air Force purposes should emphasize sufficiency at minimum cost to implement. Consideration of any new costing methodology must include the specification of costing requirements to be met by it and some indication of the extent to which current cost data collection procedures must be modified or supplemented to support it.

The objectives of cost analysts, as well as data collection procedure, are determined by costing policy. This, the second factor, is not quite as amenable to adaptive change as the first cited above. If one many assume that costing policy is predicated upon clearly defined and validated cost product user requirements, the cost analyst's objectives and requirements are likely to be equally well defined. His choices concerning whether to employ such concepts as intrinsic value or return on investment will be limited by the stringency of his costing objectives, as dictated by the policy requirements. Thus it would seem that existing Air Force costing policy might be a guideline for determining applicability. The fact is that user requirements are rarely definitized and the costing policies now governing the actions of Air Force cost analysts, supposedly derived therefrom, are determined more often by generalization than an exact knowledge of the total requirements of the ultimate cost product users. Therefore, a determination of applicability must not be constrained by existent policy.

Closely related is a consideration for the facility with which the new costing methodology can be incorporated into on-going Air Force costing practices and organizational costing structures. Although not as important a consideration as specific applicability to accurately defined costing objectives, it can be instrumental in deciding the relative effectiveness of competing methodologies. Perhaps the most advantageous, if not the most accurate, direction which the Air Force might take toward enhancing its personnel costing capability is one which calls for a minimum disruption of existent facilities. Procedures requiring a large scale reorganization of personnel, such as might be the case if personnel costing were to be completely centralized, might result in a higher degree of accuracy at the expense of creating a new bureaucracy with an inordinate attendant cost. The goal of cost effectiveness should extend to the costing procedure itself and should be a guideline to prohibit the establishment of inordinately high accuracy requirements in the determination of personnel costs.

Two other criteria, which the Air Force should use when evaluating new personnel costing methodology, are its potential for accuracy and the adequacy with which it will produce desired results within the Air Force. Many available costing models, approaches, and techniques appear adequate under certain circumstances but, embody procedural limitations when applied outside of the application for which they were developed. This is true of many of the procedures which provide adequate personnel cost estimates within the context of industry and its managerial and financial operations. They may be either totally inadequate or in need of additional development when applied in an Air Force setting. An example of this is the Causal-Intervening Variable Technique described earlier. Relationships which are the basis for the technique may hold true within a certain organizational atmosphere but, be totally invalid in another. A major advantage of adopting the technique would stem from the concurrent adoption of the mathematical relationships which make it work within an organization. If the circumstances were different within the organization to which the technique and existent relationships are transferred, it would be necessary to perform substantial research to determine transform functions or derive new relationships. In any event, significant work would have to be performed to validate them for the new environment. Of additional concern would be their stability over time.

The potential for standardization exhibited by a particular costing method is also important

because Air Force personnel costing requirements must be satisfied on two levels: that of the individual user, and that of the total Air Force. In this context, standardization implies the ability or potential to provide a means to satisfy a large number of costing requirements without the need for substantial tailoring by individual analysts. It also implies the capability to suffice with stable data. Stable data are those which are not subject to precipitous changes brought about by minor fluctuations within the organization targeted for application. An example of unstable data are those describing attitudes within an organization. Techniques such as the Causal-Intervening Variable Technique rely heavily upon capturing the effects of minor organizational changes in order to translate them into personnel cost predictors. They require a constant and complex updating of data bases. This and the fact that they often use data which are extremely subjective and difficult to interpret, make their use particularly difficult to standardize. However, if the collection of data and the use of the formulae within this technique are not standardized, the credibility as well as the accuracy of individual results will suffer.

The preceding represent a set of general acceptance criteria for use in the evaluation of personnel costing methods considered for use by the Air Force. In summation, each method should be examined in terms of the following: (a) outputs generated, (b) cost factors to be included, (c) formulas used to generate outputs, (d) input data requirements, (e) input data formats, (f) available sources of required input data, and (g) input data not currently available. The following summarize the acceptance criteria which should be applied: (a) specific applicability to Air Force personnel costing requirements, (b) data availability requirements and/or need for further development, (c) potential impact on Air Force operations and/or procedures, (d) accuracy potential, and (e) potential for standardization.

Evaluation of Available Methodology

The approaches and techniques described in section two were reviewed in terms of the above criteria. Of the three approaches which generically represent those to be found within the civilian economy, only the accounting approach appears to merit Air Force consideration; at least for the immediate future. Most personnel costing activity within the military is now being accomplished by using some form of this approach. The review did not uncover any startling methodological innovations which are directly transferable to the Air Force. What it did produce, through a systematic examination of the available approaches and the environment within which they would be called upon to operate, was the conclusion that many of the basic data requirements of approaches requiring the use of economic considerations cannot be accommodated by the Air Force at the present time.

Generic approaches such as the Economic-and Alternative Investiment-Approaches, appear to offer extremely desirable cost information. However, they provide nothing which is essential to the majority of Air Force requirements and cannot be obtained through simpler means. Their main deficiency is a requirement for highly subjective, even speculative data. It is also difficult to justify their use in terms of the criteria of sufficiency at minimum cost. The accurate evaluation of individual productivity and the plotting of individual career paths, which they require, are beyond present capabilities. However, even if the Air Force were to expend the effort necessary to gather and process the data required to effect appropriate productivity estimates and career projections, the confidence level of the final results would be extremely low.

Perhaps of greater importance is a consideration of the reality of costing needs within the Air Force. The perception of a need for the use of approaches which embody the concept of a return on investment is based on the premise that a requirement exists to produce either absolute cost estimates or to quantify cost effectiveness in absolute terms. At least two factors serve to undermine its validity. They are: (a) military budgets are enacted on a yearly basis, and (b) expenditures are, or should be, predicated on the basis of justifiable need. There are a few exceptions which are described within this report, but they are rare cases. The Air Force, for most purposes, does not have a valid need to include economic considerations in its personnel cost calculations.

The three techniques selected as representative of the gamut of those available within either the civilian or military sector of the economy were also evaluated in terms of the previously described acceptance criteria. Of the three, the Investment Quantification Technique appears to be most satisfactory. Like the Accounting Approach, its various forms are much in use within the military

today. The inadequacies of the Key Man Insurance Technique and the Causal-Intervening Variable Technique are similar to those of the Economic- and Alternative Investment-Approaches. They stem from a dependency on subjective analysis and a great many assumptions concerning human producitivity and behavior. Data concerning individual productivity within the Air Force is either nonexistent or of insufficient reliability to instill confidence in any long range calculations based upon it. The criteria of standardization potential, alone, precludes these techniques from Air Force use. This is due to: (a) the fact that their use would require numerous sets of subjective measurements for each type of military personnel, and (b) the existence of gross organizational differences which would greatly hinder the establishment of causal-intervening variable relationships valid on a service-wide basis. Another constraining factor is that, in addition to a lack of data, there exists no universal criterion measure for individual productivity relevant for the diversity of personnel types to be found in the Air Force. It follows that the implementation of methodology entailing a balancing of productivity with the dollar cost to achieve it would be less than successful.

Current personnel costing practices of the Army and Navy were examined to determine whether they included any specific approach or technique which might provide a shortcut toward improving Air Force capability through direct transference. It was determined that Army practices roughly parallel those of the Air Force. Personnel cost assessments take the form of: cost factors based, for the most part, on relatively unsophisticated aggregations of training and sustenance expenditures; and budget line items, associated with systems, which include certain personnel cost elements. These appear to relate fairly closely to Army needs but, are insufficient to meet those of the Air Force. The Army, appearing to be more system oriented than either the Air Force or the Navy, tends to imbed its personnel cost estimates in those for systems. Whether this categorical treatment of personnel as a function of systems reflects an absence of, or simply a lesser attention to, the kinds of cost apportionment problems which are a concern to the Air Force and Navy is debatable. It is, however, a personnel costing viewpoint which should be accorded increased attention by the Air Force. In any event, it was concluded that the Army has little to offer to the Air Force in terms of specific methodology capable of effecting improvements in its personnel costing capability.

The Navy has developed and implemented to a substantial degree two unique and potentially useful ways of viewing personnel related expenditures. While they do not obviate certain of the most difficult personnel costing problems which face both the Navy and the Air Force, they do provide means to circumnavigate many of the lesser ones. These viewpoints are reflected in the Navy's use of billet cost notation and its procedure to determine the manpower cost implications associated with changes in reenlistment rates. (The details were described in section two.)

Specific advantages to be gained by the Air Force from billet costing lie in simplifying the attribution of manpower costs to systems while, at the same time, maintaining a good handle on personnel planning cost data needs. Despite the fact that billet costing entails many assumptions concerning career progression and the flow of personnel through the Service, it can, if adapted and applied selectively, provide a basis for system cost comparisons of a more comprehensive nature than is now possible (40). In addition, it can provide a means of standardization allowing greater costing precision than the use of cost and planning factors, the composition of which may be contaminated for the intended purpose by the inclusion of inappropraite cost elements. The potential usefulness of the technique might be expanded by continuing its development to a point which includes a capability to calculate billet costs on a parametric basis. This would allow the analyst to manipulate the major variables which affect billet cost. Optimization could occur along several lines; e.g., manpower policy and system design itself. There is a decided advantage to be gained by tying billet cost to billet requirements, and then to system design. Although billet costing should not be the primary means to cost military personnel, it can suffice to procure acceptably accurate standardized costs for limited application in the performance of system cost trade-offs.

The second personnel costing viewpoint of the Navy holding intriguing possibilities for Air Force application entails the possibility of costing personnel in terms of their potential to avoid the incurrence of cost to an organization. In the simplest application, the cost avoidance could take the form of the acquisition cost of a replacement. This is a clever way of getting around the problem of how to apply econometric costing procedures, which require the attribution of a return on investment cost, to personnel who essentially render a service rather than produce a product which can be used as a measure of their efforts. It is unique

from the usual cost and planning factors because it allows manpower flow and behavior to be taken into account. This was not the Navy's stated purpose in developing this technique. However, its use by the Air Force as a means to place a defendable value on manpower in the performance of man versus machine trade-offs bears further examination. Of course, its intended purpose of assessing the cost impact of varying reenlistment rate would also be useful in the area of manpower and budget planning.

One of the most unsettling findings of the examination of available personnel costing methods was the strong indication that there is little hope that the Air Force can attain a high degree of personnel costing accuracy, within the framework of a high level of standardization, without a major reduction in the number of what are presently considered to be mutually exclusive cost data applications. Such things as the dynamics of the personnel flow through the system, the lack of productivity measures, and the inability to differentially value the service of personnel by type do not promote standardization. The vast differences which serve to differentiate the civilian from the military personnel costing situation are quite apparent. Less apparent are those serve to compartmentalize Air Force costing activities. The latter stem from a proliferation of costing interests which will have to be stemmed. The only apparent solution to effecting an overall military personnel costing program within the Air Force which will produce accurate cost estimates, be amenable to standardization, and rank high in terms of the other acceptance criteria previously described is to somehow categorize individual requirements within a framework of lowest common denominators. More will be said about this in the following section.

Summary

Little, other than the Accounting Approach and Investment Quantification Technique, is available in the civilian economy which can be of practical use to Air Force personnel cost analyst. Basic differences between the operation and costing goals of industry and the military combine to render the methods of one almost totally unsuitable for the other. Of the methods available from military sources, only the Navy's billet costing and calculation of reenlistment value in terms of cost avoidance appear to be more than minimally useful. Although the Navy has progressed toward achieving many of its own personnel costing goals, the results of its work offer very little in the way of products or specific procedures which are directly transferable to the Air Force. This is due to basic differences in personnel classification and operational utilization. However, many of the Navy's policies for the conduct of personnel costing activity should be seriously considered. These include: consolidation of requirements, standardization of cost products, refinement and consolidation of data bases, and coordination and integrated planning at all levels of costing activity.

Many of the factors which prevent the Air Force from achieving its personnel costing goals can be substantially counteracted by an optimization of the policies which govern its costing activities. Of crucial importance is the coordination of cost data gathering activity with long range costing goals. However, this is dependent upon their immediate establishment and the standardization of cost term definitions and cost procedure. At least for the present, it appears that the standardization of procedure should be based upon the Accounting Approach, using the Investment Quantification Technique. This seems to afford the most versatile yet simple solution to most Air Force personnel costing problems. It can form the basis for more complex cost analyses involving economic benefit or return on investment, and retain the ability to stand alone as a method to achieve straight accounting products of immediate use.

Perhaps the most essential lesson to be learned from observing the costing activities within industry and other elements of the military is the absolute necessity for the conduct of personnel costing to take place within a framework of total planning. This must extend from the highest level of long range goal projection to the lowest level of raw data collection. Of equal importance, is the fact that the costing of a quantity as complex and variated as personnel cannot be accomplished with an absolute certainty of the correctness of either the procedure or the raw data. Despite the relative merits of methodology in that respect, the bottom line determinants of their acceptance must be the measure of their pragmatism, breadth of utility, and practicality for implementation within the Air Force environment.

VI. CONCLUSIONS AND RECOMMENDED ACTIONS TO IMPROVE USAF MILITARY PERSONNEL COSTING CAPABILITY

This section is based on an overview of the present state-of-the-art in personnel costing and the personnel costing situation within the Air Force. The major costing approaches and techniques described in section two were examined to determine the best overlay of methodology and Air Force application. General conclusions and recommendations are presented to afford direction concerning steps which might be taken to effect both an immediate and long term improvement in USAF military personnel costing capability.

Utility of Civilian Methodology

The examination of civilian methods of human resource accounting revealed little which would be of practical use toward fulfilling the general requirements of the Air Force. That which would be of use and whose implementation is feasible, under present circumstances of data availability, is already within the repertoire of military personnel cost analysts. Civilian personnel costing methodology may be dichotomized: that which manipulates recorded dollar expenditures and returns, and that which deals with projections and correlations of human behavior. The latter, although used within many sectors of industry, suffers from a lack of empirical substantiation and mathematical exactitude. It is, therefore, considered to be a poor candidate for military use until such time when more objective means are developed to place a dollar value on the services of military personnel and improvements are made in the projection of individual career progression and productivity.

Civilian personnel costing methodology which manipulates recorded dollar expenditures and returns can, itself, be divided into two categories: that which entails projections of human potential and productivity; and that which consists of straight investment accounting procedures. The latter is used by military cost analysts. Adoption of the former would require a more detailed knowledge of the productivity of individual military personnel than is currently available. Fluctuations in career progression and a high mobility across job assignments within the military also tend to preclude the use of such methodology because it requires the longitudinal analysis of individual performance and rigid assumptions concerning career progression. The possibility for military application exists but, would entail sizeable tailoring of the methodology for singular purposes. It would also mandate significant changes in military procedure and record keeping.

As indicated in section five, one possible approach to evading the complexities of longitudinal analysis, while providing an approximate measure of personnel cost, is the costing of a job or billet as opposed to a person. However, in order to accommodate the economic objective of balancing a cost with some measure of return on investment, even the billet cost user needs a measure of cost effectiveness. One possibility, involving reenlistment rate analysis, was also indicated. Potentially useful, it lacks the capability to adequately measure the returns accrued to the Service by the adequate performance of a given job, not to mention the accurate measurement of differentials created by the whole range of possible levels of performance falling within the bounds of adequacy. The advantages to be gained through the use of economic analysis are still not captured. Computations are restricted to investment costs. Returns on investment remain obscure. Based on the above, it is recommended that, at least for the present, USAF military personnel costing should remain clear of costing methodology which entails the balancing of investment to returns. Those returns which can be adequately quantified are insufficient to totally reflect the proceeds of military personnel investments.

Perhaps the most meaningful measure of the Air Force's capability to carry out its assigned mission is the potential effectiveness of its weapon systems. However, weapon system effectiveness is not solely a function of the weapon systems themselves. It is the product of numerous trade-offs, many of which involve the actions and products of Air Force personnel. Their primary role is usually considered to be the manning and support of weapon systems. In fact, their own effectiveness is usually judged in terms of their contribution to weapon system effectiveness. It seems, therefore, logical that the cost and relative cost effectiveness of Air Force military personnel should primarily be tied to weapon systems. Under present conditions of fiscal awareness, it appears that the most relevant measure of personnel cost is that which relates to system cost effectiveness calculation requirements. This is true within all three categories of personnel cost data application

described in section four. Even total force planning and budgetary analyses often include the performance of intra- and inter-system trade-offs including hardware, as well as human resources considerations. Efforts to improve Air Force military personnel costing capability should be concentrated on the costing of personnel as they relate to weapon systems. This is the area in which immediate and most useful payoffs can be achieved. Total objectivity is more attainable there, and personnel planning and budgetary cost data requirements will be at least minimally met. Air Force cost analysts already have a good grasp of the primary costs to be included. The major problem yet to be resolved is that of apportioning costs to personnel. This is a problem of decision rather than one requiring additional research and development. Hence, it can be almost immediately resolved.

There are only two basic ways in which trade-offs involving personnel cost are made: (a) the comparison of absolute costs, and (b) the comparison of relative costs. Both can be performed on the basis of either on-going or time cycle cost incurrence. Both on-going and time cycle cost assessment are desirable and within the scope of present Air Force computational capability for the latter type of trade-off. However, until many of the problems described in section three are resolved, estimations of absolute cost, other than that of the on-going variety, will continue to suffer from a lack of accuracy. Solutions do not seem to rest in civilian methodology but, rather in military policy.

The nature of the military is very unlike that of industry, wherein almost all action is justified on the basis of the potential returns. The military is not profit oriented. It operates on the principle of the performance of a service to be achieved at the least monetary expenditure. Under these circumstances, costing sufficiency can be achieved by comparing relative rather than absolute cost in all but one case. This case may be described as that in which the procurement of a means to provide a service is questioned in the light of the perceived need for that service. This is, however, not a question capable of being resolved solely through costing means. Whereas the value of an intangible military service cannot be defined in terms of tangible measures, the question of comparing that valuation with the absolute cost of the means of providing it becomes meaningless. A more valid approach is to justify a military capability or need, and then to perform cost comparisons to ascertain the most cost effective means of achieving it. It appears that there has been a trend within military costing activities to forget the basic differences between the ultimate objectives of military and civilian organizations, in a desire to assimilate costing viewpoints which deceptively offer straightforward solutions to complex problems.

Civilian personnel costing methodology is available which, under limited circumstances, can be made applicable to Air Force utilization. In addition, as can be witnessed at any gathering of military personnel costing experts, there is no dearth of seemingly valid recommendations concerning directions to be taken and priorities to be noted in the performance of military personnel costing. The crux of the matter is that recommendations and priorities are currently established in a kind of intellectual vacuum. Individual costing experts have not had the opportunity to develop a comprehensive insight into all of the various kinds of requirements and work problems facing the many organizations in the Air Force. It also appears that there is no personnel costing organization within the Air Force which, by itself, possesses the depth of knowledge and insight into the total Air Force military personnel costing situation required to perform a completely valid assessment of the recommendations of individuals. There are innumerable directions which could be taken. Each is dependent upon the desired accuracy, flexibility, and comprehensiveness of the end products and the policy established concerning the limits for operational implementation of new procedures. Adequate costing tools and techniques are available. What is immediately required is the influence of an organizing force with the power to make decisions concerning the establishment of goals and the implementation of policy for selecting procedures.

Some of the findings of the Air Force Human Resources Laboratory Military Personnel Costing Conference (13) bear on the subject of defining objectives. It was recommended that a top-down approach be taken in the development of military personnel costing methodology and cost data. This would necessitate the structuring of requirements such that each would be part of a subset generated by a more general need within the Air Force. It was further recommended that, in order to be effective, personnel costing must be conducted such that the needs of system acquisition and total force planners are served, as well as those of individual organizations. This would require a very systematic and exacting approach to the definition of Air Force personnel costing objectives, to

include an allowance for future contingencies regarding costing requirements.

There are reasons of practicality involved, in addition to those of the relative merit of final solutions, for emphasizing the importance of the conduct of a systematic definition of the Air Force's total military personnel costing objectives. Requirements must not be taken at their face value. The potential exists for the expenditure of a great deal of time, money, and effort in the development of a truly comprehensive and uniform personnel costing program for the entire Air Force. The potential also exists for a long drawn out effort which may not result in completely satisfactory products. With no criticism intended, the Navy, in their efforts in military personnel costing, can be cited as an example of a victim of the latter potential. Their personnel costing efforts extended over a period of more than ten years before substantial progress was made. It is admitted that the products are less than ideal and could have been enhanced by the existence of a higher degree of coordination within the Navy's costing activities. The lesson to be learned is that priorities and direction are essential to preclude the possibility of wasted effort and inadequate products.

Directions Toward Improvement

Perhaps the single most advantageous step which the Air Force could take in order to greatly enhance its overall costing capability is to establish uniform costing standards. A second major step would be to realize that, for many purposes, relative personnel costs are just as useful as absolute personnel costs. For example, given that the maintenance of certain force levels are justifiable on the basis of need, the driving force of cost effectiveness necessitates only the derivation of cost assessments sufficient to designate the most appropriate courses of action to take in order to achieve it; e.g., training, job structuring, manpower utilization, etc. Manpower cost trends and the relative merits of competing weapon systems, in terms of their potential to incur personnel cost expenditures can, in many cases, be assessed adequately by straightforward accounting procedures; given that adequate costing standards are established and maintained, and that cost data collection procedures are implemented commensurate with the data requirements which they will undoubtedly impose. This would not suffice for budgetary purposes, but would yield usable results.

The Air Force currently has at its disposal, the essentials of costing methodology needed to resolve most of its personnel costing problems arising from post hoc (investment) costing requirements. A requirement exists for improving the accuracy and internal compatibility of this kind of cost assessment but, it can be accomplished through improved guidelines for the use of "in hand" means. There is no pressing need for new methodology in this area. The most logical and direct costing approach for this type of problem also, upon close examination of the complexity and difficulties involved in the use of the alternatives, seems to offer sizeable and immediate payoffs. It is the Accounting Approach, using the Investment Quantification Technique. This approach does not afford total comprehensiveness, either in terms of applicability to the entire military personnel costing spectrum or degree of optimal cost element inclusion within individual problem areas. It does offer ease of standardization, a high degree of universal applicability to USAF personnel costing requirements, compatibility with inanimate resource accounting practices currently in use and understood, and the means to assess its relative accuracy. Of importance is the fact that it is an approach based on cost analysis rather than cost estimation. While retaining a useful degree of accuracy and comprehensiveness, it is not burdened by the difficult task of defining relationships between cost and human behavior. Its capacity to make use of presently available data, perhaps in a reorganized format, and its potential to resolve the majority of USAF military personnel costing problems favor its use.

The relative success of private industry in costing its personnel is largely due to the centralization of costing authority and well defined organizational structuring by function. To a lesser extent, this is also true of the Navy. Standardization and a systematic planning of the data system in coordination with methodology development are key factors, as is the ability to tailor standard methodology from categorical to specific application on a building block basis.

A major prerequisite for the Air Force to capitalize on this knowledge is an increased centralization of costing authority. The high degree of Air Force costing autonomy along organizational lines must be minimized if progress is to be made in standardizing procedures and resolving problems cited in section three. Performance of the costing need not be centralized but, there must be at least a central authority

capable of defining and mandating procedure, authenticating and implementing data collection requirements, and adjudicating questions concerning cost apportionment such as those encountered in defining direct costs. This authority should also be responsible for creating and updating standard costs for Air Force personnel. This should be accomplished on a basis similar to, but more highly refined than, that upon which the USAF Cost and Planning Factors Manual 173-10 (99) are presently predicated. The main differences between the cost factors presently available and those recommended is that the composition of the latter would be much more discernible to potential users and there would be subset aggregations available for users whose special requirements preclude their acceptance of the entire composite calculation.

Categorization and detailing of Air Force cost data requirements should initiate the standardization of USAF military personnel costing procedures. This will help to provide Air Force cost analysts a basis for a fuller understanding of the consequences of choosing particular personnel cost data aggregations for inclusion in their calculations. The object is to produce a standard chart of cost data elements, indexed in such a way that various applications for processed personnel cost data may be easily associated with a predetermined pattern of data elements required for various costing objectives within the application. How the indexing is accomplished is relatively unimportant. The important thing is that a personnel cost analyst working within a particular application category (such as system support analysis), may look up a particular costing objective within his category and be provided with a listing of the specific data elements which he must aggregate in order to generate an answer. The data will change over time but the cost element inclusion structure; i.e., the pattern of data elements which comprise the solution to a question, will remain stable. The following paragraphs illustrate how such a cost data system might take shape.

Most Air Force military personnel costing requirements may be collapsed into three generic groups of applications; i.e., engineering design trade-offs, subsystem support trade-offs, and manpower planning/budgetary allocation decisions. It appears that each of these generic groups may be comprised of definable subsets of costing objectives which demand the inclusion of fewer cost elements in their calculation due to differential requirements for accuracy. The standard chart of cost data elements described above might take the form of a matrix of military personnel cost applications grouped in such a way that one axis indicates the generic group in which they belong and the other axis indicates specific costing objectives or, perhaps, degraded accuracy mode levels at which the generic group costing requirement may be satisfied; i.e., requiring successively less complicated data element structures. Each cell in the matrix would contain a list of specific applications whose requirements are acceptably met by the data element structure associated with that particular cell. It is likely that some of the cells cannot be accommodated by a single data element inclusion structure. However, a close examination of realistic needs may well define a simplified composite structure, representing a degraded but adequate coverage. The list of "sub"-applications in each cell designates the appropriateness of either a single or small group of cost element structures to the costing objectives within it. If cell requirements cannot be met by a single composite data element structure, a third dimension of the matrix could be constructed to provide the appropriate cost inclusion structure for each application within the cells bounded by the first two dimensions. Once this is accomplished, a handbook similar to a supply catalog can be compiled in which a cost analyst can index his application category, cross index his objective subset (accuracy model level), cross index his required subapplication, and find a standard listing of the data elements which should be entered into his calculation.

This kind of system opens up additional ways to aid the cost analyst. The next step would be to provide a source list for the data elements within the cost element structure he has accessed. A further advancement would be to tie a computerized data bank to the system which could provide the latest updates for the value of each data element. The ultimate would be to tie in a computer program which generates compilations based on the standard cost data element inclusion structures, upon the inputting of specific problem parameters. However, even a handbook would prove to be a giant step toward achieving the standardization of personnel calculations. It would at least provide the user with a standard procedure, standard costing definitions, and a knowledge of what he might reasonably expect to accomplish with the data available to him. Such a system would allow new requirements to be accommodated by relatively simple comparative evaluations using old requirements whose data

element structures were already in the system.

Any viable personnel costing system requires precise guidelines for apportioning costs which do not readily fall within cost element definitions; e.g., fixed facilities costs. The one described would probably call for revised methods of data collection. In any case, present methods of cost data collection could be greatly improved if they were more purposive; i.e., more closely attuned to the requirements of specific personnel cost calculations in terms of their ultimate use. Presently, data collection objectives and methods do not appear to be planned wholly on the basis of well defined needs.

Concerning the sufficiency of relative as opposed to absolute cost estimates, in some cases it is advisable to eliminate the collection of certain cost data on the basis of whether they afford a means of discriminating between the costs of different personnel types. Successive attempts should be made to reduce the number of data elements in the previously described cost element inclusion structures on the basis of minimal utility and accuracy requirements. For example, while certain cost data may denote a substantial cost incurrance to the Air Force and be of value for budgetary purposes, they may have little or no value in serving a particular purpose such as calculating military personnel costs to maximize cost effectiveness in systems acquisition.

Weapon system requirements drive personnel requirements. Since personnel requirements, both qualitative and quantitative, can be derived from an analysis of weapon system characteristics and support planning, all that remains in order to achieve a relative figure of merit for a system, in terms of personnel cost effectiveness, is to factor in a standard cost for each of the personnel types required. Total costs of individual personnel types would not be necessary. The main consideration would be to include those costs which serve to differentiate the various personnel types required by the system. To a certain extent, this is the way in which Air Force military personnel are currently costed by the models which serve as a basis for the derivation of Air Force personnel cost and planning factors (99). An extension of this procedure is needed to include the production of expanded tables indicating the cost breakdowns for various personnel and the recommended cost inclusion items for specified purposes. A major problem with the personnel cost factors available to Air Force cost analysts is the enigmatic nature of the factors themselves. This could be rectified with minimal effort.

Many Air Force needs could be satisfied by a kind of pharmacopoeia of standard personnel cost data, arranged in standard formats, presenting highly defined aggregations for general purposes. These should be supplemented with guidelines for the user which indicate ways in which aggregations might be fine tuned for highly specific conditions. In addition, aggregations analogous to those presently compiled for hardware items; e.g., acquisition cost, replacement cost, cost associated with performance reliability, should also be included. An essential part of such a presentation is the coincident presentation of knowledge concerning those cost data items which ideally should be included but, are not. A singular aggravation which the Air Force cost data user currently faces is that he is often unsure of the comprehensiveness of a personnel cost factor guide because he is not provided information concerning that which is missing but should ideally be included.

Other Air Force personnel costing needs would best be served by the use of methods based on parametric relationships. These are more suitable to resolve ad hoc (predictive) costing requirements, wherein cost estimation is required for the prediction of human resources related costs affected by design, major advances in technology, or the revamping of operational procedure. It is here where the primary need exists for the development of new methodology to account for dynamic processes affecting personnel cost. To address these, future personnel costing endeavors should investigate the development of personnel cost estimating relationships which directly tie personnel costs to operational procedure and equipment design. For the immediate future, the establishment of standard cost element definitions, and the construction of tables which depict standardized cost element structures for specifically defined applications is mandatory. These objectives are attainable now. While the development of personnel cost estimating relationships would open new horizons to Air Force personnel cost analysts in the prediction of costs associated with weapon systems, the more pressing need is to augment present efforts to enhance Air Force capability to compute the cost of personnel associated with weapon systems presently in inventory.

Manpower planning and budget activities cite a need for estimating the life cycle cost (LCC) of

military personnel. However, their needs can essentially be satisfied by billet costing procedures such as have been developed by the Navy. LCC estimates for personnel would, indeed, be of lesser value because they incorporate highly tenuous assumptions concerning human behavior. It is therefore recommended that the pursuit of a comprehensive personnel life cycle cost be dropped in favor of procedures which cost the job rather than the person performing it; e.g., billet cost procedures.

The primary USAF applications for long term personnel costing; such as life cycle or billet costing, are in predicting total costs precipitated by either the ownership of weapon systems or changes in total force planning. (Total force planning is, itself, an artifact of weapon system ownership plans.) In the former case, wherein they are used to differentiate between the potential LCC of two or more competing systems, they are not sufficiently specific to pinpoint factors of system design which precipitate high personnel cost (for pre-buy design correction). They cannot provide the analyst artifacts of cost which he could trace back to a particular weapon system or weapon system attribute. Although more practical for total force planning purposes, the quality of estimates attainable would be less than needed to realize the perceived advantages of that form of personnel costing over either yearly operating costing or billet costing.

It is therefore recommended that the estimation of long term personnel cost for use in weapon systems analysis be approached in a manner in which the attributes of personnel which give rise to cost are related to weapon system descriptors. A table of relationships (which tie fluctuations in personnel cost to weapon system attributes) would be of considerably more value to most personnel cost analysts than a table of average LCC totals for selected personnel types.

Summary of Recommendations

1. A critical need exists to establish uniform costing standards tied to specific costing requirements. Such standards should include standard cost term definitions, methods of cost apportionment and allocation, personnel cost parameters, data source lists, and data availability and accuracy measures.

2. The Accounting Approach and the Investment Quantification Technique are most suited to USAF needs and most appropriate within the circumstances of data availability and applicability to the total force structure which are likely to exist within the foreseeable future.

3. Costing authority should be increasingly centralized, not necessarily to include the calculation of costs but, to define and mandate procedures, authenticate and implement data collection requirements, adjudicate questions concerning cost apportionment, and to be responsible for creating and updating standard cost data packages.

4. Personnel cost breakdown structures should be constructed which permit problem solving on a building block basis. These should reflect a categorization of USAF personnel costing requirements and provide well defined rules for aggregating specific cost data to yield low order products and for integrating these to form higher order products.

5. Data system architecture and requirements assessment should be an integral part of costing methodology development from its initiation. It should be attuned to the requirements of specific personnel cost calculations.

6. Effort should be directed toward improving USAF capability to cost personnel in terms of the weapon systems they support. Rules should be developed to categorize personnel on the basis of whether they constitute direct or indirect support to weapon systems. Standard cost data items should be defined for personnel which reflect a common yet discriminant aspect of weapon systems; e.g., specialized training, or a highly definitized aspect of personnel capability.

7. All standard personnel cost data packages should be accompanied by a guide or index for quickly determining the consequences of their use in terms of comprehensiveness, accuracy, reliability, and underlying assumptions governing their applicability and the conduct of data collection pursuant to their development.

8. Costing methodology which balances investment against returns should be avoided until considerable improvements have been made in the technology available to quantify the returns of military investments.

9. Greater emphasis should be accorded the use of relative cost estimation as opposed to absolute cost accounting.

10. The determination of life cycle personnel cost is not critical to fulfill most USAF requirements. Other procedures such as billet costing are almost as useful and infinitely more accessible.

11. It is recommended that attempts be made to functionally relate artifacts of weapon system design and support plans to personnel cost by means of cost driving personnel attributes required for system support. It is both desirable and feasible to develop cost estimating relationships for personnel analogous to those already developed for hardware.

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