Logistics Management Institute

The Defense Manufacturing Base:

Activity-Based Cost Profiles and Their Implications for Funding Manufacturing Technology

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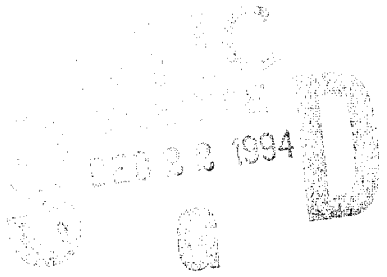

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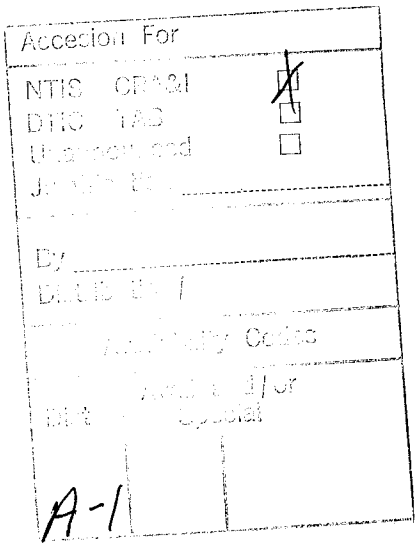

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Executive Summary

The Department of Defense's Manufacturing Science and Technology (MS&T) Program and the Department of Commerce's National Institute of Standards and Technology (NIST) sponsor research to advance manufacturing technology. A continuing challenge is how to allocate R&D funding among the myriad materials, products, and processes that collectively constitute the output of the U.S. manufacturing base. It would be helpful to have a snapshot of the relative costs of various manufacturing processes within that manufacturing base in order to better focus the R&D funding allocation.

In 1991, defense outlays for manufacturing activities – including those embedded in purchased materials – were $90 billion, and total defense-related manufacturing employment stood at about 1.5 million full-time equivalents. Wages, salaries, and benefits account for between half and three-quarters of the $90 billion. The remainder consists of non-labor items such as taxes, interest, dividends, and profit.

We have developed a comprehensive profile of labor costs for all defense manufacturing, including all supplier tiers and all product life-cycle phases; it covers 287 occupations in 91 major industries. Our method can focus on a single occupation across all industries or on all occupations in a given industry. We can compare the cost distribution of one industry to that of another or make comparisons among groups of industries. This method can easily be extended from defense manufacturing to all domestic economic activity. While our method does not reflect the capital costs associated with production facilities and equipment, it does reflect the labor required to build production machinery, because we capture each manufacturing industry's labor output to and input from every other manufacturing industry. The labor costs we identify represent the portion of manufacturing costs that can be affected by manufacturing technology R&D projects.

We analyze the profile by showing differences among defense industry sectors and by comparing aggregate defense manufacturing to nondefense manufacturing. Our calculations are based on publicly available Government data from 1991. Because of continuing reductions in defense expenditures, our absolute results (dollars and numbers of people) should be considered high.

However, to the extent that the mix of defense hardware has not greatly changed since 1991, the relative proportions presented are still representative.

Identifying relative manufacturing costs is just one step in planning manufacturing R&D. Our profiles provide a ranking from which technical experts can systematically evaluate the efficiency and effectiveness of manufacturing activities (although, it should be noted, high cost does not automatically imply large opportunity). Our profiles also establish a baseline from which project evaluators can estimate the broad impact of cost-reducing technologies.

Our results confirm the importance of "above-the-shop-floor" R&D. Above-the-shop-floor technical and administrative costs represent 71 percent of defense manufacturing industries' labor costs; shop-floor costs represent the remaining 29 percent. Engineering and product development is the largest above-the-shop-floor category (at 26 percent), followed by management and administration (24 percent), production support (20 percent), and other support (1 percent). We recommend that NIST and DoD continue their involvement in above-the-shop-floor R&D. In particular, they should focus on tools and methods that make engineers more productive. These technologies tend to be generic and can benefit manufacturing of both civilian and defense items.

From a process cost perspective, DoD spends slightly more on mechanical and structural activities than on electrical and electronic activities. On the factory floor, mechanical and structural activities – casting, machining, welding, etc. – represent 11 percent of defense industry labor costs and are the largest portion of shop-floor costs. In comparison, electronics shop-floor processes represent 5 percent of defense industry labor costs. On the other hand, above the shop floor, mechanical engineers represent 2 percent of defense industry labor costs, while electrical engineers represent 6 percent. Thus total, directly attributable mechanical and structural activity costs are 13 percent and electrical and electronic costs are 11 percent. These totals do not include other occupations, such as industrial engineers (representing 2 percent of cost), that lack a clear mechanical or electronic activity affinity.

Given this profile, the present (Fiscal Year 1993) DoD funding allocation disproportionately favors electronics process R&D. The MS&T allocation for process technologies is manufacturing systems – 3 percent, mechanical and structural – 14 percent, and electronics – 83 percent. DoD should audit the current levels and scope of MS&T funds flowing to above-the-shop-floor projects and to mechanical process, electronics process, and other shop-floor process projects and verify they are consistent with the relative opportunities for improvement. Specifically, DoD should consider increasing the relative amount of R&D funding for manufacturing systems and for mechanical and structural process technologies.

Our results also suggest that the popular conception that the subtiers perform most of DoD's fabrication is untrue and that DoD's historic practice of funding process R&D at both large, upper-tier firms and smaller, subtier-firms is appropriate. We categorized factory floor activities as either fabrication,

assembly, or test. While upper tier industries do more assembly and test (as expected) than lower tier industries, they also do almost as much fabrication (on an absolute dollar basis). Fabrication labor costs in upper tier industries total $3.5 billion; those in lower tier industries total $3.7 billion. From an overall activity perspective, then, we feel that no special consideration should be given to a firm's position in the supplier hierarchy. For R&D of broadly applicable manufacturing technologies, the quality of the R&D and the ability to transfer the technology upon the project's completion are more important than whether the performing organization is a prime contractor or subtier supplier.

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CHAPTER 1

Introduction and Summary

PURPOSE

This report provides a process-oriented cost profile of defense manufacturing embracing all tiers of suppliers. The Department of Defense's Manufacturing Science and Technology (MS&T) Program and the Department of Commerce's National Institute of Standards and Technology (NIST) sponsored the research embodied in this report as part of their efforts to:

- Identify defense-unique process technology needs,
- Identify opportunities for broad cost reduction across the manufacturing base,
- Identify technical barriers to the application of civilian processes to defense production (and vice versa) and to the commingling of defense and civilian production, and
- Develop technology insertion (into products) and transfer (between companies) mechanisms for the maximum utilization of project results.

A continuing challenge is how to allocate R&D funding among the myriad materials, products, and processes that collectively constitute the output of the U.S. industrial base. One element that has heretofore been lacking is a snapshot of the relative costs attributable to various manufacturing processes and industries.

A previous LMI study examined the cost profile of manufacturing processes for 32 major weapon programs representing 39 percent of expected procurements.[1] In that study, we defined a taxonomy of activities relevant to defense manufacturing and developed a profile of defense manufacturing costs based on those activities rather than on the traditional accounting categories of material, labor, and overhead. Figure 1-1 shows the summary results.

[1] LMI Report PL106RD1. *A Profile of Defense Manufacturing Costs and Enabling Technologies.* Eric L. Gentsch and John W. McGinnis. January 1992.

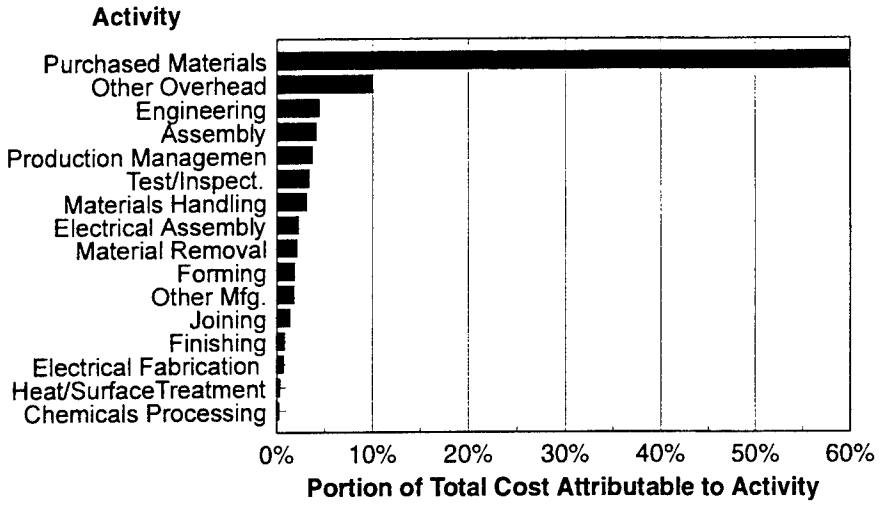


Figure 1-1.
Summary Results from LMI's 1992 Defense Manufacturing Survey

The 1992 results leave three areas for improvement. First, and most obvious, the report portrays manufacturing activities at upper-tier companies only. We estimate that about 60 percent of the revenue these companies receive from the Government is passed to lower tiers in exchange for purchased materials.[2] We intuitively would expect the cost profile at the lower tiers to be different because they do less system integration and more basic manufacturing and are more distant from Government-unique acquisition procedures. Second, the results reflect only production-phase costs. Industry, however, commits significant development resources to designing production facilities, defining process plans, and building prototypes. In addition, some manufacturing costs are expended in maintenance and repair activities. A broader study would examine all product life-cycle phases for manufacturing cost content. Third, our 1992 study is limited primarily to major systems (although we did include some small ammunition programs). To capture significantly more than 39 percent of procurements, and to capture defense manufacturing dollars expended for developmental programs and operations and maintenance programs, a broader study would include modification programs, spare-parts acquisitions, and other relatively small programs.

The present study addresses these opportunities for improvement. Specifically, we develop an occupation-based cost profile that includes all manufacturing tiers, including the portion of upper tier revenues passed to lower tier suppliers. We also cover development-phase as well as production-phase costs and expand the scope to include all private-sector manufacturing for defense.

[2] In this sense, purchased materials include everything a company buys from an external supplier, including parts, components, subassemblies, services, utilities, etc.

Identifying manufacturing costs is just one aspect of planning manufacturing R&D. While high cost does not automatically imply large opportunity, our cost profiles do provide a basis from which technical experts can evaluate the efficiency and effectiveness of high-cost activities. Other important steps in MS&T planning include evaluating the impact of certain activities on other activities' costs and estimating a return on investment for technology project proposals. We establish a baseline from which project evaluators can estimate the DoD-wide impact of cost-reducing technologies.

APPROACH

We develop the cost profile of defense manufacturing by multiplying three factors: the number of workers in an occupation and industry, the median pay for that occupation, and the defense share of that industry. The result is a data base covering 287 occupations and 91 industries — listed in Appendices A and B, respectively — with a total of 10,093 entries (not every occupation/industry combination has an entry). Each entry represents the dollars flowing from defense purchases of manufactured goods to pay workers in that occupation in that industry. With these basic data, we then aggregate by occupation and by industry. We use a taxonomy of occupations that closely matches industrial organizations' activities. For example, welders, solderers, brazers, and gluing-machine operators all perform joining processes. Using this approach, it is possible to compare one industry to another, an industry to all other industries, or groups of industries to each other. We can also focus on an occupation to show the industries that require that activity. We provide several examples to illustrate the power of this method.[3]

Our calculations are based on data available from the Bureau of Labor Statistics' (BLS) industry-occupation matrix, the BLS' *Occupational Outlook Handbook*, the Bureau of the Census' *Census of Manufactures*, and DoD's Defense Economic Impact Modeling System (DEIMS). Figure 1-2 graphically summarizes this approach.

[3] See also Brian K. Dickson and Leonard Sullivan, *A Comparative Assessment of the Defense and Commercial Sectors*, The Analytic Sciences Corporation (TASC), 31 March 1993. This TASC study employs a similar approach, and our results are in general agreement. However, our model covers twice as many industries as does TASC, our dollar values are in 1991 constant dollars, and our taxonomy differs slightly. Therefore, many of the results of the two studies are not directly comparable.

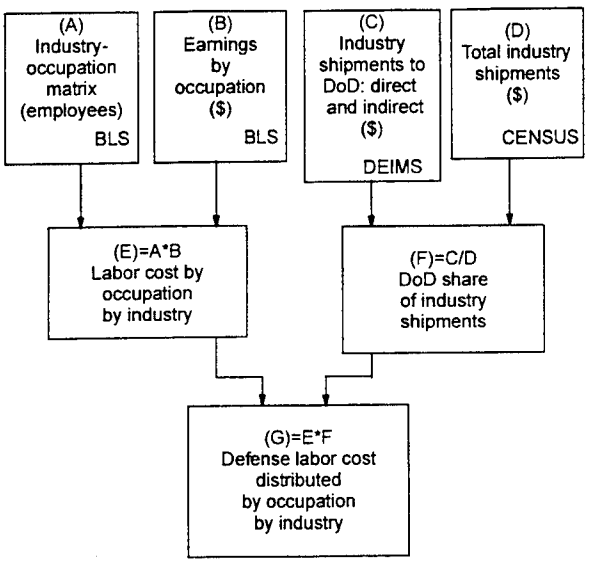


Figure 1-2.
Study Approach

Our approach is based on the notion that the occupations in an industry describe what activities take place in that industry. All manufactured products used to satisfy defense demands – whether going directly to DoD, to other manufacturing industries for additional processing, or to industries providing services to DoD – are included.[4] The method captures manufacturing at all tiers, from the prime contractors selling finished end items directly to DoD to the primes' suppliers, and even includes the capital equipment manufacturers that supply the machines used to produce defense goods.

The main drawback to this approach is that using the occupational distribution to define an industry's processes focuses on the labor portion of cost. We cannot draw conclusions about the type or quantity of capital used by each process within each industry. The BLS' Office of Productivity estimates that labor represents 70 percent of total manufacturing value added.[5] The remaining 30 percent consists of capital costs: depreciation, interest on debt, taxes, dividends, and profits. Note that while our method does not reflect the capital costs associated with production facilities and equipment, it does reflect the labor required to build production machinery, because we capture each manufacturing industry's labor output to and input from every other manufacturing industry. The labor costs we identify represent the portion of manufacturing costs that can be affected by manufacturing technology R&D projects.

[4] Service industries use manufactured goods such as computers, fax machines, and paper. Also, manufacturing industries purchase many services such as accounting services, software development, cleaning services, and a wide variety of others.

[5] Value added is the dollar value of an industry's shipments less the value of purchased materials.

While our approach provides examples useful for comparing defense industry with commercial industry, our data do not completely capture the differences between defense and commercial production. We estimate the number of defense workers in an industry by multiplying the portion of that industry's output going to defense (both directly and indirectly) by the total number of workers in that industry. Where systemic differences in labor productivity exist between defense and commercial production, they cannot be captured by our approach. (Such differences might arise from different product specifications or buying practices.) While we offer no data to compare defense and civilian production costs within any given industry (a timely question but not the purpose of this study), some insight can be gained by comparing industries that are defense-oriented with industries that are civilian-oriented. In our analysis, we compare industries that have greater than 15 percent defense share (for example, guided missiles, space vehicles, and parts) with industries that have less than 15 percent defense share (for example, electric lighting and wiring equipment).

DEFENSE OUTLAYS FOR MANUFACTURING

DoD budgets consist of two principal types of expenditures: those that pay active duty military, selected reserve military, DoD civilian workers, and retirees; and those that purchase goods and services from the private sector. Our research focuses on DoD purchases of manufactured goods from the private sector.

To identify the manufacturing portion of defense outlays, we first separate outlays for goods and services from outlays for pay. DoD outlays totaled $304 billion in FY91 (unless otherwise noted, all dollars are constant 1991 dollars).[6] The DoD budget comprises five major accounts: military personnel; research, development, test, and evaluation (RDT&E); procurement; operations and maintenance (O&M); and military construction and family housing (MILCON). DoD purchases of goods and services flow from virtually all of these major budget categories, not just the highly visible procurement account. We estimate that purchases of goods and services represented 56 percent of total DoD outlays, or $172 billion, in FY91 (see Figure 1-3).[7]

Given the outlays for goods and services, we next determine the amount flowing to the manufacturing sector. Defense outlays flow to eight major economic sectors: agriculture, mining, construction, manufacturing, transportation/public utilities, wholesale/retail trade, finance/insurance/real estate, and services. DoD's purchases of goods are supplied by the manufacturing sector, which we define to include defense prime contractors (those firms selling directly to the Government) and their supplier chain (firms that supply the Government indirectly). Note that many defense companies sell both directly and indirectly to the Government. For each dollar of defense outlays for goods, the prime contractor keeps a portion (to pay workers and provide capital)

[6] See Table 1-3 of LMI Report DC201R1, *The DoD Drawdown: Planned Spending and Employment Cuts*, Peter F. Kostiuk et al., February 1993.

[7] See Table 3.10 in Department of Commerce, *Survey of Current Business*, June 1992, p. 9.

and uses the remainder to purchase materials from its suppliers. The suppliers, in turn, do the same. The Defense Economic Impact Modeling System (DEIMS) estimates the distribution, by industry, of direct defense outlays as well as the subsequent indirect demand placed on all defense suppliers. We use data from DEIMS and the Department of Commerce's *Survey of Current Business* to estimate the activity cost in the manufacturing sector. As shown in Figure 1-4, the manufacturing sector consumes $90 billion, or 52 percent, of defense outlays for goods and services.

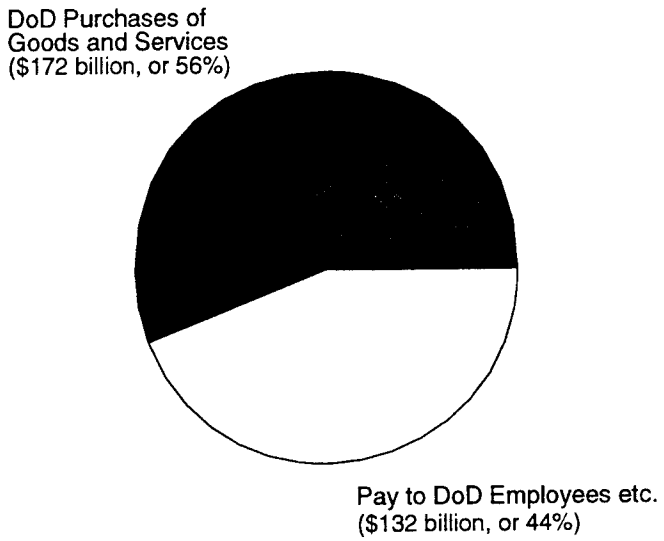


Figure 1-3.
Total FY91 DoD Outlays ($304 billion FY91 dollars)

Since manufacturing activities consume 52 percent of outlays for goods and services, which in turn account for 56 percent of total DoD outlays, manufacturing activities represent 30 percent of total outlays.

Findings and Recommendations — Occupation Profile

All Defense Manufacturing

We estimate that, in 1991, total defense-related manufacturing employment was about 1.5 million.[8] Base wages and salaries paid to those defense workers were $41 billion, or 46 percent of the $90 billion figure for defense manufacturing costs. Including benefits and other labor-related costs would bring the cost of

[8] The 1993 figure is probably lower, because of continuing reductions in defense purchases. However, to the extent that the mix of defense hardware has not greatly changed from 1991, the relative proportions presented are still accurate.

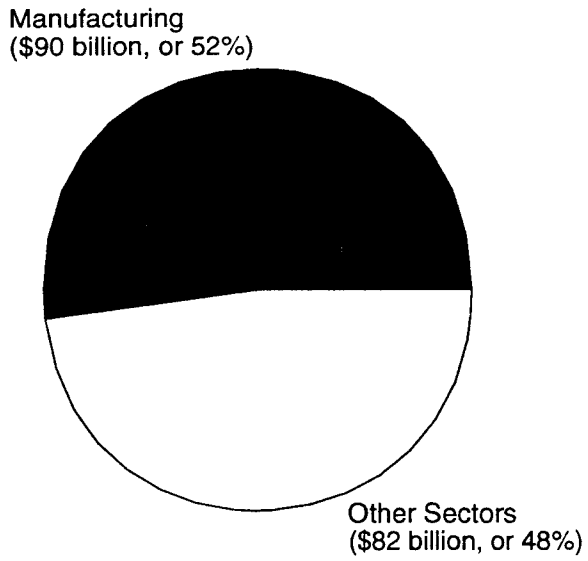


Figure 1-4.
FY91 DoD Outlays for Goods and Services ($172 billion FY91 dollars)

defense labor to between half and three-quarters of that $90 billion figure. Those costs include vacation, health insurance, social security taxes, unemployment taxes, workers' compensation taxes, and other items. Benefits are difficult to estimate, because they vary by industry and region, and some are tied to salary while others are constant. The nonlabor portion of the the $90 billion (that is, one-quarter to one-half of the cost of manufactured defense goods) consists of items such as taxes, interest, dividends, and profit.[9]

We base our occupation profile on the wages and salaries that constitute $41 billion of the $90 billion in Figure 1-4. We aggregated the 287 occupations in our data base according to a taxonomy that closely matches the functional organization of many manufacturing firms. The labor cost distribution for defense manufacturing industry workers at the topmost level of this taxonomy is shown in Figure 1-5.

Factory floor activity is the largest category, closely followed by engineering and product development and then by management and administration. As reported in our 1992 study, "above-the-shop-floor" costs are large relative to shop-floor costs. For all defense manufacturing industries, above-the-shop-floor costs represent almost three-quarters of total labor costs. Of these, all of production support and some product development labor provides direct assistance to manufacturing activities; the remainder performs other business activities, such as accounting and sales. This result is no surprise to those in industry accustomed to 300 percent (or higher) burden rates on shop-floor labor.

[9] The defense manufacturing cost we cite is, in economic terms, value added, which is the value of an industry or firm's shipments less purchases.

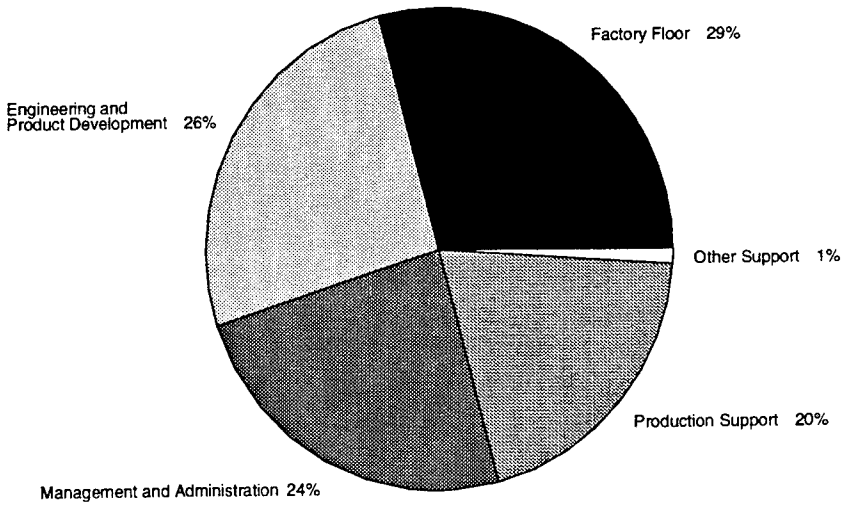


Figure 1-5.
Top-Level Defense Labor Cost Distribution, All Defense Industries

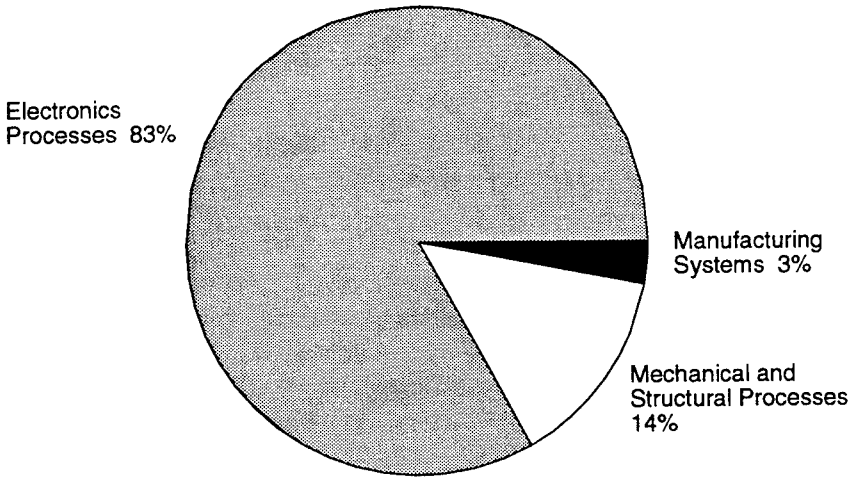
Our results confirm the importance of "above-the-shop-floor" R&D. We recommend that NIST and DoD continue their involvement in above-the-shop-floor R&D. In particular, they should focus on tools and methods that make engineers more productive. These technologies tend to be generic and can benefit manufacturing of both civilian and defense items.

From a process cost perspective, DoD spends slightly more for mechanical and structural activities than for electrical and electronic activities. On the factory floor, activities related to producing mechanical and structural products — casting, machining, welding, etc. — represent 11 percent of defense industry labor costs and are the largest portion of shop-floor costs. In comparison, electronics shop-floor processes represent five percent of labor costs. On the other hand, above the shop-floor, mechanical engineers represent two percent of defense industry labor costs, while electrical engineers represent six percent. Note the reversal from the factory floor cost breakdown: whereas shop-floor mechanical processes (material removal, joining, etc.) represent a higher portion of costs than do electrical processes, mechanical engineers represent a lower portion of costs than do electrical engineers.[10] (The relatively low cost of shop-floor electronics processing may result from performance requirements that lead to high levels of automation.) Thus total, directly attributable mechanical and structural activity costs are 13 percent and electrical and electronic costs are 11 percent. These

[10] These results are based on labor activity and represent all inter-industry supply relationships in the manufacturing sector. While we do not capture capital costs, we do capture the labor embedded in production equipment. For example, our results include the activities to produce the equipment used by the electronics industries, such as the casting of vacuum chambers. The manufacturing activities we show include those generated by DoD prime contractors, those generated by subtier suppliers, and those generated by equipment suppliers to defense manufacturers.

totals do not include other occupations, such as industrial engineers (representing 2 percent of cost), that lack a clear mechanical or electronic activity affinity.

Given this profile, the present (FY93) DoD funding allocation disproportionately favors electronics process R&D (see Figure 1-6). DoD should examine the current levels and scope of MS&T funds flowing to above-the-shop-floor projects and to mechanical process, electronics process, and other shop-floor process projects and verify that they are consistent with the relative opportunities for improvement. Specifically, DoD should consider increasing the relative amount of R&D funding for manufacturing systems and for mechanical and structural process technologies.



Source: Defense Manufacturing Science and Technology Integration Plan, ODDR&E (Thrust 7), 21 December 1992, p.6

Figure 1-6.
Allocation of DoD FY93 Funding for Process-Related R&D

Technologies for manufacturing systems and factory floor processes often are complementary or even inseparable. Design and development activities are inherently costly and implicitly drive shop-floor costs. For mechanical and structural activities, the Government should examine why the shop-floor portion is so costly relative to the engineering portion (11 percent of defense industry labor cost is for mechanical and structural activities on the factory floor, but only 2 percent is for mechanical engineers). This disparity becomes all the more pronounced when set beside the comparable figures for electronics shop-floor work and for electrical engineers (5 percent and 6 percent of defense industry labor cost, respectively). Undoubtedly, some shop-floor processes can benefit from shop-floor technology improvements, such as the application of sensors for real-time control. Other processes might be better served by improved engineering, such as would be provided by more realistic process models. As has been demonstrated, new technologies and techniques sometimes increase the cost of

engineering (for example, by increasing the time spent designing more flexible tooling and simpler-to-assemble parts) but lower both shop-floor and total costs.

Sector Analysis

We now analyze the activity profile across selected industry sectors and individual industries.

We divided the 91 industries in our data base into "upper tier" and "lower tier." Upper tier industries are (somewhat arbitrarily) defined as those with defense share of industry output greater than 15 percent. In addition to having a relatively large defense business, upper tier industries are those that are frequently thought of as "prime" and "first-tier" major defense suppliers, including aircraft, missile, and shipbuilding industries. In addition to these two industry tiers, we selected three industries to illustrate our method: the electronic components industry, the screw machine products industry, and the metalworking machinery industry.

Our results suggest that the popular conception that the subtiers perform the bulk of DoD's fabrication is untrue and that DoD's historic practice of funding process R&D at both large, upper-tier firms and smaller, subtier-firms is appropriate. We categorized factory floor activities as either fabrication, assembly, or test. While upper tier industries do more assembly and test (as expected) than lower tier industries, they also do almost as much fabrication (on an absolute dollar basis). Fabrication labor costs in upper tier industries total $3.5 billion; those in lower tier industries total $3.7 billion. From an overall activity perspective, then, we feel that no special consideration should be given to a firm's position in the supplier hierarchy. For R&D of broadly applicable manufacturing technologies, the quality of the R&D and the ability to transfer the technology upon the project's completion are more important than whether the performing organization is a prime contractor or subtier supplier.

One question often asked is whether DoD's unique buying practices, in comparison to those in the private sector, make DoD business significantly more expensive. Our approach yields insight on differences caused by the mix of production (i.e., DoD buys a set of goods different from that bought in the general economy, leading to a different manufacturing profile). We find that management and administration costs, as a percentage of total labor costs, vary little across industries. The management and administration costs for our selected tiers and industries range from 23 percent to 26 percent of labor costs, as shown in Figure 1-7.

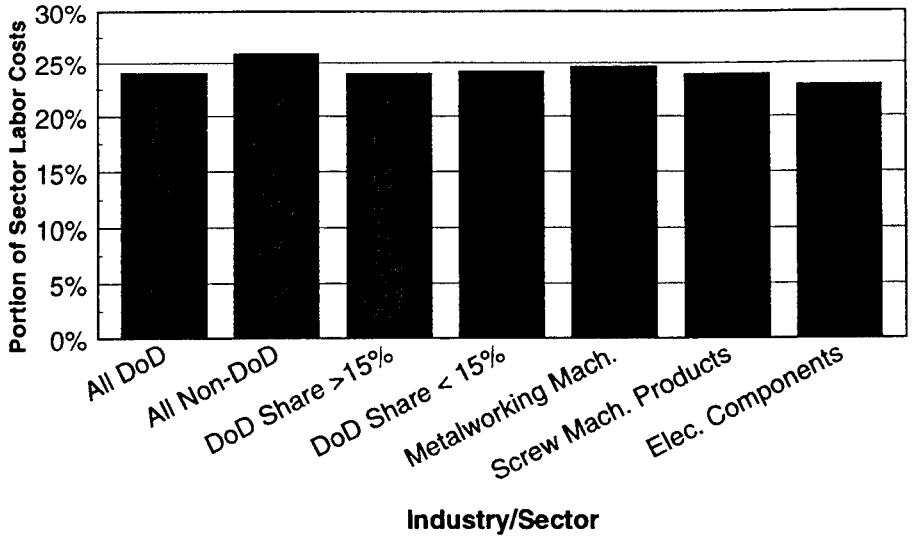


Figure 1-7.
Management and Administration Costs as a Percentage of Labor Cost for Selected Sectors and Industries

We define another measure, called production support intensity; it is the ratio of production support activity (such as production supervision and materials handling) to manufacturing costs. Production support intensity is shown in Figure 1-8. Our data indicate little difference in production support intensity between industries with large DoD shares and those with small DoD shares. Nondefense production support intensity is actually higher than that for defense

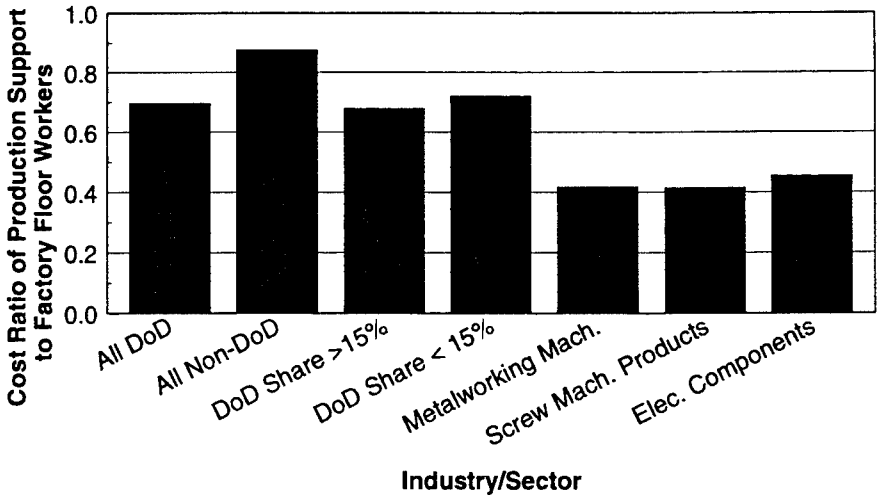


Figure 1-8.
Production Support Intensity for Selected Sectors and Industries

industries as a whole. For the individual industries that we examined, however, the production support intensity is about two-thirds that of all DoD production.

These results reveal no apparently higher premium that DoD might be paying for management and administration or for production support. Our study, however, was not designed to identify systemic productivity differences that might exist between the defense and commercial sectors. Such differences might arise from Government-imposed specifications, standards, and accounting practices. We recommend that DoD continue to look for and resolve systemic productivity differences between the defense and private sectors.

FINDINGS AND RECOMMENDATIONS — INDUSTRY PROFILE

We now present defense manufacturing cost profiles from an overall industry perspective (i.e., all activities aggregated). For this exercise, our definition of an industry becomes more specific, and we examine the 330 manufacturing industries defined by DEIMS.[11]

Defense production is highly concentrated across industries. Roughly half (173) of the 330 DEIMS manufacturing industries account for almost all (98.5 percent) defense manufacturing. We divided these 173 industries into seven categories that roughly correspond to stages of processing, from raw materials to finished goods. Figure 1-9 illustrates the defense manufacturing performed at each of these stages.

[11] We are actually referring to the same industries, but at different levels of coding. The 91 industries cited in the occupation profile are based on the three-digit Standard Industrial Classification (SIC) system. The 330 DEIMS manufacturing industries cited here correspond to the more detailed four-digit SIC coding. Thus the 91 three-digit industries collectively comprise the 330 DEIMS industries.

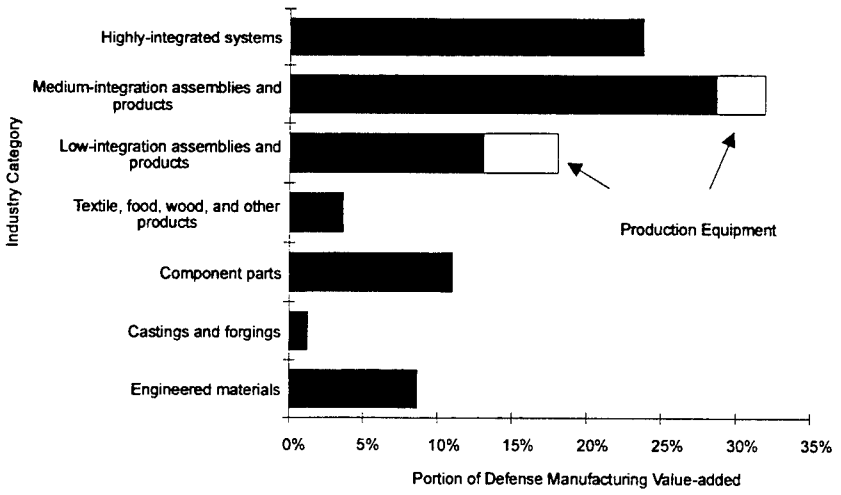


Figure 1-9.
Contribution to Defense Manufacturing Activity Cost by Industry Category

In the low- and medium-integration categories, we have separately displayed production equipment suppliers. These suppliers make production tooling, machinery, controls, and other supplies that all manufacturing industries need. For example, "low-integration assemblies and products" includes the engineering and scientific instruments industry. "Medium-integration assemblies and products" includes the metalworking machinery industry.

The engineered materials and production equipment sectors, together representing 17 percent of defense activity costs, have a major impact on the defense industries they supply. Quality problems in engineered materials create inspection costs, scrap and rework, excess processing costs, and delays in all downstream industries. The production equipment industries supply all defense producers with equipment; the quality and cost of their products affect the quality and cost of all other defense products, and their financial and technical viability (versus that of foreign competitors) strongly influences the long-term potential of the U.S. industrial base to mobilize for war.

The cost distribution within a manufacturing industry, discussed in our occupation profile, is only one piece of information needed for effective investment of Government R&D. Another is that industry's relationship to DoD. We ranked industries on the basis of their economic dependence on DoD (how large a share of industry production goes into defense goods) and on DoD's economic dependence on the industry (how large a portion of DoD dollars goes to the industry). When the two rankings are compared, we get a picture of varying economic interdependence that will be outlined in Chapter 3.

MS&T investments that are principally intended to reduce DoD acquisition costs should be limited to industries or products where there is high mutual

dependence. When DoD is a buyer in a competitive market, there is probably little role for intervention other than to ensure that defense prime and subcontractors obtain the best commercially available price. However, when DoD is a large buyer and the industry depends upon DoD, there may not exist sufficient market forces to ensure that DoD obtains high-quality products at fair and reasonable prices in a timely fashion. Because DoD cannot count on industry competition to ensure that the most efficient technology or production process will be used, it might be desirable to resort to direct technology investments. MS&T investments in other cases (i.e., large outlays from DoD but small portion of industry output, and vice versa) should be evaluated on a case-by-case basis, depending upon the criticality and military uniqueness of the product. As always, MS&T investments may be warranted independent of economic dependence; for instance, to spur development of high-risk production processes that are directly linked with achieving state-of-the-art weapon system performance.

Report Organization

In the remainder of this report we discuss in more detail our profiles of the occupations and industries that constitute the defense manufacturing base. Chapter 2 presents an occupation profile that represents the labor portion. We develop occupation profiles for all defense industries combined, and for selected defense subsectors (i.e., groups of industries), and we demonstrate how our method can be applied to individual industries. Chapter 3 presents an industry profile (with all occupations summarized). Finally, we present a series of appendices containing data listings and setting forth other technical details.

CHAPTER 2

The Defense Manufacturing Base: Occupation Profile

INTRODUCTION

We develop a profile of the industrial activities associated with defense manufacturing by combining four data elements. The BLS industry-occupation matrix gives the number of workers (economy-wide) in each of 306 3-digit Standard Industrial Classification industries and 621 occupations. For example, we find that the "aircraft and parts" industry employs 8,420 "welding machine setters, operators, and tenders." For each manufacturing industry, we then estimate the portion devoted to defense by dividing industry defense output by total industry output. Multiplying these data elements (the number of workers in an industry-occupation "cell" times the share of industry activity for defense) gives an estimate of the number of workers supporting defense production. For "aircraft and parts," approximately 32 percent of industry activity is defense-oriented, and therefore we estimate that about 2,700 (8,420 times 0.32) of the welders are supporting defense. Multiplying by the fourth data element – median pay by occupation – gives an estimate of the relative dollar amounts devoted to each industry-occupation pair. Median pay for welders, excluding benefits, is $24,700, and so we estimate that each year DoD spends at least $67 million (2,700 times $24,700) for welding in the aircraft industry.[1] Figure 2-1 illustrates this approach, laid out in a slightly different fashion.

[1] Pay statistics reported by the Department of Labor's BLS include neither benefits, such as health care and vacation, nor other labor-associated costs, such as social security, unemployment, and workers' compensation taxes.

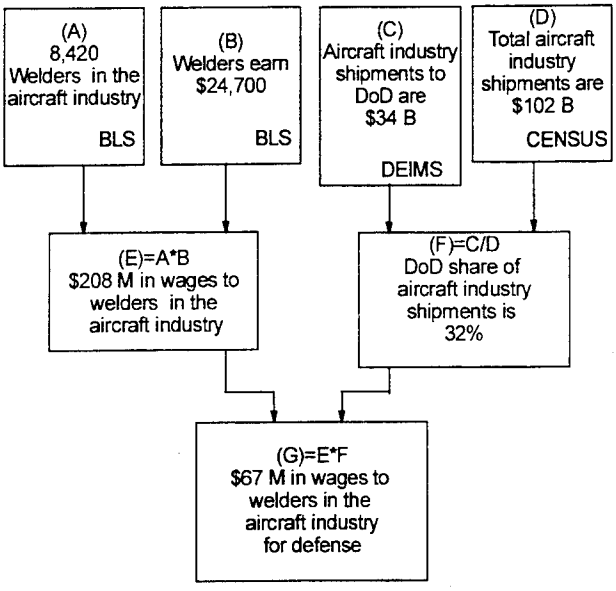


Figure 2-1.
Example of Industry/Occupation Profile Approach

The resulting data base comprises 287 occupations and 91 manufacturing industries serving defense (see Appendices A and B for lists of the occupations and industries). It contains 10,093 entries. This is considerably less than the 287×91= 26,117 possible entries because not every occupation appears in every industry. For each entry, the data base contains the number of defense workers and DoD dollars spent for that occupation in that industry. Therefore, it is possible to compare one industry to another, an industry to all other industries, or groups of industries to each other. We can also focus on an occupation to show the industries that perform that activity. We provide several examples to illustrate the power of this method. We first combine all industries to develop an occupation profile representing all DoD production. This satisfies our goal of producing a picture of defense manufacturing covering all systems, development and production activities, and defense industries. We then show how the data can be used to compare groups of industries, by examining industries that do a large amount of business with DoD and those that do a small amount of business with DoD. We examine the occupation profile of individual industries and present the metalworking machinery, screw machine products, and electronic components industries as examples. We also compare the occupation profile of DoD manufacturing (all industries combined) to that for non-DoD manufacturing. We conclude the chapter by discussing the validity of our model and comparing our results to those of our 1992 study.

TAXONOMY

We developed a taxonomy of industrial activities that emulates how manufacturing firms are organized. The taxonomy enables us to aggregate our results

for analysis and presentation. For shop-floor manufacturing activities, this taxonomy closely matches that used in our 1992 study. In the above-the-shop-floor areas and in product development, we have expanded that earlier taxonomy to include more categories. Figure 2-2 shows the highest level of aggregation.

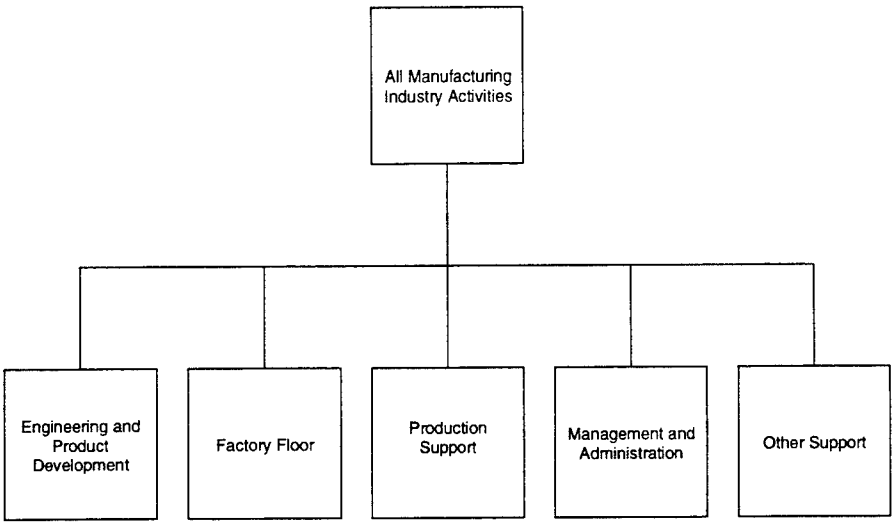


Figure 2-2.
Top-Level Taxonomy of Manufacturing Industry Activities

Figure 2-3 breaks down the activities on the factory floor.

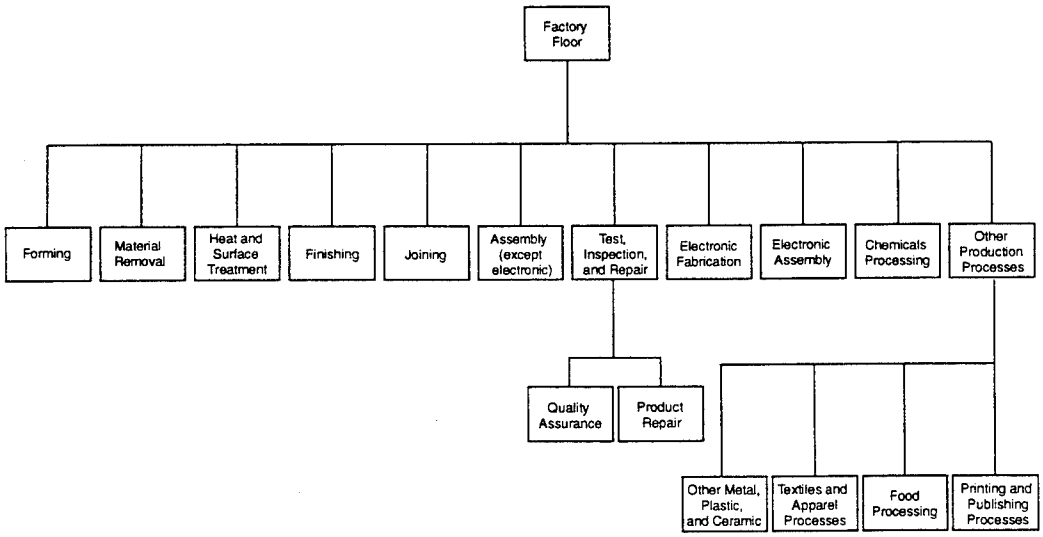


Figure 2-3.
Factory Floor Taxonomy

Appendix C contains the complete taxonomy. At the lowest level of detail, all 287 defense-related occupations that we identified are represented in the taxonomy.

Our results include the cost of software written by manufacturing firms and embedded in weapon systems (we classify systems analysts and programmers as "management and administration," because we are unable to discern between people writing business software for internal use and those writing embedded software). Our results do not include the costs of software written by service firms. While our analyses are limited to DoD purchases of hard goods, we could readily extend the approach to include defense-related activities in the service industries (where an increasing amount of engineering and programming occurs) and in other economic sectors.

All Industries Combined

We estimate that, in 1991, total defense-related manufacturing industry employment was about 1.5 million.[2] The top-level labor cost distribution for these workers is shown in Figure 2-4 (repeated from Chapter 1).

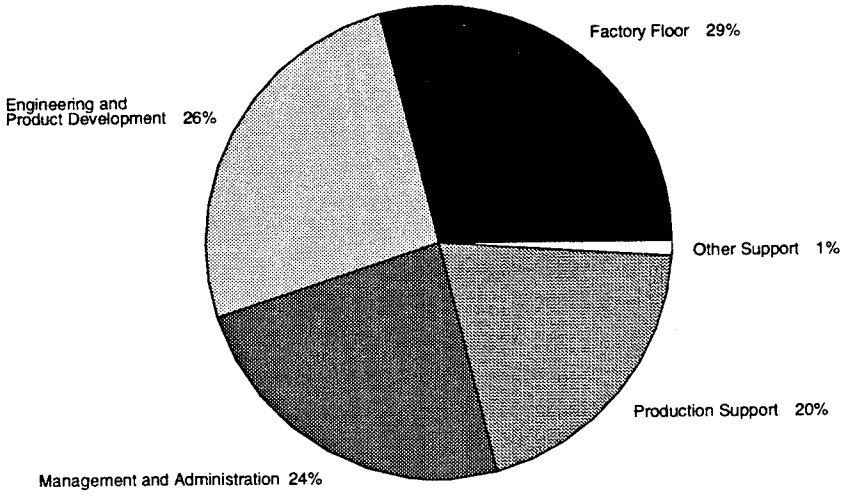


Figure 2-4.
Top-Level Defense Labor Cost Distribution, All Defense Industries

We discuss here some of the highlights underlying this distribution. A list of relative activity costs for all occupations in our taxonomy appears in Appendix D. Factory floor activities form the largest category, closely followed by engineering and product development and then by management and administration. However, as reported in our 1992 study, the aggregate of all above-the-

[2]The current figure is probably lower, because of continuing reductions in defense purchases. However, to the extent that the mix of defense hardware has not greatly changed from 1991, the relative proportions presented are still accurate.

shop-floor costs is large relative to that of factory floor costs. For all defense industries, above-the-shop-floor costs represent almost three-quarters of total labor costs. Of these, most production support labor and some product development labor provide direct assistance to factory floor activities. We are unable to determine the precise amount of engineering and product development that is devoted to supporting the factory floor, because the Department of Labor's BLS reports engineers by training (e.g. mechanical, electrical) rather than by function (e.g. design engineer, process engineer).

Figure 2-5 displays the activities that make up factory floor costs.

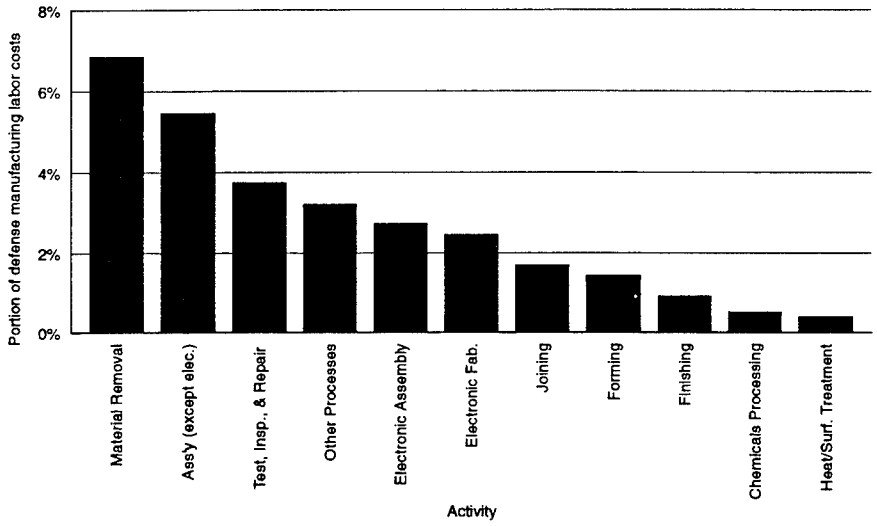


Figure 2-5.
Factory Floor Activity Cost Breakdown, All Defense Industries

The largest factory floor category is material removal, representing over 7 percent of defense manufacturing labor costs. "Traditional" fabrication activities, including material removal, joining, forming, finishing, and heat and surface treatment, collectively account for 11 percent of defense manufacturing labor costs. Over 4 percent of defense manufacturing labor costs are devoted to test, inspection, and repair activities.

Activities related to electrical and electronics processing consume almost 5 percent of the dollars DoD spends on the manufacturing sector. Note that our results are based on value added and thus represent all inter-industry supply relationships. While electronics industries are typically considered more capital intensive than metalworking industries, we capture the activities to produce the equipment used by the electronics industries wherever they occur (for example, the machining of vacuum chambers). Conversely, the electronics activities we show total those needed for direct DoD demand, plus the electronics activities required to fulfill indirect DoD demand, as well as electronics in the production equipment used by all manufacturing industries supporting DoD.

Figure 2-6 breaks down the activities in material removal.

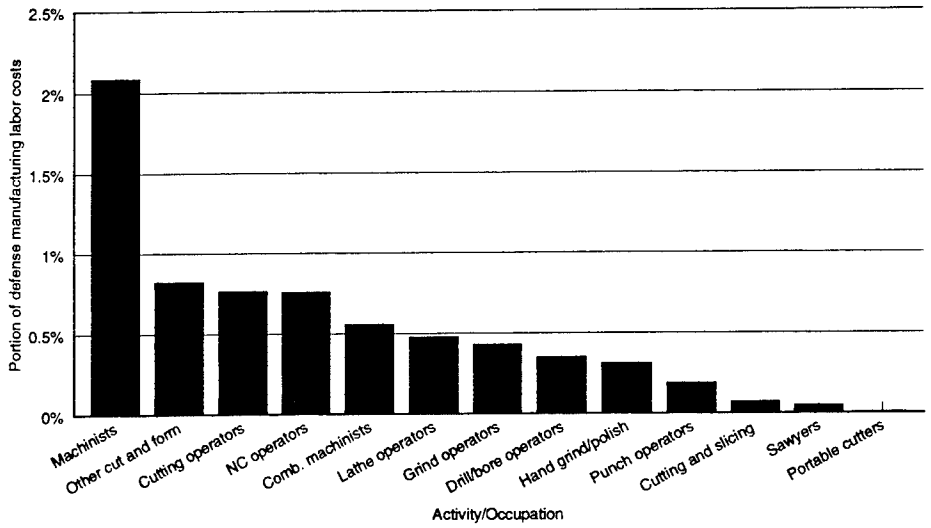


Figure 2-6.
Material Removal Activity Cost Breakdown, All Defense Industries

The activities in this figure are occupations defined by the Department of Labor and represent our level of greatest detail. About one-third of material removal is performed by workers classified as general machinists. The remainder is attributable to more specific processes, such as turning and grinding. We note that, with time, it will be harder to identify a specific process cost from these statistics. More and more workers are being cross-trained as general machinists, and new production equipment frequently combines several functions.

In addition to designing, the activities that we identify as engineering and product development (see Figure 2-7) assist manufacturing by developing production plans, building special tools, and solving technical problems on the shop floor.

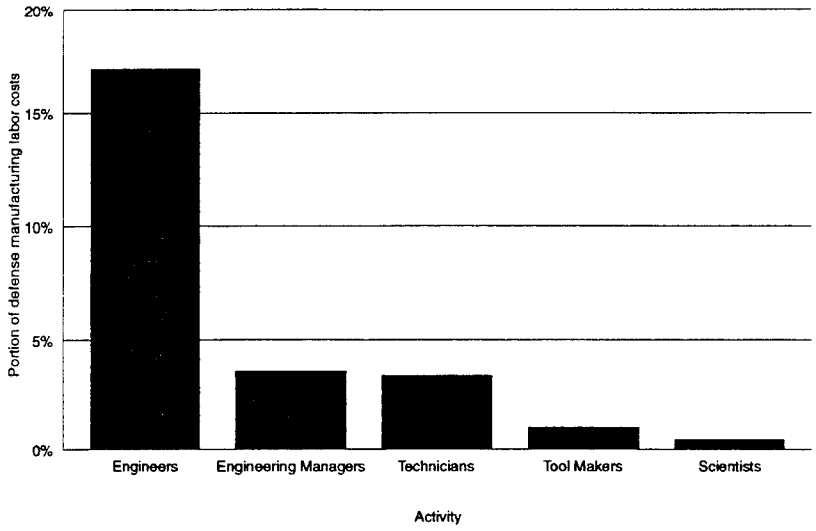


Figure 2-7.
Engineering and Product Development Activity Breakdown, All Defense Industries

These functions also play a major role in prototype hardware fabrication, process qualification, and product testing. Figure 2-8 shows the relative proportion of DoD dollars flowing to the various engineering disciplines.

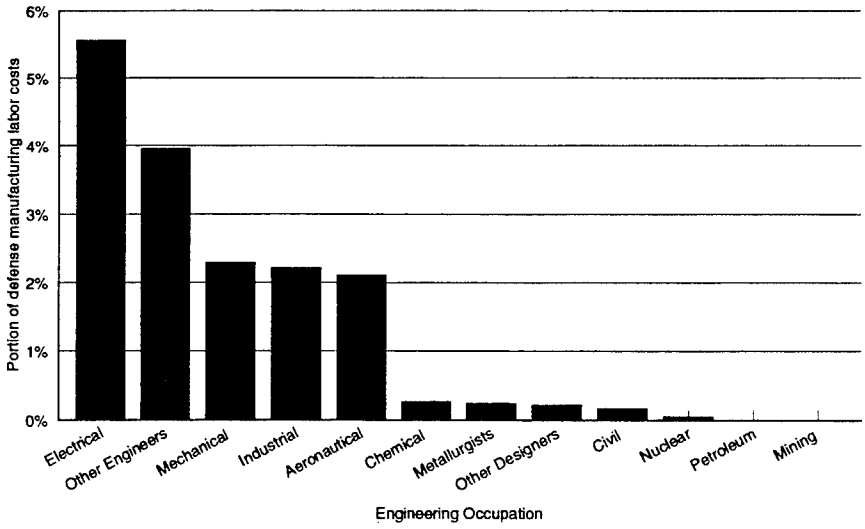


Figure 2-8.
Breakdown of Engineering and Designer Occupations, All Defense Industries

Chapter 1 noted the contrast between (1) the relatively high portion of resources – on the shop floor – devoted to mechanical and structural activities compared to electronics activities (11:5), and (2) the ratio of costs – above the shop-floor – for mechanical compared to electrical engineers (1:3). This disparity suggests that, for electronics-related products, the MS&T program should

concentrate on the engineering aspects, which are inherently costly and which implicitly drive shop-floor costs. For mechanical products, the MS&T program should examine why the shop floor activities are so costly relative to their engineering. Undoubtedly, some shop-floor processes can benefit from technology improvements, such as the application of sensors for real-time control. Other mechanical processes might be better served by improved engineering. As has been demonstrated, new technologies and techniques sometimes increase the cost of engineering (for example, by providing more flexible tooling and simpler-to-assemble designs) but lower shop-floor fabrication costs and total costs.

SECTOR ANALYSES

In this section we compare the cost profiles of several sectors and industries. First, we separate all DoD manufacturing from all non-DoD manufacturing. This comparison focuses only on the differences that arise from the mix of products produced for DoD versus the mix of products produced for civilian markets and on the occupations required for making those products. Our approach does not provide visibility into any systemic differences in labor productivity that exist between defense and nondefense sectors. Such systemic differences could arise from the unique acquisition practices, regulations, and legislation found in defense markets. Next, we group industries into those whose defense share is greater than 15 percent and those whose defense share is less than 15 percent. Industries with large defense share are by definition "defense-intensive"; found here are the major weapons industries of aircraft, missiles, ships, and transport vehicles (including combat vehicles like tanks). The group with small defense share is more likely to include subtier suppliers and spare parts manufacturers. Appendix B lists the industries in our study and their respective defense shares. Finally, we offer a view of three industries: metalworking machinery, screw machine products, and electronic components. Complete cost profile listings for these sectors and industries are contained in Appendices E through J.

Figure 2-9 shows the contribution of factory floor activities to total labor cost for the sectors we analyzed. Overall, shop-floor activities account for 29 percent of defense manufacturing industry labor costs. For industries with a large defense share (this category includes major weapons producers), the factory floor accounts for about 25 percent of those costs, while for industries with a small defense share, including most subtier suppliers, the factory floor accounts for about 35 percent of costs.

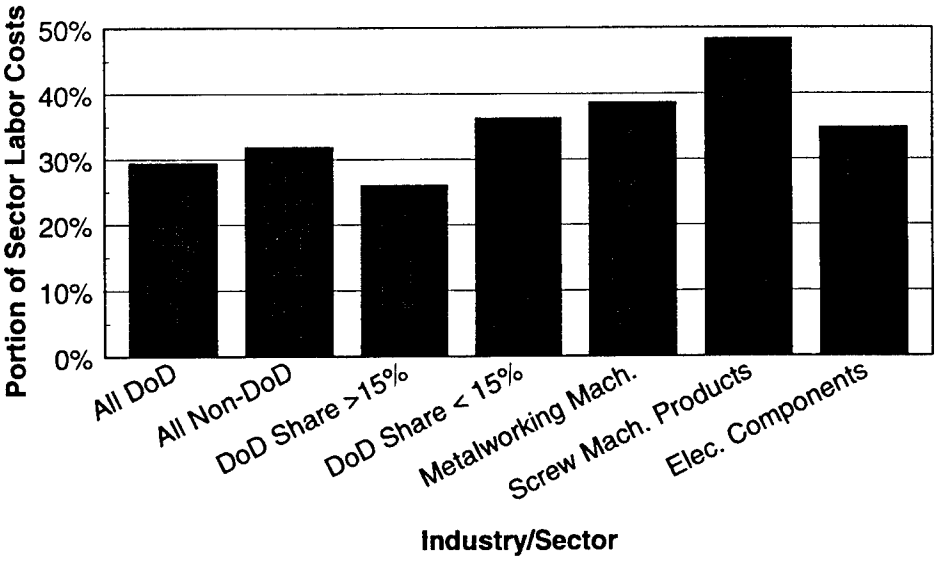


Figure 2-9.
Contribution of Factory Floor Activities to Labor Costs for Various Sectors and Industries

Figure 2-10 shows a breakdown of factory floor labor costs. Across all defense manufacturing industries, the composition of those costs is 59 percent fabrication, 28 percent assembly, and 13 percent test, inspection, and repair. The composition varies by sector and by industry. The level of assembly activity at the upper tiers (greater than 15 percent defense share) is relatively high, as might be expected. Upper tier industries incur test, inspection, and repair costs that are proportionally twice those of industries with low DoD share, possibly indicating the effects of DoD acquisition policies, product complexity, or both. Fabrication activities, both mechanical and electronic, represent 13 percent of upper tier industries' total labor costs.[3] Labor value added for these industries is $27.7 billion, so fabrication labor costs are $3.5 billion. At the lower tiers, fabrication costs represent a larger percentage of total labor costs, 27 percent, but because lower tier sector labor cost is only about half as large as that of the upper tier, $13.7 billion, the lower tiers spend only slightly more dollars for fabrication ($3.7 billion).[4] This illustrates that upper tier contractors are more than merely integrators; they are fabricators as well.

[3] 26 percent of sector labor cost is on the factory floor; 49 percent of that is related to fabrication.

[4] 36 percent of sector labor cost is on the factory floor; 75 percent of that is related to fabrication.

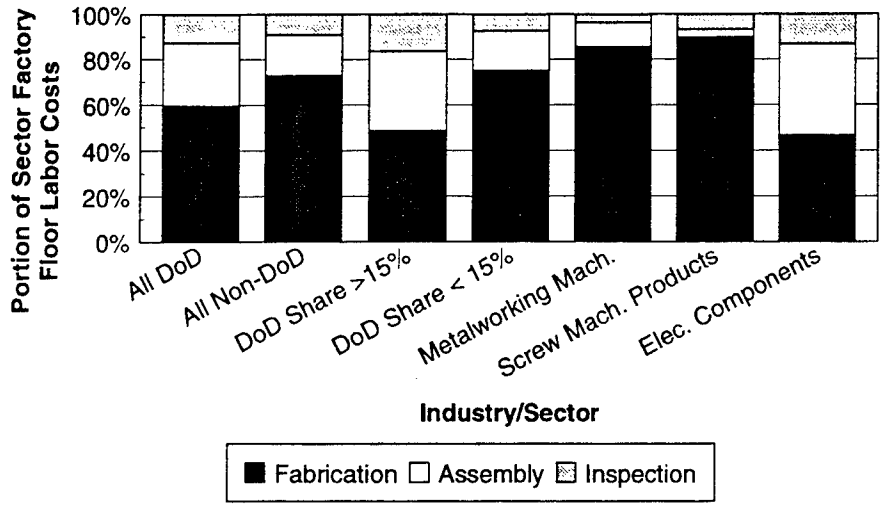


Figure 2-10.
Composition of Factory Floor Labor Costs for Various Sectors and Industries

Figure 2-11 shows that engineering and product development activities represent one quarter of labor costs across all DoD sectors/industries. Across all defense production, engineering costs are more than twice those in nondefense production.

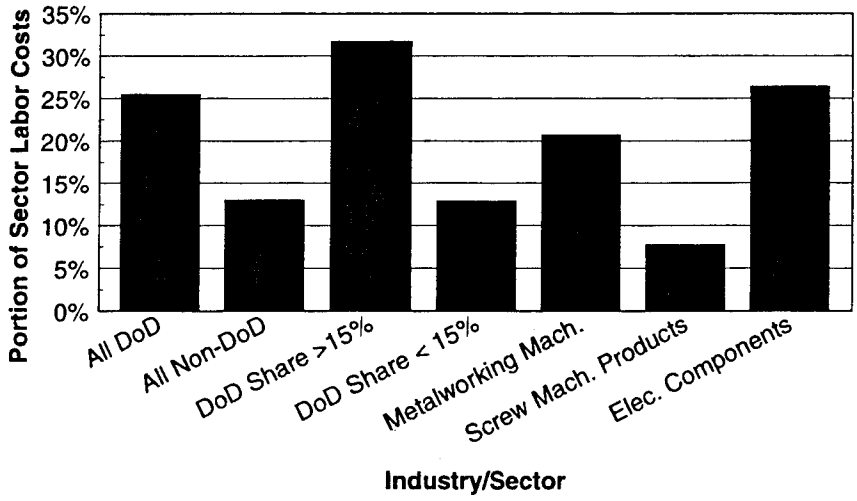


Figure 2-11.
Contribution of Engineering and Product Development to Labor Costs for Various Sectors and Industries

For a more valid comparison of the engineering in defense sectors and industries, we define a measure called "development intensity." The development intensity for an industry is the ratio of its engineering and product development costs to its factory floor costs. The development intensity for selected sectors and industries is shown in Figure 2-12.

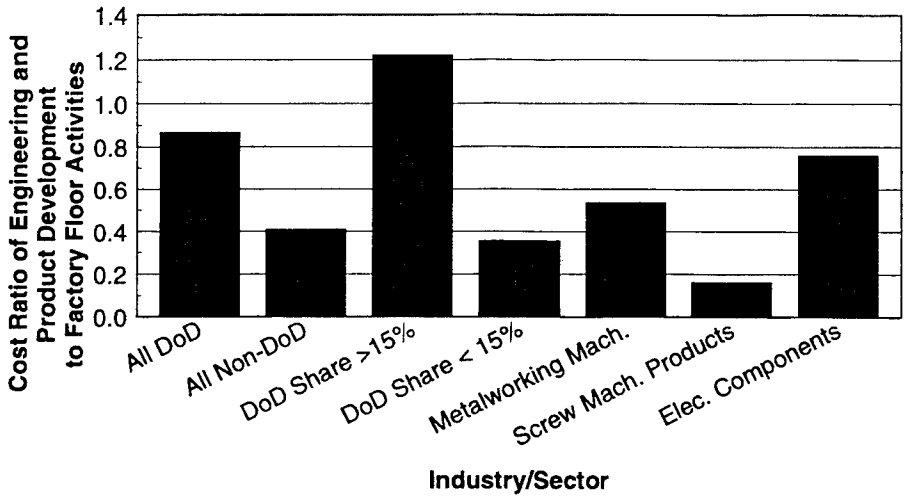


Figure 2-12.
Development Intensity for Various Sectors and Industries

Some products are clearly more development-intensive than others. As expected, we find that DoD production is more development-intensive than non-DoD production and that industries with a large defense share (including weapon system integrators) are more development-intensive than industries with a small defense share. The development intensity of the upper tier industries is over three times that of lower tier industries. At the individual industry level, we see considerable variation. The electronic components industry is relatively development-intensive, the metalworking machinery is moderately so, and the screw machine products industry is low in development intensity.

Production support activities consume 20 percent of the dollars DoD spends on manufacturing labor (see Figure 2-4 on p. 2-4). Production support includes production management, purchasing, materials handling, and plant operations. We note that engineers and other technical personnel also provide support to the factory floor; unfortunately, these costs are not separable and are included in the engineering and product development category. Figure 2-13 shows the portion of labor costs generated by production support activities for the groups and industries we studied. Because these various groups and industries have varying amounts of factory floor activity, it would not be accurate to base comparisons on these data alone. Rather, we define a measure called "production support intensity." Production support intensity is the ratio of an industry's production support costs to its factory floor costs and is shown in Figure 2-14. Our data

indicate little difference in production support intensity between industries with large DoD shares and those with small DoD shares. For the individual industries that we examined, however, the production support intensity is about two-thirds that for all DoD production.

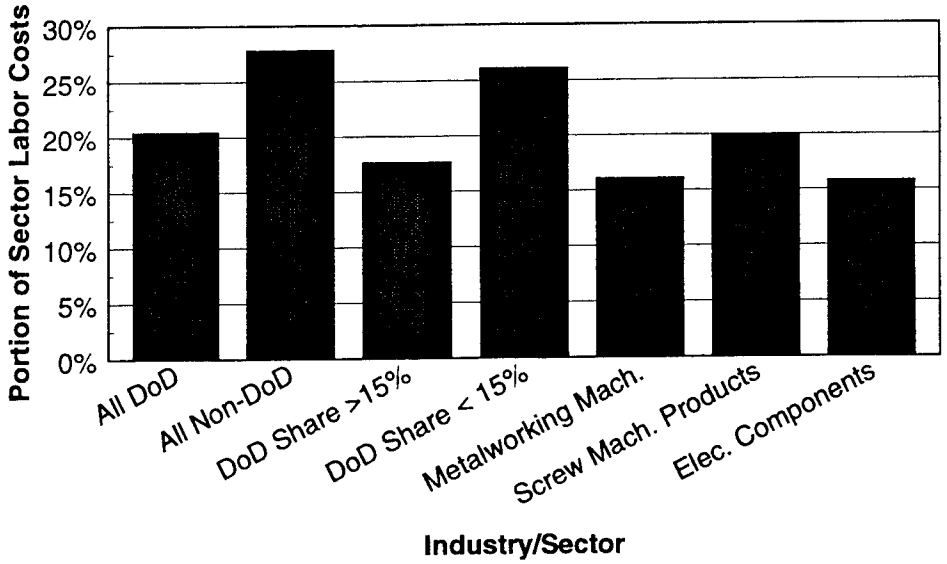


Figure 2-13.
Contribution of Production Support Activities to Labor Costs for Various Sectors and Industries

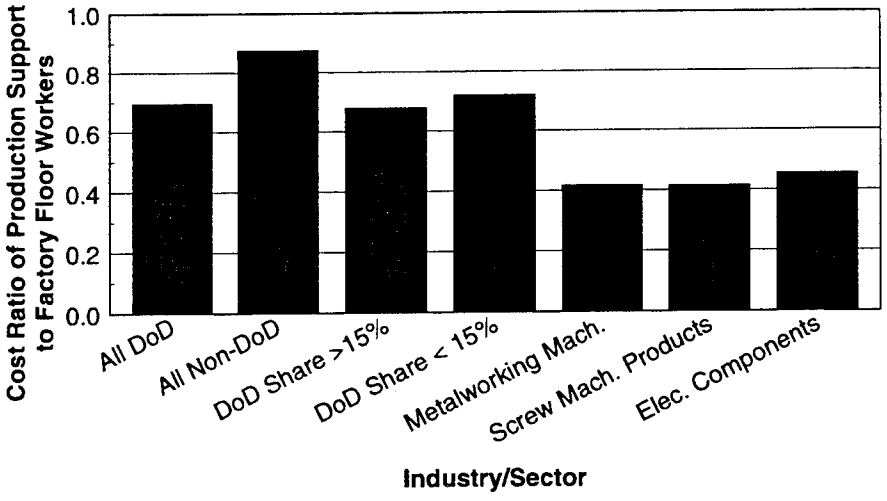


Figure 2-14.
Production Support Intensity for Various Sectors and Industries

Across all defense industries, the portion of labor costs represented by management and administration is 24 percent. Interestingly, this figure varies little from that in nondefense production and that found in various individual defense sectors (see Figure 2-15). Even looking at a breakout of that category, we find only small differences: for example, the nondefense sector spends a bit more in marketing, and the defense sector spends somewhat more in information systems. Additional management costs can be associated with engineering and manufacturing. To illustrate these, we define two measures, an "engineering management intensity," and a "production supervision intensity." Engineering management intensity is the ratio of engineering managers' costs to total engineering and product development costs. Production supervision intensity is the ratio of production supervisors' plus blue collar working supervisors' labor costs to factory floor labor costs.

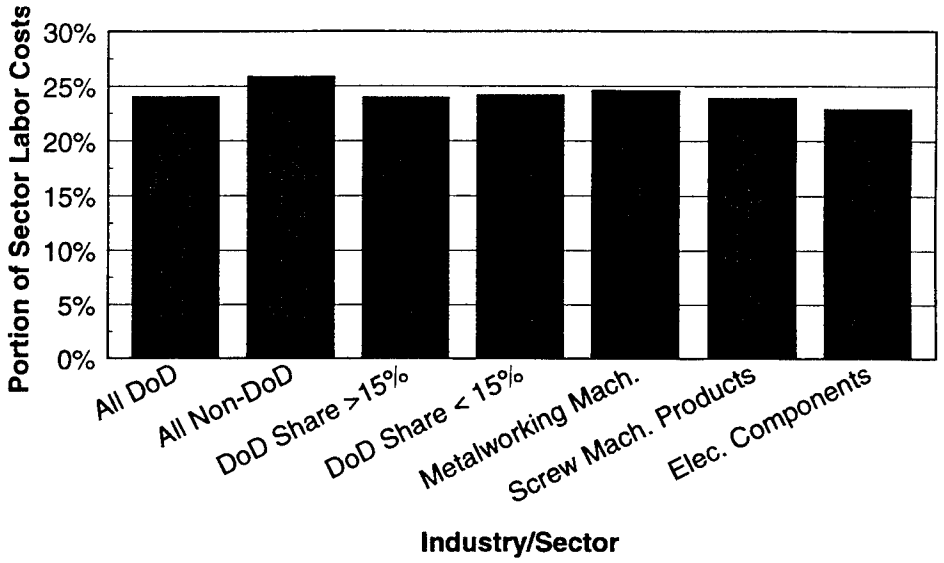


Figure 2-15.
Contribution of Management and Administration Activities to Labor Costs for Various Sectors and Industries

The engineering management intensity for industries with much defense production is somewhat less than that for industries with little defense production (see Figure 2-16). This is somewhat surprising, because the defense-intensive industries (which include the upper tier industries of aircraft, missiles, ships, and armored vehicles) spend twice as much on engineering as do the civilian-intensive industries. Contrary to the view that large development teams lead to over-managed bureaucracies, this suggests that there are, in practice, economies of scale, at least from an organizational perspective.

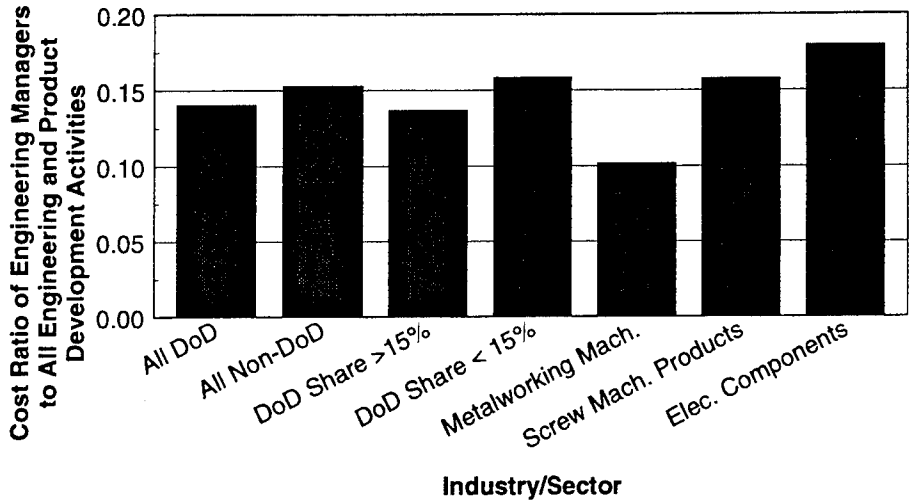


Figure 2-16.
Engineering Management Intensity for Various Sectors and Industries

Figure 2-17 shows production supervision intensity. The production supervision intensity for industries with much defense production (greater than 15 percent) is only slightly greater than that for industries with little (less than 15 percent) defense production. There is considerable variation by industry. The metalworking machinery industry, for example, requires only three-quarters the production supervision that the electronic components industry requires.

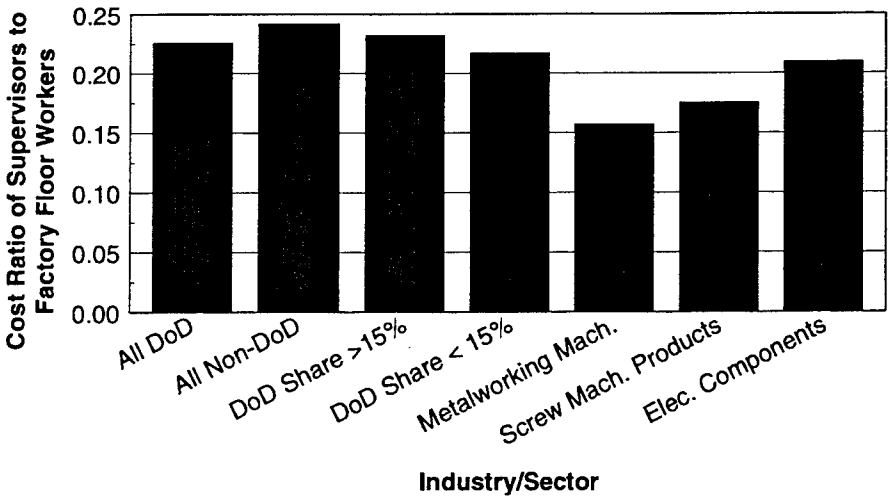


Figure 2-17.
Production Supervision Intensity for Various Sectors and Industries

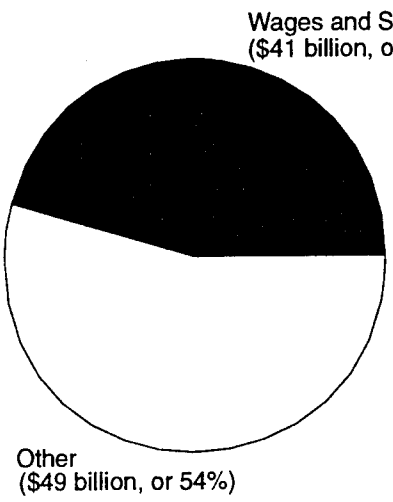
VALIDITY OF THE MODEL

As stated in Chapter 1, our model is based on the concept that the occupations in an industry describe what activities take place in that industry. All manufactured products used to satisfy defense demands – whether going directly to DoD, to other manufacturing industries for additional processing, or to industries providing services to DoD – are included. The method captures manufacturing at all tiers, from the prime contractors selling finished end items directly to DoD to the primes' suppliers, and even includes the capital equipment manufacturers that supply the machines used to produce defense goods.

The main drawback to this approach is that using the occupational distribution to define an industry's processes focuses on the labor portion of cost. We cannot draw conclusions about the type or quantity of capital used by each industry. The BLS' Office of Productivity estimates that labor represents 70 percent of total manufacturing value added. The remaining 30 percent consists of capital costs: depreciation, interest on debt, taxes, dividends, and profits.

Our estimate putting the total number of defense workers at 1.5 million (in 1991) agrees well with an earlier estimate of 1.7 million for the same period.[5] When extended by base salaries and wages, our estimate translates into unburdened defense labor costs totaling $41 billion (see Figure 2-18). This also agrees well with independent sources, by the following reasoning. We would expect total labor value added to be about $90 billion (total value added for defense manufacturing) times 70 percent (labor's share), or $63 billion. Assuming that our unburdened estimate of $41 billion is correct, this implicitly leaves $63 billion less $41 billion, or $22 billion, as benefits and other costs of labor. Is this reasonable? We believe that the combined effect of labor taxes (principally social security, unemployment, and workers' compensation), retirement plans, vacations and holidays, health care and other benefits can easily total more than 40 percent of base wages and may approach the 54 percent of $41 billion represented by the $22 billion. For example, social security adds over 15 percent and health care for the average worker adds approximately 14 percent.

[5] LMI Report DC201R2. *Impacts of Defense Spending Cuts on Industry Sectors, Occupational Groups, and Localities*. Earl R. Wingrove, Donna J.S. Peterson, and Scott E. Dahne. January 1993, p. 5-5.



Note: " Wages and Salaries" includes all tiers of defense manufacturing and direct labor and indirect labor. "Other" includes nonwage benefits to labor (health care, vacation, other), taxes (income, FICA, workers' compensation, other), depreciation, interest on debt, dividends, and profit.

Figure 2-18.
Composition of $90 Billion Total (Labor Plus Capital) Defense Manufacturing Value Added

While our approach provides examples by which to compare defense industry with commercial industry, it does not completely capture the differences between defense and commercial production. Such differences might arise from differing product specifications or buying practices. Identifying these differences, however, is not the objective of this study. Finally, our use of median pay does not account for regional differences and any systemic pay differences that may exist between defense and civilian sectors.

COMPARISON WITH EARLIER RESULTS

We now compare our results from this study to the results we obtained in our 1992 study. A direct comparison is difficult, because the studies have different bases; the current study is much broader. Table 2-1 summarizes the differences underlying the two approaches.

Table 2-1.
Differences Between 1992 and Current Study Approaches

1992 Study	Current Study
Mostly major systems	All defense manufacturing
Primes and some upper tier suppliers	All tiers
Production phase only	Development and production
Activity embedded in purchased parts not captured	Activity embedded in purchased parts is captured

To make the comparison, we express the 1992 numbers in terms of value added. This is easily done by dividing each number by the complement of the purchased-parts percentage. Table 2-2 shows the original and adjusted numbers.

Table 2-2.
1992 Results Expressed as Value Added

Activity	1992 results (percent)	1992 results expressed as value added (percent)
Purchased parts	59.8	
Other overhead	10.0	24.9
Engineering	4.4	10.9
Assembly	4.1	10.2
Production management	3.7	9.2
Test/inspection	3.4	8.5
Materials handling	3.1	7.7
Electronic assembly	2.3	5.7
Material removal	2.1	5.2
Forming	1.9	4.7
Other manufacturing	1.8	4.5
Joining	1.4	3.5
Finishing	0.8	2.0
Electronic fabrication	0.7	1.7
Treatment	0.3	0.7
Chemical process	0.2	0.5
Total	100.0	100.0

In Figure 2-19 we compare the two results. We make the comparison using numbers representing value added but caution the reader that the remaining differences shown in Table 2-1 still exist.

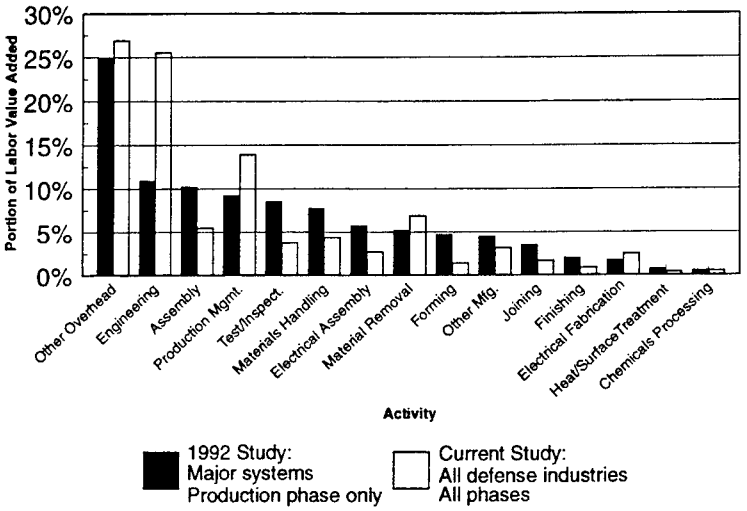


Figure 2-19.
Comparison with 1992 Study Results

For consistency, we map the current results into the 1992 taxonomy. All factory floor processes directly match. Because we modified the taxonomy for the current study, several above-the-shop-floor activities do not directly match, but they are easily mapped. "Engineering," which in 1992 included only manufacturing engineering, in the current study includes all engineering and technical product development activities. "Production Management" includes the current categories of production management and physical plant. "Other Overhead" includes the current categories of management and administration, purchasing, and other support.

As expected, engineering represents a much higher portion of total costs, because the current study includes product development activities. That material removal is higher – and assembly, joining, and test/inspection are lower – in the current study is also to be expected, because inclusion of the lower tiers means that final product integration and checkout become proportionally smaller. We expected forming to be the same or higher, because much metals casting and forging is done by lower tier suppliers. Forming, however, is a broad category that includes composite materials layup, and so our results probably reflect the increasing amount of composites forming done by major contractors.[6] Expecting that broad industry would be "leaner," we are somewhat surprised that production management in the current study is so high in relation to the 1992 study. We are also somewhat surprised that "Other Manufacturing" is lower, having expected that the production of food, clothing, and other goods not conforming to our taxonomy would contribute to a larger amount in the current, broader study.

[6] Northrop, for example, operates a composites facility next door to its F/A-18 assembly line. Hence what is often thought of as a lower tier activity is performed by a major systems integrator.

CHAPTER 3

The Defense Manufacturing Base: Industry Profile

INTRODUCTION

This chapter describes the industries constituting the defense manufacturing base. While the basis for the data in this chapter is somewhat different from the basis for those in the occupation profile, we feel that an industry view provides a useful illustration of the diversity of industries serving DoD. Output obtained from the Defense Economic Impact Modeling System (DEIMS) is the primary basis for our industry profile. DEIMS is an analytical tool developed by the Economic Analysis and Resource Planning Division of the Office of Program Analysis and Evaluation (PA&E) within the Office of the Secretary of Defense. Its objective is to estimate the effects of defense spending on industries, employment, and states. DEIMS grew out of a concern during the early 1980s that rapidly increasing defense expenditures would create bottlenecks as capacity was reached in certain sectors and would fuel inflation and/or lead to shortages.

Given a specified defense budget, DEIMS produces the value of each industry's shipments that flow to DoD – both directly through prime contracts and indirectly through materials supplied to other defense industries. With data derived from the Department of Commerce's *Annual Survey of Manufacturers* and the input-output tables published in the *Survey of Current Business*, we estimate the fraction of each industry's shipments that represents value added. Multiplying these two – industry shipments to DoD times the industry value-added fraction – gives the dollar value of each industry's value added for defense production.

THE TOP 173 DEIMS MANUFACTURING INDUSTRIES

DEIMS defines 432 (426 private-sector and 6 public-sector) industries. Three hundred-thirty of them belong to the manufacturing sector; in FY91 they had a combined defense production value added of $90 million. One-hundred-seventy-three of the 330 manufacturing industries account for 98.5 percent of that value added, and it is on these industries that we concentrate our analysis.

Table 3-1 lists the top 10 DEIMS manufacturing industries in value-added order.[1] Appendices K and L list all 173 DEIMS industries that we studied, in order of value added and in alphabetical order, respectively.

Table 3-1.
The Top 10 DEIMS Manufacturing Industries, in Order of Descending Value Added for Defense

	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (percent)
1	Communication/search and navigation	18,637	20.7
2	Aircraft	8,771	9.8
3	Complete guided missiles	7,218	8.0
4	Aircraft/missile parts and equip, NEC	6,161	6.9
5	Shipbuilding and repairing	3,750	4.2
6	Aircraft/missile engines and parts	3,735	4.2
7	Inorganic and organic chemicals	1,735	1.9
8	Engineering and scientific instruments	1,684	1.9
9	Ammunition, except small arms, NEC	1,640	1.8
10	Electronic components, NEC	1,526	1.7

STAGES OF PROCESSING

We aggregated the top 173 DEIMS defense manufacturing industries into seven categories that roughly correspond to stages of processing, from raw materials to finished goods. Table 3-2 describes the seven categories, while Figure 3-1 (repeated from Chapter 1) shows the portion of defense manufacturing performed at each of these stages. Appendix M lists the industries that we assigned to each category.

[1] We call these "DEIMS industries" because DEIMS carries its own classification system. DEIMS industries are easily translated to four-digit SIC industries, which can be aggregated to the three-digit industries used in the occupation analysis of the preceding chapter.

Table 3-2.
Stages of Processing

Category	Description
Highly integrated systems	Major defense end items (e.g., aircraft).
Medium-integration assemblies and products	Industries that produce and assemble relatively complex end products, or major assemblies feeding more complex products (e.g., turbine engines).
Low-integration assemblies and products	Industries that produce and assemble relatively simple end products (e.g., pistols), or assemblies that feed more complex products.
Textile, food, wood, and other products	Industries producing products that do not generally utilize the manufacturing taxonomy of "conventional" electrical/mechanical processes.
Component parts	Industries that produce individual piece parts but that do not generally assemble them into finished products.
Castings and forgings	Industries that cast, form, mold, forge, or otherwise work bulk primary materials into near-net-shape blanks.
Engineered materials	Industries that transform raw materials, such as bauxite and iron ore, into primary materials, such as aluminum sheet and steel bar stock.

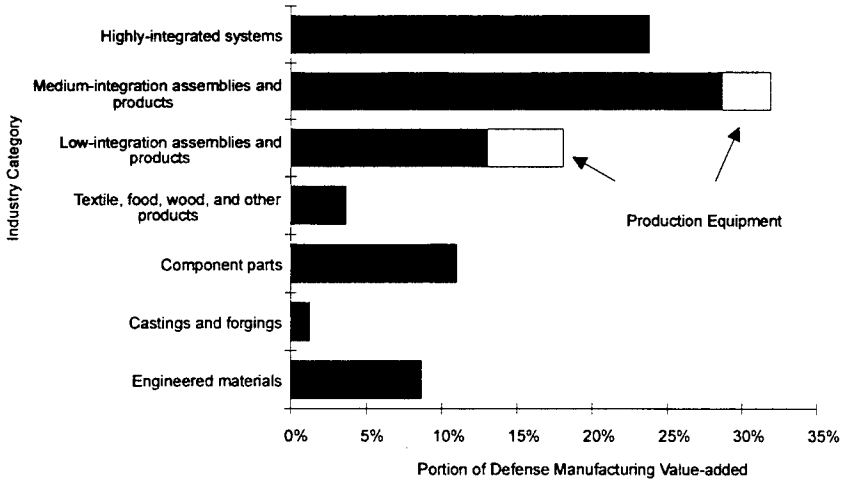


Figure 3-1.
Contribution to Defense Manufacturing Value Added by Stage of Processing

In the low- and medium-integration categories, we have separately displayed the value added performed by production equipment suppliers. As previously noted, these suppliers make production tooling, machinery, controls, and other supplies that all manufacturing industries need. For example, low-

integration assemblies and products includes the engineering and scientific instruments industry. Medium-integration assemblies and products includes the metalworking machinery industry.

The numbers in Figure 3-1 total 98.5 percent, the portion of defense value added represented by the underlying 173 industries. Industries producing assemblies and end products account for 73.8 percent of defense manufacturing value added (this includes the production equipment manufacturing industries, at 8.3 percent of defense value added). Industries typically thought of as "subtier" – engineered materials, castings and forgings, and component parts – account for 21.0 percent of value added, while textile, food, and other industries frequently not viewed as defense manufacturers contribute 3.7 percent.

DoD/Industry Interdependence

We used the data from Appendix K (illustrated by Table 3-1), along with data on total industry value added, to produce a graph illustrating the relative interdependence between DoD and the top 173 DEIMS manufacturing industries. In Figure 3-2 we plot the relative portion of DoD outlays for manufacturing flowing to the various industries and the relative portion of their outputs that constitute DoD work.

In Figure 3-2, the ordinate indicates the rank order of the industry's degree of dependence on DoD for business, with a high number indicating large dependency. For example, DEIMS industry 243, "Brass, bronze, and copper castings," devotes 4.46 percent of its production to defense and ranks much higher (95) than DEIMS industry 348, "Automobiles," which devotes only 0.07 percent of its production to defense (ranking 1). The abscissa indicates the rank order of the degree of DoD's dependence on the industry, with a high number signifying that the industry supplies a large share of DoD's total requirements. For example, DEIMS industry 349, "Other motor vehicles," provides 0.44 percent of DoD's manufacturing value added and ranks much higher (141) than industry 348, "Automobiles," which provides only 0.03 percent (ranking 3; see the circled DEIMS numbers in Figure 3-2).

When the two rankings are compared, we see a picture of varying economic interdependence. Some industries rank high with regard to both parameters; this group appears in the upper right quadrant of the figure. This group includes all the major DoD procurement categories (aircraft, missiles, ships, etc.) as well as a number of engineered materials, component parts, and production equipment industries. In this quadrant, DoD depends heavily on the industry, and the industry is also heavily dependent upon DoD. Our use of the term "depends" here refers to broad economic dependence, not necessarily technical dependence on any specific product or production process.

At the other end of the spectrum, industries in the lower left quadrant rank low according to both measures of dependence. Industries in this quadrant include food, textile, and paper producers, and some component parts industries,

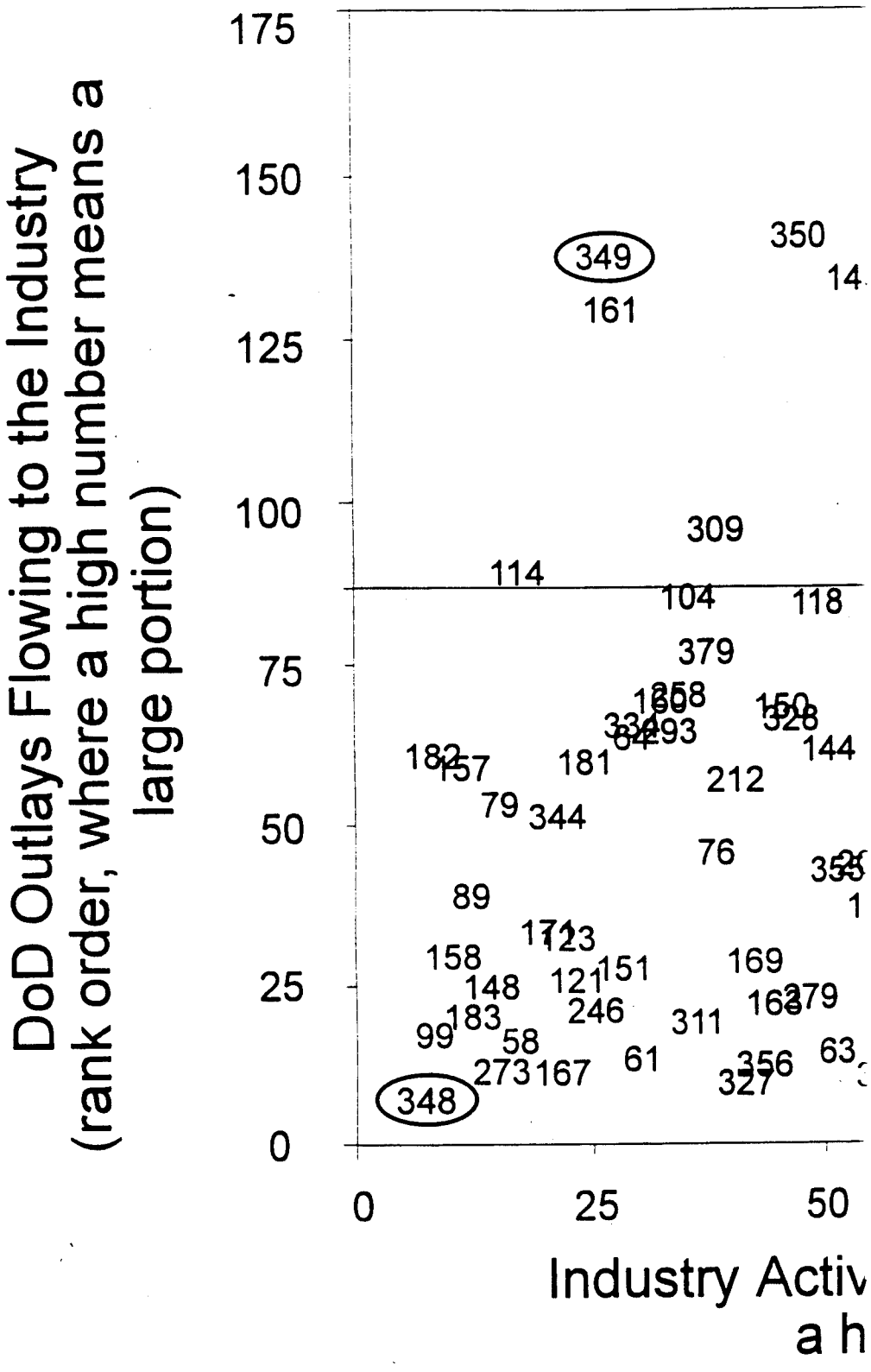
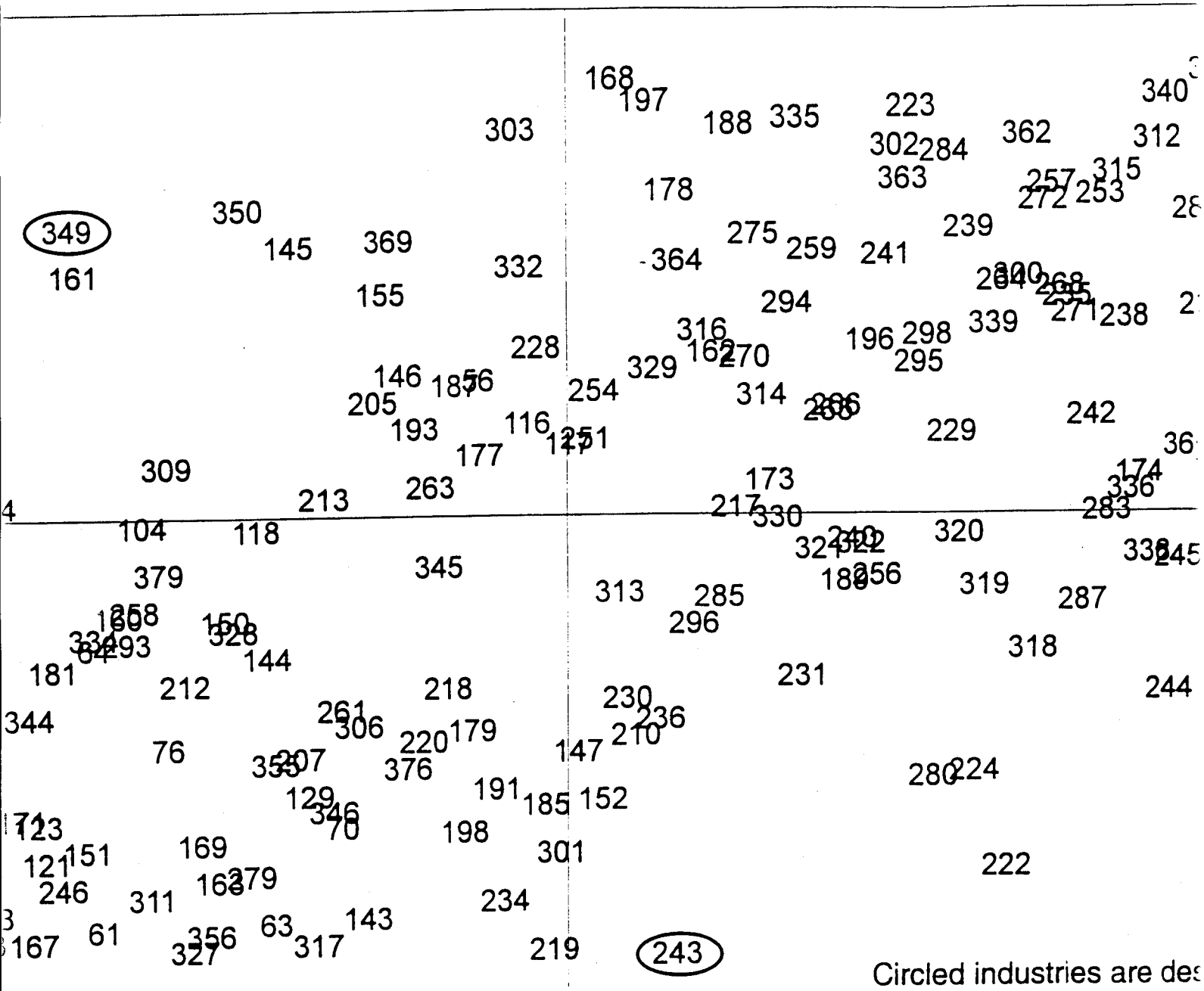


Figure 3-2.
Industry/DoD Economic Interdependence (plotted with DEIMS industry codes see Appendix N for translation table)

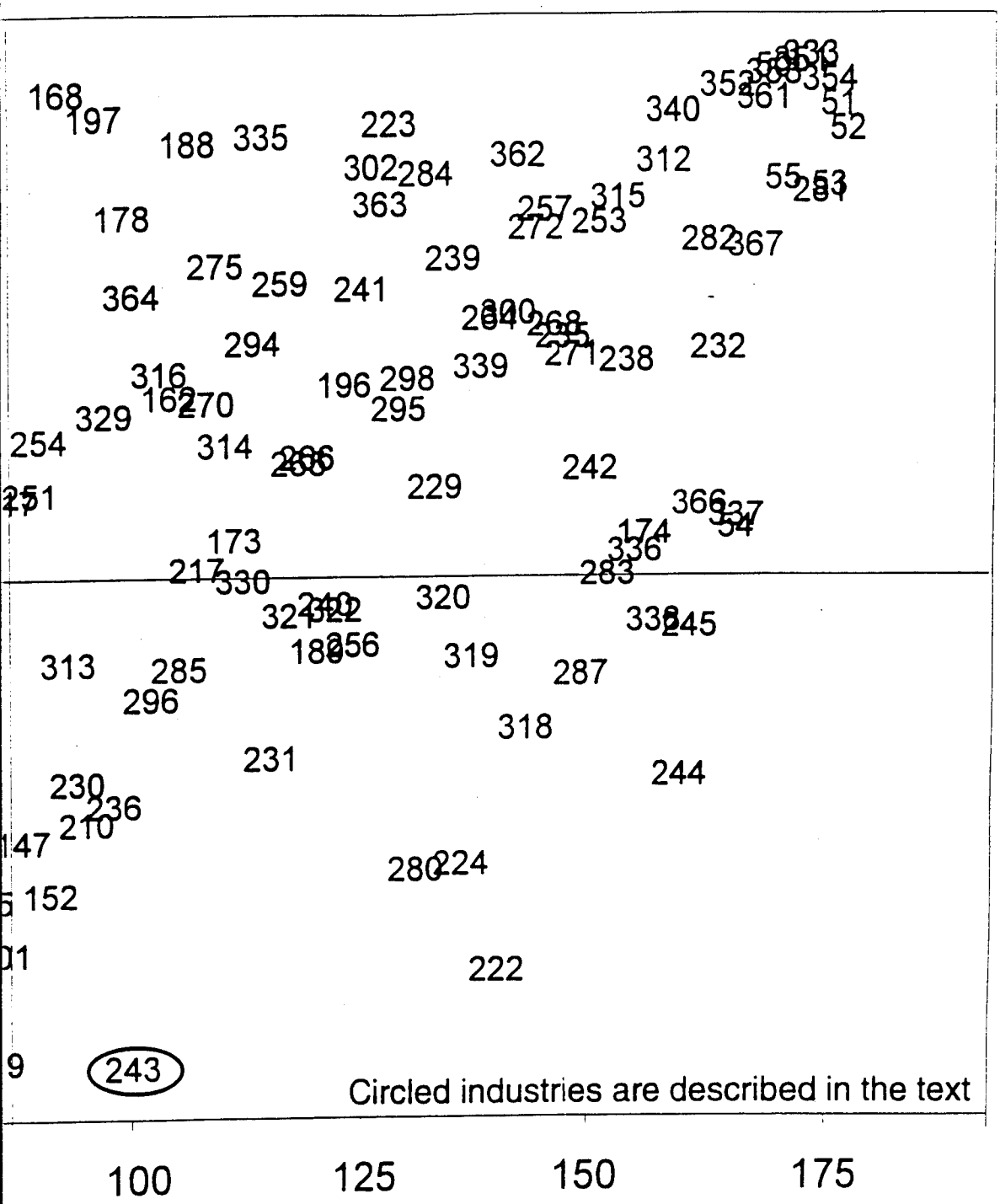


Circled industries are des

Industry Activity Performed for Defense (rank order, whe a high number means a large portion)

ted with DEIMS industry codes:

2



ed for Defense (rank order, where
means a large portion)

3

such as "electron tubes" and "carburetors, pistons, and rings." In this quadrant, DoD does not depend much on the industry, nor is the industry particularly dependent upon DoD.

A third situation (lower right) prevails for industries such as "electrometallurgical products," "hoists, cranes, and monorails," and "carbon and graphite products." Essentially, while DoD is not heavily dependent upon them, these industries are moderately dependent upon DoD. The mirror-image situation (upper left) characterizes industries such as "electronic computing equipment" and "motor vehicle parts and accessories": while DoD purchases from the industry are large in absolute magnitude, they are small in comparison to total industry output.

What do these data tell us about opportunities for investment in technology? The analysis embodied in this report must be coupled with an analysis of the market forces affecting DoD's cost minimization objectives. The mere fact that an industry provides a large portion of the manufacturing activity supporting defense purchases does not in itself imply that the industry is inefficient or requires Government intervention. When DoD is a small buyer in a competitive market, there is probably little role for intervention other than to ensure that defense prime contractors and subcontractors obtain the best commercially available price. This situation generally describes manufacturing industries in the lower left quadrant. However, when DoD is a large buyer and the industry is dependent upon DoD, there may not exist sufficient market forces to ensure that DoD obtains fair and reasonable prices. This situation occurs in the upper right hand quadrant. Because DoD cannot count on industry competition to ensure that the most efficient technology or production process will be used, it may be necessary to directly intervene in the market through MS&T investments.[2] DoD process R&D for industries in the upper left and lower right hand quadrants should be evaluated on a case-by-case basis, depending upon the criticality and military uniqueness of the product. In all cases (i.e., all quadrants), additional Government-sponsored manufacturing R&D may be warranted to spur development of high-risk production processes that are directly linked with achieving state-of-the-art weapon system performance.

[2]U.S. Congress, Office of Technology Assessment, *Redesigning Defense: Planning the Transition to the Future U.S. Defense Industrial Base*, OTA-ISC-500 (Washington, D.C.: U.S. Government Printing Office, July 1991), p. 53.

Appendix A

Occupations in the Activity Data Base

Occupations in the Activity Data Base

Occupation Code (1)	Title	Annual Pay (2)
19005011	General managers and top executives	$96,000
13017007	Engineering, mathematical, and natural science managers	$70,000
15014013	Industrial production managers	$68,000
28108119	Lawyers	$65,000
24102096	Physicists and astronomers	$56,600
87823702	Sheet metal workers and duct installers	$54,080
87802562	Insulation workers	$54,080
22111059	Petroleum engineers	$50,200
22114051	Chemical engineers	$50,100
25302091	Operations research analysts	$50,000
87811559	Glaziers	$49,920
24198097	All other physical scientists	$48,000
25312087	Statisticians	$48,000
24111094	Geologists, geophysicists, and oceanographers	$47,900
22105056	Metallurgists and metallurgical, ceramic, and materials engineers	$47,200
22135055	Mechanical engineers	$47,100
22126053	Electrical and electronics engineers	$46,800
22117058	Nuclear engineers	$46,700
22198060	All other engineers	$46,200
19998018	All other managers and administrators	$45,500
22102050	Aeronautical and astronautical engineers	$45,500
22128054	Industrial engineers, except safety engineers	$45,500
24105093	Chemists	$45,000
24108095	Meteorologists	$44,700
22108057	Mining engineers, including mine safety engineers	$44,400
24305075	Agricultural and food scientists	$44,350
24302077	Foresters and conservation scientists	$43,500
22121052	Civil engineers, including traffic engineers	$43,100
97308944	Rail yard engineers, dinkey operators, and hostlers	$42,000
13011014	Marketing, advertising, and public relations managers	$41,400
97317942	Railroad brake, signal, and switch operators	$41,000
24311078	Medical scientists	$40,000
24398079	All other life scientists	$40,000
13008017	Purchasing managers	$39,350
85302640	Automotive mechanics	$38,740
25101084	Systems analysts and computer scientists	$38,700
85305639	Automotive body and related repairers	$37,960
21114024	Accountants and auditors	$37,000
34001194	Writers and editors, including technical writers	$36,900
89717723	Strippers, printing	$36,556
32502164	Registered nurses	$36,400
25317088	Mathematicians and all other mathematical scientists	$36,000

Occupations in the Activity Data Base

Occupation Code (1)	Title	Annual Pay (2)
13005015	Personnel, training, and labor relations managers	$36,000
13002008	Financial managers	$35,800
31502152	Librarians, professional	$35,400
34011193	Reporters and correspondents	$34,268
25104253	Computer programmers	$34,000
13014003	Administrative services managers	$33,000
91502781	Numerical control machine tool operators and tenders, metal and plastic	$32,916
25111265	Programmers, numerical, tool, and process control	$32,240
24308076	Biological scientists	$31,300
21998039	All other management support workers	$30,800
95010768	Gas and petroleum plant and system occupations	$30,680
95008762	Chemical plant and system operators	$30,680
95028764	Power distributors and dispatchers	$30,680
85705614	Data processing equipment repairers	$30,420
21911031	Inspectors and compliance officers, except construction	$30,300
85323638	Aircraft mechanics	$30,000
49998283	All other sales and related workers	$30,000
21117025	Budget analysts	$30,000
89123700	Jewelers and silversmiths	$30,000
85326637	Aircraft engine specialists	$30,000
34038180	Designers, except interior designers	$30,000
34008189	Public relations specialists and publicity writers	$30,000
39998197	All other professional workers	$30,000
21511034	Personnel, training, and labor relations specialists	$30,000
34023187	Photographers	$30,000
21902028	Cost estimators	$30,000
85311641	Bus and truck mechanics and diesel engine specialists	$29,952
95032773	Stationary engineers	$29,224
81000536	Blue collar worker supervisors	$29,120
89102706	Tool and die makers	$28,964
89135699	Boilermakers	$28,600
85123634	Millwrights	$28,600
35199232	All other engineering technicians and technologists	$28,300
22505231	Electrical and electronic technicians/technologists	$28,300
85514608	Radio mechanics	$28,184
85598610	All other communications equipment mechanics, installers, and repairers	$28,184
87202558	Electricians	$27,248
91510782	Combination machine tool setters, set-up operators, operators, and tenders	$27,040
21308035	Purchasing agents, except wholesale, retail, and farm products	$26,900
87502569	Plumbers, pipefitters, and steamfitters	$26,416
87310545	Bricklayers and stone masons	$26,312
31314143	Teachers and instructors, vocational education and training	$26,100

Occupations in the Activity Data Base

Occupation Code (1)	Title	Annual Pay (2)
91108786	Drilling and boring machine tool setters and set-up operators, metal and plastic	$26,000
93102675	Aircraft assemblers, precision	$26,000
97956968	Operating engineers	$26,000
22512238	Drafters	$25,900
51002375	Clerical supervisors and managers	$25,800
89108701	Machinists	$25,272
97001936	Truck drivers, light and heavy	$25,064
97199939	All other motor vehicle operators	$25,064
97117935	Driver/sales workers	$25,064
92599844	All other printing, binding, and related workers	$25,012
92545841	Photoengraving and lithographic machine operators and tenders	$25,012
92541843	Typesetting and composing machine operators and tenders	$25,012
89712721	Photoengravers	$25,012
79002515	Forest and conservation workers	$25,000
72000525	Supervisors, farming, forestry, and agricultural related occupations	$25,000
32514216	Opticians, dispensing and measuring	$25,000
85314643	Mobile heavy equipment mechanics	$24,960
91114787	Grinding machine setters and set-up operators, metal and plastic	$24,960
85109624	Industrial machinery mechanics	$24,960
89721716	Bookbinders	$24,960
97944963	Crane and tower operators	$24,960
91714801	Metal fabricators, structural metal products	$24,700
91750805	Welding machine setters, operators, and tenders	$24,700
91710802	Soldering and brazing machine operators and tenders	$24,700
24501241	Science and mathematics technicians	$24,700
85708616	Electronic home entertainment equipment repairers	$24,544
85720620	All other electrical and electronic equipment mechanics, installers, and repairers	$24,544
85717617	Electronics repairers, commercial and industrial equipment	$24,544
95002774	Water and liquid waste treatment plant and system operators	$24,400
55198366	Secretaries, except legal and medical	$24,100
85926659	Office machine and cash register servicers	$23,504
87898574	All other construction trades workers	$23,400
93902910	Machine assemblers	$23,296
85902654	Heat, air conditioning, and refrigeration mechanics and installers	$23,244
32998221	All other health professionals, paraprofessionals, and technicians	$22,984
95098775	All other plant and system operators	$22,984
89716725	All other printing workers, precision	$22,984
89718724	Platemakers	$22,984
85935661	Riggers	$22,984
85905660	Precision instrument repairers	$22,984
89121705	Shipfitters	$22,984
93917917	Solderers and brazers	$22,984

Occupations in the Activity Data Base

Occupation Code (1)	Title	Annual Pay (2)
97898958	All other transportation and related workers	$22,984
97941966	Hoist and winch operators	$22,984
87708564	Paving, surfacing, and tamping equipment operators	$22,984
89998752	All other precision workers	$22,984
93941912	Metal pourers and casters, basic shapes	$22,984
87988598	All other extraction and related workers	$22,984
93947913	Painting, coating, and decorating workers, hand	$22,984
85947650	Coin and vending machine servicers and repairers	$22,880
91117790	Machine tool cutting operators and tenders, metal and plastic	$22,880
91105788	Lathe and turning machine tool setters and set-up operators, metal and plastic	$22,880
93914918	Welders and cutters	$22,100
55323359	Order clerks, materials, merchandise, and service	$21,900
91399792	All other machine tool cutting and forming etc.	$21,736
85998664	All other mechanics, installers, and repairers	$21,632
85132633	Maintenance repairers, general utility	$21,632
87311553	Concrete and terrazzo finishers	$21,528
87110548	Carpenters	$21,424
34035176	Artists and commercial artists	$21,400
92519839	All other printing press setters and set-up operators	$21,320
97938965	Grader, dozer, and scraper operators	$21,320
92524842	Screen printing machine setters and set-up operators	$21,320
92515834	Letterpress operators	$21,320
92512835	Offset lithographic press operators	$21,320
92542836	Printing press machine setters, operators and tenders	$21,320
55302369	Stenographers	$21,100
91932816	Heat treating machine operators and tenders, metal and plastic	$20,956
91930820	Nonelectrolytic plating machine operators and tenders, setters and set-up operator	$20,956
92100826	All other metal and plastic machine setters, operators, and related workers	$20,956
91914812	Foundry mold assembly and shakeout workers	$20,956
91920809	Electrolytic plating machine operators and tenders, setters and set-up operators,	$20,956
91928815	Heating equipment setters and set-up operators, metal and plastic	$20,956
91935813	Furnace operators and tenders	$20,956
91910817	Metal molding machine operators and tenders, setters and set-up operators	$20,956
91938814	Heaters, metal and plastic	$20,956
89198707	All other precision metal workers	$20,956
91321789	Machine forming operators and tenders, metal and plastic	$20,956
91950823	Plastic molding machine operators and tenders, setters and set-up operators	$20,956
97910969	All other material moving equipment operators	$20,800
89706719	Paste-up workers	$20,800
89707720	Electronic pagination systems workers	$20,800
89705718	Job printers	$20,800
89713722	Camera operators	$20,800

Occupations in the Activity Data Base

Occupation Code (1)	Title	Annual Pay (2)
89702717	Compositors and typesetters, precision	$20,644
92932879	Dairy processing equipment operators, including setters	$20,020
92926867	Boiler operators and tenders, low pressure	$20,020
92940876	Cutting and slicing machine setters, operators and tenders	$20,020
92930869	Chemical equipment controllers, operators and tenders	$20,020
92960889	Coating, painting, and spraying machine operators, tenders, setters, and set-up op	$20,020
92962895	Separating and still machine operators and tenders	$20,020
92947892	Painters, transportation equipment	$20,020
92956868	Cement and gluing machine operators and tenders	$20,020
92999898	All other machine operators, tenders, setters, and set-up operators	$20,020
92902880	Electronic semiconductor processors	$20,020
92540830	Bindery machine operators and set-up operators	$20,020
92914893	Paper goods machine setters and set-up operators	$20,020
92965875	Crushing and mixing machine operators and tenders	$20,020
92911897	Tire building machine operators	$20,020
92970881	Extruding and forming machine setters, operators and tenders	$20,020
92923884	Furnace, kiln, or kettle operators and tenders	$20,020
92974887	Packaging and filling machine operators and tenders	$20,020
79998529	All other agricultural, forestry, fishing, and related workers	$20,000
34050182	Musicians	$20,000
87402563	Painters and paperhangers, construction and maintenance	$19,864
58005340	Dispatchers, except police, fire, and ambulance	$19,800
83000692	Inspectors, testers, and graders, precision	$19,760
56011317	Computer operators, except peripheral equipment	$19,400
56014318	Peripheral EDP equipment operators	$19,400
97947967	Industrial truck and tractor operators	$19,240
91302791	Punching machine setters and set-up operators, metal and plastic	$19,240
55341323	Payroll and timekeeping clerks	$19,100
53508298	Bill and account collectors	$19,000
58023346	Stock clerks, stockrooom, warehouse, or yard	$18,600
58098349	All other material recording, scheduling, and distribution workers	$18,600
58017348	Weighers, measurers, checkers, and samplers, recordkeeping	$18,600
55326344	Procurement clerks	$18,600
58008345	Production, planning, and expediting clerks	$18,600
55314360	Personnel clerks, except payroll and timekeeping	$18,500
89314741	Furniture finishers	$18,460
89398743	All other precision woodworkers	$18,460
89311740	Cabinetmakers and bench carpenters	$18,460
85328646	Small engine specialists	$18,408
53123297	Adjustment clerks	$18,200
93997919	All other assemblers and fabricators	$18,200
93998923	All other hand workers	$18,200

Occupations in the Activity Data Base

Occupation Code (1)	Title	Annual Pay (2)
49011279	Salespersons, retail	$17,680
55338322	Bookkeeping, accounting, and auditing clerks	$17,600
58028347	Traffic, shipping, and receiving clerks	$17,500
85321642	Farm equipment mechanics	$17,472
55347390	General office clerks	$16,800
56017383	Data entry keyers, except composing	$16,700
55344320	Billing, cost, and rate clerks	$16,700
56021384	Data entry keyers, composing	$16,700
59998398	All other clerical and administrative support workers	$16,700
56002321	Billing, posting, and calculating machine operators	$16,700
55307370	Typists and word processors	$16,700
55328394	Statistical clerks	$16,700
56200385	Duplicating, mail, and other office machine operators	$16,700
53911392	Proofreaders and copy markers	$16,700
92710854	Textile draw-out and winding machine operators and tenders	$16,640
92714853	Textile bleaching and dyeing machine operators and tenders	$16,640
92702857	Textile machine setters and set-up operators	$16,640
92708849	Extruding and forming machine operators and tenders, synthetic or glass fibers	$16,640
57102312	Switchboard operators	$16,600
89914751	Photographic process workers, precision	$16,380
92908894	Photographic processing machine operators and tenders	$16,380
93938911	Meat, poultry, and fish cutters and trimmers, hand	$16,328
89898689	All other precision food and tobacco workers	$16,328
89805685	Bakers, manufacturing	$16,328
89803686	Butchers and meatcutters	$16,328
73002517	Fallers and buckers	$15,900
73008519	Log handling equipment operators	$15,900
73098520	All other timber cutting and related logging workers	$15,900
73011518	Logging tractor operators	$15,900
89508733	Upholsterers	$15,600
55332326	Interviewing clerks, except personnel and social welfare	$15,600
98902990	Hand packers and packagers	$15,600
92910872	Cooking and roasting machine operators and tenders, food and tobacco	$15,600
98905004	Vehicle washers and equipment cleaners	$15,600
57302333	Mail clerks, except mail machine operators and postal service	$15,600
98998005	All other helpers, laborers, and material movers, hand	$15,600
98710986	Freight, stock, and material movers, hand	$15,600
98310991	Helpers, construction trades	$15,600
98502000	Machine feeders and offbearers	$15,600
92726885	Laundry and drycleaning machine operators and tenders, except pressing	$15,600
93953909	Grinders and polishers, hand	$15,496
93908906	Coil winders, tapers, and finishers	$15,496

Occupations in the Activity Data Base

Occupation Code (1)	Title	Annual Pay (2)
93105679	Machine builders and other precision machine assemblers	$15,496
93114676	Electrical and electronic equipment assemblers, precision	$15,496
93196680	All other precision assemblers	$15,496
93905908	Electrical and electronic assemblers	$15,496
93108678	Fitters, structural metal, precision	$15,496
93111677	Electromechanical equipment assemblers, precision	$15,496
93935905	Cannery workers	$15,496
92305859	Head sawyers and sawing machine operators and tenders, setters and set-up ope	$15,340
92310863	Woodworking machine operators and tenders, setters and set-up operators	$15,340
89308742	Wood machinists	$15,340
53908354	Advertising clerks	$15,000
55321357	File clerks	$14,700
53902358	Library assistants and bookmobile drivers	$14,600
89511732	Shoe and leather workers and repairers, precision	$14,560
89598734	All other precision textile, apparel, and furnishings workers	$14,560
89502731	Patternmakers and layout workers, fabric and apparel	$14,560
89505730	Custom tailors and sewers	$14,560
89917750	Optical goods workers, precision	$14,500
79014524	Gardeners and groundskeepers, except farm	$14,040
67001404	Janitors and cleaners, including maids and housekeeping cleaners	$14,040
55305328	Receptionists and information clerks	$14,040
67098408	All other clean and building service workers	$14,040
63047490	Guards	$13,500
57311334	Messengers	$13,260
69998493	All other service workers	$13,000
93928914	Portable machine cutters	$12,480
92728850	Pressing machine operators and tenders, textile, garment, and related materials	$12,480
79017502	Animal caretakers, except farm	$11,900
93923916	Sewers, hand	$11,544
49023272	Cashiers	$11,180
92717851	Sewing machine operators, garment	$11,128
93926907	Cutters and trimmers, hand	$11,128
93921915	Pressers, hand	$11,128
92721852	Sewing machine operators, non-garment	$11,128
65300431	All other food preparation and service workers	$9,776

(1) Bureau of Labor Statistics code.

(2) Source: Bureau of Labor Statistics, "Occupational Outlook Handbook," 1992-93 Edition.

23-Dec-93

Appendix B

Industries in the Activity Data Base

Industries in the Activity Data Base

Industry Code (1)	Title	Defense Share (2)
413480	Ordnance and accessories, nec	0.89275
413730	Ship and boat building and repairing	0.60283
413760	Guided missiles, space vehicles, and parts	0.58411
413660	Communications equipment	0.49710
413810	Search and navigation equipment	0.44698
413720	Aircraft and parts	0.31863
413820	Measuring and controlling devices	0.22854
413670	Electronic components and accessories	0.17264
413799	All other transportation equipment	0.15394
413450	Screw machine products, bolts, etc.	0.14274
413399	All other primary metals	0.13274
413360	Nonferrous foundries (castings)	0.12062
413470	Metal services, nec	0.11048
413540	Metalworking machinery	0.10955
413620	Electrical industrial apparatus	0.10440
413510	Engines and turbines	0.10414
413350	Nonferrous rolling and drawing	0.09548
413530	Construction and related machinery	0.08350
413310	Blast furnaces and basic steel products	0.08122
413899	All other professional and scientific instruments	0.08076
413590	Industrial machinery, nec	0.07874
413560	General industrial machinery	0.07581
413630	Household appliances	0.07310
413440	Fabricated structural metal products	0.06481
413320	Iron and steel foundries	0.06213
413460	Metal forgings and stampings	0.06150
413610	Electric distributing equipment	0.05948
422890	Miscellaneous chemical products	0.05640
422959	Miscellaneous petroleum and coal products	0.05398
413490	Miscellaneous fabricated metal products	0.05005
422810	Industrial inorganic chemicals	0.05003
422860	Industrial organic chemicals	0.04980
413570	Computer and office equipment	0.04944
413840	Medical instruments and supplies	0.04789
423080	Miscellaneous plastics products	0.04760
423026	Rubber products and plastic hose and footwear	0.04568
413690	Miscellaneous electrical equipment and supplies	0.04244
422820	Plastics materials and synthetics	0.04047
413299	All other stone, clay, and misc. min. products	0.03796
413640	Electric lighting and wiring equipment	0.03563
422910	Petroleum refining	0.03481

Industries in the Activity Data Base

Industry Code (1)	Title	Defense Share (2)
422850	Paints and allied products	0.03387
412449	Wood containers and miscellaneous wood products	0.03283
422390	Miscellaneous fabricated textile products	0.03271
413860	Photographic equipment and supplies	0.03253
423010	Tires and inner tubes	0.03087
413213	Flat glass and products of purchased glass	0.03065
413420	Cutlery, handtools, and hardware	0.02891
422613	Pulp, paper, and paperboard mills	0.02671
413650	Household audio and video equipment	0.02228
422290	Miscellaneous textile goods	0.02029
413270	Concrete, gypsum, and plaster products	0.01969
413580	Refrigeration and service machinery	0.01802
412420	Sawmills and planing mills	0.01754
422780	Blankbooks and bookbinding	0.01733
413220	Glass and glassware, pressed or blown	0.01720
422756	Commercial printing and business forms	0.01683
412430	Millwork, plywood, and structural members	0.01680
413939	Manufactured products, nec	0.01564
422740	Miscellaneous publishing	0.01468
422670	Miscellaneous converted paper products	0.01374
423119	Luggage, handbags, and leather products, nec	0.01249
413710	Motor vehicles and equipment	0.01197
413410	Metal cans and shipping containers	0.01106
413550	Special industry machinery	0.01094
422870	Agricultural chemicals	0.01074
413430	Plumbing and heating, except electric	0.01053
422020	Dairy products	0.00970
422090	Miscellaneous foods and kindred products	0.00949
422010	Meat products	0.00904
422050	Bakery products	0.00734
422080	Beverages	0.00712
413520	Farm and garden machinery	0.00709
422047	Grain mill products and fats and oils	0.00705
422318	Apparel	0.00652
412529	Office and miscellaneous furniture and fixtures	0.00646
422799	All other printing trade services	0.00641
413910	Jewelry, silverware, and plated ware	0.00608
422720	Periodicals	0.00524
412510	Household furniture	0.00518
422030	Preserved fruits and vegetables	0.00506
422730	Books	0.00500

Industries in the Activity Data Base

Industry Code (1)	Title	Defense Share (2)
422840	Soap, cleaners, and toilet goods	0.00489
422060	Sugar and confectionery products	0.00447
412450	Wood buildings and mobile homes	0.00364
422250	Knitting mills	0.00293
412540	Partitions and fixtures	0.00270
413940	Toys and sporting goods	0.00216
422218	Weaving, finishing, yarn and thread mills	0.00167
423134	Footwear, except rubber and plastic	0.00113
422710	Newspapers	0.00006

(1) Bureau of Labor Statistics Code. Digits 3-5 correspond to 3-digit Standard Industrial Classification (SIC) code.

(2) Sources: Defense Economic Impact Modeling System, 1991 Annual Survey of Manufactures.

23-Dec-93

Appendix C

Taxonomy of Industrial Activities

Aggregation Levels			
Level 1	**Level 2**	**Level 3**	**Occupation Title**
Engineering and Product Development			
	Engineering Managers		
			Engineering, mathematical, and natural science managers
	Engineers and Designers		
			Aeronautical and astronautical engineers
			Metallurgists and metallurgical, ceramic, and materials engineers
			Mining engineers, including mine safety engineers
			Petroleum engineers
			Chemical engineers
			Nuclear engineers
			Civil engineers, including traffic engineers
			Electrical and electronics engineers
			Industrial engineers, except safety engineers
			Mechanical engineers
			All other engineers
			Designers, except interior designers
	Scientists		
			Physicists and astronomers
			Chemists
			Meteorologists
			Geologists, geophysicists, and oceanographers
			All other physical scientists
			Agricultural and food scientists
			Biological scientists
			Medical scientists
			All other life scientists
			Mathematicians and all other mathematical scientists
	Technicians		
			Drafters
			Science and mathematics technicians
			Programmers, numerical, tool, and process control
			Writers and editors, including technical writers
			Artists and commercial artists
			All other engineering technicians and technologists
	Tool Makers		
			Tool and die makers
			Patternmakers and layout workers, fabric and apparel
Manufacturing (Factory Floor)			
	Assembly (except electronic)		
			Shipfitters
			Boilermakers
			Aircraft assemblers, precision
			Machine builders and other precision machine assemblers
			Electromechanical equipment assemblers, precision
			All other precision assemblers
			Machine assemblers
			All other assemblers and fabricators
	Chemicals Processing		

Aggregation Levels			
Level 1	**Level 2**	**Level 3**	**Occupation Title**
			Photographic processing machine operators and tenders
			Chemical equipment controllers, operators and tenders
			Separating and still machine operators and tenders
			Crushing and mixing machine operators and tenders
			Chemical plant and system operators
			Gas and petroleum plant and system occupations
	Electronic Assembly		
			Electrical and electronic equipment assemblers, precision
			Electrical and electronic assemblers
			Coil winders, tapers, and finishers
	Electronic Fabrication		
			Electrical and electronic technicians/technologists
			Electronic semiconductor processors
	Finishing		
			Electrolytic plating machine operators and tenders, setters and set-up operators, metal and plastic
			Nonelectrolytic plating machine operators and tenders, setters and set-up operators, metal and plastic
			Painters, transportation equipment
			Coating, painting, and spraying machine operators, tenders, setters, and set-up operators
			Painting, coating, and decorating workers, hand
	Forming		
			Machine forming operators and tenders, metal and plastic
			Metal fabricators, structural metal products
			Metal molding machine operators and tenders, setters and set-up operators
			Foundry mold assembly and shakeout workers
			Plastic molding machine operators and tenders, setters and set-up operators
			Extruding and forming machine operators and tenders, synthetic or glass fibers
			Tire building machine operators
			Extruding and forming machine setters, operators and tenders
			Metal pourers and casters, basic shapes
	Heat and Surface Treatment		
			Heating equipment setters and set-up operators, metal and plastic
			Heat treating machine operators and tenders, metal and plastic
			Furnace operators and tenders
			Heaters, metal and plastic
			Furnace, kiln, or kettle operators and tenders
	Joining		
			Soldering and brazing machine operators and tenders
			Welding machine setters, operators, and tenders
			Cement and gluing machine operators and tenders
			Fitters, structural metal, precision
			Welders and cutters
			Solderers and brazers

Aggregation Levels			
Level 1	**Level 2**	**Level 3**	**Occupation Title**
	Material Removal		
			Machinists
			Lathe and turning machine tool setters and set-up operators, metal and plastic
			Drilling and boring machine tool setters and set-up operators, metal and plastic
			Grinding machine setters and set-up operators, metal and plastic
			Machine tool cutting operators and tenders, metal and plastic
			Punching machine setters and set-up operators, metal and plastic
			All other machine tool cutting and forming etc.
			Numerical control machine tool operators and tenders, metal and plastic
			Combination machine tool setters, set-up operators, operators, and tenders
			Head sawyers and sawing machine operators and tenders, setters and set-up operators
			Cutting and slicing machine setters, operators and tenders
			Portable machine cutters
			Grinders and polishers, hand
	Other Production Processes		
		Food Processing	
			Butchers and meatcutters
			Bakers, manufacturing
			All other precision food and tobacco workers
			Cooking and roasting machine operators and tenders, food and tobacco
			Dairy processing equipment operators, including setters
			Cannery workers
			Meat, poultry, and fish cutters and trimmers, hand
		Other Metal, Plastic, and Ceramic	
			All other extraction and related workers
			All other precision metal workers
			Optical goods workers, precision
			All other precision workers
			All other metal and plastic machine setters, operators, and related workers
			All other machine operators, tenders, setters, and set-up operators
			All other hand workers
		Printing and Publishing Processes	
			Proofreaders and copy markers
			Compositors and typesetters, precision
			Job printers
			Paste-up workers
			Electronic pagination systems workers
			Photoengravers
			Camera operators
			All other printing workers, precision
			Strippers, printing

Aggregation Levels			
Level 1	**Level 2**	**Level 3**	**Occupation Title**
			Platemakers
			Bookbinders
			Offset lithographic press operators
			Letterpress operators
			All other printing press setters and set-up operators
			Screen printing machine setters and set-up operators
			Bindery machine operators and set-up operators
			Typesetting and composing machine operators and tenders
			Printing press machine setters, operators and tenders
			Photoengraving and lithographic machine operators and tenders
			All other printing, binding, and related workers
			Paper goods machine setters and set-up operators
		Textiles and Apparel Processes	
			Custom tailors and sewers
			Upholsterers
			Shoe and leather workers and repairers, prec
			All other precision textile, apparel, and furnishings workers
			Textile machine setters and set-up operators
			Textile draw-out and winding machine operators and tenders
			Textile bleaching and dyeing machine operators and tenders
			Sewing machine operators, garment
			Sewing machine operators, non-garment
			Pressing machine operators and tenders, textile, garment, and related materials
			Pressers, hand
			Sewers, hand
			Cutters and trimmers, hand
	Test, Inspection, and Repair		
		Product Repair	
			Automotive mechanics
			Automotive body and related repairers
			Bus and truck mechanics and diesel engine specialists
			Mobile heavy equipment mechanics
			Aircraft mechanics
			Aircraft engine specialists
			Small engine specialists
			Radio mechanics
			All other communications equipment mechanics, installers, and repairers
			All other electrical and electronic equipment mechanics, installers, and repairers
			Heat, air conditioning, and refrigeration mechanics and installers
			Precision instrument repairers
			Office machine and cash register servicers
		Quality Assurance	
			Inspectors and compliance officers, except construction
			Weighers, measurers, checkers, and samplers, recordkeeping
			Inspectors, testers, and graders, precision

Aggregation Levels			
Level 1	**Level 2**	**Level 3**	**Occupation Title**
Production Support			
	Materials Handling		
			Stock clerks, stockrooom, warehouse, or yard
			Packaging and filling machine operators and tenders
			Truck drivers, light and heavy
			All other motor vehicle operators
			All other transportation and related workers
			All other material moving equipment operators
			Hoist and winch operators
			Crane and tower operators
			Industrial truck and tractor operators
			Machine feeders and offbearers
			Freight, stock, and material movers, hand
			Hand packers and packagers
			All other helpers, laborers, and material movers, hand
	Physical Plant Operations and Maintenance		
		Electrical and Electronic Maintenance	
			Electronics repairers, commercial and industrial equipment
			Electricians
		Mechanical and Structural Maintenance	
			Industrial machinery mechanics
			Millwrights
			Plumbers, pipefitters, and steamfitters
			Sheet metal workers and duct installers
		Other Maint., Construction, and Repair	
			Maintenance repairers, general utility
			All other mechanics, installers, and repairers
			Painters and paperhangers, construction and maintenance
			Vehicle washers and equipment cleaners
		Plant Operations and Security	
			Guards
			Janitors and cleaners, including maids and housekeeping cleaners
			All other clean and building service workers
			Gardeners and groundskeepers, except farm
			Boiler operators and tenders, low pressure
			Water and liquid waste treatment plant and system operators
			Stationary engineers
			All other plant and system operators
			Operating engineers
		Woodworking	
			Carpenters
			Wood machinists
			Cabinetmakers and bench carpenters
			All other precision woodworkers
			Woodworking machine operators and tenders, setters and set-up operators
	Production Management		
			Industrial production managers

Aggregation Levels			
Level 1	**Level 2**	**Level 3**	**Occupation Title**
			Production, planning, and expediting clerks
			All other material recording, scheduling, and distribution workers
			Blue collar worker supervisors
	Purchasing		
			Purchasing managers
			Purchasing agents, except wholesale, retail, and farm products
			Order clerks, materials, merchandise, and service
			Procurement clerks
			Traffic, shipping, and receiving clerks
Management and Administration			
	Finance and Accounting		
			Financial managers
			Accountants and auditors
			Budget analysts
			Cost estimators
			Statisticians
			Bill and account collectors
			Statistical clerks
			Bookkeeping, accounting, and auditing clerks
			Payroll and timekeeping clerks
			Billing, cost, and rate clerks
			Billing, posting, and calculating machine operators
	Management Information Systems		
			Systems analysts and computer scientists
			Computer programmers
			Computer operators, except peripheral equipment
			Peripheral EDP equipment operators
			Data entry keyers, except composing
			Data entry keyers, composing
			Data processing equipment repairers
	Marketing, Sales, Public Relations		
			Marketing, advertising, and public relations managers
			Public relations specialists and publicity writers
			Salespersons, retail
			All other sales and related workers
			Adjustment clerks
			Advertising clerks
			Driver/sales workers
	Other Management and Administration		
			Administrative services managers
			General managers and top executives
			All other managers and administrators
			All other management support workers
			Operations research analysts
			Lawyers
			All other professional workers
			Clerical supervisors and managers
			Secretaries, except legal and medical

Aggregation Levels			
Level 1	**Level 2**	**Level 3**	**Occupation Title**
			Stenographers
			Receptionists and information clerks
			Typists and word processors
			File clerks
			General office clerks
			Duplicating, mail, and other office machine operators
			Switchboard operators
			Mail clerks, except mail machine operators and postal service
			Messengers
			All other clerical and administrative support workers
	Personnel		
			Personnel, training, and labor relations managers
			Personnel, training, and labor relations specialists
			Personnel clerks, except payroll and timekeeping
Other Support			
			Foresters and conservation scientists
			Teachers and instructors, vocational education and training
			Librarians, professional
			Veterinarians and veterinary inspectors
			Registered nurses
			Opticians, dispensing and measuring
			Pharmacists
			All other health professionals, paraprofessionals, and technicians
			Reporters and correspondents
			Photographers
			Musicians
			Cashiers
			Library assistants and bookmobile drivers
			Interviewing clerks, except personnel and social welfare
			Dispatchers, except police, fire, and ambulance
			All other food preparation and service workers
			All other service workers
			Supervisors, farming, forestry, and agricultural related occupations
			Fallers and buckers
			Log handling equipment operators
			Logging tractor operators
			All other timber cutting and related logging workers
			Forest and conservation workers
			Animal caretakers, except farm
			All other agricultural, forestry, fishing, and related workers
			Farm equipment mechanics
			Electronic home entertainment equipment repairers
			Riggers
			Coin and vending machine servicers and repairers
			Bricklayers and stone masons
			Concrete and terrazzo finishers
			Paving, surfacing, and tamping equipment operators
			Insulation workers

Aggregation Levels			
Level 1	**Level 2**	**Level 3**	**Occupation Title**
			Glaziers
			All other construction trades workers
			Furniture finishers
			Photographic process workers, precision
			Laundry and drycleaning machine operators and tenders, except pressing
			Power distributors and dispatchers
			Rail yard engineers, dinkey operators, and hostlers
			Railroad brake, signal, and switch operators
			Grader, dozer, and scraper operators
			Helpers, construction trades

Appendix D

Activity Profile: All Defense Manufacturing

Industry/Sector Summary

All Industries

Number of Defense Workers (1)	1,472,831
Defense Labor Cost (2)	$41,434,770,955

(1) Number of "people-equivalents." For example, two workers each devoting half their time to defense-related work equals one person-equivalent.

(2) Reflects median earnings, exclusive of benefits. 1991 Dollars.

24-Nov-93

Contribution of Activities to Defense Manufacturing Labor Costs

All Industries

Activity	Portion of DoD Mfg. Dollars
Engineering and Product Development	
Engineering Managers :	
Engineering, mathematical, and natural science managers	3.575%
SUBTOTAL	**3.575%**
Engineers and Designers :	
Petroleum engineers	0.003%
Designers, except interior designers	0.218%
Electrical and electronics engineers	5.558%
Industrial engineers, except safety engineers	2.217%
Civil engineers, including traffic engineers	0.170%
Chemical engineers	0.268%
Mining engineers, including mine safety engineers	0.001%
Metallurgists and metallurgical, ceramic, and materials engineers	0.241%
Aeronautical and astronautical engineers	2.107%
All other engineers	3.954%
Nuclear engineers	0.053%
Mechanical engineers	2.293%
SUBTOTAL	**17.083%**
Scientists :	
Medical scientists	0.001%
Physicists and astronomers	0.074%
Chemists	0.242%
Meteorologists	0.009%
Geologists, geophysicists, and oceanographers	0.005%
Biological scientists	0.006%
Agricultural and food scientists	0.002%
Mathematicians and all other mathematical scientists	0.043%
All other life scientists	0.015%
All other physical scientists	0.036%
SUBTOTAL	**0.434%**
Technicians :	
Science and mathematics technicians	0.295%
Drafters	0.861%
All other engineering technicians and technologists	1.626%
Programmers, numerical, tool, and process control	0.094%
Artists and commercial artists	0.058%
Writers and editors, including technical writers	0.435%
SUBTOTAL	**3.369%**

Contribution of Activities to Defense Manufacturing Labor Costs

All Industries

Activity	Portion of DoD Mfg. Dollars
Tool Makers :	
Patternmakers and layout workers, fabric and apparel	0.005%
Tool and die makers	0.994%
SUBTOTAL	**0.999%**
SUBTOTAL FOR Engineering and Product Development :	**25.460%**
Management and Administration	
Finance and Accounting :	
Payroll and timekeeping clerks	0.129%
Bill and account collectors	0.000%
Billing, posting, and calculating machine operators	0.006%
Billing, cost, and rate clerks	0.088%
Accountants and auditors	0.901%
Cost estimators	0.367%
Bookkeeping, accounting, and auditing clerks	0.532%
Budget analysts	0.200%
Statisticians	0.035%
Financial managers	0.694%
Statistical clerks	0.030%
SUBTOTAL	**2.980%**
Management Information Systems :	
Systems analysts and computer scientists	1.393%
Computer programmers	0.995%
Data entry keyers, except composing	0.155%
Computer operators, except peripheral equipment	0.177%
Data processing equipment repairers	0.050%
Peripheral EDP equipment operators	0.019%
Data entry keyers, composing	0.004%
SUBTOTAL	**2.792%**
Marketing, Sales, Public Relations :	
Advertising clerks	0.001%
Driver/sales workers	0.026%
Marketing, advertising, and public relations managers	0.853%
All other sales and related workers	1.939%
Public relations specialists and publicity writers	0.036%
Salespersons, retail	0.010%
Adjustment clerks	0.141%
SUBTOTAL	**3.005%**

Contribution of Activities to Defense Manufacturing Labor Costs

All Industries

Activity	Portion of DoD Mfg. Dollars
Other Management and Administration :	
Operations research analysts	0.221%
All other professional workers	1.173%
All other clerical and administrative support workers	0.214%
Switchboard operators	0.082%
Duplicating, mail, and other office machine operators	0.084%
Clerical supervisors and managers	0.590%
Messengers	0.002%
Receptionists and information clerks	0.066%
Stenographers	0.046%
Secretaries, except legal and medical	1.712%
Lawyers	0.029%
File clerks	0.042%
All other management support workers	1.815%
Typists and word processors	0.200%
Mail clerks, except mail machine operators and postal service	0.020%
General office clerks	0.795%
All other managers and administrators	1.621%
General managers and top executives	5.257%
Administrative services managers	0.416%
SUBTOTAL	**14.384%**
Personnel :	
Personnel, training, and labor relations specialists	0.414%
Personnel clerks, except payroll and timekeeping	0.101%
Personnel, training, and labor relations managers	0.341%
SUBTOTAL	**0.857%**
SUBTOTAL FOR Management and Administration :	**24.018%**
Manufacturing	
Assembly (except electronic) :	
Shipfitters	0.319%
Boilermakers	0.047%
Electromechanical equipment assemblers, precision	0.352%
Machine builders and other precision machine assemblers	0.197%
All other assemblers and fabricators	3.338%
Machine assemblers	0.268%
All other precision assemblers	0.246%
Aircraft assemblers, precision	0.686%
SUBTOTAL	**5.453%**

Contribution of Activities to Defense Manufacturing Labor Costs

All Industries

Activity	Portion of DoD Mfg. Dollars
Chemicals Processing :	
Crushing and mixing machine operators and tenders	0.198%
Gas and petroleum plant and system occupations	0.042%
Chemical plant and system operators	0.098%
Separating and still machine operators and tenders	0.033%
Photographic processing machine operators and tenders	0.000%
Chemical equipment controllers, operators and tenders	0.137%
SUBTOTAL	**0.508%**
Electronic Assembly :	
Coil winders, tapers, and finishers	0.082%
Electrical and electronic assemblers	1.405%
Electrical and electronic equipment assemblers, precision	1.241%
SUBTOTAL	**2.728%**
Electronic Fabrication :	
Electrical and electronic technicians/technologists	2.203%
Electronic semiconductor processors	0.251%
SUBTOTAL	**2.454%**
Finishing :	
Painting, coating, and decorating workers, hand	0.114%
Nonelectrolytic plating machine operators and tenders, setters and set-up	0.030%
Coating, painting, and spraying machine operators, tenders, setters, and s	0.355%
Painters, transportation equipment	0.158%
Electrolytic plating machine operators and tenders, setters and set-up ope	0.258%
SUBTOTAL	**0.916%**
Forming :	
Metal fabricators, structural metal products	0.081%
Plastic molding machine operators and tenders, setters and set-up operat	0.381%
Metal pourers and casters, basic shapes	0.061%
Foundry mold assembly and shakeout workers	0.039%
Extruding and forming machine setters, operators and tenders	0.146%
Extruding and forming machine operators and tenders, synthetic or glass fi	0.025%
Metal molding machine operators and tenders, setters and set-up operator	0.153%
Tire building machine operators	0.021%
Machine forming operators and tenders, metal and plastic	0.522%
SUBTOTAL	**1.428%**
Heat and Surface Treatment :	

Contribution of Activities to Defense Manufacturing Labor Costs

All Industries

Activity	Portion of DoD Mfg. Dollars
Heat treating machine operators and tenders, metal and plastic	0.112%
Heaters, metal and plastic	0.016%
Furnace, kiln, or kettle operators and tenders	0.123%
Heating equipment setters and set-up operators, metal and plastic	0.040%
Furnace operators and tenders	0.107%
SUBTOTAL	**0.398%**
Joining :	
Cement and gluing machine operators and tenders	0.048%
Welders and cutters	1.003%
Welding machine setters, operators, and tenders	0.359%
Fitters, structural metal, precision	0.025%
Solderers and brazers	0.188%
Soldering and brazing machine operators and tenders	0.066%
SUBTOTAL	**1.691%**
Material Removal :	
Drilling and boring machine tool setters and set-up operators, metal and pl	0.349%
Combination machine tool setters, set-up operators, operators, and tender	0.554%
Numerical control machine tool operators and tenders, metal and plastic	0.757%
All other machine tool cutting and forming etc.	0.820%
Punching machine setters and set-up operators, metal and plastic	0.187%
Machine tool cutting operators and tenders, metal and plastic	0.763%
Machinists	2.084%
Grinding machine setters and set-up operators, metal and plastic	0.428%
Lathe and turning machine tool setters and set-up operators, metal and pl	0.476%
Grinders and polishers, hand	0.310%
Portable machine cutters	0.004%
Head sawyers and sawing machine operators and tenders, setters and set	0.048%
Cutting and slicing machine setters, operators and tenders	0.070%
SUBTOTAL	**6.850%**
Other Production Processes :	
Food Processing	
All other precision food and tobacco workers	0.008%
Dairy processing equipment operators, including setters	0.008%
Bakers, manufacturing	0.009%
Butchers and meatcutters	0.022%
Meat, poultry, and fish cutters and trimmers, hand	0.043%
Cannery workers	0.018%
Cooking and roasting machine operators and tenders, food and tobacco	0.008%
Other Metal, Plastic, and Ceramic	
All other extraction and related workers	0.094%
All other precision metal workers	0.479%

Contribution of Activities to Defense Manufacturing Labor Costs

All Industries

Activity	Portion of DoD Mfg. Dollars
All other hand workers	0.500%
All other machine operators, tenders, setters, and set-up operators	0.545%
Optical goods workers, precision	0.038%
All other precision workers	0.309%
All other metal and plastic machine setters, operators, and related workers	0.407%
Printing and Publishing Processes	
Proofreaders and copy markers	0.005%
Photoengravers	0.005%
Camera operators	0.009%
Strippers, printing	0.037%
Platemakers	0.009%
Bookbinders	0.005%
Offset lithographic press operators	0.055%
Electronic pagination systems workers	0.005%
All other printing press setters and set-up operators	0.005%
All other printing workers, precision	0.006%
Screen printing machine setters and set-up operators	0.039%
Bindery machine operators and set-up operators	0.046%
Typesetting and composing machine operators and tenders	0.014%
Printing press machine setters, operators and tenders	0.080%
Photoengraving and lithographic machine operators and tenders	0.001%
All other printing, binding, and related workers	0.046%
Paper goods machine setters and set-up operators	0.032%
Letterpress operators	0.007%
Paste-up workers	0.011%
Job printers	0.009%
Compositors and typesetters, prec	0.004%
Textiles and Apparel Processes	
Textile bleaching and dyeing machine operators and tenders	0.003%
All other precision textile, apparel, and furnishings workers	0.003%
Textile draw-out and winding machine operators and tenders	0.044%
Sewing machine operators, garment	0.105%
Sewing machine operators, non-garment	0.073%
Pressing machine operators and tenders, textile, garment, and related mat	0.006%
Shoe and leather workers and repairers, prec	0.002%
Upholsterers	0.006%
Pressers, hand	0.002%
Sewers, hand	0.003%
Cutters and trimmers, hand	0.032%
Custom tailors and sewers	0.002%
Textile machine setters and set-up operators	0.012%
SUBTOTAL	**3.213%**
Test, Inspection, and Repair :	

Contribution of Activities to Defense Manufacturing Labor Costs

All Industries

Activity	Portion of DoD Mfg. Dollars
Product Repair	
All other electrical and electronic equipment mechanics, installers, and rep	0.171%
Automotive mechanics	0.074%
Office machine and cash register servicers	0.002%
Precision instrument repairers	0.181%
Heat, air conditioning, and refrigeration mechanics and installers	0.048%
Mobile heavy equipment mechanics	0.009%
All other communications equipment mechanics, installers, and repairers	0.008%
Automotive body and related repairers	0.002%
Radio mechanics	0.007%
Small engine specialists	0.002%
Aircraft engine specialists	0.055%
Aircraft mechanics	0.387%
Bus and truck mechanics and diesel engine specialists	0.045%
Quality Assurance	
Inspectors and compliance officers, except construction	0.017%
Inspectors, testers, and graders, precision	2.701%
Weighers, measurers, checkers, and samplers, recordkeeping	0.042%
SUBTOTAL	**3.750%**
SUBTOTAL FOR Manufacturing :	**29.388%**
Other Support	
Other Support :	
Other Support	
Opticians, dispensing and measuring	0.009%
All other health professionals, paraprofessionals, and technicians	0.061%
Reporters and correspondents	0.002%
Photographers	0.024%
Registered nurses	0.003%
Teachers and instructors, vocational education and training	0.000%
Cashiers	0.001%
Concrete and terrazzo finishers	0.005%
Musicians	0.000%
Library assistants and bookmobile drivers	0.000%
Librarians, professional	0.003%
Foresters and conservation scientists	0.002%
All other construction trades workers	0.019%
All other agricultural, forestry, fishing, and related workers	0.010%
Farm equipment mechanics	0.001%
Electronic home entertainment equipment repairers	0.003%
Riggers	0.132%
Coin and vending machine servicers and repairers	0.001%
Bricklayers and stone masons	0.013%

Contribution of Activities to Defense Manufacturing Labor Costs

All Industries

Activity	Portion of DoD Mfg. Dollars
Animal caretakers, except farm	0.000%
Glaziers	0.001%
Insulation workers	0.115%
Jewelers and silversmiths	0.003%
Furniture finishers	0.004%
Photographic process workers, precision	0.000%
Laundry and drycleaning machine operators and tenders, except pressing	0.001%
Power distributors and dispatchers	0.011%
Rail yard engineers, dinkey operators, and hostlers	0.011%
Railroad brake, signal, and switch operators	0.005%
Grader, dozer, and scraper operators	0.007%
Helpers, construction trades	0.065%
Paving, surfacing, and tamping equipment operators	0.001%
Fallers and buckers	0.001%
Forest and conservation workers	0.000%
Dispatchers, except police, fire, and ambulance	0.034%
Interviewing clerks, except personnel and social welfare	0.000%
All other service workers	0.128%
All other timber cutting and related logging workers	0.002%
Logging tractor operators	0.002%
Log handling equipment operators	0.006%
All other food preparation and service workers	0.018%
Supervisors, farming, forestry, and agricutural related occupations	0.003%
SUBTOTAL	**0.710%**
SUBTOTAL FOR Other Support :	**0.710%**
Production Support	
Materials Handling :	
All other material moving equipment operators	0.138%
Industrial truck and tractor operators	0.427%
Crane and tower operators	0.172%
Hoist and winch operators	0.002%
Machine feeders and offbearers	0.271%
Stock clerks, stockrooom, warehouse, or yard	0.690%
Truck drivers light and heavy	0.531%
All other motor vehicle operators	0.015%
All other transportation and related workers	0.062%
Packaging and filling machine operators and tenders	0.248%
Hand packers and packagers	0.376%
Freight, stock, and material movers, hand	0.477%
All other helpers, laborers, and material movers, hand	0.983%
SUBTOTAL	**4.392%**

Contribution of Activities to Defense Manufacturing Labor Costs

All Industries

Activity	Portion of DoD Mfg. Dollars
Physical Plant Operations and Maintenance :	
Electrical and Electronic Maintenance	
Electronics repairers, commercial and industrial equipment	0.173%
Electricians	0.637%
Mechanical and Structural Maintenance	
Industrial machinery mechanics	1.000%
Millwrights	0.212%
Plumbers, pipefitters, and steamfitters	0.439%
Sheet metal workers and duct installers	1.405%
Other Maint., Construction, and Repair	
Vehicle washers and equipment cleaners	0.031%
Maintenance repairers, general utility	0.534%
All other mechanics, installers, and repairers	0.450%
Painters and paperhangers, construction and maintenance	0.134%
Plant Operations and Security	
Janitors and cleaners, including maids and housekeeping cleaners	0.360%
Stationary engineers	0.041%
All other plant and system operators	0.069%
Gardeners and groundskeepers, except farm	0.000%
Guards	0.225%
Operating engineers	0.004%
All other clean and building service workers	0.015%
Boiler operators and tenders, low pressure	0.018%
Water and liquid waste treatment plant and system operators	0.009%
Woodworking	
Woodworking machine operators and tenders, setters and set-up operator	0.032%
All other precision woodworkers	0.117%
Cabinetmakers and bench carpenters	0.030%
Wood machinists	0.017%
Carpenters	0.295%
SUBTOTAL	**6.246%**
Production Management :	
Production, planning, and expediting clerks	0.897%
All other material recording, scheduling, and distribution workers	0.132%
Industrial production managers	2.915%
Blue collar worker supervisors	3.718%
SUBTOTAL	**7.661%**
Purchasing :	
Purchasing agents, except wholesale, retail, and farm products	0.889%
Procurement clerks	0.102%
Order clerks, materials, merchandise, and service	0.202%

Contribution of Activities to Defense Manufacturing Labor Costs

All Industries

Activity	Portion of DoD Mfg. Dollars
Purchasing managers	0.342%
Traffic, shipping, and receiving clerks	0.590%
SUBTOTAL	**2.126%**
SUBTOTAL FOR Production Support :	**20.425%**
TOTAL FOR ALL ACTIVITIES :	**100.000%**

24-Nov-93

Appendix E

Activity Profile: Nondefense Manufacturing

Industry/Sector Summary

All Non-defense Production

Number of Non-Defense Workers (1)	17,464,123
Non-Defense Labor Cost (2)	$421,751,033,290

(1) Number of "people-equivalents." For example, two workers each devoting half their time to non-defense-related work equals one person-equivalent.

(2) Reflects median earnings, exclusive of benefits. 1991 Dollars.

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Contribution of Activities to Manufacturing Labor Costs

All Non-defense Production

Activity	Portion of Mfg. Dollars
Engineering and Product Development	
Engineering Managers :	
Engineering, mathematical, and natural science managers	1.984%
SUBTOTAL	1.984%
Engineers and Designers :	
Petroleum engineers	0.007%
Designers, except interior designers	0.248%
Industrial engineers, except safety engineers	0.861%
Electrical and electronics engineers	1.617%
Civil engineers, including traffic engineers	0.068%
Chemical engineers	0.351%
Mining engineers, including mine safety engineers	0.000%
Metallurgists and metallurgical, ceramic, and materials engineers	0.121%
Aeronautical and astronautical engineers	0.346%
All other engineers	1.733%
Nuclear engineers	0.008%
Mechanical engineers	1.329%
SUBTOTAL	6.690%
Scientists :	
Biological scientists	0.090%
All other physical scientists	0.031%
All other life scientists	0.018%
Medical scientists	0.038%
Agricultural and food scientists	0.022%
Geologists, geophysicists, and oceanographers	0.008%
Meteorologists	0.003%
Physicists and astronomers	0.018%
Chemists	0.508%
Mathematicians and all other mathematical scientists	0.015%
SUBTOTAL	0.752%
Technicians :	
Programmers, numerical, tool, and process control	0.048%
Writers and editors, including technical writers	0.671%
Artists and commercial artists	0.119%
Drafters	0.567%
Science and mathematics technicians	0.509%

Contribution of Activities to Manufacturing Labor Costs

All Non-defense Production

Activity	Portion of Mfg. Dollars
All other engineering technicians and technologists	0.762%
SUBTOTAL	2.676%
Tool Makers :	
Tool and die makers	0.836%
Patternmakers and layout workers, fabric and apparel	0.050%
SUBTOTAL	0.886%
SUBTOTAL FOR Engineering and Product Development :	12.988%
Management and Administration	
Finance and Accounting :	
Billing, posting, and calculating machine operators	0.020%
Bill and account collectors	0.005%
Bookkeeping, accounting, and auditing clerks	0.831%
Billing, cost, and rate clerks	0.140%
Statistical clerks	0.024%
Statisticians	0.021%
Cost estimators	0.314%
Budget analysts	0.067%
Accountants and auditors	0.820%
Financial managers	0.758%
Payroll and timekeeping clerks	0.188%
SUBTOTAL	3.189%
Management Information Systems :	
Data entry keyers, composing	0.047%
Data entry keyers, except composing	0.171%
Computer programmers	0.701%
Systems analysts and computer scientists	0.736%
Data processing equipment repairers	0.030%
Peripheral EDP equipment operators	0.011%
Computer operators, except peripheral equipment	0.172%
SUBTOTAL	1.867%
Marketing, Sales, Public Relations :	
Adjustment clerks	0.310%
Advertising clerks	0.058%
Marketing, advertising, and public relations managers	1.100%
Driver/sales workers	0.431%

Contribution of Activities to Manufacturing Labor Costs

All Non-defense Production

Activity	Portion of Mfg. Dollars
All other sales and related workers	3.361%
Salespersons, retail	0.097%
Public relations specialists and publicity writers	0.036%
SUBTOTAL	5.394%
Other Management and Administration :	
Operations research analysts	0.080%
Secretaries, except legal and medical	1.720%
Messengers	0.023%
Mail clerks, except mail machine operators and postal service	0.042%
Clerical supervisors and managers	0.645%
Duplicating, mail, and other office machine operators	0.089%
All other professional workers	0.638%
Lawyers	0.039%
All other clerical and administrative support workers	0.174%
All other management support workers	0.884%
Administrative services managers	0.224%
Receptionists and information clerks	0.122%
File clerks	0.043%
Switchboard operators	0.105%
All other managers and administrators	1.301%
General managers and top executives	7.368%
General office clerks	0.878%
Typists and word processors	0.205%
Stenographers	0.025%
SUBTOTAL	14.603%
Personnel :	
Personnel clerks, except payroll and timekeeping	0.108%
Personnel, training, and labor relations managers	0.376%
Personnel, training, and labor relations specialists	0.302%
SUBTOTAL	0.787%
SUBTOTAL FOR Management and Administration :	25.840%
Manufacturing	
Assembly (except electronic) :	
Shipfitters	0.021%
All other precision assemblers	0.096%
All other assemblers and fabricators	3.599%
Aircraft assemblers, precision	0.130%

Contribution of Activities to Manufacturing Labor Costs

All Non-defense Production

Activity	Portion of Mfg. Dollars
Machine assemblers	0.252%
Boilermakers	0.029%
Machine builders and other precision machine assemblers	0.163%
Electromechanical equipment assemblers, precision	0.144%
SUBTOTAL	4.432%
Chemicals Processing :	
Photographic processing machine operators and tenders	0.003%
Crushing and mixing machine operators and tenders	0.527%
Separating and still machine operators and tenders	0.093%
Gas and petroleum plant and system occupations	0.113%
Chemical plant and system operators	0.236%
Chemical equipment controllers, operators and tenders	0.339%
SUBTOTAL	1.312%
Electronic Assembly :	
Electrical and electronic assemblers	0.713%
Electrical and electronic equipment assemblers, precision	0.500%
Coil winders, tapers, and finishers	0.063%
SUBTOTAL	1.276%
Electronic Fabrication :	
Electrical and electronic technicians/technologists	0.757%
Electronic semiconductor processors	0.122%
SUBTOTAL	0.879%
Finishing :	
Coating, painting, and spraying machine operators, tenders, setters, and s	0.520%
Painting, coating, and decorating workers, hand	0.128%
Painters, transportation equipment	0.053%
Electrolytic plating machine operators and tenders, setters and set-up ope	0.185%
Nonelectrolytic plating machine operators and tenders, setters and set-up	0.027%
SUBTOTAL	0.912%
Forming :	
Metal pourers and casters, basic shapes	0.059%
Metal fabricators, structural metal products	0.117%
Tire building machine operators	0.066%
Extruding and forming machine operators and tenders, synthetic or glass fi	0.074%
Metal molding machine operators and tenders, setters and set-up operator	0.171%

Contribution of Activities to Manufacturing Labor Costs

All Non-defense Production

Activity	Portion of Mfg. Dollars
Foundry mold assembly and shakeout workers	0.044%
Machine forming operators and tenders, metal and plastic	0.766%
Extruding and forming machine setters, operators and tenders	0.425%
Plastic molding machine operators and tenders, setters and set-up operat	0.145%
SUBTOTAL	1.866%
Heat and Surface Treatment :	
Heaters, metal and plastic	0.021%
Furnace, kiln, or kettle operators and tenders	0.231%
Heating equipment setters and set-up operators, metal and plastic	0.028%
Heat treating machine operators and tenders, metal and plastic	0.090%
Furnace operators and tenders	0.096%
SUBTOTAL	0.466%
Joining :	
Cement and gluing machine operators and tenders	0.154%
Soldering and brazing machine operators and tenders	0.057%
Welders and cutters	0.828%
Welding machine setters, operators, and tenders	0.512%
Fitters, structural metal, precision	0.038%
Solderers and brazers	0.109%
SUBTOTAL	1.697%
Material Removal :	
Punching machine setters and set-up operators, metal and plastic	0.216%
Grinders and polishers, hand	0.277%
Portable machine cutters	0.037%
Lathe and turning machine tool setters and set-up operators, metal and pl	0.387%
Drilling and boring machine tool setters and set-up operators, metal and pl	0.288%
Machine tool cutting operators and tenders, metal and plastic	0.703%
All other machine tool cutting and forming etc.	0.893%
Numerical control machine tool operators and tenders, metal and plastic	0.475%
Combination machine tool setters, set-up operators, operators, and tender	0.503%
Head sawyers and sawing machine operators and tenders, setters and set	0.232%
Cutting and slicing machine setters, operators and tenders	0.372%
Machinists	1.527%
Grinding machine setters and set-up operators, metal and plastic	0.364%
SUBTOTAL	6.275%
Other Production Processes :	
Food Processing	
Meat, poultry, and fish cutters and trimmers, hand	0.462%

Contribution of Activities to Manufacturing Labor Costs

All Non-defense Production

Activity	Portion of Mfg. Dollars
Butchers and meatcutters	0.236%
All other precision food and tobacco workers	0.118%
Cooking and roasting machine operators and tenders, food and tobacco	0.111%
Bakers, manufacturing	0.113%
Cannery workers	0.283%
Dairy processing equipment operators, including setters	0.083%
Other Metal, Plastic, and Ceramic	
All other precision metal workers	0.386%
All other machine operators, tenders, setters, and set-up operators	1.183%
Optical goods workers, precision	0.031%
All other precision workers	0.363%
All other metal and plastic machine setters, operators, and related workers	0.442%
All other hand workers	0.886%
All other extraction and related workers	0.080%
Printing and Publishing Processes	
Electronic pagination systems workers	0.057%
All other printing, binding, and related workers	0.224%
Paper goods machine setters and set-up operators	0.272%
Photoengraving and lithographic machine operators and tenders	0.010%
Compositors and typesetters, prec	0.041%
Job printers	0.063%
Paste-up workers	0.149%
Bookbinders	0.035%
Offset lithographic press operators	0.397%
All other printing workers, precision	0.061%
Letterpress operators	0.075%
Printing press machine setters, operators and tenders	0.466%
Strippers, printing	0.271%
Proofreaders and copy markers	0.062%
All other printing press setters and set-up operators	0.037%
Typesetting and composing machine operators and tenders	0.151%
Camera operators	0.082%
Photoengravers	0.045%
Bindery machine operators and set-up operators	0.301%
Screen printing machine setters and set-up operators	0.128%
Platemakers	0.075%
Textiles and Apparel Processes	
Cutters and trimmers, hand	0.146%
Sewing machine operators, non-garment	0.285%
Pressing machine operators and tenders, textile, garment, and related mat	0.076%
Textile machine setters and set-up operators	0.148%
Textile draw-out and winding machine operators and tenders	0.772%

Contribution of Activities to Manufacturing Labor Costs

All Non-defense Production

Activity	Portion of Mfg. Dollars
Textile bleaching and dyeing machine operators and tenders	0.105%
Pressers, hand	0.031%
Sewing machine operators, garment	0.194%
Sewers, hand	0.040%
Custom tailors and sewers	0.025%
Upholsterers	0.099%
Shoe and leather workers and repairers, prec	0.051%
All other precision textile, apparel, and furnishings workers	0.042%
SUBTOTAL	9.793%
Test, Inspection, and Repair :	
Product Repair	
All other communications equipment mechanics, installers, and repairers	0.004%
Office machine and cash register servicers	0.003%
Precision instrument repairers	0.135%
Automotive mechanics	0.106%
All other electrical and electronic equipment mechanics, installers, and rep	0.032%
Radio mechanics	0.001%
Small engine specialists	0.001%
Aircraft engine specialists	0.011%
Aircraft mechanics	0.080%
Mobile heavy equipment mechanics	0.023%
Bus and truck mechanics and diesel engine specialists	0.137%
Automotive body and related repairers	0.013%
Heat, air conditioning, and refrigeration mechanics and installers	0.047%
Quality Assurance	
Inspectors, testers, and graders, precision	2.213%
Weighers, measurers, checkers, and samplers, recordkeeping	0.101%
Inspectors and compliance officers, except construction	0.018%
SUBTOTAL	2.925%
SUBTOTAL FOR Manufacturing :	31.834%
Other Support	
Other Support :	
Other Support	
Library assistants and bookmobile drivers	0.004%
Cashiers	0.016%
Musicians	0.001%
Concrete and terrazzo finishers	0.023%
Reporters and correspondents	0.357%
All other health professionals, paraprofessionals, and technicians	0.056%
Pharmacists	0.008%

Contribution of Activities to Manufacturing Labor Costs

All Non-defense Production

Activity	Portion of Mfg. Dollars
Opticians, dispensing and measuring	0.007%
Registered nurses	0.011%
Veterinarians and veterinary inspectors	0.005%
Librarians, professional	0.018%
Teachers and instructors, vocational education and training	0.007%
Foresters and conservation scientists	0.016%
Photographers	0.068%
All other construction trades workers	0.039%
All other agricultural, forestry, fishing, and related workers	0.092%
Farm equipment mechanics	0.006%
Electronic home entertainment equipment repairers	0.003%
Riggers	0.027%
Coin and vending machine servicers and repairers	0.020%
Bricklayers and stone masons	0.013%
Animal caretakers, except farm	0.004%
Glaziers	0.002%
Insulation workers	0.026%
Jewelers and silversmiths	0.043%
Furniture finishers	0.062%
Photographic process workers, precision	0.003%
Laundry and drycleaning machine operators and tenders, except pressing	0.009%
Power distributors and dispatchers	0.020%
Rail yard engineers, dinkey operators, and hostlers	0.012%
Railroad brake, signal, and switch operators	0.006%
Grader, dozer, and scraper operators	0.024%
Helpers, construction trades	0.049%
Paving, surfacing, and tamping equipment operators	0.004%
Fallers and buckers	0.065%
Forest and conservation workers	0.005%
Dispatchers, except police, fire, and ambulance	0.032%
Interviewing clerks, except personnel and social welfare	0.003%
All other service workers	0.108%
All other timber cutting and related logging workers	0.044%
Logging tractor operators	0.072%
Log handling equipment operators	0.049%
All other food preparation and service workers	0.026%
Supervisors, farming, forestry, and agricutural related occupations	0.046%
SUBTOTAL	1.515%
SUBTOTAL FOR Other Support :	1.515%

Production Support

Materials Handling :

Contribution of Activities to Manufacturing Labor Costs

All Non-defense Production

Activity	Portion of Mfg. Dollars
All other material moving equipment operators	0.297%
Industrial truck and tractor operators	1.033%
Crane and tower operators	0.149%
Hoist and winch operators	0.015%
Machine feeders and offbearers	0.859%
Stock clerks, stockrooom, warehouse, or yard	0.528%
Truck drivers light and heavy	1.476%
All other motor vehicle operators	0.018%
All other transportation and related workers	0.055%
Packaging and filling machine operators and tenders	1.155%
Hand packers and packagers	1.306%
Freight, stock, and material movers, hand	0.975%
All other helpers, laborers, and material movers, hand	1.843%
SUBTOTAL	9.709%
Physical Plant Operations and Maintenance :	
Electrical and Electronic Maintenance	
Electronics repairers, commercial and industrial equipment	0.041%
Electricians	0.601%
Mechanical and Structural Maintenance	
Industrial machinery mechanics	1.743%
Millwrights	0.317%
Plumbers, pipefitters, and steamfitters	0.188%
Sheet metal workers and duct installers	1.245%
Other Maint., Construction, and Repair	
Vehicle washers and equipment cleaners	0.075%
Maintenance repairers, general utility	0.954%
All other mechanics, installers, and repairers	0.308%
Painters and paperhangers, construction and maintenance	0.069%
Plant Operations and Security	
Gardeners and groundskeepers, except farm	0.002%
Janitors and cleaners, including maids and housekeeping cleaners	0.515%
Stationary engineers	0.062%
All other plant and system operators	0.117%
Guards	0.148%
Operating engineers	0.018%
All other clean and building service workers	0.031%
Boiler operators and tenders, low pressure	0.069%
Water and liquid waste treatment plant and system operators	0.022%
Woodworking	
Woodworking machine operators and tenders, setters and set-up operator	0.199%

Contribution of Activities to Manufacturing Labor Costs

All Non-defense Production

Activity	Portion of Mfg. Dollars
All other precision woodworkers	0.092%
Cabinetmakers and bench carpenters	0.265%
Wood machinists	0.127%
Carpenters	0.219%
SUBTOTAL	7.427%
Production Management :	
Production, planning, and expediting clerks	0.613%
All other material recording, scheduling, and distribution workers	0.124%
Industrial production managers	3.090%
Blue collar worker supervisors	4.608%
SUBTOTAL	8.433%
Purchasing :	
Purchasing agents, except wholesale, retail, and farm products	0.566%
Procurement clerks	0.090%
Order clerks, materials, merchandise, and service	0.383%
Purchasing managers	0.314%
Traffic, shipping, and receiving clerks	0.902%
SUBTOTAL	2.255%
SUBTOTAL FOR Production Support :	27.824%
TOTAL FOR ALL ACTIVITIES :	100.000%

26-Nov-93

Appendix F

Activity Profile: Upper Tier Defense Industries

Industry/Sector Summary

Industries with DoD Share > 15%

Number of Defense Workers (1)	944,710
Defense Labor Cost (2)	$27,711,687,060

(1) Number of "people-equivalents." For example, two workers each devoting half their time to defense-related work equals one person-equivalent.

(2) Reflects median earnings, exclusive of benefits. 1991 Dollars.

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Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share > 15%

Activity	Portion of DoD Mfg. Dollars
Engineering and Product Development	
Engineering Managers :	
Engineering, mathematical, and natural science managers	4.338%
SUBTOTAL	**4.338%**
Engineers and Designers :	
Designers, except interior designers	0.251%
All other engineers	5.150%
Metallurgists and metallurgical, ceramic, and materials engineers	0.252%
Chemical engineers	0.192%
Mechanical engineers	2.521%
Nuclear engineers	0.078%
Civil engineers, including traffic engineers	0.218%
Electrical and electronics engineers	7.666%
Industrial engineers, except safety engineers	2.944%
Aeronautical and astronautical engineers	3.144%
SUBTOTAL	**22.415%**
Scientists :	
Mathematicians and all other mathematical scientists	0.060%
All other life scientists	0.016%
Biological scientists	0.002%
All other physical scientists	0.041%
Geologists, geophysicists, and oceanographers	0.004%
Meteorologists	0.013%
Chemists	0.133%
Physicists and astronomers	0.103%
SUBTOTAL	**0.370%**
Technicians :	
Science and mathematics technicians	0.202%
Artists and commercial artists	0.072%
Programmers, numerical, tool, and process control	0.099%
Drafters	0.906%
Writers and editors, including technical writers	0.564%
All other engineering technicians and technologists	2.081%
SUBTOTAL	**3.924%**
Tool Makers :	
Tool and die makers	0.652%

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share > 15%

Activity	Portion of DoD Mfg. Dollars
SUBTOTAL	**0.652%**
SUBTOTAL FOR Engineering and Product Development :	**31.700%**
Management and Administration	
Finance and Accounting :	
Statistical clerks	0.036%
Billing, posting, and calculating machine operators	0.006%
Financial managers	0.608%
Statisticians	0.049%
Budget analysts	0.266%
Bookkeeping, accounting, and auditing clerks	0.404%
Accountants and auditors	0.958%
Payroll and timekeeping clerks	0.111%
Billing, cost, and rate clerks	0.072%
Cost estimators	0.367%
SUBTOTAL	**2.877%**
Management Information Systems :	
Data entry keyers, except composing	0.168%
Computer programmers	1.138%
Data processing equipment repairers	0.063%
Peripheral EDP equipment operators	0.026%
Computer operators, except peripheral equipment	0.189%
Systems analysts and computer scientists	1.785%
SUBTOTAL	**3.368%**
Marketing, Sales, Public Relations :	
Public relations specialists and publicity writers	0.044%
Marketing, advertising, and public relations managers	0.833%
Adjustment clerks	0.094%
All other sales and related workers	1.392%
SUBTOTAL	**2.363%**
Other Management and Administration :	
File clerks	0.045%
General managers and top executives	3.832%
General office clerks	0.807%
Duplicating, mail, and other office machine operators	0.106%
All other management support workers	2.390%
All other managers and administrators	1.892%
Typists and word processors	0.218%

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share > 15%

Activity	Portion of DoD Mfg. Dollars
Stenographers	0.054%
All other clerical and administrative support workers	0.255%
Mail clerks, except mail machine operators and postal service	0.020%
Secretaries, except legal and medical	1.735%
Switchboard operators	0.076%
Receptionists and information clerks	0.052%
Operations research analysts	0.301%
Administrative services managers	0.528%
All other professional workers	1.481%
Clerical supervisors and managers	0.599%
Lawyers	0.030%
SUBTOTAL	**14.421%**
Personnel :	
Personnel, training, and labor relations specialists	0.488%
Personnel, training, and labor relations managers	0.332%
Personnel clerks, except payroll and timekeeping	0.104%
SUBTOTAL	**0.925%**
SUBTOTAL FOR Management and Administration :	**23.954%**
Manufacturing	
Assembly (except electronic) :	
All other assemblers and fabricators	2.948%
Aircraft assemblers, precision	1.026%
Machine assemblers	0.248%
Boilermakers	0.043%
All other precision assemblers	0.323%
Electromechanical equipment assemblers, precision	0.450%
Machine builders and other precision machine assemblers	0.154%
Shipfitters	0.477%
SUBTOTAL	**5.669%**
Chemicals Processing :	
Chemical equipment controllers, operators and tenders	0.007%
Crushing and mixing machine operators and tenders	0.043%
Separating and still machine operators and tenders	0.006%
SUBTOTAL	**0.055%**
Electronic Assembly :	
Electrical and electronic equipment assemblers, precision	1.629%
Coil winders, tapers, and finishers	0.067%

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share > 15%

Activity	Portion of DoD Mfg. Dollars
Electrical and electronic assemblers	1.723%
SUBTOTAL	**3.419%**
Electronic Fabrication :	
Electrical and electronic technicians/technologists	2.993%
Electronic semiconductor processors	0.366%
SUBTOTAL	**3.359%**
Finishing :	
Painting, coating, and decorating workers, hand	0.124%
Coating, painting, and spraying machine operators, tenders, setters, and s	0.200%
Painters, transportation equipment	0.231%
Electrolytic plating machine operators and tenders, setters and set-up ope	0.163%
SUBTOTAL	**0.718%**
Forming :	
Metal molding machine operators and tenders, setters and set-up operator	0.030%
Machine forming operators and tenders, metal and plastic	0.175%
Plastic molding machine operators and tenders, setters and set-up operat	0.100%
Extruding and forming machine setters, operators and tenders	0.029%
SUBTOTAL	**0.334%**
Heat and Surface Treatment :	
Heating equipment setters and set-up operators, metal and plastic	0.026%
Heat treating machine operators and tenders, metal and plastic	0.052%
Furnace operators and tenders	0.010%
Furnace, kiln, or kettle operators and tenders	0.027%
SUBTOTAL	**0.115%**
Joining :	
Soldering and brazing machine operators and tenders	0.059%
Cement and gluing machine operators and tenders	0.036%
Welders and cutters	0.918%
Solderers and brazers	0.241%
Welding machine setters, operators, and tenders	0.165%
SUBTOTAL	**1.420%**
Material Removal :	
Machinists	1.565%
Drilling and boring machine tool setters and set-up operators, metal and pl	0.261%
Grinding machine setters and set-up operators, metal and plastic	0.273%
Machine tool cutting operators and tenders, metal and plastic	0.505%

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share > 15%

Activity	Portion of DoD Mfg. Dollars
Punching machine setters and set-up operators, metal and plastic	0.104%
Numerical control machine tool operators and tenders, metal and plastic	0.672%
Lathe and turning machine tool setters and set-up operators, metal and pl	0.296%
Combination machine tool setters, set-up operators, operators, and tender	0.377%
Head sawyers and sawing machine operators and tenders, setters and set	0.005%
Grinders and polishers, hand	0.248%
All other machine tool cutting and forming etc.	0.392%
SUBTOTAL	**4.698%**
Other Production Processes :	
Other Metal, Plastic, and Ceramic	
All other extraction and related workers	0.102%
All other precision metal workers	0.425%
All other precision workers	0.232%
All other metal and plastic machine setters, operators, and related workers	0.266%
All other machine operators, tenders, setters, and set-up operators	0.359%
All other hand workers	0.429%
Optical goods workers, precision	0.023%
Printing and Publishing Processes	
Screen printing machine setters and set-up operators	0.028%
Printing press machine setters, operators and tenders	0.015%
All other printing, binding, and related workers	0.022%
Textiles and Apparel Processes	
Sewing machine operators, non-garment	0.024%
Cutters and trimmers, hand	0.005%
SUBTOTAL	**1.928%**
Test, Inspection, and Repair :	
Product Repair	
Office machine and cash register servicers	0.002%
All other electrical and electronic equipment mechanics, installers, and rep	0.250%
Automotive mechanics	0.067%
Heat, air conditioning, and refrigeration mechanics and installers	0.057%
Precision instrument repairers	0.198%
All other communications equipment mechanics, installers, and repairers	0.011%
Radio mechanics	0.010%
Aircraft engine specialists	0.082%
Aircraft mechanics	0.579%
Bus and truck mechanics and diesel engine specialists	0.016%
Quality Assurance	
Weighers, measurers, checkers, and samplers, recordkeeping	0.019%
Inspectors and compliance officers, except construction	0.019%
Inspectors, testers, and graders, precision	2.956%
SUBTOTAL	**4.268%**

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share > 15%

Activity	Portion of DoD Mfg. Dollars
SUBTOTAL FOR Manufacturing :	**25.983%**
Other Support	
Other Support :	
Other Support	
Opticians, dispensing and measuring	0.005%
Helpers, construction trades	0.075%
Riggers	0.182%
All other food preparation and service workers	0.024%
Insulation workers	0.161%
Dispatchers, except police, fire, and ambulance	0.043%
All other health professionals, paraprofessionals, and technicians	0.065%
Electronic home entertainment equipment repairers	0.003%
Photographers	0.033%
All other service workers	0.152%
All other agricultural, forestry, fishing, and related workers	0.003%
SUBTOTAL	**0.746%**
SUBTOTAL FOR Other Support :	**0.746%**
Production Support	
Materials Handling :	
Hand packers and packagers	0.130%
All other material moving equipment operators	0.060%
Machine feeders and offbearers	0.087%
Industrial truck and tractor operators	0.168%
Crane and tower operators	0.091%
Freight, stock, and material movers, hand	0.328%
All other transportation and related workers	0.076%
All other motor vehicle operators	0.014%
Truck drivers light and heavy	0.273%
Packaging and filling machine operators and tenders	0.083%
All other helpers, laborers, and material movers, hand	0.606%
Stock clerks, stockrooom, warehouse, or yard	0.780%
SUBTOTAL	**2.696%**
Physical Plant Operations and Maintenance :	
Electrical and Electronic Maintenance	
Electronics repairers, commercial and industrial equipment	0.241%
Electricians	0.612%
Mechanical and Structural Maintenance	
Sheet metal workers and duct installers	1.253%

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share > 15%

Activity	Portion of DoD Mfg. Dollars
Industrial machinery mechanics	0.660%
Millwrights	0.108%
Plumbers, pipefitters, and steamfitters	0.554%
Other Maint., Construction, and Repair	
Painters and paperhangers, construction and maintenance	0.164%
Vehicle washers and equipment cleaners	0.026%
All other mechanics, installers, and repairers	0.566%
Maintenance repairers, general utility	0.274%
Plant Operations and Security	
All other plant and system operators	0.040%
Stationary engineers	0.036%
Guards	0.276%
Janitors and cleaners, including maids and housekeeping cleaners	0.318%
All other clean and building service workers	0.013%
Woodworking	
All other precision woodworkers	0.112%
Carpenters	0.376%
SUBTOTAL	**5.630%**
Production Management :	
Blue collar worker supervisors	3.205%
Industrial production managers	2.816%
All other material recording, scheduling, and distribution workers	0.148%
Production, planning, and expediting clerks	1.049%
SUBTOTAL	**7.217%**
Purchasing :	
Order clerks, materials, merchandise, and service	0.133%
Traffic, shipping, and receiving clerks	0.453%
Purchasing managers	0.356%
Procurement clerks	0.107%
Purchasing agents, except wholesale, retail, and farm products	1.025%
SUBTOTAL	**2.074%**
SUBTOTAL FOR Production Support :	**17.617%**
TOTAL FOR ALL ACTIVITIES :	**100.000%**

26-Nov-93

Appendix G

Activity Profile: Lower Tier Defense Industries

Industry/Sector Summary

Industries with DoD Share < 15%

Number of Defense Workers (1)	528,121
Defense Labor Cost (2)	$13,723,083,895

(1) Number of "people-equivalents." For example, two workers each devoting half their time to defense-related work equals one person-equivalent.

(2) Reflects median earnings, exclusive of benefits. 1991 Dollars.

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Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share < 15%

Activity	Portion of DoD Mfg. Dollars
Engineering and Product Development	
Engineering Managers :	
Engineering, mathematical, and natural science managers	2.034%
SUBTOTAL	**2.034%**
Engineers and Designers :	
Civil engineers, including traffic engineers	0.073%
Designers, except interior designers	0.150%
All other engineers	1.539%
Mechanical engineers	1.832%
Electrical and electronics engineers	1.302%
Nuclear engineers	0.003%
Chemical engineers	0.422%
Petroleum engineers	0.009%
Mining engineers, including mine safety engineers	0.002%
Metallurgists and metallurgical, ceramic, and materials engineers	0.219%
Aeronautical and astronautical engineers	0.015%
Industrial engineers, except safety engineers	0.749%
SUBTOTAL	**6.315%**
Scientists :	
Chemists	0.462%
Physicists and astronomers	0.017%
Meteorologists	0.000%
Medical scientists	0.004%
All other life scientists	0.013%
Biological scientists	0.014%
Agricultural and food scientists	0.007%
All other physical scientists	0.026%
Mathematicians and all other mathematical scientists	0.009%
Geologists, geophysicists, and oceanographers	0.009%
SUBTOTAL	**0.562%**
Technicians :	
Writers and editors, including technical writers	0.175%
Drafters	0.769%
Science and mathematics technicians	0.483%
Artists and commercial artists	0.031%
Programmers, numerical, tool, and process control	0.083%
All other engineering technicians and technologists	0.706%
SUBTOTAL	**2.247%**

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share < 15%

Activity	Portion of DoD Mfg. Dollars
Tool Makers :	
Patternmakers and layout workers, fabric and apparel	0.017%
Tool and die makers	1.683%
SUBTOTAL	**1.699%**
SUBTOTAL FOR Engineering and Product Development :	**12.857%**
Management and Administration	
Finance and Accounting :	
Billing, posting, and calculating machine operators	0.007%
Bill and account collectors	0.001%
Cost estimators	0.366%
Financial managers	0.868%
Payroll and timekeeping clerks	0.166%
Billing, cost, and rate clerks	0.120%
Budget analysts	0.065%
Statisticians	0.006%
Accountants and auditors	0.784%
Bookkeeping, accounting, and auditing clerks	0.789%
Statistical clerks	0.017%
SUBTOTAL	**3.189%**
Management Information Systems :	
Data entry keyers, composing	0.011%
Systems analysts and computer scientists	0.601%
Computer operators, except peripheral equipment	0.151%
Data processing equipment repairers	0.025%
Computer programmers	0.707%
Data entry keyers, except composing	0.128%
Peripheral EDP equipment operators	0.005%
SUBTOTAL	**1.629%**
Marketing, Sales, Public Relations :	
Marketing, advertising, and public relations managers	0.892%
Public relations specialists and publicity writers	0.020%
Salespersons, retail	0.029%
All other sales and related workers	3.045%
Adjustment clerks	0.235%
Advertising clerks	0.003%
Driver/sales workers	0.077%
SUBTOTAL	**4.301%**

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share < 15%

Activity	Portion of DoD Mfg. Dollars
Other Management and Administration :	
Clerical supervisors and managers	0.573%
Administrative services managers	0.189%
Lawyers	0.028%
General managers and top executives	8.134%
All other management support workers	0.655%
All other professional workers	0.552%
Secretaries, except legal and medical	1.667%
Duplicating, mail, and other office machine operators	0.040%
Operations research analysts	0.059%
Switchboard operators	0.094%
Mail clerks, except mail machine operators and postal service	0.020%
Messengers	0.005%
File clerks	0.036%
Stenographers	0.028%
Receptionists and information clerks	0.093%
Typists and word processors	0.162%
All other managers and administrators	1.075%
All other clerical and administrative support workers	0.130%
General office clerks	0.771%
SUBTOTAL	**14.309%**
Personnel :	
Personnel clerks, except payroll and timekeeping	0.097%
Personnel, training, and labor relations specialists	0.265%
Personnel, training, and labor relations managers	0.358%
SUBTOTAL	**0.720%**
SUBTOTAL FOR Management and Administration :	**24.148%**
Manufacturing	
Assembly (except electronic) :	
Aircraft assemblers, precision	0.000%
Boilermakers	0.055%
Machine assemblers	0.307%
All other precision assemblers	0.090%
Electromechanical equipment assemblers, precision	0.155%
Machine builders and other precision machine assemblers	0.283%
All other assemblers and fabricators	4.127%
SUBTOTAL	**5.016%**
Chemicals Processing :	

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share < 15%

Activity	Portion of DoD Mfg. Dollars
Chemical plant and system operators	0.297%
Gas and petroleum plant and system occupations	0.126%
Crushing and mixing machine operators and tenders	0.510%
Separating and still machine operators and tenders	0.087%
Photographic processing machine operators and tenders	0.001%
Chemical equipment controllers, operators and tenders	0.400%
SUBTOTAL	**1.421%**
Electronic Assembly :	
Electrical and electronic equipment assemblers, precision	0.460%
Coil winders, tapers, and finishers	0.112%
Electrical and electronic assemblers	0.762%
SUBTOTAL	**1.333%**
Electronic Fabrication :	
Electrical and electronic technicians/technologists	0.607%
Electronic semiconductor processors	0.018%
SUBTOTAL	**0.626%**
Finishing :	
Coating, painting, and spraying machine operators, tenders, setters, and s	0.669%
Electrolytic plating machine operators and tenders, setters and set-up ope	0.450%
Nonelectrolytic plating machine operators and tenders, setters and set-up	0.090%
Painting, coating, and decorating workers, hand	0.094%
Painters, transportation equipment	0.012%
SUBTOTAL	**1.315%**
Forming :	
Metal molding machine operators and tenders, setters and set-up operator	0.402%
Tire building machine operators	0.065%
Metal pourers and casters, basic shapes	0.183%
Extruding and forming machine operators and tenders, synthetic or glass fi	0.074%
Foundry mold assembly and shakeout workers	0.117%
Extruding and forming machine setters, operators and tenders	0.382%
Metal fabricators, structural metal products	0.246%
Plastic molding machine operators and tenders, setters and set-up operat	0.947%
Machine forming operators and tenders, metal and plastic	1.222%
SUBTOTAL	**3.638%**
Heat and Surface Treatment :	
Furnace operators and tenders	0.303%

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share < 15%

Activity	Portion of DoD Mfg. Dollars
Heaters, metal and plastic	0.049%
Heating equipment setters and set-up operators, metal and plastic	0.070%
Heat treating machine operators and tenders, metal and plastic	0.233%
Furnace, kiln, or kettle operators and tenders	0.316%
SUBTOTAL	**0.970%**
Joining :	
Fitters, structural metal, precision	0.077%
Welders and cutters	1.175%
Solderers and brazers	0.081%
Soldering and brazing machine operators and tenders	0.080%
Cement and gluing machine operators and tenders	0.074%
Welding machine setters, operators, and tenders	0.752%
SUBTOTAL	**2.239%**
Material Removal :	
Grinders and polishers, hand	0.434%
Portable machine cutters	0.013%
Cutting and slicing machine setters, operators and tenders	0.210%
Machinists	3.131%
Head sawyers and sawing machine operators and tenders, setters and set	0.134%
Combination machine tool setters, set-up operators, operators, and tender	0.912%
Numerical control machine tool operators and tenders, metal and plastic	0.928%
All other machine tool cutting and forming etc.	1.684%
Punching machine setters and set-up operators, metal and plastic	0.354%
Machine tool cutting operators and tenders, metal and plastic	1.285%
Grinding machine setters and set-up operators, metal and plastic	0.742%
Drilling and boring machine tool setters and set-up operators, metal and pl	0.527%
Lathe and turning machine tool setters and set-up operators, metal and pl	0.840%
SUBTOTAL	**11.194%**
Other Production Processes :	
Food Processing	
Butchers and meatcutters	0.066%
Dairy processing equipment operators, including setters	0.025%
Bakers, manufacturing	0.026%
Meat, poultry, and fish cutters and trimmers, hand	0.129%
All other precision food and tobacco workers	0.026%
Cannery workers	0.055%
Cooking and roasting machine operators and tenders, food and tobacco	0.026%
Other Metal, Plastic, and Ceramic	
All other precision metal workers	0.589%
All other extraction and related workers	0.078%
All other precision workers	0.463%

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share < 15%

Activity	Portion of DoD Mfg. Dollars
Optical goods workers, precision	0.070%
All other hand workers	0.644%
All other machine operators, tenders, setters, and set-up operators	0.920%
All other metal and plastic machine setters, operators, and related workers	0.690%
Printing and Publishing Processes	
Printing press machine setters, operators and tenders	0.211%
Compositors and typesetters, prec	0.011%
All other printing, binding, and related workers	0.095%
Screen printing machine setters and set-up operators	0.062%
Bindery machine operators and set-up operators	0.139%
Offset lithographic press operators	0.167%
Letterpress operators	0.022%
Paper goods machine setters and set-up operators	0.097%
All other printing press setters and set-up operators	0.016%
Photoengraving and lithographic machine operators and tenders	0.004%
Job printers	0.026%
Electronic pagination systems workers	0.014%
Typesetting and composing machine operators and tenders	0.043%
Bookbinders	0.015%
Platemakers	0.028%
Strippers, printing	0.111%
All other printing workers, precision	0.020%
Camera operators	0.029%
Proofreaders and copy markers	0.015%
Photoengravers	0.014%
Paste-up workers	0.034%
Textiles and Apparel Processes	
Pressers, hand	0.007%
Sewers, hand	0.010%
Cutters and trimmers, hand	0.086%
Textile machine setters and set-up operators	0.037%
Textile draw-out and winding machine operators and tenders	0.134%
Textile bleaching and dyeing machine operators and tenders	0.010%
Sewing machine operators, garment	0.316%
Custom tailors and sewers	0.006%
Upholsterers	0.018%
Sewing machine operators, non-garment	0.172%
All other precision textile, apparel, and furnishings workers	0.010%
Shoe and leather workers and repairers, prec	0.006%
Pressing machine operators and tenders, textile, garment, and related mat	0.018%
SUBTOTAL	**5.809%**
Test, Inspection, and Repair :	
Product Repair	

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share < 15%

Activity	Portion of DoD Mfg. Dollars
Precision instrument repairers	0.145%
Mobile heavy equipment mechanics	0.028%
Small engine specialists	0.005%
Bus and truck mechanics and diesel engine specialists	0.105%
Heat, air conditioning, and refrigeration mechanics and installers	0.030%
Office machine and cash register servicers	0.003%
All other electrical and electronic equipment mechanics, installers, and rep	0.011%
Automotive mechanics	0.088%
Automotive body and related repairers	0.005%
All other communications equipment mechanics, installers, and repairers	0.001%
Quality Assurance	
Inspectors, testers, and graders, precision	2.184%
Inspectors and compliance officers, except construction	0.012%
Weighers, measurers, checkers, and samplers, recordkeeping	0.089%
SUBTOTAL	**2.706%**
SUBTOTAL FOR Manufacturing :	**36.264%**
Other Support	
Other Support :	
Other Support	
Jewelers and silversmiths	0.008%
Photographic process workers, precision	0.001%
Foresters and conservation scientists	0.006%
Teachers and instructors, vocational education and training	0.001%
All other construction trades workers	0.057%
Concrete and terrazzo finishers	0.015%
Helpers, construction trades	0.045%
Grader, dozer, and scraper operators	0.021%
Railroad brake, signal, and switch operators	0.016%
Cashiers	0.003%
Musicians	0.001%
Power distributors and dispatchers	0.033%
Librarians, professional	0.009%
Registered nurses	0.009%
Opticians, dispensing and measuring	0.017%
Photographers	0.007%
All other health professionals, paraprofessionals, and technicians	0.053%
Paving, surfacing, and tamping equipment operators	0.003%
Reporters and correspondents	0.007%
Rail yard engineers, dinkey operators, and hostlers	0.034%
All other food preparation and service workers	0.007%
All other timber cutting and related logging workers	0.008%
Logging tractor operators	0.005%

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share < 15%

Activity	Portion of DoD Mfg. Dollars
Log handling equipment operators	0.018%
Fallers and buckers	0.004%
Supervisors, farming, forestry, and agricutural related occupations	0.010%
All other service workers	0.081%
Glaziers	0.002%
All other agricultural, forestry, fishing, and related workers	0.024%
Library assistants and bookmobile drivers	0.000%
Furniture finishers	0.013%
Dispatchers, except police, fire, and ambulance	0.017%
Farm equipment mechanics	0.002%
Electronic home entertainment equipment repairers	0.002%
Laundry and drycleaning machine operators and tenders, except pressing	0.002%
Insulation workers	0.023%
Interviewing clerks, except personnel and social welfare	0.000%
Riggers	0.030%
Coin and vending machine servicers and repairers	0.005%
Bricklayers and stone masons	0.038%
Forest and conservation workers	0.001%
Animal caretakers, except farm	0.000%
SUBTOTAL	**0.637%**
SUBTOTAL FOR Other Support :	**0.637%**
Production Support	
Materials Handling :	
All other material moving equipment operators	0.296%
Hand packers and packagers	0.873%
Freight, stock, and material movers, hand	0.778%
Machine feeders and offbearers	0.643%
Industrial truck and tractor operators	0.948%
Crane and tower operators	0.335%
All other helpers, laborers, and material movers, hand	1.745%
Packaging and filling machine operators and tenders	0.581%
All other transportation and related workers	0.034%
All other motor vehicle operators	0.017%
Stock clerks, stockrooom, warehouse, or yard	0.510%
Truck drivers light and heavy	1.051%
Hoist and winch operators	0.006%
SUBTOTAL	**7.816%**
Physical Plant Operations and Maintenance :	
Electrical and Electronic Maintenance	
Electricians	0.687%

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share < 15%

Activity	Portion of DoD Mfg. Dollars
Electronics repairers, commercial and industrial equipment	0.034%
Mechanical and Structural Maintenance	
Plumbers, pipefitters, and steamfitters	0.206%
Sheet metal workers and duct installers	1.712%
Millwrights	0.423%
Industrial machinery mechanics	1.685%
Other Maint., Construction, and Repair	
Painters and paperhangers, construction and maintenance	0.073%
Vehicle washers and equipment cleaners	0.041%
Maintenance repairers, general utility	1.058%
All other mechanics, installers, and repairers	0.214%
Plant Operations and Security	
Guards	0.121%
Janitors and cleaners, including maids and housekeeping cleaners	0.444%
All other clean and building service workers	0.018%
Gardeners and groundskeepers, except farm	0.001%
Operating engineers	0.013%
All other plant and system operators	0.128%
Stationary engineers	0.051%
Water and liquid waste treatment plant and system operators	0.026%
Boiler operators and tenders, low pressure	0.055%
Woodworking	
Woodworking machine operators and tenders, setters and set-up operator	0.095%
All other precision woodworkers	0.126%
Wood machinists	0.052%
Cabinetmakers and bench carpenters	0.092%
Carpenters	0.132%
SUBTOTAL	**7.489%**
Production Management :	
All other material recording, scheduling, and distribution workers	0.099%
Industrial production managers	3.115%
Production, planning, and expediting clerks	0.589%
Blue collar worker supervisors	4.755%
SUBTOTAL	**8.558%**
Purchasing :	
Procurement clerks	0.091%
Order clerks, materials, merchandise, and service	0.341%
Traffic, shipping, and receiving clerks	0.868%
Purchasing managers	0.314%
Purchasing agents, except wholesale, retail, and farm products	0.615%
SUBTOTAL	**2.229%**

Contribution of Activities to Defense Manufacturing Labor Costs

Industries with DoD Share < 15%

Activity	Portion of DoD Mfg. Dollars
SUBTOTAL FOR Production Support :	26.093%
TOTAL FOR ALL ACTIVITIES :	100.000%

26-Nov-93

Appendix H

Activity Profile: The Metalworking Machinery Industry

Industry/Sector Summary

The Metalworking Machinery Industry (SIC 354)

Number of Defense Workers (1)	36,145
Defense Labor Cost (2)	$1,028,234,840

(1) Number of "people-equivalents." For example, two workers each devoting half their time to defense-related work equals one person-equivalent.

(2) Reflects median earnings, exclusive of benefits. 1991 Dollars.

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Contribution of Activities to Defense Manufacturing Labor Costs

The Metalworking Machinery Industry (SIC 354)

Activity	Portion of DoD Mfg. Dollars
Engineering and Product Development	
Engineering Managers :	
Engineering, mathematical, and natural science managers	2.102%
SUBTOTAL	**2.102%**
Engineers and Designers :	
Metallurgists and metallurgical, ceramic, and materials engineers	0.149%
Designers, except interior designers	0.146%
All other engineers	0.858%
Industrial engineers, except safety engineers	0.616%
Mechanical engineers	3.187%
Electrical and electronics engineers	0.868%
Civil engineers, including traffic engineers	0.032%
SUBTOTAL	**5.857%**
Technicians :	
Writers and editors, including technical writers	0.087%
All other engineering technicians and technologists	0.464%
Programmers, numerical, tool, and process control	0.400%
Science and mathematics technicians	0.033%
Drafters	1.377%
SUBTOTAL	**2.361%**
Tool Makers :	
Tool and die makers	10.361%
SUBTOTAL	**10.361%**
SUBTOTAL FOR Engineering and Product Development :	**20.681%**
Management and Administration	
Finance and Accounting :	
Payroll and timekeeping clerks	0.131%
Financial managers	1.185%
Accountants and auditors	0.513%
Budget analysts	0.049%
Billing, cost, and rate clerks	0.089%
Bookkeeping, accounting, and auditing clerks	0.811%
Statistical clerks	0.020%
Cost estimators	0.575%
SUBTOTAL	**3.373%**

Contribution of Activities to Defense Manufacturing Labor Costs

The Metalworking Machinery Industry (SIC 354)

Activity	Portion of DoD Mfg. Dollars
Management Information Systems :	
Computer operators, except peripheral equipment	0.091%
Systems analysts and computer scientists	0.314%
Computer programmers	0.552%
Data entry keyers, except composing	0.085%
SUBTOTAL	**1.042%**
Marketing, Sales, Public Relations :	
Adjustment clerks	0.114%
Marketing, advertising, and public relations managers	0.573%
All other sales and related workers	2.729%
SUBTOTAL	**3.417%**
Other Management and Administration :	
All other management support workers	0.210%
Switchboard operators	0.080%
Typists and word processors	0.114%
All other professional workers	0.168%
File clerks	0.052%
Clerical supervisors and managers	0.641%
Secretaries, except legal and medical	1.862%
Stenographers	0.024%
Receptionists and information clerks	0.084%
General managers and top executives	11.652%
All other managers and administrators	0.539%
Administrative services managers	0.102%
All other clerical and administrative support workers	0.035%
General office clerks	0.780%
Duplicating, mail, and other office machine operators	0.023%
SUBTOTAL	**16.366%**
Personnel :	
Personnel, training, and labor relations specialists	0.093%
Personnel clerks, except payroll and timekeeping	0.065%
Personnel, training, and labor relations managers	0.236%
SUBTOTAL	**0.394%**
SUBTOTAL FOR Management and Administration :	**24.592%**
Manufacturing	
Assembly (except electronic) :	

Contribution of Activities to Defense Manufacturing Labor Costs

The Metalworking Machinery Industry (SIC 354)

Activity	Portion of DoD Mfg. Dollars
Electromechanical equipment assemblers, precision	0.216%
Machine builders and other precision machine assemblers	1.061%
All other assemblers and fabricators	1.765%
Machine assemblers	0.531%
All other precision assemblers	0.049%
SUBTOTAL	**3.622%**
Chemicals Processing :	
Crushing and mixing machine operators and tenders	0.106%
SUBTOTAL	**0.106%**
Electronic Assembly :	
Electrical and electronic equipment assemblers, precision	0.290%
Coil winders, tapers, and finishers	0.036%
Electrical and electronic assemblers	0.212%
SUBTOTAL	**0.538%**
Electronic Fabrication :	
Electrical and electronic technicians/technologists	0.325%
SUBTOTAL	**0.325%**
Finishing :	
Coating, painting, and spraying machine operators, tenders, setters, and s	0.296%
Electrolytic plating machine operators and tenders, setters and set-up ope	0.051%
SUBTOTAL	**0.348%**
Forming :	
Machine forming operators and tenders, metal and plastic	0.928%
Metal molding machine operators and tenders, setters and set-up operator	0.225%
SUBTOTAL	**1.153%**
Heat and Surface Treatment :	
Heating equipment setters and set-up operators, metal and plastic	0.065%
Heat treating machine operators and tenders, metal and plastic	0.223%
Furnace operators and tenders	0.081%
Furnace, kiln, or kettle operators and tenders	0.109%
SUBTOTAL	**0.479%**
Joining :	
Welding machine setters, operators, and tenders	0.408%

Contribution of Activities to Defense Manufacturing Labor Costs

The Metalworking Machinery Industry (SIC 354)

Activity	Portion of DoD Mfg. Dollars
Solderers and brazers	0.028%
Welders and cutters	0.601%
Soldering and brazing machine operators and tenders	0.144%
SUBTOTAL	**1.181%**
Material Removal :	
Punching machine setters and set-up operators, metal and plastic	0.545%
Grinders and polishers, hand	0.485%
Combination machine tool setters, set-up operators, operators, and tender	1.691%
All other machine tool cutting and forming etc.	1.799%
Machine tool cutting operators and tenders, metal and plastic	2.806%
Grinding machine setters and set-up operators, metal and plastic	2.216%
Drilling and boring machine tool setters and set-up operators, metal and pl	1.140%
Lathe and turning machine tool setters and set-up operators, metal and pl	1.527%
Machinists	10.697%
Numerical control machine tool operators and tenders, metal and plastic	3.195%
SUBTOTAL	**26.103%**
Other Production Processes :	
Other Metal, Plastic, and Ceramic	
All other extraction and related workers	0.013%
All other precision workers	0.367%
All other precision metal workers	1.820%
All other metal and plastic machine setters, operators, and related workers	0.509%
All other machine operators, tenders, setters, and set-up operators	0.358%
All other hand workers	0.255%
SUBTOTAL	**3.321%**
Test, Inspection, and Repair :	
Product Repair	
Precision instrument repairers	0.021%
Heat, air conditioning, and refrigeration mechanics and installers	0.020%
Automotive mechanics	0.035%
Quality Assurance	
Weighers, measurers, checkers, and samplers, recordkeeping	0.034%
Inspectors, testers, and graders, precision	1.331%
SUBTOTAL	**1.441%**
SUBTOTAL FOR Manufacturing :	**38.617%**
Other Support	
Other Support :	
Other Support	
All other service workers	0.035%
All other health professionals, paraprofessionals, and technicians	0.012%

Contribution of Activities to Defense Manufacturing Labor Costs

The Metalworking Machinery Industry (SIC 354)

Activity	Portion of DoD Mfg. Dollars
SUBTOTAL	**0.048%**
SUBTOTAL FOR Other Support :	**0.048%**
Production Support	
Materials Handling :	
Machine feeders and offbearers	0.159%
Freight, stock, and material movers, hand	0.264%
Hand packers and packagers	0.251%
All other helpers, laborers, and material movers, hand	0.338%
Truck drivers light and heavy	0.244%
Industrial truck and tractor operators	0.228%
Stock clerks, stockrooom, warehouse, or yard	0.487%
Crane and tower operators	0.058%
All other material moving equipment operators	0.049%
Packaging and filling machine operators and tenders	0.075%
SUBTOTAL	**2.153%**
Physical Plant Operations and Maintenance :	
Electrical and Electronic Maintenance	
Electricians	0.239%
Mechanical and Structural Maintenance	
Plumbers, pipefitters, and steamfitters	0.081%
Millwrights	0.091%
Industrial machinery mechanics	0.810%
Sheet metal workers and duct installers	1.196%
Other Maint., Construction, and Repair	
All other mechanics, installers, and repairers	0.139%
Painters and paperhangers, construction and maintenance	0.054%
Maintenance repairers, general utility	0.555%
Vehicle washers and equipment cleaners	0.104%
Plant Operations and Security	
Guards	0.024%
Janitors and cleaners, including maids and housekeeping cleaners	0.583%
All other clean and building service workers	0.010%
All other plant and system operators	0.015%
Woodworking	
Carpenters	0.047%
All other precision woodworkers	1.093%
SUBTOTAL	**5.041%**
Production Management :	
Production, planning, and expediting clerks	0.446%

Contribution of Activities to Defense Manufacturing Labor Costs

The Metalworking Machinery Industry (SIC 354)

Activity	Portion of DoD Mfg. Dollars
All other material recording, scheduling, and distribution workers	0.051%
Industrial production managers	2.803%
Blue collar worker supervisors	3.259%
SUBTOTAL	**6.559%**
Purchasing :	
Order clerks, materials, merchandise, and service	0.388%
Procurement clerks	0.082%
Purchasing agents, except wholesale, retail, and farm products	0.772%
Traffic, shipping, and receiving clerks	0.785%
Purchasing managers	0.281%
SUBTOTAL	**2.309%**
SUBTOTAL FOR Production Support :	**16.063%**
TOTAL FOR ALL ACTIVITIES :	**100.000%**

26-Nov-93

Appendix I

Activity Profile: The Screw Machine Products Industry

Industry/Sector Summary

The Screw Machine Products Industry (SIC 345)

Number of Defense Workers (1)	13,658
Defense Labor Cost (2)	$363,497,705

(1) Number of "people-equivalents." For example, two workers each devoting half their time to defense-related work equals one person-equivalent.

(2) Reflects median earnings, exclusive of benefits. 1991 Dollars.

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Contribution of Activities to Defense Manufacturing Labor Costs

The Screw Machine Products Industry (SIC 345)

Activity	Portion of DoD Mfg. Dollars
Engineering and Product Development	
Engineering Managers :	
Engineering, mathematical, and natural science managers	1.218%
SUBTOTAL	**1.218%**
Engineers and Designers :	
Metallurgists and metallurgical, ceramic, and materials engineers	0.176%
Electrical and electronics engineers	0.228%
Industrial engineers, except safety engineers	0.381%
Mechanical engineers	1.938%
All other engineers	0.161%
SUBTOTAL	**2.884%**
Technicians :	
Programmers, numerical, tool, and process control	0.156%
All other engineering technicians and technologists	0.523%
Drafters	0.433%
SUBTOTAL	**1.112%**
Tool Makers :	
Tool and die makers	2.516%
SUBTOTAL	**2.516%**
SUBTOTAL FOR Engineering and Product Development :	**7.730%**
Management and Administration	
Finance and Accounting :	
Payroll and timekeeping clerks	0.137%
Accountants and auditors	0.911%
Financial managers	1.165%
Billing, cost, and rate clerks	0.123%
Bookkeeping, accounting, and auditing clerks	0.919%
Cost estimators	0.549%
SUBTOTAL	**3.804%**
Management Information Systems :	
Systems analysts and computer scientists	0.305%
Data entry keyers, except composing	0.119%
Computer operators, except peripheral equipment	0.108%

Contribution of Activities to Defense Manufacturing Labor Costs

The Screw Machine Products Industry (SIC 345)

Activity	Portion of DoD Mfg. Dollars
Computer programmers	0.322%
SUBTOTAL	**0.855%**
Marketing, Sales, Public Relations :	
Adjustment clerks	0.157%
Marketing, advertising, and public relations managers	0.683%
All other sales and related workers	3.012%
SUBTOTAL	**3.852%**
Other Management and Administration :	
All other managers and administrators	0.686%
File clerks	0.056%
Switchboard operators	0.102%
All other clerical and administrative support workers	0.060%
Typists and word processors	0.179%
Clerical supervisors and managers	0.502%
Administrative services managers	0.196%
All other management support workers	0.208%
General managers and top executives	10.273%
Secretaries, except legal and medical	1.442%
All other professional workers	0.088%
General office clerks	0.846%
Receptionists and information clerks	0.105%
SUBTOTAL	**14.743%**
Personnel :	
Personnel clerks, except payroll and timekeeping	0.118%
Personnel, training, and labor relations specialists	0.170%
Personnel, training, and labor relations managers	0.351%
SUBTOTAL	**0.639%**
SUBTOTAL FOR Management and Administration :	**23.892%**
Manufacturing	
Assembly (except electronic) :	
All other assemblers and fabricators	1.594%
All other precision assemblers	0.141%
SUBTOTAL	**1.736%**
Chemicals Processing :	
Crushing and mixing machine operators and tenders	0.086%

Contribution of Activities to Defense Manufacturing Labor Costs

The Screw Machine Products Industry (SIC 345)

Activity	Portion of DoD Mfg. Dollars
SUBTOTAL	**0.086%**
Finishing :	
Nonelectrolytic plating machine operators and tenders, setters and set-up	0.218%
Electrolytic plating machine operators and tenders, setters and set-up ope	0.386%
Coating, painting, and spraying machine operators, tenders, setters, and s	0.097%
SUBTOTAL	**0.701%**
Forming :	
Metal fabricators, structural metal products	0.157%
Machine forming operators and tenders, metal and plastic	2.512%
Metal molding machine operators and tenders, setters and set-up operator	0.066%
SUBTOTAL	**2.734%**
Heat and Surface Treatment :	
Heating equipment setters and set-up operators, metal and plastic	0.081%
Heat treating machine operators and tenders, metal and plastic	0.407%
Furnace operators and tenders	0.055%
SUBTOTAL	**0.542%**
Joining :	
Welding machine setters, operators, and tenders	0.177%
Welders and cutters	0.091%
SUBTOTAL	**0.269%**
Material Removal :	
Drilling and boring machine tool setters and set-up operators, metal and pl	3.078%
Machinists	9.191%
Lathe and turning machine tool setters and set-up operators, metal and pl	8.038%
Grinding machine setters and set-up operators, metal and plastic	1.568%
Machine tool cutting operators and tenders, metal and plastic	5.956%
Punching machine setters and set-up operators, metal and plastic	0.868%
All other machine tool cutting and forming etc.	2.643%
Numerical control machine tool operators and tenders, metal and plastic	1.227%
Combination machine tool setters, set-up operators, operators, and tender	2.826%
Grinders and polishers, hand	0.205%
SUBTOTAL	**35.599%**
Other Production Processes :	
Other Metal, Plastic, and Ceramic	
All other metal and plastic machine setters, operators, and related workers	1.341%
All other machine operators, tenders, setters, and set-up operators	0.900%
All other hand workers	0.222%

Contribution of Activities to Defense Manufacturing Labor Costs

The Screw Machine Products Industry (SIC 345)

Activity	Portion of DoD Mfg. Dollars
All other precision metal workers	0.930%
SUBTOTAL	**3.394%**
Test, Inspection, and Repair :	
Quality Assurance	
Inspectors, testers, and graders, precision	3.156%
Weighers, measurers, checkers, and samplers, recordkeeping	0.110%
SUBTOTAL	**3.265%**
SUBTOTAL FOR Manufacturing :	**48.327%**
Other Support	
Other Support :	
Other Support	
All other service workers	0.062%
SUBTOTAL	**0.062%**
SUBTOTAL FOR Other Support :	**0.062%**
Production Support	
Materials Handling :	
Packaging and filling machine operators and tenders	0.226%
Hand packers and packagers	0.772%
Freight, stock, and material movers, hand	0.622%
Machine feeders and offbearers	0.699%
Industrial truck and tractor operators	0.497%
Crane and tower operators	0.066%
Truck drivers light and heavy	0.465%
All other helpers, laborers, and material movers, hand	0.675%
Stock clerks, stockrooom, warehouse, or yard	0.587%
All other material moving equipment operators	0.071%
SUBTOTAL	**4.679%**
Physical Plant Operations and Maintenance :	
Electrical and Electronic Maintenance	
Electricians	0.214%
Mechanical and Structural Maintenance	
Industrial machinery mechanics	1.173%
Millwrights	0.091%
Other Maint., Construction, and Repair	
All other mechanics, installers, and repairers	0.048%
Maintenance repairers, general utility	0.799%
Plant Operations and Security	
Guards	0.054%

Contribution of Activities to Defense Manufacturing Labor Costs

The Screw Machine Products Industry (SIC 345)

Activity	Portion of DoD Mfg. Dollars
Janitors and cleaners, including maids and housekeeping cleaners	0.489%
All other clean and building service workers	0.050%
SUBTOTAL	**2.918%**
Production Management :	
Production, planning, and expediting clerks	0.698%
Industrial production managers	3.861%
Blue collar worker supervisors	4.598%
All other material recording, scheduling, and distribution workers	0.127%
SUBTOTAL	**9.284%**
Purchasing :	
Order clerks, materials, merchandise, and service	0.203%
Purchasing agents, except wholesale, retail, and farm products	0.730%
Procurement clerks	0.096%
Traffic, shipping, and receiving clerks	1.671%
Purchasing managers	0.408%
SUBTOTAL	**3.108%**
SUBTOTAL FOR Production Support :	**19.989%**
TOTAL FOR ALL ACTIVITIES :	**100.000%**

26-Nov-93

Appendix J

Activity Profile: The Electronic Components Industry

Industry/Sector Summary

The Electronic Components Industry (SIC 367)

Number of Defense Workers (1)	100,204
Defense Labor Cost (2)	$2,748,562,938

(1) Number of "people-equivalents." For example, two workers each devoting half their time to defense-related work equals one person-equivalent.

(2) Reflects median earnings, exclusive of benefits. 1991 Dollars.

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Contribution of Activities to Defense Manufacturing Labor Costs

The Electronic Components Industry (SIC 367)

Activity	Portion of DoD Mfg. Dollars
Engineering and Product Development	
Engineering Managers :	
Engineering, mathematical, and natural science managers	4.741%
SUBTOTAL	**4.741%**
Engineers and Designers :	
Designers, except interior designers	0.262%
All other engineers	4.326%
Aeronautical and astronautical engineers	0.067%
Metallurgists and metallurgical, ceramic, and materials engineers	0.390%
Chemical engineers	0.375%
Nuclear engineers	0.016%
Civil engineers, including traffic engineers	0.229%
Electrical and electronics engineers	8.666%
Industrial engineers, except safety engineers	1.519%
Mechanical engineers	1.674%
SUBTOTAL	**17.524%**
Scientists :	
Chemists	0.188%
Mathematicians and all other mathematical scientists	0.033%
SUBTOTAL	**0.220%**
Technicians :	
Programmers, numerical, tool, and process control	0.103%
Writers and editors, including technical writers	0.308%
Drafters	0.828%
Science and mathematics technicians	0.222%
All other engineering technicians and technologists	2.024%
SUBTOTAL	**3.486%**
Tool Makers :	
Tool and die makers	0.427%
SUBTOTAL	**0.427%**
SUBTOTAL FOR Engineering and Product Development :	**26.398%**
Management and Administration	
Finance and Accounting :	

Contribution of Activities to Defense Manufacturing Labor Costs

The Electronic Components Industry (SIC 367)

Activity	Portion of DoD Mfg. Dollars
Statistical clerks	0.026%
Budget analysts	0.114%
Financial managers	0.887%
Cost estimators	0.168%
Payroll and timekeeping clerks	0.114%
Billing, cost, and rate clerks	0.054%
Bookkeeping, accounting, and auditing clerks	0.607%
Accountants and auditors	0.920%
SUBTOTAL	**2.889%**
Management Information Systems :	
Data processing equipment repairers	0.080%
Systems analysts and computer scientists	0.983%
Computer programmers	1.045%
Computer operators, except peripheral equipment	0.287%
Peripheral EDP equipment operators	0.019%
Data entry keyers, except composing	0.123%
SUBTOTAL	**2.537%**
Marketing, Sales, Public Relations :	
All other sales and related workers	2.635%
Marketing, advertising, and public relations managers	1.264%
Adjustment clerks	0.212%
Public relations specialists and publicity writers	0.054%
SUBTOTAL	**4.165%**
Other Management and Administration :	
Lawyers	0.093%
Operations research analysts	0.143%
Switchboard operators	0.098%
Mail clerks, except mail machine operators and postal service	0.057%
Secretaries, except legal and medical	1.593%
General office clerks	0.760%
Duplicating, mail, and other office machine operators	0.037%
Stenographers	0.009%
Clerical supervisors and managers	0.368%
All other managers and administrators	0.911%
Receptionists and information clerks	0.091%
Typists and word processors	0.128%
All other clerical and administrative support workers	0.052%
File clerks	0.046%
All other management support workers	0.919%
Administrative services managers	0.322%

Contribution of Activities to Defense Manufacturing Labor Costs

The Electronic Components Industry (SIC 367)

Activity	Portion of DoD Mfg. Dollars
All other professional workers	0.900%
General managers and top executives	5.790%
SUBTOTAL	**12.316%**
Personnel :	
Personnel clerks, except payroll and timekeeping	0.118%
Personnel, training, and labor relations managers	0.421%
Personnel, training, and labor relations specialists	0.442%
SUBTOTAL	**0.981%**
SUBTOTAL FOR Management and Administration :	**22.888%**
Manufacturing	
Assembly (except electronic) :	
Machine assemblers	0.151%
Machine builders and other precision machine assemblers	0.059%
All other assemblers and fabricators	3.557%
All other precision assemblers	0.369%
Electromechanical equipment assemblers, precision	0.603%
SUBTOTAL	**4.739%**
Chemicals Processing :	
Separating and still machine operators and tenders	0.058%
Crushing and mixing machine operators and tenders	0.023%
SUBTOTAL	**0.081%**
Electronic Assembly :	
Coil winders, tapers, and finishers	0.520%
Electrical and electronic assemblers	5.569%
Electrical and electronic equipment assemblers, precision	3.133%
SUBTOTAL	**9.223%**
Electronic Fabrication :	
Electronic semiconductor processors	3.462%
Electrical and electronic technicians/technologists	4.969%
SUBTOTAL	**8.431%**
Finishing :	
Painting, coating, and decorating workers, hand	0.033%
Coating, painting, and spraying machine operators, tenders, setters, and s	0.444%
Electrolytic plating machine operators and tenders, setters and set-up ope	0.759%

Contribution of Activities to Defense Manufacturing Labor Costs

The Electronic Components Industry (SIC 367)

Activity	Portion of DoD Mfg. Dollars
SUBTOTAL	**1.236%**
Forming :	
Machine forming operators and tenders, metal and plastic	0.229%
Metal molding machine operators and tenders, setters and set-up operator	0.028%
Plastic molding machine operators and tenders, setters and set-up operat	0.206%
Extruding and forming machine setters, operators and tenders	0.083%
SUBTOTAL	**0.545%**
Heat and Surface Treatment :	
Furnace operators and tenders	0.030%
Furnace, kiln, or kettle operators and tenders	0.174%
Heat treating machine operators and tenders, metal and plastic	0.040%
SUBTOTAL	**0.244%**
Joining :	
Welding machine setters, operators, and tenders	0.200%
Cement and gluing machine operators and tenders	0.089%
Welders and cutters	0.063%
Solderers and brazers	0.741%
Soldering and brazing machine operators and tenders	0.228%
SUBTOTAL	**1.321%**
Material Removal :	
Machinists	0.801%
Drilling and boring machine tool setters and set-up operators, metal and pl	0.246%
Grinding machine setters and set-up operators, metal and plastic	0.072%
Punching machine setters and set-up operators, metal and plastic	0.095%
Lathe and turning machine tool setters and set-up operators, metal and pl	0.107%
All other machine tool cutting and forming etc.	0.247%
Numerical control machine tool operators and tenders, metal and plastic	0.812%
Combination machine tool setters, set-up operators, operators, and tender	0.139%
Head sawyers and sawing machine operators and tenders, setters and set	0.023%
Grinders and polishers, hand	0.063%
Machine tool cutting operators and tenders, metal and plastic	0.196%
SUBTOTAL	**2.802%**
Other Production Processes :	
Other Metal, Plastic, and Ceramic	
All other extraction and related workers	0.033%
All other precision workers	0.062%
All other metal and plastic machine setters, operators, and related workers	0.236%
All other machine operators, tenders, setters, and set-up operators	0.268%

Contribution of Activities to Defense Manufacturing Labor Costs

The Electronic Components Industry (SIC 367)

Activity	Portion of DoD Mfg. Dollars
All other hand workers	0.355%
All other precision metal workers	0.119%
Printing and Publishing Processes	
Screen printing machine setters and set-up operators	0.250%
Printing press machine setters, operators and tenders	0.072%
All other printing, binding, and related workers	0.130%
Textiles and Apparel Processes	
Cutters and trimmers, hand	0.006%
SUBTOTAL	**1.530%**
Test, Inspection, and Repair :	
Product Repair	
All other electrical and electronic equipment mechanics, installers, and rep	0.013%
Precision instrument repairers	0.255%
Heat, air conditioning, and refrigeration mechanics and installers	0.054%
Office machine and cash register servicers	0.019%
Quality Assurance	
Weighers, measurers, checkers, and samplers, recordkeeping	0.032%
Inspectors and compliance officers, except construction	0.026%
Inspectors, testers, and graders, precision	4.217%
SUBTOTAL	**4.618%**
SUBTOTAL FOR Manufacturing :	**34.768%**
Other Support	
Other Support :	
Other Support	
Photographers	0.033%
All other health professionals, paraprofessionals, and technicians	0.052%
All other food preparation and service workers	0.015%
All other service workers	0.093%
SUBTOTAL	**0.194%**
SUBTOTAL FOR Other Support :	**0.194%**
Production Support	
Materials Handling :	
Freight, stock, and material movers, hand	0.346%
Machine feeders and offbearers	0.115%
Hand packers and packagers	0.306%
Packaging and filling machine operators and tenders	0.147%
All other helpers, laborers, and material movers, hand	0.430%
Stock clerks, stockrooom, warehouse, or yard	0.619%

Contribution of Activities to Defense Manufacturing Labor Costs

The Electronic Components Industry (SIC 367)

Activity	Portion of DoD Mfg. Dollars
Industrial truck and tractor operators	0.063%
All other material moving equipment operators	0.102%
All other transportation and related workers	0.009%
Truck drivers light and heavy	0.105%
SUBTOTAL	**2.243%**
Physical Plant Operations and Maintenance :	
Electrical and Electronic Maintenance	
Electronics repairers, commercial and industrial equipment	0.171%
Electricians	0.145%
Mechanical and Structural Maintenance	
Sheet metal workers and duct installers	0.224%
Plumbers, pipefitters, and steamfitters	0.054%
Millwrights	0.051%
Industrial machinery mechanics	0.985%
Other Maint., Construction, and Repair	
Painters and paperhangers, construction and maintenance	0.012%
Maintenance repairers, general utility	0.446%
Vehicle washers and equipment cleaners	0.046%
All other mechanics, installers, and repairers	0.129%
Plant Operations and Security	
Guards	0.132%
Janitors and cleaners, including maids and housekeeping cleaners	0.350%
All other clean and building service workers	0.009%
All other plant and system operators	0.041%
Woodworking	
Carpenters	0.024%
SUBTOTAL	**2.819%**
Production Management :	
Production, planning, and expediting clerks	0.993%
All other material recording, scheduling, and distribution workers	0.109%
Industrial production managers	3.788%
Blue collar worker supervisors	3.494%
SUBTOTAL	**8.383%**
Purchasing :	
Order clerks, materials, merchandise, and service	0.163%
Procurement clerks	0.103%
Purchasing agents, except wholesale, retail, and farm products	0.809%
Traffic, shipping, and receiving clerks	0.831%
Purchasing managers	0.402%
SUBTOTAL	**2.307%**

Contribution of Activities to Defense Manufacturing Labor Costs

The Electronic Components Industry (SIC 367)

Activity	Portion of DoD Mfg. Dollars
SUBTOTAL FOR Production Support :	15.753%
TOTAL FOR ALL ACTIVITIES :	100.000%

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Appendix K

The Top 173 DEIMS Manufacturing Industries

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
1	333	Communication/search and navigation	$18,637	20.7%
2	351	Aircraft	$8,771	9.8%
3	50	Complete guided missiles	$7,218	8.0%
4	353	Aircraft/missile parts and equip, NEC	$6,161	6.9%
5	354	Shipbuilding and repairing	$3,750	4.2%
6	352	Aircraft/missile engines and parts	$3,735	4.2%
7	168	Inorganic and organic chemicals	$1,735	1.9%
8	361	Engineering and scientific instruments	$1,684	1.9%
9	51	Ammunition, except small arms, NEC	$1,640	1.8%
10	340	Electronic components, NEC	$1,526	1.7%
11	197	Miscellaneous plastic products	$1,472	1.6%
12	223	Blast furnaces and steel mills	$1,410	1.6%
13	52	Tanks and tank components	$1,216	1.4%
14	335	Semiconductors	$1,135	1.3%
15	188	Petroleum refining	$1,098	1.2%
16	303	Electronic computing equipment	$918	1.0%
17	362	Measuring and control instruments	$894	1.0%
18	312	Electric measuring instruments	$889	1.0%
19	302	Miscellaneous machinery	$878	1.0%
20	284	Special dies, tools, and accessories	$843	0.9%
21	55	Guns, howitzers, mortars, etc.	$688	0.8%
22	53	Small arms	$582	0.6%
23	281	Industrial trucks and tractors	$568	0.6%
24	315	Motors and generators	$561	0.6%
25	363	Surgical and medical instruments	$550	0.6%
26	257	Screw machine products	$549	0.6%
27	178	Plastic materials and resins	$544	0.6%
28	253	Fabricated plate work (boilershop)	$529	0.6%
29	272	Internal combustion engines, NEC	$516	0.6%
30	350	Motor vehicle parts and accessories	$464	0.5%
31	282	Machine tools, metal cutting	$457	0.5%
32	367	Optical instruments and lenses	$406	0.5%
33	349	Other motor vehicles	$398	0.4%
34	239	Aluminum rolling and drawing	$376	0.4%
35	275	Construction machinery	$374	0.4%
36	369	Photographic equipment and supplies	$351	0.4%
37	145	Paper mills, except building paper	$338	0.4%
38	259	Other metal stampings	$332	0.4%
39	241	Nonferrous wire drawing and insulating	$331	0.4%
40	364	Surgical appliances and supplies	$326	0.4%
41	332	Telephone and telegraph equipment	$318	0.4%
42	161	Commercial printing	$299	0.3%
43	300	General industrial machinery, NEC	$297	0.3%
44	264	Plating and polishing	$290	0.3%
45	268	Pipe, valves, and pipe fittings	$279	0.3%

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
46	155	Paperboard containers and boxes	$267	0.3%
47	235	Primary aluminum	$256	0.3%
48	294	Pumps and compressors	$254	0.3%
49	232	Primary copper	$241	0.3%
50	271	Steam engines and turbines	$238	0.3%
51	238	Copper rolling and drawing	$233	0.3%
52	339	Connectors, for electronic applications	$232	0.3%
53	316	Industrial controls	$231	0.3%
54	298	Power transmission equipment	$229	0.3%
55	196	Fabricated rubber products, NEC	$222	0.2%
56	228	Iron and steel foundries	$221	0.2%
57	162	Manifold business forms	$208	0.2%
58	270	Fabricated metal products, NEC	$204	0.2%
59	295	Ball and roller bearings	$199	0.2%
60	329	Wiring devices	$198	0.2%
61	146	Paperboard mills	$195	0.2%
62	56	Packed meat	$191	0.2%
63	187	Paints and allied products	$189	0.2%
64	254	Sheet metal work	$184	0.2%
65	314	Switchgear and switchboards	$181	0.2%
66	205	Glass and products except containers	$170	0.2%
67	266	Miscellaneous fabricated wire products	$169	0.2%
68	265	Metal coating and allied services	$162	0.2%
69	242	Aluminum castings	$162	0.2%
70	116	Fabricated textile products, NEC	$161	0.2%
71	193	Tires and inner tubes	$157	0.2%
72	229	Iron and steel forgings	$156	0.2%
73	251	Fabricated structural metal	$153	0.2%
74	117	Logging camps and contractors	$149	0.2%
75	366	Watches and clocks	$142	0.2%
76	177	Chemical preparations, NEC	$140	0.2%
77	337	Electrical resistors	$137	0.2%
78	309	Refrigeration and heating equipment	$132	0.1%
79	54	Small arms ammunition	$131	0.1%
80	174	Explosives	$129	0.1%
81	173	Adhesives and sealants	$129	0.1%
82	263	Hardware, NEC	$126	0.1%
83	336	Electronic capacitors	$121	0.1%
84	213	Ready-mix concrete	$119	0.1%
85	114	Apparel from purchased material	$116	0.1%
86	217	Abrasive products	$115	0.1%
87	283	Machine tools, metal forming	$112	0.1%
88	330	Radio and TV receiving sets	$111	0.1%
89	104	Broadwoven fabric plants	$109	0.1%
90	118	Sawmills and planing mills, general	$109	0.1%

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
91	320	Household cooking equipment	$105	0.1%
92	240	Nonferrous rolling and drawing, NEC	$105	0.1%
93	322	Household laundry equipment	$105	0.1%
94	321	Household refrigerators and freezers	$104	0.1%
95	338	Coils, transformers, other inductors	$100	0.1%
96	245	Nonferrous forgings	$99	0.1%
97	345	Electrical equipment, NEC	$91	0.1%
98	379	Miscellaneous manufactured durable goods	$86	0.1%
99	256	Miscellaneous metal work	$85	0.1%
100	189	Lubricating oils and greases	$84	0.1%
101	319	Electric industrial apparatus, NEC	$82	0.1%
102	313	Tranformers	$80	0.1%
103	287	Metalworking machinery, NEC	$76	0.1%
104	285	Power driven hand tools	$76	0.1%
105	258	Automotive stampings	$76	0.1%
106	160	Miscellaneous publishing	$76	0.1%
107	150	Paper coating and glazing	$74	0.1%
108	296	Blowers and fans	$73	0.1%
109	328	Lighting fixtures	$73	0.1%
110	334	Electron tubes	$68	0.1%
111	293	Special industry machines	$67	0.1%
112	64	Fluid milk	$62	0.1%
113	318	Carbon and graphite products	$62	0.1%
114	144	Pulp mills	$62	0.1%
115	182	Drugs	$59	0.1%
116	181	Organic fibers, noncellulosic	$57	0.1%
117	157	Periodicals	$56	0.1%
118	231	Primary metal products, NEC	$56	0.1%
119	218	Asbestos products and sealing devices	$54	0.1%
120	212	Concrete products, NEC	$54	0.1%
121	244	Nonferrous casting, NEC	$53	0.1%
122	230	Metal heat treating	$53	0.1%
123	79	Bread, cake and related products	$53	0.1%
124	344	Engine electrical equipment	$52	0.1%
125	261	Hand and edge tools, NEC	$52	0.1%
126	236	Primary nonferrous metals, NEC	$51	0.1%
127	306	Office machines, NEC	$49	0.1%
128	179	Synthetic rubber	$48	0.1%
129	220	Mineral wool	$46	0.1%
130	210	Porcelain plumbing and elec. supplies	$46	0.1%
131	76	Prepared feed, NEC	$45	0.1%
132	147	Envelopes	$44	0.0%
133	207	Cement, hydraulic	$43	0.0%
134	355	Boatbuilding and repairing	$42	0.0%
135	376	Office and artists' materials	$42	0.0%

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
136	224	Electrometallurgical products	$42	0.0%
137	280	Hoists, cranes, and monorails	$42	0.0%
138	89	Bottled and canned soft drinks	$41	0.0%
139	152	Die-cut paper and board	$41	0.0%
140	191	Paving mixtures and blocks	$41	0.0%
141	129	Wood products, NEC	$41	0.0%
142	185	Surface active agents	$40	0.0%
143	346	Truck and bus bodies	$40	0.0%
144	171	Agricultural chemicals, NEC	$39	0.0%
145	70	Fresh or frozen packaged fish	$39	0.0%
146	123	Veneer and plywood	$39	0.0%
147	198	Hose belting	$38	0.0%
148	151	Bags, except textile bags	$38	0.0%
149	158	Book publishing	$38	0.0%
150	169	Fertilizers	$38	0.0%
151	301	Carburetors, pistons, rings	$37	0.0%
152	279	Conveyors and conveying equipment	$37	0.0%
153	121	Millwork	$37	0.0%
154	222	Nonmetallic mineral products, NEC	$37	0.0%
155	148	Sanitary paper products	$37	0.0%
156	163	Blankbooks and looseleaf binders	$36	0.0%
157	246	Metal cans	$36	0.0%
158	311	Service industry machines, NEC	$36	0.0%
159	183	Soap and other detergents	$36	0.0%
160	234	Primary zinc	$35	0.0%
161	99	Food preparations, NEC	$35	0.0%
162	143	Furniture and fixtures, NEC	$34	0.0%
163	58	Poultry dressing plants	$34	0.0%
164	63	Ice Cream and frozen desserts	$33	0.0%
165	61	Cheese, natural and processed	$31	0.0%
166	356	Railroad equipment	$31	0.0%
167	273	Farm machinery	$30	0.0%
168	317	Welding apparatus	$30	0.0%
169	327	Electric lamps	$29	0.0%
170	348	Automobiles	$28	0.0%
171	219	Minerals, ground or treated	$28	0.0%
172	167	Printing trade services	$28	0.0%
173	243	Brass, bronze, and copper castings	$28	0.0%
		Other defense manufacturing	$1,343	1.5%
		Total	$89,848	100.0%

Appendix L

Alphabetical Listing of DEIMS Manufacturing Industries

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
1	217	Abrasive products	$115	0.1%
2	173	Adhesives and sealants	$129	0.1%
3	171	Agricultural chemicals, NEC	$39	0.0%
4	351	Aircraft	$8,771	9.8%
5	352	Aircraft/missile engines and parts	$3,735	4.2%
6	353	Aircraft/missile parts and equip, NEC	$6,161	6.9%
7	242	Aluminum castings	$162	0.2%
8	239	Aluminum rolling and drawing	$376	0.4%
9	51	Ammunition, except small arms, NEC	$1,640	1.8%
10	114	Apparel from purchased material	$116	0.1%
11	218	Asbestos products and sealing devices	$54	0.1%
12	348	Automobiles	$28	0.0%
13	258	Automotive stampings	$76	0.1%
14	151	Bags, except textile bags	$38	0.0%
15	295	Ball and roller bearings	$199	0.2%
16	163	Blankbooks and looseleaf binders	$36	0.0%
17	223	Blast furnaces and steel mills	$1,410	1.6%
18	296	Blowers and fans	$73	0.1%
19	355	Boatbuilding and repairing	$42	0.0%
20	158	Book publishing	$38	0.0%
21	89	Bottled and canned soft drinks	$41	0.0%
22	243	Brass, bronze, and copper castings	$28	0.0%
23	79	Bread, cake and related products	$53	0.1%
24	104	Broadwoven fabric plants	$109	0.1%
25	318	Carbon and graphite products	$62	0.1%
26	301	Carburetors, pistons, rings	$37	0.0%
27	207	Cement, hydraulic	$43	0.0%
28	61	Cheese, natural and processed	$31	0.0%
29	177	Chemical preparations, NEC	$140	0.2%
30	338	Coils, transformers, other inductors	$100	0.1%
31	161	Commercial printing	$299	0.3%
32	333	Communication/search and navigation	$18,637	20.7%
33	50	Complete guided missiles	$7,218	8.0%
34	212	Concrete products, NEC	$54	0.1%
35	339	Connectors, for electronic applications	$232	0.3%
36	275	Construction machinery	$374	0.4%
37	279	Conveyors and conveying equipment	$37	0.0%
38	238	Copper rolling and drawing	$233	0.3%
39	152	Die-cut paper and board	$41	0.0%
40	182	Drugs	$59	0.1%
41	319	Electric industrial apparatus, NEC	$82	0.1%
42	327	Electric lamps	$29	0.0%
43	312	Electric measuring instruments	$889	1.0%
44	345	Electrical equipment, NEC	$91	0.1%
45	337	Electrical resistors	$137	0.2%

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
46	224	Electrometallurgical products	$42	0.0%
47	334	Electron tubes	$68	0.1%
48	336	Electronic capacitors	$121	0.1%
49	340	Electronic components, NEC	$1,526	1.7%
50	303	Electronic computing equipment	$918	1.0%
51	344	Engine electrical equipment	$52	0.1%
52	361	Engineering and scientific instruments	$1,684	1.9%
53	147	Envelopes	$44	0.0%
54	174	Explosives	$129	0.1%
55	270	Fabricated metal products, NEC	$204	0.2%
56	253	Fabricated plate work (boilershop)	$529	0.6%
57	196	Fabricated rubber products, NEC	$222	0.2%
58	251	Fabricated structural metal	$153	0.2%
59	116	Fabricated textile products, NEC	$161	0.2%
60	273	Farm machinery	$30	0.0%
61	169	Fertilizers	$38	0.0%
62	64	Fluid milk	$62	0.1%
63	99	Food preparations, NEC	$35	0.0%
64	70	Fresh or frozen packaged fish	$39	0.0%
65	143	Furniture and fixtures, NEC	$34	0.0%
66	300	General industrial machinery, NEC	$297	0.3%
67	205	Glass and products except containers	$170	0.2%
68	55	Guns, howitzers, mortars, etc.	$688	0.8%
69	261	Hand and edge tools, NEC	$52	0.1%
70	263	Hardware, NEC	$126	0.1%
71	280	Hoists, cranes, and monorails	$42	0.0%
72	198	Hose belting	$38	0.0%
73	320	Household cooking equipment	$105	0.1%
74	322	Household laundry equipment	$105	0.1%
75	321	Household refrigerators and freezers	$104	0.1%
76	63	Ice Cream and frozen desserts	$33	0.0%
77	316	Industrial controls	$231	0.3%
78	281	Industrial trucks and tractors	$568	0.6%
79	168	Inorganic and organic chemicals	$1,735	1.9%
80	272	Internal combustion engines, NEC	$516	0.6%
81	229	Iron and steel forgings	$156	0.2%
82	228	Iron and steel foundries	$221	0.2%
83	328	Lighting fixtures	$73	0.1%
84	117	Logging camps and contractors	$149	0.2%
85	189	Lubricating oils and greases	$84	0.1%
86	282	Machine tools, metal cutting	$457	0.5%
87	283	Machine tools, metal forming	$112	0.1%
88	162	Manifold business forms	$208	0.2%
89	362	Measuring and control instruments	$894	1.0%
90	246	Metal cans	$36	0.0%

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
91	265	Metal coating and allied services	$162	0.2%
92	230	Metal heat treating	$53	0.1%
93	287	Metalworking machinery, NEC	$76	0.1%
94	121	Millwork	$37	0.0%
95	220	Mineral wool	$46	0.1%
96	219	Minerals, ground or treated	$28	0.0%
97	266	Miscellaneous fabricated wire products	$169	0.2%
98	302	Miscellaneous machinery	$878	1.0%
99	379	Miscellaneous manufactured durable goods	$86	0.1%
100	256	Miscellaneous metal work	$85	0.1%
101	197	Miscellaneous plastic products	$1,472	1.6%
102	160	Miscellaneous publishing	$76	0.1%
103	350	Motor vehicle parts and accessories	$464	0.5%
104	315	Motors and generators	$561	0.6%
105	244	Nonferrous casting, NEC	$53	0.1%
106	245	Nonferrous forgings	$99	0.1%
107	240	Nonferrous rolling and drawing, NEC	$105	0.1%
108	241	Nonferrous wire drawing and insulating	$331	0.4%
109	222	Nonmetallic mineral products, NEC	$37	0.0%
110	376	Office and artists' materials	$42	0.0%
111	306	Office machines, NEC	$49	0.1%
112	367	Optical instruments and lenses	$406	0.5%
113	181	Organic fibers, noncellulosic	$57	0.1%
114	259	Other metal stampings	$332	0.4%
115	349	Other motor vehicles	$398	0.4%
116	56	Packed meat	$191	0.2%
117	187	Paints and allied products	$189	0.2%
118	150	Paper coating and glazing	$74	0.1%
119	145	Paper mills, except building paper	$338	0.4%
120	155	Paperboard containers and boxes	$267	0.3%
121	146	Paperboard mills	$195	0.2%
122	191	Paving mixtures and blocks	$41	0.0%
123	157	Periodicals	$56	0.1%
124	188	Petroleum refining	$1,098	1.2%
125	369	Photographic equipment and supplies	$351	0.4%
126	268	Pipe, valves, and pipe fittings	$279	0.3%
127	178	Plastic materials and resins	$544	0.6%
128	264	Plating and polishing	$290	0.3%
129	210	Porcelain plumbing and elec. supplies	$46	0.1%
130	58	Poultry dressing plants	$34	0.0%
131	285	Power driven hand tools	$76	0.1%
132	298	Power transmission equipment	$229	0.3%
133	76	Prepared feed, NEC	$45	0.1%
134	235	Primary aluminum	$256	0.3%
135	232	Primary copper	$241	0.3%

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
136	231	Primary metal products, NEC	$56	0.1%
137	236	Primary nonferrous metals, NEC	$51	0.1%
138	234	Primary zinc	$35	0.0%
139	167	Printing trade services	$28	0.0%
140	144	Pulp mills	$62	0.1%
141	294	Pumps and compressors	$254	0.3%
142	330	Radio and TV receiving sets	$111	0.1%
143	356	Railroad equipment	$31	0.0%
144	213	Ready-mix concrete	$119	0.1%
145	309	Refrigeration and heating equipment	$132	0.1%
146	148	Sanitary paper products	$37	0.0%
147	118	Sawmills and planing mills, general	$109	0.1%
148	257	Screw machine products	$549	0.6%
149	335	Semiconductors	$1,135	1.3%
150	311	Service industry machines, NEC	$36	0.0%
151	254	Sheet metal work	$184	0.2%
152	354	Shipbuilding and repairing	$3,750	4.2%
153	53	Small arms	$582	0.6%
154	54	Small arms ammunition	$131	0.1%
155	183	Soap and other detergents	$36	0.0%
156	284	Special dies, tools, and accessories	$843	0.9%
157	293	Special industry machines	$67	0.1%
158	271	Steam engines and turbines	$238	0.3%
159	185	Surface active agents	$40	0.0%
160	363	Surgical and medical instruments	$550	0.6%
161	364	Surgical appliances and supplies	$326	0.4%
162	314	Switchgear and switchboards	$181	0.2%
163	179	Synthetic rubber	$48	0.1%
164	52	Tanks and tank components	$1,216	1.4%
165	332	Telephone and telegraph equipment	$318	0.4%
166	193	Tires and inner tubes	$157	0.2%
167	313	Tranformers	$80	0.1%
168	346	Truck and bus bodies	$40	0.0%
169	123	Veneer and plywood	$39	0.0%
170	366	Watches and clocks	$142	0.2%
171	317	Welding apparatus	$30	0.0%
172	329	Wiring devices	$198	0.2%
173	129	Wood products, NEC	$41	0.0%
		Other defense manufacturing	$1,343	1.5%
		Total	$89,848	100.0%

Appendix M

DEIMS Industries by Stage of Processing

	Stage of Processing	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
1	Highly-integrated systems	351	Aircraft	$8,771	9.8%
2		50	Complete guided missiles	$7,218	8.0%
3		354	Shipbuilding and repairing	$3,750	4.2%
4		52	Tanks and tank components	$1,216	1.4%
5		349	Other motor vehicles	$398	0.4%
6		356	Railroad equipment	$31	0.0%
7		348	Automobiles	$28	0.0%
8	Medium-integration capital equipment	302	Miscellaneous machinery	$878	1.0%
9		281	Industrial trucks and tractors	$568	0.6%
10		282	Machine tools, metal cutting	$457	0.5%
11		275	Construction machinery	$374	0.4%
12		300	General industrial machinery, NEC	$297	0.3%
13		283	Machine tools, metal forming	$112	0.1%
14		345	Electrical equipment, NEC	$91	0.1%
15		287	Metalworking machinery, NEC	$76	0.1%
16		293	Special industry machines	$67	0.1%
17	Medium-integration assemblies and products	333	Communication/search and navigation	$18,637	20.7%
18		352	Aircraft/missile engines and parts	$3,735	4.2%
19		303	Electronic computing equipment	$918	1.0%
20		55	Guns, howitzers, mortars, etc.	$688	0.8%
21		315	Motors and generators	$561	0.6%
22		272	Internal combustion engines, NEC	$516	0.6%
23		294	Pumps and compressors	$254	0.3%
24		271	Steam engines and turbines	$238	0.3%
25		330	Radio and TV receiving sets	$111	0.1%
26		182	Drugs	$59	0.1%
27		355	Boatbuilding and repairing	$42	0.0%
28		273	Farm machinery	$30	0.0%
29	Low-integration capital equipment	361	Engineering and scientific instruments	$1,684	1.9%
30		362	Measuring and control instruments	$894	1.0%
31		312	Electric measuring instruments	$889	1.0%
32		284	Special dies, tools, and accessories	$843	0.9%
33		285	Power driven hand tools	$76	0.1%
34		261	Hand and edge tools, NEC	$52	0.1%
35		280	Hoists, cranes, and monorails	$42	0.0%
36		279	Conveyors and conveying equipment	$37	0.0%
37		317	Welding apparatus	$30	0.0%
38	Low-integration assemblies and products	353	Aircraft/missile parts and equip, NEC	$6,161	6.9%
39		51	Ammunition, except small arms, NEC	$1,640	1.8%
40		53	Small arms	$582	0.6%
41		363	Surgical and medical instruments	$550	0.6%
42		367	Optical instruments and lenses	$406	0.5%
43		369	Photographic equipment and supplies	$351	0.4%
44		364	Surgical appliances and supplies	$326	0.4%
45		332	Telephone and telegraph equipment	$318	0.4%
46		314	Switchgear and switchboards	$181	0.2%
47		366	Watches and clocks	$142	0.2%
48		309	Refrigeration and heating equipment	$132	0.1%
49		54	Small arms ammunition	$131	0.1%
50		174	Explosives	$129	0.1%

	Stage of Processing	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
51		320	Household cooking equipment	$105	0.1%
52		322	Household laundry equipment	$105	0.1%
53		321	Household refrigerators and freezers	$104	0.1%
54		319	Electric industrial apparatus, NEC	$82	0.1%
55		296	Blowers and fans	$73	0.1%
56		306	Office machines, NEC	$49	0.1%
57		376	Office and artists' materials	$42	0.0%
58		346	Truck and bus bodies	$40	0.0%
59		311	Service industry machines, NEC	$36	0.0%
60		327	Electric lamps	$29	0.0%
61	Textile, food, wood, and other products	145	Paper mills, except building paper	$338	0.4%
62		161	Commercial printing	$299	0.3%
63		155	Paperboard containers and boxes	$267	0.3%
64		162	Manifold business forms	$208	0.2%
65		146	Paperboard mills	$195	0.2%
66		56	Packed meat	$191	0.2%
67		116	Fabricated textile products, NEC	$161	0.2%
68		117	Logging camps and contractors	$149	0.2%
69		114	Apparel from purchased material	$116	0.1%
70		104	Broadwoven fabric plants	$109	0.1%
71		118	Sawmills and planing mills, general	$109	0.1%
72		379	Miscellaneous manufactured durable goods	$86	0.1%
73		160	Miscellaneous publishing	$76	0.1%
74		150	Paper coating and glazing	$74	0.1%
75		64	Fluid milk	$62	0.1%
76		144	Pulp mills	$62	0.1%
77		157	Periodicals	$56	0.1%
78		79	Bread, cake and related products	$53	0.1%
79		76	Prepared feed, NEC	$45	0.1%
80		147	Envelopes	$44	0.0%
81		89	Bottled and canned soft drinks	$41	0.0%
82		152	Die-cut paper and board	$41	0.0%
83		129	Wood products, NEC	$41	0.0%
84		70	Fresh or frozen packaged fish	$39	0.0%
85		123	Veneer and plywood	$39	0.0%
86		151	Bags, except textile bags	$38	0.0%
87		158	Book publishing	$38	0.0%
88		121	Millwork	$37	0.0%
89		148	Sanitary paper products	$37	0.0%
90		163	Blankbooks and looseleaf binders	$36	0.0%
91		99	Food preparations, NEC	$35	0.0%
92		143	Furniture and fixtures, NEC	$34	0.0%
93		58	Poultry dressing plants	$34	0.0%
94		63	Ice Cream and frozen desserts	$33	0.0%
95		61	Cheese, natural and processed	$31	0.0%
96		167	Printing trade services	$28	0.0%
97	Component parts	340	Electronic components, NEC	$1,526	1.7%
98		197	Miscellaneous plastic products	$1,472	1.6%
99		335	Semiconductors	$1,135	1.3%
100		257	Screw machine products	$549	0.6%
101		253	Fabricated plate work (boilershop)	$529	0.6%
102		350	Motor vehicle parts and accessories	$464	0.5%
103		264	Plating and polishing	$290	0.3%
104		268	Pipe, valves, and pipe fittings	$279	0.3%
105		339	Connectors, for electronic applications	$232	0.3%
106		316	Industrial controls	$231	0.3%

	Stage of Processing	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
107		298	Power transmission equipment	$229	0.3%
108		196	Fabricated rubber products, NEC	$222	0.2%
109		270	Fabricated metal products, NEC	$204	0.2%
110		295	Ball and roller bearings	$199	0.2%
111		329	Wiring devices	$198	0.2%
112		254	Sheet metal work	$184	0.2%
113		205	Glass and products except containers	$170	0.2%
114		266	Miscellaneous fabricated wire products	$169	0.2%
115		265	Metal coating and allied services	$162	0.2%
116		193	Tires and inner tubes	$157	0.2%
117		251	Fabricated structural metal	$153	0.2%
118		337	Electrical resistors	$137	0.2%
119		263	Hardware, NEC	$126	0.1%
120		336	Electronic capacitors	$121	0.1%
121		338	Coils, transformers, other inductors	$100	0.1%
122		256	Miscellaneous metal work	$85	0.1%
123		313	Tranformers	$80	0.1%
124		328	Lighting fixtures	$73	0.1%
125		334	Electron tubes	$68	0.1%
126		218	Asbestos products and sealing devices	$54	0.1%
127		212	Concrete products, NEC	$54	0.1%
128		230	Metal heat treating	$53	0.1%
129		344	Engine electrical equipment	$52	0.1%
130		210	Porcelain plumbing and elec. supplies	$46	0.1%
131		198	Hose belting	$38	0.0%
132		301	Carburetors, pistons, rings	$37	0.0%
133		246	Metal cans	$36	0.0%
134	Castings and forgings	259	Other metal stampings	$332	0.4%
135		228	Iron and steel foundries	$221	0.2%
136		242	Aluminum castings	$162	0.2%
137		229	Iron and steel forgings	$156	0.2%
138		245	Nonferrous forgings	$99	0.1%
139		258	Automotive stampings	$76	0.1%
140		244	Nonferrous casting, NEC	$53	0.1%
141		243	Brass, bronze, and copper castings	$28	0.0%
142	Engineered materials	168	Inorganic and organic chemicals	$1,735	1.9%
143		223	Blast furnaces and steel mills	$1,410	1.6%
144		188	Petroleum refining	$1,098	1.2%
145		178	Plastic materials and resins	$544	0.6%
146		239	Aluminum rolling and drawing	$376	0.4%
147		241	Nonferrous wire drawing and insulating	$331	0.4%
148		235	Primary aluminum	$256	0.3%
149		232	Primary copper	$241	0.3%
150		238	Copper rolling and drawing	$233	0.3%
151		187	Paints and allied products	$189	0.2%
152		177	Chemical preparations, NEC	$140	0.2%
153		173	Adhesives and sealants	$129	0.1%
154		213	Ready-mix concrete	$119	0.1%
155		217	Abrasive products	$115	0.1%
156		240	Nonferrous rolling and drawing, NEC	$105	0.1%
157		189	Lubricating oils and greases	$84	0.1%
158		318	Carbon and graphite products	$62	0.1%
159		181	Organic fibers, noncellulosic	$57	0.1%
160		231	Primary metal products, NEC	$56	0.1%
161		236	Primary nonferrous metals, NEC	$51	0.1%
162		179	Synthetic rubber	$48	0.1%

	Stage of Processing	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
163		220	Mineral wool	$46	0.1%
164		207	Cement, hydraulic	$43	0.0%
165		224	Electrometallurgical products	$42	0.0%
166		191	Paving mixtures and blocks	$41	0.0%
167		185	Surface active agents	$40	0.0%
168		171	Agricultural chemicals, NEC	$39	0.0%
169		169	Fertilizers	$38	0.0%
170		222	Nonmetallic mineral products, NEC	$37	0.0%
171		183	Soap and other detergents	$36	0.0%
172		234	Primary zinc	$35	0.0%
173		219	Minerals, ground or treated	$28	0.0%
			Other defense manufacturing	$1,343	1.5%
			Total	$89,848	100.0%

Appendix N

DEIMS Industry Codes

The Top 173 DEIMS Manufacturing Industries, by DEIMS Code

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
1	50	Complete guided missiles	$7,218	8.0%
2	51	Ammunition, except small arms, NEC	$1,640	1.8%
3	52	Tanks and tank components	$1,216	1.4%
4	53	Small arms	$582	0.6%
5	54	Small arms ammunition	$131	0.1%
6	55	Guns, howitzers, mortars, etc.	$688	0.8%
7	56	Packed meat	$191	0.2%
8	58	Poultry dressing plants	$34	0.0%
9	61	Cheese, natural and processed	$31	0.0%
10	63	Ice Cream and frozen desserts	$33	0.0%
11	64	Fluid milk	$62	0.1%
12	70	Fresh or frozen packaged fish	$39	0.0%
13	76	Prepared feed, NEC	$45	0.1%
14	79	Bread, cake and related products	$53	0.1%
15	89	Bottled and canned soft drinks	$41	0.0%
16	99	Food preparations, NEC	$35	0.0%
17	104	Broadwoven fabric plants	$109	0.1%
18	114	Apparel from purchased material	$116	0.1%
19	116	Fabricated textile products, NEC	$161	0.2%
20	117	Logging camps and contractors	$149	0.2%
21	118	Sawmills and planing mills, general	$109	0.1%
22	121	Millwork	$37	0.0%
23	123	Veneer and plywood	$39	0.0%
24	129	Wood products, NEC	$41	0.0%
25	143	Furniture and fixtures, NEC	$34	0.0%
26	144	Pulp mills	$62	0.1%
27	145	Paper mills, except building paper	$338	0.4%
28	146	Paperboard mills	$195	0.2%
29	147	Envelopes	$44	0.0%
30	148	Sanitary paper products	$37	0.0%
31	150	Paper coating and glazing	$74	0.1%
32	151	Bags, except textile bags	$38	0.0%
33	152	Die-cut paper and board	$41	0.0%
34	155	Paperboard containers and boxes	$267	0.3%
35	157	Periodicals	$56	0.1%
36	158	Book publishing	$38	0.0%
37	160	Miscellaneous publishing	$76	0.1%
38	161	Commercial printing	$299	0.3%
39	162	Manifold business forms	$208	0.2%
40	163	Blankbooks and looseleaf binders	$36	0.0%
41	167	Printing trade services	$28	0.0%
42	168	Inorganic and organic chemicals	$1,735	1.9%
43	169	Fertilizers	$38	0.0%
44	171	Agricultural chemicals, NEC	$39	0.0%
45	173	Adhesives and sealants	$129	0.1%

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
46	174	Explosives	$129	0.1%
47	177	Chemical preparations, NEC	$140	0.2%
48	178	Plastic materials and resins	$544	0.6%
49	179	Synthetic rubber	$48	0.1%
50	181	Organic fibers, noncellulosic	$57	0.1%
51	182	Drugs	$59	0.1%
52	183	Soap and other detergents	$36	0.0%
53	185	Surface active agents	$40	0.0%
54	187	Paints and allied products	$189	0.2%
55	188	Petroleum refining	$1,098	1.2%
56	189	Lubricating oils and greases	$84	0.1%
57	191	Paving mixtures and blocks	$41	0.0%
58	193	Tires and inner tubes	$157	0.2%
59	196	Fabricated rubber products, NEC	$222	0.2%
60	197	Miscellaneous plastic products	$1,472	1.6%
61	198	Hose belting	$38	0.0%
62	205	Glass and products except containers	$170	0.2%
63	207	Cement, hydraulic	$43	0.0%
64	210	Porcelain plumbing and elec. supplies	$46	0.1%
65	212	Concrete products, NEC	$54	0.1%
66	213	Ready-mix concrete	$119	0.1%
67	217	Abrasive products	$115	0.1%
68	218	Asbestos products and sealing devices	$54	0.1%
69	219	Minerals, ground or treated	$28	0.0%
70	220	Mineral wool	$46	0.1%
71	222	Nonmetallic mineral products, NEC	$37	0.0%
72	223	Blast furnaces and steel mills	$1,410	1.6%
73	224	Electrometallurgical products	$42	0.0%
74	228	Iron and steel foundries	$221	0.2%
75	229	Iron and steel forgings	$156	0.2%
76	230	Metal heat treating	$53	0.1%
77	231	Primary metal products, NEC	$56	0.1%
78	232	Primary copper	$241	0.3%
79	234	Primary zinc	$35	0.0%
80	235	Primary aluminum	$256	0.3%
81	236	Primary nonferrous metals, NEC	$51	0.1%
82	238	Copper rolling and drawing	$233	0.3%
83	239	Aluminum rolling and drawing	$376	0.4%
84	240	Nonferrous rolling and drawing, NEC	$105	0.1%
85	241	Nonferrous wire drawing and insulating	$331	0.4%
86	242	Aluminum castings	$162	0.2%
87	243	Brass, bronze, and copper castings	$28	0.0%
88	244	Nonferrous casting, NEC	$53	0.1%
89	245	Nonferrous forgings	$99	0.1%
90	246	Metal cans	$36	0.0%

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
91	251	Fabricated structural metal	$153	0.2%
92	253	Fabricated plate work (boilershop)	$529	0.6%
93	254	Sheet metal work	$184	0.2%
94	256	Miscellaneous metal work	$85	0.1%
95	257	Screw machine products	$549	0.6%
96	258	Automotive stampings	$76	0.1%
97	259	Other metal stampings	$332	0.4%
98	261	Hand and edge tools, NEC	$52	0.1%
99	263	Hardware, NEC	$126	0.1%
100	264	Plating and polishing	$290	0.3%
101	265	Metal coating and allied services	$162	0.2%
102	266	Miscellaneous fabricated wire products	$169	0.2%
103	268	Pipe, valves, and pipe fittings	$279	0.3%
104	270	Fabricated metal products, NEC	$204	0.2%
105	271	Steam engines and turbines	$238	0.3%
106	272	Internal combustion engines, NEC	$516	0.6%
107	273	Farm machinery	$30	0.0%
108	275	Construction machinery	$374	0.4%
109	279	Conveyors and conveying equipment	$37	0.0%
110	280	Hoists, cranes, and monorails	$42	0.0%
111	281	Industrial trucks and tractors	$568	0.6%
112	282	Machine tools, metal cutting	$457	0.5%
113	283	Machine tools, metal forming	$112	0.1%
114	284	Special dies, tools, and accessories	$843	0.9%
115	285	Power driven hand tools	$76	0.1%
116	287	Metalworking machinery, NEC	$76	0.1%
117	293	Special industry machines	$67	0.1%
118	294	Pumps and compressors	$254	0.3%
119	295	Ball and roller bearings	$199	0.2%
120	296	Blowers and fans	$73	0.1%
121	298	Power transmission equipment	$229	0.3%
122	300	General industrial machinery, NEC	$297	0.3%
123	301	Carburetors, pistons, rings	$37	0.0%
124	302	Miscellaneous machinery	$878	1.0%
125	303	Electronic computing equipment	$918	1.0%
126	306	Office machines, NEC	$49	0.1%
127	309	Refrigeration and heating equipment	$132	0.1%
128	311	Service industry machines, NEC	$36	0.0%
129	312	Electric measuring instruments	$889	1.0%
130	313	Tranformers	$80	0.1%
131	314	Switchgear and switchboards	$181	0.2%
132	315	Motors and generators	$561	0.6%
133	316	Industrial controls	$231	0.3%
134	317	Welding apparatus	$30	0.0%
135	318	Carbon and graphite products	$62	0.1%

	DEIMS Code	Industry	Industry value added for defense (millions of FY91 dollars)	Portion of defense manufacturing represented by the industry (Percent)
136	319	Electric industrial apparatus, NEC	$82	0.1%
137	320	Household cooking equipment	$105	0.1%
138	321	Household refrigerators and freezers	$104	0.1%
139	322	Household laundry equipment	$105	0.1%
140	327	Electric lamps	$29	0.0%
141	328	Lighting fixtures	$73	0.1%
142	329	Wiring devices	$198	0.2%
143	330	Radio and TV receiving sets	$111	0.1%
144	332	Telephone and telegraph equipment	$318	0.4%
145	333	Communication/search and navigation	$18,637	20.7%
146	334	Electron tubes	$68	0.1%
147	335	Semiconductors	$1,135	1.3%
148	336	Electronic capacitors	$121	0.1%
149	337	Electrical resistors	$137	0.2%
150	338	Coils, transformers, other inductors	$100	0.1%
151	339	Connectors, for electronic applications	$232	0.3%
152	340	Electronic components, NEC	$1,526	1.7%
153	344	Engine electrical equipment	$52	0.1%
154	345	Electrical equipment, NEC	$91	0.1%
155	346	Truck and bus bodies	$40	0.0%
156	348	Automobiles	$28	0.0%
157	349	Other motor vehicles	$398	0.4%
158	350	Motor vehicle parts and accessories	$464	0.5%
159	351	Aircraft	$8,771	9.8%
160	352	Aircraft/missile engines and parts	$3,735	4.2%
161	353	Aircraft/missile parts and equip, NEC	$6,161	6.9%
162	354	Shipbuilding and repairing	$3,750	4.2%
163	355	Boatbuilding and repairing	$42	0.0%
164	356	Railroad equipment	$31	0.0%
165	361	Engineering and scientific instruments	$1,684	1.9%
166	362	Measuring and control instruments	$894	1.0%
167	363	Surgical and medical instruments	$550	0.6%
168	364	Surgical appliances and supplies	$326	0.4%
169	366	Watches and clocks	$142	0.2%
170	367	Optical instruments and lenses	$406	0.5%
171	369	Photographic equipment and supplies	$351	0.4%
172	376	Office and artists' materials	$42	0.0%
173	379	Miscellaneous manufactured durable goods	$86	0.1%
		Other defense manufacturing	$1,343	1.5%
		Total	$89,848	100.0%

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This report provides an occupation-based cost profile of the manufacturing activities that contribute to defense production. We base our analysis on direct and indirect industry shipments to DoD, the number of workers in each manufacturing occupation, and the median pay by occupation. We cover 91 industries as defined by the 3-digit Standard Industrial Classification system and 287 Bureau of Labor Standards-defined occupations. Our results reflect the activities of all defense-related manufacturing industries in the domestic economy, including prime contractors, subtier suppliers, and development and production activities ranging from major systems to spare parts. We report occupation cost profiles for all industries combined, for industries grouped on the basis of their degree of defense involvement, and for selected individual industries and industrial sectors.

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