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REPORT TO THE JOINT ECONOMIC COMMITTEE CONGRESS OF THE UNITED STATES

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Feasibility Of Constructing Price Indexes For Weapon Systems

B-159896

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APRIL 10, 1972

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-159896

Dear Mr. Chairman:

As a result of recommendations made by the Joint Economic Committee, the General Accounting Office has inquired into the feasibility of constructing price indexes for weapon systems. The accompanying report on our work includes demonstrations of the construction of such indexes and suggests means for undertaking a more complete program for this purpose.

We believe that the contents of this report will be of interest to other committees and members of Congress. Release of the report, however, will be made only after your agreement has been obtained or public announcement has been made by you concerning the contents of the report.

Sincerely yours,

Elmer B. Staats

Comptroller General
of the United States

The Honorable William Proxmire
Chairman, Joint Economic Committee
Congress of the United States

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D I G E S T

WHY THE REVIEW WAS MADE

As a result of recommendations made by the Joint Economic Committee, the General Accounting Office (GAO) reviewed the feasibility of constructing price indexes for weapon systems. The primary need for indexes is for evaluating the effect of inflation on cost overruns. Inability to measure inflation accurately makes it difficult for the Congress to evaluate the effectiveness of Government's management in procuring weapon systems and to identify appropriate remedial action.

FINDINGS AND CONCLUSIONS

Available price indexes are unsuitable because they are based on purchases of other than military items or because they do not include a sufficient cross section of military items. Therefore GAO undertook a study of what would be needed to construct price indexes for military weapon systems. Two types were considered: end-item indexes which show trends in the prices of entire systems, such as ships or aircraft, and input indexes which show the prices of labor and materials used in production.

End-item index

Specification change is a fundamental characteristic of weapon systems, so much so that it is not practicable to construct an end-item index. This is not the case for such military items as Army trucks that do not involve such rapid or numerous changes as do complex aircraft and ships.

Input price indexes

Sufficient data were available to construct meaningful input price indexes for labor and materials. GAO constructed demonstration indexes for aircraft, ships, and electronics and determined that:

--Labor price indexes for direct pay could be constructed for virtually all types of labor, direct or indirect (overhead). The necessary data were available from company records.

--Material price indexes could be developed at the prime contractor level for only part of the material used owing to the specification change problem. The proportion covered by the index would depend on how far the material is advanced technologically--the greater the degree of advance the greater the proportion of the labor cost involved. Input price indexes covering major subcontractors could be used to judge the effect of inflation on the material not covered in the prime contractor's price index.

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--To identify the extent of the price change and the component of change due to general inflation, both contractor and marketwide price indexes were necessary.

--To construct industrywide price indexes for classes of systems, such as aircraft and ships, it would be necessary to develop representative bills of materials for those systems. Representative bills of materials could be developed for the relatively common items covered by a conventional price index. Hence GAO's conclusions on the feasibility of constructing price indexes for individual weapon systems apply also to marketwide indexes.

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Contractors participate in private areawide and salary surveys, and the Bureau of Labor Statistics (BLS) conducts various wage and salary surveys as part of its regular programs. It appears that the types of surveys conducted by BLS could be extended to defense industries. (See p. 19.) Price indexes of the types described could best be constructed by the Department of Defense (DOD) and BLS. This could be done by:

--Requiring contractors and major subcontractors to submit to DOD the data necessary to construct labor and material price indexes.

--Directing DOD to construct price indexes and report the results to the Congress.

--Making BLS responsible for regularly preparing marketwide price indexes for different types of weapon systems.

RECOMMENDATIONS OR SUGGESTIONS

This report contains no recommendations for action by the agencies but discusses matters warranting consideration by the Committee.

AGENCY COMMENTS AND UNRESOLVED ISSUES

Comments by both BLS and DOD indicate that additional resources would be required to carry out a program for constructing the desired indexes. Neither agency, however, has indicated what the estimated cost of such a program would be. An alternative (but, GAO believes, less desirable) approach toward constructing the indexes has been suggested by DOD. It involves consolidation of marketwide indexes into measures of inflation for specific weapon systems. (See p. 31.)

MATTERS FOR CONSIDERATION BY THE COMMITTEE

The Committee might wish to obtain, from the organizations that would carry out the program, cost estimates for construrting and reporting the proposed indexes. Such estimates would be useful in deciding whether such a program should be undertaken.

CHAPTER 1

INTRODUCTION

The Joint Economic Committee has made a series of recommendations designed to establish a basis for developing methods for systematically obtaining and disclosing information on such aspects of military procurement as profitability, status of program costs, overruns, subcontracting, cost allocation, and performance. In the area of military prices, the Joint Economic Committee stated that:

> "GAO should develop a military procurement cost index to show the prices of military end products paid by the Department of Defense and the cost of labor, materials and capital used to produce the military end products."

The primary need for such indexes is to evaluate the contribution of inflation to cost overruns. The inability to accurately identify the role of inflation renders it difficult for the Congress to evaluate the effectiveness of management in procuring weapon systems and to identify appropriate remedial action.

In response to the recommendations by the Joint Economic Committee, we surveyed the literature on price indexes and, in particular, military price indexes. The price indexes we could identify generally were not applicable to weapon systems procurements because they were based on prices of many materials not important in military procurements. Additionally it appeared to us that end-item price indexes probably could not be constructed for specific military end-items because the index number theory is not applicable to items displaying the rapid technological changes which appear to be characteristic of military systems.

Our preliminary work did suggest, however, that conventional price indexes could be constructed for labor and material inputs used in weapon systems production. Since the necessary data were not available, we decided to explore the feasibility of constructing price indexes by collecting the required data directly from prime contractors in four different defense industries.

We confined our study to labor and the relatively standard material inputs because their prices were not significantly affected by the specification changes that characterized weapon systems. We did not explore capital prices during our initial efforts because of the general infrequency with which capital was purchased and because of the difficulty in allocating the cost of capital equitably to individual weapon systems. During our work we obtained the views of a panel of consultants expert in the theory and use of price indexes.

CHAPTER 2

INDEXES IN USE FOR WEAPON SYSTEMS PROCUREMENT

Several price indexes have been officially promulgated for use in budgeting and contracting within the Department of Defense, and numerous research efforts have been addressed to the development of weapon system price indexes.

These generally are based on mostly nonmilitary purchases or do not include a sufficient cross section of military items to ensure that the price indexes are truly representative. As an aid in understanding the drawbacks to the presently available indexes and the way in which GAO attempted to overcome them, this chapter is prefaced by a short discussion of index number concepts.

PRICE INDEXES

A price index is a ratio of prices at one time or place to those at another time or place selected as the frame of reference. The index may relate to a single item and thus could be called a simple price index, or it may relate to a group of items, in which case it may be called an aggregative price index. Two indexes in common use, the Consumer Price Index (CPI) and the Wholesale Price Index (WPI), are aggregative price indexes. They are based on the price changes of a large collection of items which are deemed representative of price changes in the universe from which the items were selected. The items are combined with weights[1] which represent their relative importance in the universe.

Weights may remain unchanged until they have become out of date, at which time the entire weighting structure is revised, or they may be changed each year to ensure that

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[1] If the value of labor is twice the value of materials in a weapon system, the labor index weight in the combined index is two thirds and the material weight is one third.

changes in relative importance are incorporated promptly. If the weights are revised each year, an element of uncertainty is introduced into the price index, for part of the year-to-year change in the index may be due to the change in the relative importance of the items and part to the change in their prices.

In this study we have employed price indexes which use base-year weights, because such indexes are easy to understand and relatively simple to calculate. They are called Laspeyres or base-year indexes. WPI and CPI are essentially Laspeyres indexes.

Input versus output prices

It is necessary to distinguish between input and output price indexes because changes in one are not necessarily the same as changes in the other. Changes in input prices (prices paid for labor and materials), interacting with changes in productivity, profits, and taxes, lead to changes in output (selling) prices. It is conceivable, for example, for labor prices to rise but for end-item prices to fall, because the substitution of capital for labor (for example, in the form of labor-saving machines) results in the use of substantially fewer man-hours and because the cost of the capital is less than the cost of the man-hours which were eliminated.

In this study the frame of reference is the prime contractor. All resources which it purchases are viewed as inputs. Each item of resource has a unit price, i.e., input price. The weapon system delivered to the appropriate service command by the prime contractor is its output, and the weapon system has a unit value, or output price. Except for Army trucks, this study deals with input prices for labor, materials, and components.

Quality change

"Quality change" is a term which refers to changes in the characteristics of an item. It is important to adjust price indexes for changes in quality, for such changes are often the cause of, or are accompanied by, changes in price.

If the characteristics of the items being priced change over time and if the index is not adjusted to compensate for changes, one would be led to believe that the prices have changed when, in reality, the articles have changed. For example, if the price of a car increases because a more costly three-speed automatic transmission has been substituted for one having two speeds, it may be misleading to say that the price of the car has gone up. The car has changed, and, until we adjust for the change, we cannot be sure which part of the overall price change is due to a change in the characteristics of the car and which part is due to other causes.

Quality change is a fundamental characteristic of weapon systems. It is manifested by minor changes in a particular system during fabrication; by model changes; and, in the extreme, by the replacement of one system with another of the same type. In our opinion, it is due mainly to the difficulty of adjusting for quality change that conceptually sound output price indexes for weapon systems have not been developed, despite the large number of attempts to do so.

PROBLEMS WITH INDEXES NOW IN USE

Attempts have been made by Government and non-Government organizations to construct price indexes for major weapon systems. Almost all indexes are based upon labor and material inputs. The labor data usually are average hourly earnings in the producing industry, and the material data usually are selected components of the regularly published WPI. Two examples are discussed in appendix II.

Two general observations may be made concerning the indexes based on WPI data. First, some of the items priced for WPI are unrelated to the weapon system for which the price index has been constructed. For example, WPI for fabricated structural metal products has been used as one of the series constituting the material index for a weapon system. Among the more important items in this WPI series are fabricated structural steel for buildings and bridges, single-hung residential aluminum windows, and steel-door assemblies. Price movements in these items are not necessarily closely related to the price movements of the weapon system material.

Second, the weights with which the labor and material indexes are combined into a weapon system price index may vary substantially for the same type of system from one study to another. In the U.S. economy, average hourly earnings historically have increased faster than WPI. Consequently systems requiring greater proportions of labor to material inputs will display greater rates of increase in their price indexes. (See app. II for additional discussion of prior index number development efforts.)

USE OF PRICE INDEXES IN BUDGET ESTIMATES

It is the policy of the Office of Management and Budget (OMB) to require the preparation and submission of budget estimates in terms of the price level at the time of budget preparation. Until December 1970 there were very limited exceptions to this policy. If increases in prices were known with assurance, as in the case of increases provided by law or by contract, the increased price was permitted to appear in the budget estimate. An exception granted to the Navy permitted the inclusion of an estimate for inflation in the procurement cost of ships because of the length of time involved in ship construction.

The DOD Comptroller has promulgated price indexes to be used in the preparation of budget estimates, in the absence of data specifically applicable to a given system. The indexes are listed in table 1 below.

Table 1

Indexes to be Used in Budget Estimates

Fiscal year	Procurement	RDT&E (note a)	Family housing and construction
	(percent)		
1971	100.0	100.0	100.0
1972	102.6	103.8	104.8
1973	104.5	107.5	109.2
1974	106.1	110.8	113.3
1975	107.5	114.1	117.3
1976	108.9	117.5	121.4
Post 1976(note b)	1.3	3.0	3.5

[a] Research, development, test, and evaluation.

[b] After fiscal year 1976 the indexes are to be increased by the compounded percentages listed.

Subsequently, in December 1970, OMB granted DOD permission to incorporate into fiscal year 1972 budget estimates such allowances as those listed above for anticipated inflation for weapon systems research, development, test, and evaluation; for the procurement of major weapon systems; and for major construction programs and family housing. This was done to provide for more realistic budget estimates for long-lead-time programs.

USE OF PRICE INDEXES IN
CONTRACT ESCALATION CLAUSES

Prior to the above exception, official weapon systems price indexes were used primarily in contract escalation clauses, where they were used retrospectively rather than prospectively. The better known of these indexes are the Navy's Material Index for Steel Vessel Contracts and the Index of Change in Straight-time Average Hourly Earnings for Selected Shipyards in Steel Vessel Construction.

The material index is computed for the Naval Ship Systems Command (NAVSHIPS) as a service by BLS. The index comprises three regularly published components of WPI combined with weights supplied by NAVSHIPS. The weights are based on an estimate by the Maritime Administration of the mix of materials in a typical commercial cargo ship constructed in the 1950's.

The earnings index is based on a survey of 18 shipyards with which the Navy does most of its business.[1] The indexes are combined with weights that represent the respective material and labor costs of the vessel under construction. The weights are predetermined on a procurement-by-procurement basis.

The Army Tank-Automotive Command (TACOM) also makes use of a specially constructed index. TACOM, together with BLS, developed the index known as the General Purpose Tactical Vehicles Index A by utilizing three regularly published BLS indexes[2] and weights specified by both TACOM and BLS. The index is used to adjust prices of vehicles procured under multiyear contracts. A discussion of the numerous

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[1] Although the present index has been used since 1962, an earlier index is still prepared because there are several contracts outstanding which use the index in their escalation clauses.

[2] Two of these indexes are components of WPI. The third index is the "Durable Goods Average Hourly Earnings, Excluding Overtime" index.

studies addressed to the development of weapon system price indexes will be found in appendix II.

In summary, the indexes which have the longest history of use in DOD are used by the Army and Navy for contract escalation clauses. The indexes promulgated by the DOD Comptroller promise to have wider application, however, and may result in greater consistency in estimating price changes due to inflation.

We believe that cost analysts at various echelons prepare price indexes for use in cost-effectiveness studies and that budget analysts prepare estimates for internal use which incorporate changes in the price level. The extent to which estimates for inflation eventually appear in budgets presented to the Congress and OMB has not been ascertained at this time.[1]

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[1]We did not attempt to exhaustively identify all price indexes used in DOD or the services for purposes of cost estimation. We did learn, however, of price indexes promulgated by Headquarters, Army Materiel Command, and percentage guidelines issued by Headquarters, Air Force Systems Command. In these indexes and guidelines, the commands permit considerable latitude to the cost analyst in the application of the indexes or percentage guidelines to the problem at hand.

CHAPTER 3

FEASIBILITY OF CONSTRUCTING WEAPON SYSTEMS INPUT PRICE INDEXES

During the early stages of our review, we learned that advances recently had been made in index number theory regarding the quality (specification) change problem. As discussed in chapter 2, it is due mainly to the difficulty of adjusting for quality change that conceptually sound output price indexes for individual weapon systems have not been developed.

An approach based on multiple correlation theory[1] has been applied to automobiles, refrigerators, single-family houses, and several other industrial and consumer items. In our review, however, we found no application of this theory to complex, rapidly changing military items.

SCOPE AND APPROACH

We believe that the application of the available theory on quality change will not result in output price indexes, which would be comparable from year to year for such weapon systems as aircraft and ships. Consequently we have confined our exploratory efforts in constructing indexes to inputs whose characteristics do not change significantly over short time periods and therefore are amenable to description by conventional price indexes.

In many prior efforts components of WPI were combined with average earnings statistics to obtain a weapon system price index. Inspection of the items constituting WPI revealed that very few exclusively military items were priced in the index. In addition, the average hourly earnings statistics are subject to the influence of changes in the composition of the work force.

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[1] A statistical technique used to determine the extent to which a change in some quantity (price in this case) is associated with changes in other quantities considered to influence the first quantity.

In the long run the composition of the work force may change because the types of skill change or because the average skill levels of workers change, or both. In the short run average earnings may be affected by layoffs of the less senior, less skilled employees during periods of business contraction. Neither of these factors bears on the price of labor services although both factors influence average hourly earnings (i.e., cost per hour).

We decided to use data which related to actual military items and to labor prices rather than to average costs. Since this type of data was not available in DOD, we embarked upon an effort to collect it directly from selected prime contractors.

To learn whether there were any institutional differences among contractors producing different types of weapon systems that would cause differences in the availability of data, we explored the feasibility of constructing labor and material price indexes for several types of systems: aircraft, ships, electronics weapon systems, and Army trucks.

We were able to develop sufficient information to demonstrate construction of labor and material input price indexes for an aircraft and for an electronics system, of a shipbuilding labor index, and of an Army truck end-item index.

We discovered that the shipyard selected for study maintained its data in such a format as to make it difficult for us to demonstrate construction of a material price index within our time constraints. This may not be the case in other shipyards, but for the one selected our time and resource limitations precluded the construction of other than a labor price index.

We learned that access to the required input data for trucks would entail great difficulties. End-item prices were readily available from the procurement contracts, however, and these data enabled us to explore the feasibility of constructing end-item indexes for this relatively simple and familiar military system. The extent to which these indexes may be representative is discussed below.

AIRCRAFT MATERIALS AND COMPONENTS

The aircraft selected for our study has been in production for more than 10 years. Our reason for selecting this plane, rather than a more recently developed aircraft, was to minimize the likelihood of encountering the problems associated with quality change when constructing the index. This aircraft may be described as a system of moderate technological advance.

The demonstration index we constructed covers approximately 50 percent of the value of the materials and components used in the aircraft. Most of the covered materials are basic industrial materials, and the components are standard, common, or representative of similar inputs in other applications. Data on the nature and quantity of materials used were available in considerable detail from the contractor.

In selecting specific items from the material accounts to be covered by the price indexes, the contractor was asked to identify those which were standard, common, or representative of similar items used in similar types of aircraft. This was done to avoid problems of quality change or discontinuity. Of the fiscal year 1968 material cost for each aircraft, 44 percent was excluded as being nonstandard. The excluded items were not amenable to description by conventional price indexes. Among the excluded items were such items as flight control, navigational, and related warfare equipment. The propulsion system, however, was able to be included because of its use in other aircraft.

In addition, 6 percent of the material cost was omitted because data were not readily available for two categories of material (compounds and paints and miscellaneous small parts) and because another category (controlled standard and commercial parts) contained so many heterogeneous, low-value items as to be considered not worth the effort. Had these three categories of material been included, the coverage of the material account would have been about 56 percent.

Various approaches were employed in the selection of the items that would represent the price changes in the universe from which the items were drawn. Categories of material inputs to the aircraft (as defined by the contractor), the contribution of each material category to aircraft cost, the portion of each category we covered in the demonstration index, and the kinds of materials covered in each category are listed and described in appendix I. Also the proportion of each account sampled and the criteria used in their selection are discussed in appendix I.

Unlike BLS prices, which are list prices quoted by sellers, the prices we used are final transaction prices obtained from the contractor's purchasing department. The price for a given item used in the index number formula is the weighted average price of all transactions during the year.

Even though most of the items priced are standard, common, or representative, variations in price occurred due to variation in the number of items procured during each transaction or due to the type of purchase order used. For example, sheet and plate were procured under a blanket purchase order which enabled the contractor to procure these items at fixed unit prices during fiscal years 1969 and 1970. Since individual transaction prices are influenced by the size of the transaction and the type of purchase order, any comparison with prices collected for WPI should be made in the light of the particular circumstances.

The demonstration indexes derived appear in table 2. The percentages in parentheses represent the proportion which that cost category bears to the material cost for each aircraft (including engines) in fiscal year 1968 prices.

As would be expected with indexes for different categories of inputs, the magnitude and direction of movement were not the same for all material accounts. Those accounts consisting of labor-intensive items (contractor-designed purchased parts, vendor-designed purchased equipment, and part of major purchased equipment) display greater rates of price increase than do accounts consisting of capital-intensive items (castings and forgings; bar, rod, tube, and extrusions; sheet and plate stock; and miscellaneous fabrication materials). Indeed, both accounts that declined in price were composed of capital-intensive items. For comparative purposes WPI for industrial commodities is included in table 2.

Table 2

Airframe Material Input Price Indexes
(Fiscal year 1968=100)

Category of material input	Fiscal year 1968	1969	1970
Sheet and plate stock (1%)	100	86	86
Castings and forging (1%)	100	105	110
Bar, rod, tube, and extrusions (3%)	100	100	107
Contractor-designed purchased parts (3%)	100	107	113
Miscellaneous fabrication materials (4%)	100	101	88
Vendor-designed purchased equipment (5%)	100	109	113
Subcontract (18%)	100	105	110
Major purchased equipment (14%)	100	105	112
Aggregate (49%)	100	105	110
WPI, industrial commodities	100	103	107

In summary, data are available for the construction of price indexes for the relatively common items used in airframe assembly. In the system selected for study, the materials which cannot be covered because the items procured and used differ over time account for 44 percent of the material value of the aircraft. For the most part, they are subsystems essential to the mission of the aircraft: weapons, navigation, and most communications subsystems.

Since the aircraft makes use of an engine which has application to other aircraft, the engine is included in the material price index. Had it been an advanced type with unique application to the subject aircraft, it, like the weapon systems, navigation subsystems, and communication subsystems, would have been excluded. This would have reduced the coverage to 37 percent of the material cost of each unit.

AIRCRAFT LABOR

Labor price indexes are considerably easier to construct than are material price indexes because material inputs are subject to frequent technological changes. The contractor aggregates labor price data on a plantwide basis rather than by specific aircraft model; however, since most of the work force in the plant receives wage and salary increases at about the same time, the approximation of a labor price index for a given system by a plantwide index does not seem to introduce undue error. We were able to confirm our initial observations by reviewing the record-keeping systems and by constructing demonstration indexes for two other contractors.

We constructed two types of labor indexes for contractor X which assembled the aircraft on which the material index is based: (1) an index of average hourly earnings of all direct employees working on Government-approved projects and (2) an index of prevailing wage and salary rates. The earnings index is an index of cost for each man-hour and included cash payments, such as base pay, overtime and premium pay, and shift differentials. The earnings index, since it is constructed from the simple arithmetic average of payroll divided by hours worked, is affected by shifts in overtime, shifts in the composition of the work force between lower and higher paid employees, changes in pay rates, and all other factors which influence the number of man-hours or the size of the payroll.

In contrast, the wage rate index is a measure of the price (direct wage rate) of labor services. It is unaffected by changes in such variables as overtime, and the composition of the work force and measures only changes in the prevailing wage and salary rate for the work force which existed in the base year.

For this reason we refer to the wage rate index as a labor price (as distinguished from cost) index. Neither index includes fringe benefits, however, and, to the extent that the trend in fringe benefits for each man-hour differs from the trend in wages and salaries for each man-hour, cost and price indexes based upon total remuneration will differ from the pilot indexes we developed.

Indexes of composite labor price and of average hourly earnings for contractor X are shown in table 3, which also includes an index of average hourly earnings in the aircraft and parts industry, SIC[1] 372, based on data reported by BLS.

For the 3 years covered by the data, average hourly earnings in this contractor's plant rose slower than the industrywide average. This differential may have been due to a shift in mix of employees to lower wage and salary earners from higher wage and salary earners, to a shift in the proportion of overtime worked, or both.

Average hourly earnings indexes and pure labor price indexes also were constructed for two other contractors in the same geographical region. These are shown in appendix I. Material indexes were not constructed because of time and manpower constraints.

Table 3

Labor Price Indexes
and Average Hourly Earnings Indexes

Contractor X

(1968=100)

	1968	1969	1970
Price indexes:			
Hourly employees	100	105	110
Salaried employees	100	107	113
Composite	100	105	111
Average hourly earnings indexes:			
Contractor X hourly employees paid	100	106	111
SIC 372	100	107	114

Note: Indexes for hourly and salaried employees are approximate.

[1] SIC is the abbreviation for standard industrial classification. All productive activity in the United States has been categorized and assigned code numbers by OMB.

The construction of industrywide labor price indexes appears to be established in practice as well as in concept. The contractors surveyed in this study participate in surveys of salaries and wage rates for occupations representative of aerospace industry employment. Thus procedures have been established and resources have been committed to the collection of data similar to those which would be required for the construction of labor price indexes.

Similarly BLS collects much of the data required for index number construction in its white-collar-employee surveys and area wage surveys. Both of these include data from the manufacturing sector of the economy. Hence, machinery presently is in operation within BLS for the collection of the appropriate data and contractors are supplying the required data for private surveys to which they subscribe.

The expansion of the BLS surveys to the aerospace industry and the publication of results with lower levels of aggregation by industrial class appear to be straightforward. This would not impose any significant reporting burden on the contractors, for they presently are participating in similar surveys. The expansion of the BLS surveys, if coupled with surveys of the value of fringe benefits for each hour, could yield price indexes for the bulk of labor used in weapon systems production.

In summary our work in three aerospace plants suggests that sound price indexes of the labor input into weapon systems can be developed. The prospect for industrywide indexes appears extremely bright because BLS and the contractors presently conduct surveys of the type which would be required for the purpose of constructing labor price indexes.

ELECTRONICS MATERIALS AND COMPONENTS

The system studied is the major subsystem of a shipboard electronics weapon system which has been in production since 1966 and is a modification of systems produced earlier. It is advanced and complex. Thus the system affords an opportunity to observe the impact of advanced technology on the feasibility of constructing input price indexes.

Our observations on the construction of an electronics materials index are very similar to those associated with the aircraft materials index. The items can be readily identified from the bill of materials, and their prices can be obtained from the purchasing department. Only a part of the material and component input can be covered by a price index because of problems of uniqueness and quality change. Engineers employed by the contractor believed that representative items of material could be identified for other types of electronics weapon systems.

Approximately 31 percent of the unit price, excluding the price of unique equipment, accrues to materials, 16 percent to labor, and the balance to overhead and profit. The bill of materials was used to identify the components of the system, and transaction prices were obtained from the purchasing department. All purchases within the year were used to obtain an average price for the item, which was taken as the price for that year.

Indexes are presented for two types of material inputs, common items and representative items. Common items, or off-the-shelf items, are those which can be used in any electronic system; e.g., screws, nuts, and bolts. Representative items are those which are manufactured to the specifications of the system studied but which are similar to items used in other types of military electronics weapon systems; e.g., servomotors and switches.

We followed the contractor's convention in establishing the categories of material input. As shown in appendix I, table I-F, these categories account for only a relatively small part of the total value of materials and components in the weapon system.

The demonstration indexes are shown in table 4. For comparative purposes, WPI for electronic components and accessories (code 11-78) is also presented in table 4. The proportions of each category sampled for index construction purposes and the individual item indexes are also shown in appendix I, table I-F.

As shown in appendix I, perhaps the most significant feature of the indexes for individual items is their wide swing from one year to the next. For example, the price index for capacitors, diodes, transistors, and resistors increased 38 points between fiscal year 1967 and fiscal year 1968 but fell 45 index points the following year to a level of 93. Similarly the index for transistors fell 13 points between fiscal year 1969 and fiscal year 1970; the index for transformers changed in roller coaster fashion--sharply going up and down and up again--between fiscal year 1967 and fiscal year 1970.

Table 4

Electronics Material Input Price Indexes

(fiscal year 1967=100)

	Percent (note a)	Fiscal year 1967	1968	1969	1970
Common items	5.2	100	136	93	88
Representative items	15.9	100	93	94	84
Agregate	21	100	98	94	85
WPI electronic components and accessories (code 11-78)	-	100	100	100	101

[a]Percent of total material cost of one system (excluding unique equipment) in fiscal year 1967 represented by the listed items.

In the plant selected for study, prices of common and representative electronics components decreased between fiscal year 1967 and fiscal year 1970, while WPI for electronic components and accessories remained virtually unchanged. It cannot be concluded, however, that indexes based on contractor data are more accurate than WPI.

Our pilot indexes are constructed from data obtained from one contractor and relate to one weapon system. Consequently their representativeness of military electronics' price movements is unknown. In addition, the qualifications raised in connection with the comparison of the airframe materials index with WPI hold; the prices are not comparable, the items are not comparable, and the sizes of the transactions are neither comparable nor fixed.

ELECTRONICS LABOR

Our observations on the feasibility of constructing labor input price indexes for electronics systems are generally the same as those relating to aircraft labor. We constructed true labor price indexes from data available in collective-bargaining agreements and plantwide salary schedules. These indexes are presented in appendix I and tables I-G through I-I for the various labor grades at the plant. Because data on the number of employees or hours worked in each grade were not available for the base year (1967), the indexes are not aggregated to a plantwide index. Data for later years are available, however, and an index could have been derived by using one of these years as the base year.

Our work on labor input price indexes for electronics contractors has been extremely limited in scope. Nevertheless the availability of collective-bargaining agreements and salary schedules suggests that the same techniques employed in the aerospace and electronics plants we visited could be duplicated in other electronics plants. Insofar as wage increases appear to become effective for most of the plant at approximately the same time, indexes based on plantwide data are appropriate for labor on individual weapon systems produced in the plant.

SHIPBUILDING MATERIAL

We selected a major shipyard for study, but, because of time and resource limitations, we confined our efforts to a review of the type of data available for the construction of material indexes and to the development of a pure labor price index.

A bill of materials did not exist for combat ships under construction at the shipyard selected. The general type of materials used in each hull could be ascertained from the purchase order obligation records. Detailed price and quantity data were available only from voluminous purchase orders. This, however, would not preclude the construction of naval ship price indexes.

If industrywide price indexes were to be constructed, any source of information on the nature and quantity of inputs could be combined with the price information obtained to develop the desired indexes. At the shipyard we selected, the purchase order records could be used for this purpose.

SHIPBUILDING LABOR

The shipbuilding labor price indexes which we developed from employment data and union agreements appear in table 5, along with an index based on BLS average hourly earnings in the shipbuilding and repair industry (SIC 3731). It may be seen that the trend in pay rates in the shipyard studied was approximately the same as the trend in average hourly earnings in the industry as a whole. Indexes beyond 1968 have not been constructed, and the availability of the data required to do so has not been completely explored.

END-ITEM PRICE INDEX FOR ARMY TRUCKS

Army trucks are amenable to description by conventional indexes because their characteristics do not change significantly over short time periods. We therefore included trucks in our exploratory efforts to learn whether there were any particular problems in the construction of indexes for such military end-items.

Our source of data was the procurement contracts for delivery of trucks between 1965 and 1970. The contracts were multiyear type awarded for deliveries over a 2- or 3-year period at a fixed unit price for the first year.

Table 5

Labor Price Index For a Major Shipyard
and Index of Hourly Earnings
in Shipbuilding and Repairing
(SIC 3731)

(1961=100)

	1961	1962	1963	1964	1965	1966	1967	1968
Labor price index	100	104	107	110	110	114	117	121
Average hourly earnings index--SIC 3731	100	103	106	108	108	113	117	122

Subsequent prices are changed under an escalation clause which employs the General Purpose Tactical Vehicles Index A, as described earlier (see ch. 2), but are subject to a price ceiling. Deliveries under the contracts studied occurred between 6 and 15 months after the award date.

Although prices for each year were available, data as to the actual delivery dates under any particular contract could not be readily obtained. Consequently, for demonstration purposes, it was assumed that the first delivery under the contract occurred in the first calendar year after the date of the contract award and that the second and third deliveries, if there were any, occurred in the second and third years, respectively, after the date of the contract award.

Two types of price indexes were developed. One was an index of weighted-average prices of all vehicles delivered in each year, and the other was an index based upon award prices only. The former index included in the weighted average vehicles whose unit price was increased under the provisions of an escalation clause, as well as the unit price of vehicles delivered in the same year under new contracts, that is, contracts under which escalation provisions had not yet come into play. Separate indexes were developed because there was an upper limit of 3 percent on the amount of escalation permitted in each year, and an index utilizing prices constrained in this manner may not fully reflect underlying market forces.

The indexes developed appear in table 6. The General Purpose Tactical Vehicles Index A and WPI for motor trucks have been included for comparison. Gaps in the award price index indicate that we could not identify a contract awarded for delivery commencing in that year. If a price index existed for the "with escalation" series for a year in which no "award price" index existed, the reason was that deliveries were made in that year under contracts executed in prior years. For 1969 and 1970 the 2-1/2-ton truck "with escalation" and "award price" indexes are identical because we could identify only 1-year contracts for those years.

On the basis of our work with indexes for Army trucks, we believe that end-item indexes for similar military procurements can be constructed.

Table 6

Indexes of Selected Army Truck Prices

(1965=100)

Type of truck	1965	1966	1967	1968	1969	1970
1/4 ton:						
With escalation	100	101	103	109	115	118
Award price	100	99	-	112	-	-
2-1/2 ton:						
With escalation	100	102	104	-	110	122
Award price	100	99	-	-	110	122
General Purpose Tactical Vehicle Index A	100	102	105	110	116	123
WPI, motor trucks (14-11-02)	100	101	103	106	109	114

CHAPTER 4

EVALUATION OF AGENCY COMMENTS

Drafts of this report were submitted to BLS of the Department of Labor and to the Office of the Assistant Secretary of Defense (OASD) (Comptroller). Written comments have been received and are included as appendixes III and IV. Details of the written comments and our related views are presented below.

BLS comments

BLS agreed with the approach proposed in this report and stated that:

> "The BLS believes that the approach proposed in the GAO draft is feasible, and that constructing price indexes for labor and materials used in the production of major weapons systems would be useful in analyzing and evaluating Defense Department costs of acquiring weapons. ***
>
> "With respect to any possible BLS role in implementing the proposals contained in the GAO report, this would represent a new program for the BLS and could not be carried out with existing resources."

BLS pointed out that, until it had determined what priority should be assigned to this and other new programs under consideration and because of manpower limitations imposed by OMB, it was unable to say whether the work outlined could be undertaken even if funds were made available.

OASD (Comptroller) comments

In a general statement describing the content of our report, OASD stated that:

> "*** By looking at systems with relatively more standard material inputs and fewer technologically advanced or unique items, it was

hoped that a larger proportion of the inputs could be included in an index."

The systems used by us to demonstrate the construction of input price indexes were chosen because they had been procured over a period sufficient to enable the construction of indexes and because they were representative of a range of procurements. We performed our study at the prime contract level, however, and consequently did not obtain input indexes for some major subsystems of certain systems.

In discussing indexes OASD commented that:

> "*** the report suggests that hard-to-define or unique items be further broken down into their constituent inputs of labor and simpler materials. In this way, cost indexes could be constructed for even more technologically advanced systems. This would, of course, require considerably more record keeping because the inputs would need to be priced each time they pass from one subcontracting tier to another ***."
>
> * * * * *
>
> "*** In our view, attempting to increase the coverage of the index by obtaining data from the various subcontracting levels, assuming the inputs could be accurately traced from one contractor to another, may add more effort and expense than the results would warrant."

We have not proposed the construction of cost indexes for which inputs would need to be traced from one subcontracting tier to another. We are suggesting that labor accounts for most of the resource inputs to technologically advanced subsystems and components and that price indexes for labor can be constructed. We therefore believe that, for those subsystems and components (materials at the prime contractor level), construction of price indexes at subcontractor levels can substantially aid in judging the contribution to system cost overruns.

OASD commented also that:

> "*** all price changes in labor and material inputs *** cannot be ascribed to general inflation."
>
> "The problem of distinguishing cost increases due to inflation from other causes would be especially difficult for indirect costs. *** there has been a broad decline in defense and aerospace business.*** As *** projects terminate or decline, the allocation of fixed overhead necessarily increases on the remaining projects. This can alter the pattern of costs from what we were originally intending to measure and as a result would confuse inflationary increases in indirect costs with other causes of cost increases."
>
> "*** Because indirect labor costs are not directly identifiable with specific product costs but are usually included in overhead expenses, it is much less likely that a workable continuous price index could be established by this approach."
>
> * * * * *
>
> "*** Also, under this approach, DOD would be required to produce price indexes that could be substantially influenced by Defense decisions, a step which OMB has indicated previously it does not consider advisable."

In this report we have concluded that price indexes can be constructed for labor and material inputs used in weapon systems production. We further believe that, to a large extent, labor (albeit indirect labor) accounts for a large part of overhead expenses. We have demonstrated that the data required to price salaried exployees in those classifications contributing to overhead are available. We therefore believe that some portion of cost changes can be ascribed to salary and wage changes in the overhead accounts.

As we have stated, however, costs may change for reasons other than inflation as, for example, contractor responses to DOD decisions or reallocation of overhead in response to business declines. The specific causes would require exploration by audit or analytical techniques--but such price changes should not appear as changes in an index designed to measure inflationary changes.

OASD commented further that:

> "*** the draft report does not appear to consider that the percentage of labor to material costs for a specific system may change substantially as that system progresses from the research and development stage to the production phase. Also, the composition of labor itself may change with say a relatively larger share of engineering group included in the early stages but with a greater proportion of maintenance or other nonproduction workers being added in the later phases."

Concerning industrywide indexes OASD stated that:

> "*** Separate indexes would, of course, be desirable for Research and Development and production-type systems."

One basis for the choice of systems studied in this report was that the systems had been in production for a period sufficient to allow for construction of input price indexes.

We agree that, if the costs of a system are to be considered over the complete range from the research and development phase through the production phase, separate indexes would be desirable for each of these phases. We believe, however, that account would need to be taken for the change in mix of labor only to the extent that concurrent development and production may occur for any weapon system. We believe also that such concurrency is generally uneconomical and should be reserved for systems needed urgently.

In stating its views on construction of individual weapon system price indexes, OASD commented that:

> "*** it would be difficult to expect to achieve this objective by collecting the data using the Selected Acquisition Reports (SARs)."

We have not examined into the feasibility of using SARs as a means of collecting the data required and therefore cannot comment on any difficulties which may arise in using them for this purpose. We believe that, if it is decided to construct such indexes, DOD should determine the most economical means for collecting the data, whether as an adjunct to SARs or by other means. We believe also that the indexes constructed should be associated with the weapon system costs which are reported to the Congress.

In commenting on industry price indexes, OASD stated that:

> "*** The first step should be to construct industry-wide indexes for defense industries. Once this is accomplished more research would be required before we could see if these industry-wide indexes could be consolidated into an acceptable measure of inflation for a specific major weapon system."

In our opinion, the Committee could have more confidence in an index constructed from actual data for a specific weapon system to measure inflation than in consolidated industrywide indexes such as those proposed. We believe further that construction of individual weapon system indexes--at least on a limited scale--would be necessary to validate the results of research proposed by DOD.

CHAPTER 5

CONCLUSIONS AND MATTERS FOR CONSIDERATION BY THE COMMITTEE

Conclusions

Input price indexes can be constructed, using conventional index number techniques, for the labor and conventional material inputs used in weapon system production. Price indexes of direct wages and salaries are conceptually sound and can be constructed from data available from labor-management wage agreements and plantwide salary schedules. We believe that their scope can be expanded to include fringe benefits.

The coverage of the material indexes at the prime contractor level is considerably less than complete, for many of the subsystems and components are technologically advanced and/or unique to a given weapon system. Nevertheless we believe that input price indexes can be developed for such technologically advanced systems, because labor accounts for most of the resource inputs and because price indexes for labor can be constructed.

For weapon systems of different complexities, the major difference in input price indexes will be in the relative amounts of labor and material inputs which are covered. For those materials not covered at the prime contractor level, input price indexes can be constructed at subcontractor levels. Such indexes can substantially aid in judging the contribution of inflation in the materials not covered at the prime contractor level to system cost overruns.

We believe also that input price indexes could materially aid in understanding the contribution of price changes to development cost overruns. Labor services represent a higher proportion of development costs than they do of production costs. It appears, therefore, that input price indexes for development would cover a greater proportion of resource inputs than would input indexes for production.

The development of end-item indexes that would be comparable from year to year for military weapon systems would require the use of analytical techniques which have not been widely applied but which nevertheless hold out promise of success for some less complex systems, such as airframes.

We believe further that, because of the great uncertainties introduced by design changes and unforeseen engineering problems, the use of end-item indexes would not provide enough additional improvement over labor and material input indexes in long-range budgeting and planning to justify the cost.

We believe that the contributions of price change can be identified by construction of individual weapon systems input price indexes. The contractor information necessary could be identified prior to contract award and incorporated into the contract.

Input price changes, however, cannot always be ascribed to fundamental inflationary forces. There are other influences on actual prices paid, such as lot size, special concessions, and changes in labor force mix. The influence of these and other factors could be identified by industrywide price indexes somewhat analogous to WPI but measuring the price change in the markets in which aerospace contractors purchase inputs. The inputs covered would be representative items used in different types of weapon systems; for example, fighter planes, bombers, destroyers, and submarines.

Such indexes can identify the contribution of inflationary forces to price change in the aerospace industry. If there are no substantial differences between the individual weapon systems price index and the marketwide price index, either may be taken as reflecting the contribution of inflation to cost overrun. If there are substantial differences, the specific reasons for a price change in an individual weapon system can then be explored by audit or other analytical techniques.

We believe that price indexes of the types described could best be constructed by DOD and BLS. This could be done by:

1. Requiring contractors and major subcontractors to submit to DOD the data necessary to construct labor and material price indexes.

2. Directing DOD to construct price indexes and report the results to the Congress.

3. Making BLS responsible for regularly preparing marketwide price indexes for different types of weapon systems.

We believe also that the suggestion by DOD--for ascertaining whether industrywide (marketwide) indexes could be consolidated into an acceptable measure of inflation for a specific weapon system--has merit. In our opinion, however, the Committee could have more confidence in indexes constructed from actual data for individual weapon systems. These indexes could further serve to validate the proposed research.

With respect to the Committee's recommendations dealing with end-item indexes, we believe that limitations in the state of the art prevent the construction of price indexes for items that change often and significantly and that are procured under market conditions in which the buyer and/or seller has a strong influence over the price. These phenomena characterize complex weapon systems.

MATTERS FOR CONSIDERATION BY THE COMMITTEE

The Committee might wish to obtain, from the organizations that would carry out the program, cost estimates for constructing and reporting the proposed indexes. Such estimates would be useful in deciding whether such a program should be undertaken.

DETAILS OF CONSTRUCTION OF THE DEMONSTRATION INDEXES

In demonstrating feasibility of index construction for individual weapon systems, we used data readily available in the particular formats being used by the individual contractors. Each contractor generally maintains materials and labor records in accounts useful for its purposes. The individual material items or labor classes constituting an account differ from contractor to contractor.

The description of accounts and the details of their use in constructing the demonstration indexes are discussed below.

AIRCRAFT MATERIALS

Contractor X for the aircraft for which the demonstration indexes were constructed maintains its material accounts as shown in table I-A. The table lists, for each material account, the percent of total unit aircraft material cost represented by that account and the percent of contribution of that account to the proportion of material covered by the price index. Because many of the material accounts cover hundreds of individual items, we sampled these accounts; the table lists also the percent of the total value of each account in the sample.

The description of items constituting each account, the rationale for the extent to which we included each in the index, and the criteria employed in sampling each account were as follows:

1. The sheet and plate stock account was composed primarily of titanium sheet, aluminum plate, sheet, and honeycomb sandwich sheet. It also included small amounts of the following kinds of sheet and plates: steel, brass, bronze, and copper. It included also small amounts of glass laminates, phenolics, and plastic sheet.

TABLE I-A

CATEGORIES OF MATERIAL INPUT AND

THEIR RELATIVE IMPORTANCE

Material account	Percent of material cost per unit in fiscal year 1968 prices	Percent of material cost per unit covered by index	Percent of account sampled
1. Sheet and plate stock	1	1	38
2. Castings and forgings	1	1	62
3. Compounds and paints	1	-	-
4. Miscellaneous small parts	2	-	-
5. Bar, rod, tube, and extrusions	3	3	46
6. Contractor-designed purchased parts	3	3	47
7. Controlled standard and commercial parts	4	-	-
8. Miscellaneous fabrication materials	4	4	20
9. Vendor-designed purchased equipment	5	5	67
10. Subcontract (engines, nacelles, and wing components)	18	18	100
11. Major purchased equipment	58	14	92[a]
Total	100	49	

[a]We sampled 92% of that part of the value of this account which was covered by the index.

Representative items were identified by the person who was in charge of material procurement for the subject airframe. Items included in the index accounted for 38 percent of the value of the sheet and plate account in fiscal year 1968.

2. In the castings and forgings account were approximately 460 line items most of which cost less than $10. A cutoff point of $18 was employed that resulted in a sample which covered 62 percent of the value of this account.

3. The compounds and paints account included such items as solvent, cement, grease, sealing compound, and lubricating oil. (In establishing the cost of these items for each aircraft, the contractor allocated the value of these items from a pool account to the airframe in proportion to the value of the several accounts, except the major purchased equipment. Hence data for this account did not appear in the bill of materials and were not readily available. In view of the insignificance of this account and the difficulty in obtaining data, a price index was not developed.)

4. The miscellaneous small parts account was composed of items of low unit cost and high use. Standard and commercial parts, such as fasteners, pins, spacers, and springs, were included in this account. (Prior to January 1969, the cost of miscellaneous small parts was allocated to the airframe in the same manner as were paints and compounds. It was decided to eliminate this account from the price index because of the heterogeneous nature of the items, their large number, and the unavailability of data for the base year.)

5. The bar, rod, tube, and extrusions account consisted primarily of aluminum extrusions. The large-dollar items were heavy press extrusions for wing planks and panels, floor sections, spar caps, and large T-sections. The account also included aluminum and steel tubing and aluminum, steel, and teflon bar. Representative items were identified by the person in charge of material procurement.

6. Contractor-designed purchased parts were those purchased parts to which the contractor had assigned drawing numbers. Typical of the parts in this category were

springs, latches, flanges, and washers. There were approximately 1,060 parts in this account, ranging in price from $0.03 to $1,150. Only those parts priced $40 or more in fiscal year 1968 were selected. The parts selected accounted for 47 percent of the value of this account.

7. The controlled standard and commercial parts account contained approximately 4,000 line items. For these 4,000 line items, over half the dollar value consisted of controlled commercial and standard electrical parts, such as plugs, switches, relays, and circuit breakers. Because of the lack of consistent information, we did not construct an index for this account.

8. The miscellaneous fabrication materials account consisted of such material as electric wire and cable, paper honeycomb core, insulation, and plywood. A representative group of items, accounting for 20 percent of the value of this account, was identified by the person in charge of material procurement.

9. The vendor-designed purchased equipment account included all supplier-designed purchased equipment conforming to the requirements of a specification-controlled drawing, such as light assemblies and switches. Generally the unit value did not exceed $1,000. There were approximately 385 items in this account. Items priced $100 or more in fiscal year 1968 were selected to represent this material account. This sample accounted for 67 percent of the value of this account.

10. The subcontract account consisted of the engines, nacelles, and wing components. Although these were major items, price trends for these items for the aircraft we studied were representative of price changes for similar items in other aircraft. Consequently this account, which covered 18 percent of the material costs for each aircraft in 1968, was included in its entirety in the pilot price index.

11. The major purchased equipment account represented 58 percent of the total material cost of the aircraft and consisted of six basic types of equipment: airframe, auto flight control, navigation, weapons, communications, and

armament. There were just a few items in each category, except for the airframe which contained 51 items. Typical of the items in this account were: compressors, landing gears, and crew seats (airframe); Loran and inertial navigation systems (navigation); the search radar and electronic countermeasures set (weapons); and a high-frequency and ultrahigh-frequency radio set (communications). In general, the items in the airframe and armament categories also were used in the prior model of the aircraft. The remaining categories include items new to the current model, as well as some items which had been furnished by the Government but are now furnished by the contractor. Over 50 percent of the dollar value of the communications subset for the airframe was included.

Aircraft labor

Aircraft contractor X whose indexes are discussed in chapter 3 maintains records of hourly earnings of employees working on Government-approved projects. The classifications maintained of hourly labor so applied are listed in table I-B, together with the indexes for each class and for the weighted composite. Additionally plantwide information was available for hourly and salaried worker rates from which true labor price indexes could be constructed.

To test the general availability of such data in the industry, we collected comparable data from two other contractors, Y and Z, in the same geographic area. Contractors X and Y each account for about 10 percent of the employment in SIC 372, but contractor Z is considerably smaller. In the aggregate the three contractors represent about 20 to 25 percent of the employment in this SIC.

Table I-C compares the labor price indexes for the three contractors, and table I-D compares the composite labor price and hourly earnings indexes we constructed for each contractor with the average earnings index for SIC 372.

Table I-E lists indexes of the number of hourly employees for the three contractors and for SIC 372. The table shows that, as employment decreased (for each of the contractors and for the industry as a whole), the average hourly earnings indexes (table I-D) increased--generally the increase in the indexes was greater where the employment decrease was greater. This tends to support the argument that labor price indexes more nearly represent inflationary changes than do hourly earnings indexes because hourly earnings indexes are affected by employment levels. Initially layoffs generally reach the newer--hence less skilled and lower paid--employees. Earnings indexes (for those remaining) then tend to go up.

TABLE I-B

INDEXES OF AVERAGE HOURLY EARNINGS OF EMPLOYEES

WORKING ON GOVERNMENT-APPROVED PROJECTS, CONTRACTOR X

(1968=100)

Classification	1968	1969	1970
Production	100	109	111
Tooling	100	109	114
Planning	100	108	112
Quality control	100	109	111
Engineering	100	104	110
Others	100	104	110
Composite	100	106	111

TABLE I-C

LABOR PRICE INDEXES, SELECTED PLANTS
(1968=100)

	1968	1969	1970
CONTRACTOR X:			
Hourly	100	105	110
Salaried	100	107	113
Composite	100	105	111
CONTRACTOR Y:			
Hourly	100	105	110
Salaried	100	104	109
Composite	100	105	110
CONTRACTOR Z:			
Hourly	100	108	114
Salaried	100	106	109
Composite	100	107	112

TABLE I-D

INDEXES OF AVERAGE HOURLY EARNINGS OF HOURLY-PAID EMPLOYEES
COMPARED WITH LABOR PRICE INDEXES OF HOURLY-PAID EMPLOYEES,
SELECTED PLANTS
(1968=100)

	1968	1969	1970
LABOR PRICE INDEXES:			
Contractor X	100	105	111
Contractor Y	100	105	110
Contractor Z	100	107	112
AVERAGE HOURLY EARNINGS INDEXES:			
Contractor X	100	106	111
Contractor Y	100	111	123
Contractor Z	100	110	121
SIC 372	100	107	114

TABLE I-E

INDEXES OF TOTAL HOURLY-PAID EMPLOYEES
IN AEROSPACE PLANTS SELECTED FOR STUDY
(1968=100)

	1968	1969	1970
CONTRACTOR X	100	105	94
CONTRACTOR Y	100	71	60
CONTRACTOR Z	100	80	45
SIC 372	100	90	70

ELECTRONICS MATERIALS

The categories of materials used in the electronics system for which the demonstration indexes were constructed are listed in table I-F. We identified items which would be representative of their respective group; e.g., screws, blowers, and lenses. In total we used about 31 percent of the value of common items to construct the price index.

To reduce the computational burden in the construction of the index for representative materials, we made use of the contractor printout which listed all items in descending order of cost (i.e., price times quantity). From the first 185 (out of 1,500 listed) representative material line items on the printout, we selected all representative items for which data existed. In some cases, the number of different items in a group, such as relays, were few and price data for each type of relay were available. We therefore utilized data for all the relays to construct the index. Hence we used 100 percent of the value of relays existing in the first 185 lines to construct the price index for relays. Continuous price data were not available for transformers. By using all the data that were available, however, we were able to include 12 percent of the value of transformers when constructing a price index for this item.

In summary we selected items from the most costly 185 representative material line items to construct price indexes, to avoid the expenditure of considerable computational effort on the large number of inconsequential items. By concentrating our efforts on 13 percent of line items (185 out of 1,500), we were able to select items for construction purposes from a group which represented three fourths of the representative material cost of the weapon system.

TABLE I-F

ELECTRONICS MATERIAL INPUT PRICE INDEXES

(FISCAL YEAR 1967=100)

Category of material	Percent of material input (note a)	Fiscal year 1967	1968	1969	1970
A. COMMON ITEMS:					
Screws, nuts, washers, etc.	0.1	100	142	104	86
Connectors, jacks, terminals	.2	100	109	102	128
Capacitors, diodes, transistors, resistors	4.0	100	138	93	87
Switches, circuit breakers, fuses, etc.	.9	100	106	91	110
Meters	(b)	100	111	105	104
Blowers	(b)	100	108	99	112
Lenses	(b)	100	100	100	100
Transformers	(b)	100	109	109	127
Lamps, light indicators, lamp-holders	.1	100	112	116	114
Total of common items	5.2	100	136	93	88
B. REPRESENTATIVE ITEMS:					
Transistors	6.9	100	91	94	81
Transformers	2.8	100	123	106	132
Relays	1.2	100	100	89	94
Connectors	2.5	100	103	98	123
Servos	1.0	100	111	104	85
Slides	.2	100	66	60	62
Printed wiring boards	.7	100	100	109	109
Resistors	.2	100	291	58	189
Rectifiers	.1	100	100	101	92
Amplifiers	.2	100	125	107	119
Filters	.1	100	98	88	78
Total of representative items	15.9	100	93	94	84
Aggregate	21.1	100	98	94	85
WPI, electronic components and accessories (code 11-78)		100	100	100	101

[a]In total material cost of one system in fiscal year 1967.

[b]Less than .05 percent.

ELECTRONICS LABOR

The electronics labor indexes are based on data obtained from one contractor's plant. For hourly- and weekly-paid employees, the index is based on the pay rate for the maximum step in each grade. The step selected for the construction of the monthly-paid employees was the midpoint of the grade. In all cases the step selected to represent the entire grade was that which contained the greatest number of employees.

The indexes appear in tables I-G through I-I. For comparative purposes an index of average hourly earnings in the electronic components and accessories industry (SIC 367) is shown in table I-G.

TABLE I-G

LABOR PRICE INDEXES FOR HOURLY-PAID EMPLOYEES

(PRODUCTION AND ASSEMBLY TYPES)

Labor grades	1967	1968	1969	1970
1	100	105	111	119
2	100	105	111	118
3	100	105	110	118
4	100	104	110	117
5	100	105	110	117
6	100	105	109	116
7	100	104	109	116
8	100	104	108	115
9	100	105	109	115
10	100	105	108	115
11	100	104	108	114
12	100	104	107	114
Average hourly earnings, electronic components and accessories (SIC 367)	100	106	111	119

TABLE I-H

LABOR PRICE INDEXES FOR MONTHLY-PAID EMPLOYEES

(PROFESSIONAL PERSONNEL)

Labor grades	1967	1968	1969	1970
1	100	103	107	120
2	100	102	107	120
3	100	102	107	119
4	100	102	107	119
5	100	102	107	117
6	100	102	107	115
7	100	102	107	115
8	100	102	107	114
9	100	102	107	113
10	100	102	107	113
11	100	102	107	113
12	100	102	107	113
13	100	102	107	113
14	100	102	107	114
15	100	102	107	113
16	100	102	107	113
17	100	102	107	113
18	100	102	107	113

APPENDIX I

TABLE I-I

LABOR PRICE INDEXES FOR WEEKLY-PAID EMPLOYEES

(CLERICAL, CUSTODIAL, DRAFTSMEN)

(1967=100)

Labor grades	1967	1968	1969	1970
1	100	105	110	118
2	100	105	110	117
3	100	105	110	118
4	100	105	110	117
5	100	105	110	117
6	100	105	110	117
7	100	105	110	118
8	100	105	110	117
9	100	105	110	118
10	100	105	110	118
11	100	105	110	117
12	100	105	110	118
13	100	105	110	117
14	100	105	110	117

SELECTED EXAMPLES OF OTHER WEAPON SYSTEMS PRICE INDEXES

Prior attempts at the construction of weapon system price indexes may conveniently be classified into two groups: those which are simple combinations of selected WPI series and data on earnings, such as those published by BLS, and those which go beyond this. Almost all the indexes which we could identify fell into the former category. We have identified three research efforts (refs. 1, 2, and 3, p. 65) in the latter category.

This appendix contains a discussion of two of the studies (refs. 4 and 5) utilizing WPI and earnings data and illustrates the approach and the limitations which are common to studies of this nature. Discussion of one study (ref. 2) is provided to illustrate a genuine approach to an industrywide index for raw materials.

INDEXES BASED ON COMBINATIONS OF WPI COMPONENTS AND EARNINGS STATISTICS

OASD (Systems Analysis)(SA))

The "Anderson Study" (ref. 4), as the OASD (SA) study is commonly called, was completed in 1969. Indexes are presented for 10 classes of procurement, including construction. The general time period covered is 1958-69. Weights for the components of the materials index were obtained from various sources. The weighting scheme of the Navy's Steel Ship Index was used for the materials index for ships, those of the Army Materiel Command's Tactical Vehicle Index was used for vehicles, and a study by H.G. Campbell of the RAND Corporation (ref. 5) yielded the weights for the airframe index. Selected contracts were the basis for other weighting factors.

The WPI series employed and the weights with which they were combined to form the materials indexes are presented in table II-A, and the various labor series and their respective weights appear in table II-B. Weights for the labor and material components were obtained from various sources. A study by OASD(SA) provided weights for helicopters. The relative labor-material components are shown in table II-C. The indexes do not explicitly consider overhead or price increases for labor other than production workers, nor do they consider profits and taxes. Since the indexes are combinations of WPI groups, they, like the series on which they are based, are base-year weighted-price indexes.

The Anderson study is an attempt to derive price indexes by utilizing readily available data. A number of unresolved conceptual problems and data deficiencies exist. The shortcomings are recognized by OASD(SA) and are stated succinctly on page 3 of the report.

"It should be made clear that the indices presented are not true output price indices for the nine procurement classes. They are not based on prices of actual outputs of items in those classes collected from contractors or from the Services. They are indices of the price movements of various combinations of items that are proxies for inputs into the production of outputs in the different procurement classes. Hence, they have several weaknesses:

"1. They are input price indices. At best, they only reflect changes in the prices of some of the factors of production of defense outputs.

"2. They do not take into consideration rates of profit, taxation and other indirect costs.

"3. They do not consider productivity changes. Consequently, they implicitly assume that there is no productivity change.

"4. They reflect price changes of materials that may be only proxies for the materials actually used in the production of defense goods. Hence, the price movements of the specific items needed for defense goods may be very different from those for the items in the WPI. This drawback may be particularly severe for the categories of Airframes, Electronics, and Ordnance, where the defense goods require highly specialized and sometimes unique materials.

"5. The labor cost indices are based on data only for production workers and may not adequately reflect the changes in salaries of professional and managerial personnel."

TABLE II-A

COMPONENTS AND WEIGHTS USED FOR

THE OASD(SA) MATERIAL PRICE INDEX

	BLS code	Weight in material index
AIRFRAMES:		
Finished steel products	10-13-02	0.02
Stainless steel sheet	10-13-02-64	.04
Titanium sponge	10-22-01-56	.07
Aluminum sheet	10-25-01-01-02	.29
Aluminum rod	10-25-01-13	.11
Aluminum extrusions	10-25-01-17	.20
Wire and cable	10-26	.12
Rivets	10-81-01-11	.15
Total		1.00
AIRCRAFT ENGINES:		
Finished steel products	10-13-02	0.30
Fabricated structural metal products	107	.40
Mechanical power transmission equipment	11-45	.30
Total		1.00
AVIONICS:		
Integrating and measuring equipment	11-72	0.50
Electronic components and accessories	11-78	.50
Total		1.00

TABLE II-A (continued)

	BLS code	Weight in material index
HELICOPTERS:		
Finished steel products	10-13-02	0.02
Stainless steel sheet	10-13-02-64	.04
Titanium sponge	10-22-01-56	.07
Aluminum sheet	10-25-01-01-02	.29
Aluminum rod	10-25-01-13	.11
Aluminum extrusions	10-25-01-17	.20
Wire and cable	10-26	.12
Rivets	10-81-01-11	.15
Total		1.00
MISSILES:		
Explosives	06-79-02	0.20
Finished steel products	10-13-02	.30
Aluminum shapes	10-25-01	.20
Fabricated structural metal products	107	.20
Rivets	10-81-01-11	.10
Total		1.00
SHIPS:		
Iron and steel	101	0.45
General-purpose machinery	114	.40
Electrical machinery	117	.15
Total		1.00
VEHICLES:		
Metal and metal products	10	0.50
Motor trucks	14-11-02	.50
Total		1.00

TABLE II-A (continued)

	BLS code	Weight in material index
ORDNANCE AND MUNITIONS:		
Explosives	06-79-02	0.60
Small-arms products	15-13-02	.20
Finished steel products	10-13-02	.20
Total		1.00
ELECTRONICS AND COMMUNICATIONS:		
Integrating and measuring equipment	11-72	0.30
Electronic components and accessories	11-78	.70
Total		1.00

TABLE II-B

COMPONENTS AND WEIGHTS USED FOR

THE OASD(SA) LABOR PRICE INDEXES

	SIC code	Weight in labor index
AIRFRAMES:		
Aircraft	3721	1.00
AIRCRAFT ENGINES:		
Aircraft engines and engine parts	3722	1.00
AVIONICS:		
Communications equipment	366	.35
Electronic components and accessories	367	.45
Other aircraft parts and equipment	3723, 9	.20
HELICOPTERS:		
Aircraft and parts	372	1.00
MISSILES:		
Complete guided missiles	1925	1.00
SHIPS:		
Shipbuilding and repairing	3731	1.00
VEHICLES:		
Motor vehicles and equipment	371	1.00
ORDNANCE AND MUNITIONS:		
Ordnance and accessories	19	1.00
ELECTRONICS AND COMMUNICATIONS:		
Communications equipment	366	.50
Electronic components and accessories	367	.50

TABLE II-C

WEIGHTING OF MATERIAL AND LABOR

IN COMPOSITE PRICE INDEX

	Category	Weight
Airframes	Material	0.40
	Labor	.60
Aircraft engines	Material	.30
	Labor	.70
Avionics	Material	.30
	Labor	.70
Helicopter airframes	Material	.30
	Labor	.70
Missiles	Material	.40
	Labor	.60
Ships	Material	.40
	Labor	.60
Vehicles	Material	.50
	Labor	.50
Ordnance and munitions	Material	.50
	Labor	.50
Electronics and communications	Material	.40
	Labor	.60

Some of the deficiencies in the data used are discussed below. They are examples of the drawbacks to the use of the WPI subindexes and average earnings data for purposes of weapon system price index construction.

1. Material indexes

a. Airframes--The weights in the raw material index are derived from the Campbell study. (Ref. 5.) In that study Campbell indicated that the weighting scheme was based on the experience of a single, albeit major, aircraft producer and "is not applicable to aircraft that use a high percentage of the more advanced materials, such as titanium."

b. Aircraft engines--The material index is composed of the WPI for finished steel products (30%), fabricated structural metal products (40%), and mechanical power transmission equipment (30%). The more important items in the fabricated structural metal products group are

--fabricated structural steel for buildings,
--fabricated structural steel for bridges,
--single-hung residential aluminum windows,
--steel-door assemblies,
--30,000-gallon pressure vessels, and
--galvanized furnace pipe.

They are typical of the entire group, which includes numerous items of lesser importance, such as 500,000-gallon elevated water tanks, aluminum combination storm sashes, aluminum siding, and concrete-reinforcing bars. Although the group was selected as a proxy whose movement was assumed to be similar to that of some of the items used in the production of aircraft engines, it appears that the items listed above would not be used in the manufacture of aircraft engines.

The mechanical power transmission equipment group similarly contains items--for example, gears and roller chains--which do not appear very important in aircraft engine fabrication.

c. Avionics--The material price index is composed of the WPI for integrating and measuring equipment (50%) and electronic components and accessories (50%). The integrating and measuring equipment series is characterized by relatively unsophisticated devices, such as voltmeters, ammeters, oscilloscopes and semiconductor bench testers. The electronic components and accessories group seems to contain many items which may have application in military electronic hardware but, in addition, many which do not. Approximately 20 percent of this series is represented by electron-receiving tubes, television picture tubes, and television antennas.

d. Missiles--The components of this series and their respective weights are

--explosives (20%),
--finished steel products (30%),
--aluminum shapes (20%),
--fabricated structural metal products (20%), and
--rivets (10%).

The characteristics and relevance of the fabricated structural metal products series, as discussed under aircraft engines, also applies to missiles.

The WPI for explosives does not contain high-energy explosives, shaped charges, or the like. Rather, the series consists primarily of dynamite and blasting caps and is oriented toward the civilian activities of mining and construction.

The above comments regarding avionics pertain also to the electronics and communications indexes. Those pertaining to the airframe index apply equally to the helicopter for the same index that was used by Anderson for both types of procurements.

2. Labor indexes

The labor indexes are based on average earnings, not wages or salaries. Hence they are influenced by changes in the average number of hours worked each week, by a shift in the mix of skills, and by changes in the average level of experience, as well as by price changes. In addition, the BLS data are for nonsupervisory production workers. White-collar workers, such as engineers, managers, and clerical personnel, are excluded.

Campbell study

The scope of the study by Campbell (ref. 5) is considerably narrower than the study by Anderson. The Campbell study deals with airframes, missiles and spacecraft, and electronic components and accessories. A series on aircraft propulsion is not included, but there is one on airframe overhead. The material indexes are presented separately for raw material and purchased equipment.

Campbell's purchased-parts index is derived by combining a raw materials index with indexes of average hourly earnings and of overhead. The airframe overhead index, in turn, is derived from an index of average hourly earnings compounded by an increase of 2-1/2 percent per year. The weights with which the raw material series were combined to yield the raw material index were obtained from a major aircraft producer and are identical to the weights appearing in table II-A under the "airframe" component. The components of Campbell's indexes and their respective weights appear in table II-D. The indexes, according to Campbell, are "based on rather arbitrary assumptions and weightings."

Since Campbell and Anderson used the same general approach, there is little expository benefit in evaluating each series in detail. The novel feature of the Campbell study, however, is the inclusion of an overhead component in the composite index for each subsystem. In general, the overhead index is derived by applying compound average annual increases to a labor wage index. For example, an electronic components overhead index was obtained by applying a 2-percent annual increase to the index of average hourly earnings in the electronic components and accessories industry (SIC 367). As indicated by Campbell, these rates were selected arbitrarily.

Differences in the proportion of labor and materials used by Anderson and Campbell highlight the importance of the relative proportion of labor and material as an influence on the movement of the aggregate price index. For airframes Campbell combined an overhead index based on earnings and several material price indexes with a labor index to obtain an aggregate price index. Some of his material price indexes, in turn, contained a labor component. Consequently the effective labor weight in the Campbell index amounted to 92 percent. In contrast, the effective labor weight in the Anderson index was 60 percent.

These differences in weight essentially account for major differences in the movement of the price indexes in the two studies. This is illustrated in charts 1 and 2. Chart 1 displays the trend of WPI for industrial commodities and the trend of average hourly earnings in the aircraft industry (SIC 3721). The difference in the trends derived by Anderson and Campbell (chart 2) is similar to the difference between the trend in WPI and aircraft hourly earnings. Anderson, who used a lower labor weight (60%) in his airframe index, presented a considerably slower rate of price change than did Campbell (92%).

INDEX BASED ON ITEMS USED IN WEAPON SYSTEM PRODUCTION

A study by H. Piccariello (see reference 2, p. 65) is the only effort we identified to construct industrywide price indexes based upon materials actually used in defense production. Piccariello ascertained the nature and approximate amount of basic materials used for defense purposes from reports required under the Defense Materials System, a system conceived to ensure that materials necessary for defense production would be available where and when needed.

These reports contain estimates of the requirements, for subsequent quarters, of four categories of basic

Table II-D

COMPONENTS AND WEIGHTS IN RAND PRICE INDEXES

Series	Components	Weight (percent)
1. Airframe purchased equipment	Airframe raw materials	20
	Average hourly earnings in aircraft parts (SIC 3723 and 29)	30
	Aircraft parts overhead (SIC 3723 and 29 increased at 2% compound interest)	50
2. Airframe materials	Airframe raw materials	25
	Airframe purchased equipment (series 1 above)	75
3. Airframe overhead	Average hourly earnings in aircraft (SIC 3721) increased at 2-1/2% annual compound rate	100
4. Airframe composite price	Airframe materials (series 2 above)	20
	Average hourly earnings in aircraft (SIC 3721)	27.5
	Airframe overhead (series 3 above)	52.5
5. Missiles and spacecraft composite price	Airframe materials (series 2 above)	10
	Electronic materials (series 6 below)	10
	Average hourly earnings in guided missiles and spacecraft (SIC 1925)	30
	Missiles and spacecraft overhead (average hourly earnings in SIC 1925 increased at 2-1/2% compounded annual rate)	50
6. Electronic components and accessories composite	Electronic components and accessories raw materials (BLS wholesale price series 11-78)	20
	Average hourly earnings in electronic components and accessories (SIC 367)	30
	Electronic components and accessories overhead (SIC 367 increased at 2% compounded annually)	50

industrial materials: steel, copper, aluminum, and nickel alloys. The estimate of requirements is obtained by the various services from their organizational components and transmitted to OASD (Supply and Logistics). The information pertains only to the quantity needed and not to price or cost. Price data for the materials were obtained from BLS and census of manufacturers' reports. (The materials are listed in DOD Instruction 4210.7.)

The labor indexes prepared by Piccariello are based upon average hourly earnings reported by BLS. Separate labor and material indexes are presented (see chs. 4 and 5 and ref. 2) for each type of weapon system. They are not combined into an aggregate, however.

The approach used is commendable in that it attempted to construct an index based on items actually used in weapon system production. If the scope of material coverage is expanded and if the level of aggregation is shifted from generic categories of weapon systems and their associated subsystems and ground support equipment to end-items, such as destroyers, submarines, fighter airframes, and bomber airframes, an approach such as Piccariello's would result in sound industrywide material input price indexes for weapon systems. In their present state of development, however, the indexes are too highly aggregated for the evaluation of cost overruns and they cover basic industrial commodities only.

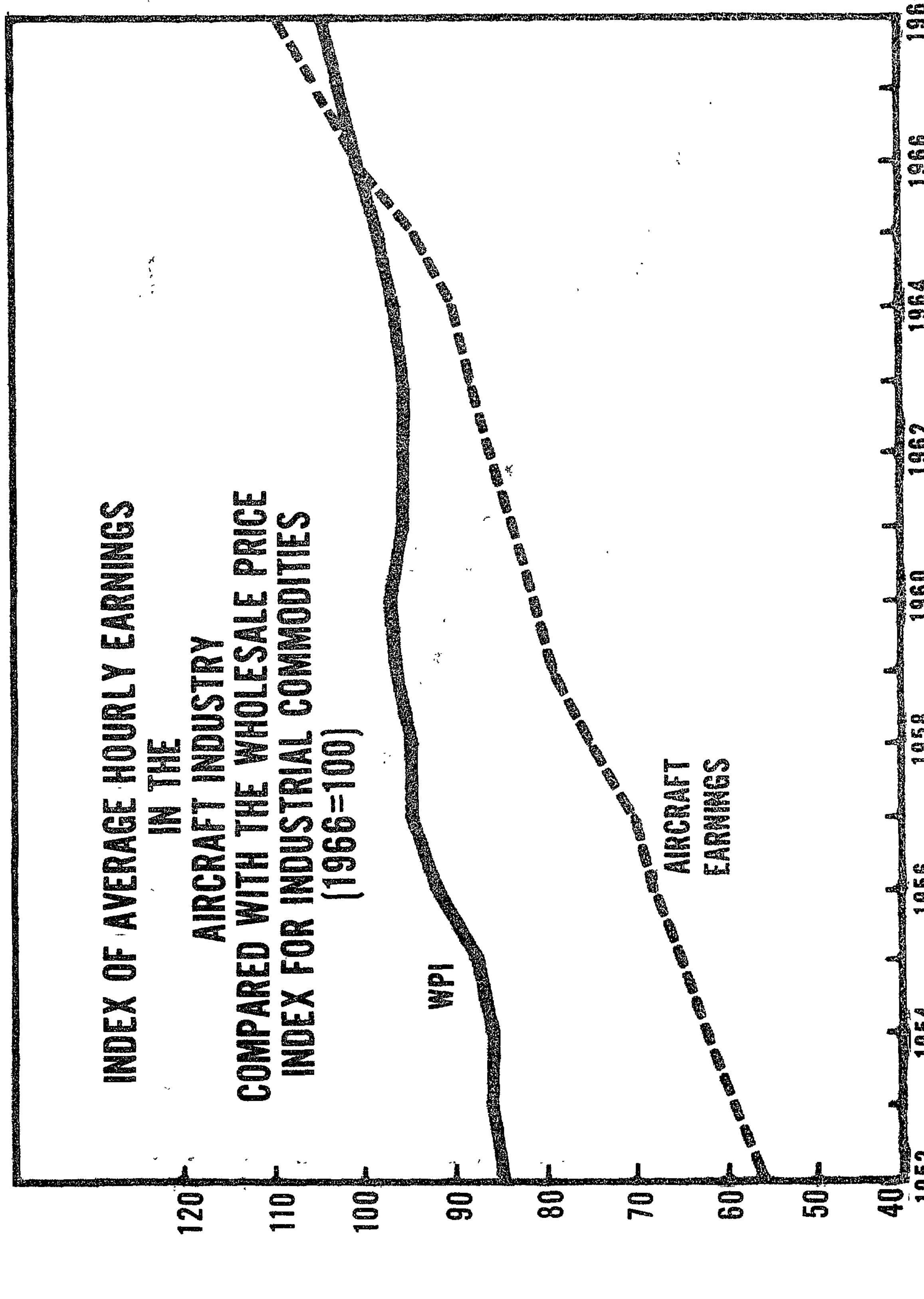
INDEX OF AVERAGE HOURLY EARNINGS
IN THE
AIRCRAFT INDUSTRY
COMPARED WITH THE WHOLESALE PRICE
INDEX FOR INDUSTRIAL COMMODITIES
(1966=100)
WPI
AIRCRAFT
EARNINGS
120
110
100
90
80
70
60
50
40
1952
1954
1956
1958
1960
1962
1964
1966
1968

CHART-1

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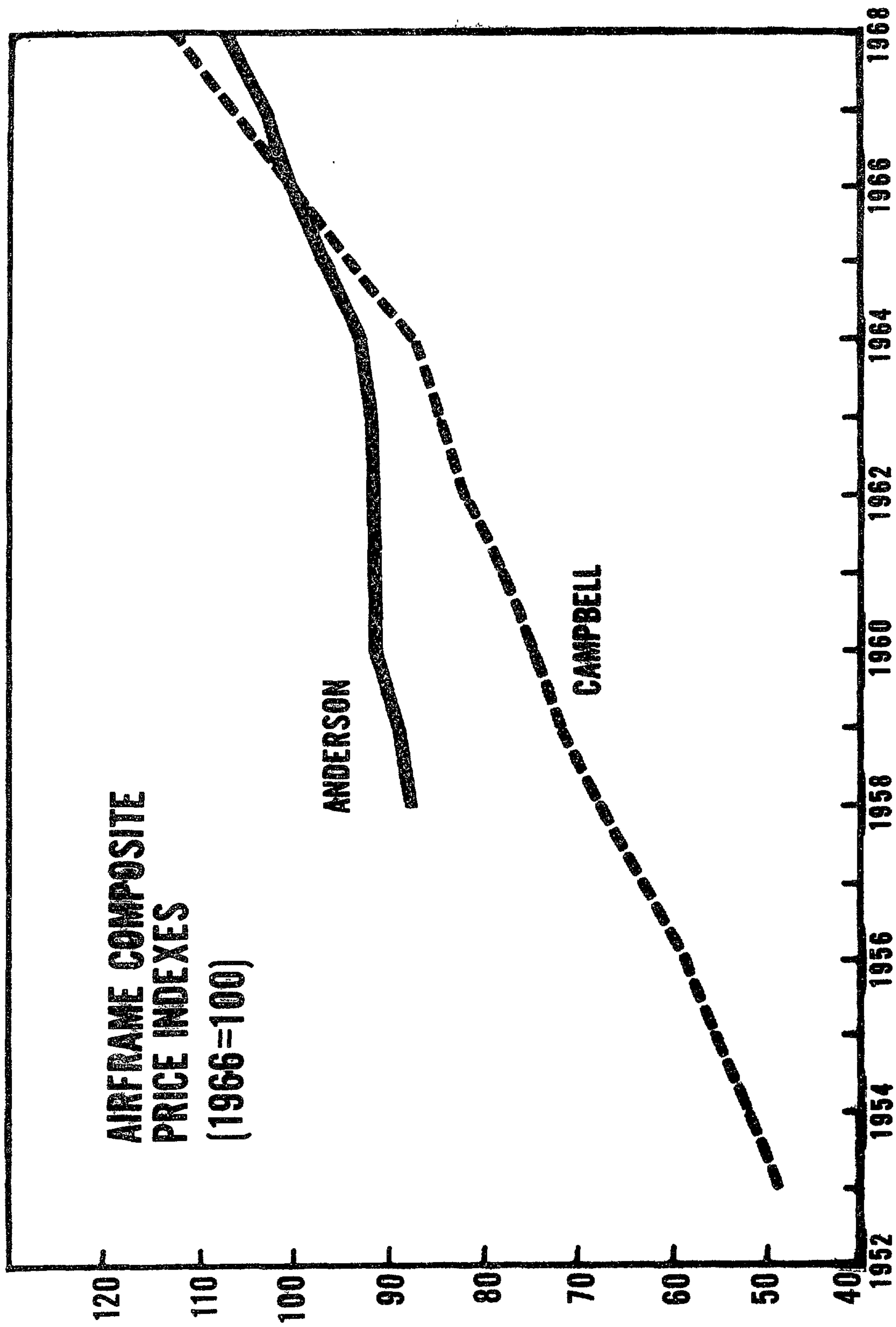

CHART 2

REFERENCES FOR APPENDIX II

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2. Piccariello, Harry, Untitled report prepared in the Directorate for Cost and Economic Analysis, Office of the Assistant Secretary of Defense (Comptroller), c. 1965.

3. Dei Rossi, James, Measuring Price and Productivity Change in the Aircraft Industry, RAND Corp., Memorandum RM-5805-PR, April 1970.

4. Office of the Assistant Secretary of Defense, Systems Analysis, (Resource Analysis, Econometrics), Price Indices for Defense Procurement Commodity Groups, Aug. 25, 1969.

5. Campbell, Harry G., Aerospace Price Indexes, RAND Corp., Dec. 1970.

U.S. DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS
WASHINGTON, D.C. 20212

OFFICE OF THE COMMISSIONER

NOV 23 1971

Mr. Elmer B. Staats
Comptroller General
General Accounting Office
441 G Street, N. W.
Washington, D.C. 20548

Dear Mr. Staats:

Several members of my staff met with representatives of GAO to discuss the draft of the GAO report, "The Feasibility of Constructing Weapons System Price Indexes."

The BLS believes that the approach proposed in the GAO draft is feasible, and that constructing price indexes for labor and materials used in the production of major weapons systems would be useful in analyzing and evaluating Defense Department costs of acquiring weapons. For much of Defense procurement, output price indexes are also feasible, but we recognize that output price indexes would require a larger investment of resources. It was agreed that the language of the draft would be changed to make clear the distinction between input price indexes and output price indexes, and also to make it clear that "industry-wide" indexes of wages or materials prices should not be based exclusively on data pertaining to the establishments of Defense contractors, but rather should be, in concept, measures of price change in the markets in which these contractors purchased inputs. Additional specific comments were provided to your staff at the meeting. [See GAO note.]

With respect to any possible BLS role in implementing the proposals contained in the GAO report, this would represent a new program for the BLS and could not be carried out with existing resources. In view of the many requests for additional output that the BLS now

GAO note: The language changes recommended have been incorporated into the report and appropriate action has been taken regarding these comments.

Mr. Elmer B. Staats--Page 2

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faces, and the OMB requirement that BLS show an overall employment reduction, it will be necessary to set up a system of priorities for new programs. Until we have determined what priorities should be, we are unable to say whether the BLS can undertake the work outlined in the GAO proposal, even if additional funds were made available.

Sincerely yours,

GEOFFREY H. MOORE
Commissioner

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

COMPTROLLER

13 JAN 1972

Mr. D. L. Scantlebury
Director, Division of Financial and
General Management Studies
U.S. General Accounting Office

Dear Mr. Scantlebury:

This responds to your draft report on the feasibility of constructing weapons system price indexes (OSD Case #3367).

The draft report considers two broad types of indexes: an end-item index, which would show price trends for an entire weapon system such as a missile or an aircraft, and an input price index which would show cost trends for some portion of the labor and material used in producing that particular end item. The report concludes because of the technologically advanced nature of today's weapon systems and the constantly changing military requirements, it is not feasible to attempt to construct end-item price indexes for major weapon systems. As an alternative, the report discusses the possibility of using an input or cost index for labor and material and concludes after a review of four selected systems that it is feasible to construct at least partial indexes of changing labor and material costs.

The systems selected as noted in the draft report were chosen principally because they were in production and their characteristics did not change significantly for some time. By looking at systems with relatively more standard material inputs and fewer technologically advanced or unique items, it was hoped that a larger proportion of the inputs could be included in an index. However, the report indicates that coverage at the prime contractor level even for these systems was still considerably less than complete.

To improve coverage of the index the report suggests that hard-to-define or unique items be further broken down into their constituent inputs of labor and simpler materials. In this way, cost indexes could be constructed for even more technologically advanced systems. This would, of course, require considerably more record keeping because the inputs would need to be priced each time they pass from one subcontracting tier to another on up to the prime contractor level.

The GAO study suggests that two different sets of indexes be developed. The first described above would be calculated by DoD from information supplied by defense contractors and would pertain to a specific major weapon system. The second set of indexes would be prepared by the Bureau of Labor Statistics (BLS) and would measure industry-wide price trends for different types of weapon systems. The report does mention that if a significant divergence between the contractor derived index and the BLS derived index appears, the latter would be accepted as representative of overall inflation.

Our views on the feasibility of these two approaches are as follows:

Contractor-Derived Price Indexes

The objective in producing contractor derived indexes is to separate cost increases caused by inflationary factors from other causes. From the evidence cited in the draft report and from our own work on this subject, it would be difficult to expect to achieve this objective by collecting the data using the Selected Acquisition Reports (SARs). The investigations described in the report are helpful and supply new insight to the problems of measuring price changes, but the four systems studied in the report are much less complex than those normally reported in the SARs. In our view, attempting to increase the coverage of the index by obtaining data from the various subcontracting levels, assuming the inputs could be accurately traced from one contractor to another, may add more effort and expense than the results would warrant. Further, all price changes in labor and material inputs reported by defense contractors cannot be ascribed to general inflation.

The problem of distinguishing cost increases due to inflation from other causes would be especially difficult for indirect costs. For example, recently there has been a broad decline in defense and aerospace business. Many of our major weapon systems have been sharing the fixed portion of overhead with other DoD and civilian projects. As these and other projects terminate or decline, the allocation of fixed overhead necessarily increases on the remaining projects. This can alter the pattern of costs from what we were originally intending to measure and as a result would confuse inflationary increases in indirect costs with other causes of cost increases.

It is understandable that some systems may experience a higher percentage of labor costs than others, but the draft report does not appear to consider that the percentage of labor to material costs for a specific system may change substantially as that system progresses from the research and development stage to the production phase. Also, the composition of labor itself may change with say a relatively larger share of engineering groups included in the early stages but with a greater proportion of maintenance or other nonproduction workers being added in the later phases. Because indirect labor costs are not directly identifiable with specific product costs but are usually included in overhead expenses, it is much less likely that a workable continuous price index could be established by this approach.

Although the SARs contain a category of cost growth for economic change, it has not been possible to identify accurately cost increases due to general inflationary pressures from other causes of cost increase that can logically appear, such as those mentioned above. Therefore, we believe that collecting price index data through the SARs would not provide a satisfactory means of properly isolating purely inflationary causes from other causes of cost increase. Given the difficulty with indirect labor costs, subcontracting tiers, and possible bias if the data are collected and results reported by DoD, we think it would be useful to have the BLS make the effort to develop indexes for appropriate input factors and supply them for DoD use. Also, under this approach, DoD would be required to produce price indexes that could be substantially influenced by Defense decisions, a step which OMB has indicated previously it does not consider advisable.

Industry Price Indexes

If we are to meet the primary objective of the GAO study, which is to evaluate the contribution of inflation to higher Defense weapons system costs, I believe it would also be beneficial to emphasize the third suggestion which is for the BLS to prepare industry-wide price indexes for different types of weapon systems. The first step should be to construct industry-wide indexes for defense industries. Once this is accomplished more research would be required before we could see if these industry-wide indexes could be consolidated into an acceptable measure of inflation for a specific major weapon system. Separate indexes would, of course, be desirable for Research and Development and production-type systems. This approach would avoid some of the difficulties likely to exist if data were collected solely through defense contractors. In this regard, we have been recently looking at several specific indexes published by various U.S. Government agencies and have been applying Defense weights to these specific series to develop price indexes that more adequately reflect a sufficient cross section of military activity.

I believe that a cooperative effort along these lines will offer the best approach to our common goal of seeking better techniques of measuring the impact of inflation on Defense purchases.

Sincerely,

R. C. Moot

Robert C. Moot
Assistant Secretary of Defense